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Development of the Employee Expertise Development Scale (EEDS)

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Development of the Employee Expertise Development Scale (EEDS)

Yujin Kim, Ph.D.

University of Connecticut, 2015

Understanding the process of expertise development is critical for human resource development. The present study aimed to develop a quantitative instrument to assess general procedural components of employee expertise development in various work contexts. Specifically, the present study answered the following two research questions: (1) What are the general dimensions of employee expertise development? and (2) To what extent can the general dimensions of employee expertise development be confirmed across various work settings? I employed an exploratory sequential mixed methods design. Based on qualitative data from 46 employees and comprehensive literature review, three constructs were generated: Developmental Work Experience (DWE), Engagement in Deliberate Practice (EDP), and Learning in Professional Networks (LPN). Through a content validation, the initial Employee Expertise Development Scale (EEDS) consists of 45 revised items out of the original 66-item pool. Using a 272 employee sample, Exploratory Factor Analysis (EFA) returned four dimensions of the EEDS that can be mapped with the original three constructs and 30 items were retained. The dimensions include: Engagement in Deliberate Practice (EDP, 11 items), Strategic Networking (SN, 5 items), Frequent and Focused Interactions (FFI, 5 items), and Developmental Work Experience (DWE, 9 items). To examine the generalizability of the four-factor structure of the EEDS, Confirmatory Factor Analysis (CFA) was conducted with another 186 employee sample. The identified four-factor structure of the EEDS showed an adequate level of internal consistency and construct validity, and 23 items were finally retained: EDP (7 items), SN (5 items), FFI (5 items) and DWE (6 items). With a total sample of 458 employees, the four factors of the EEDS demonstrated a satisfactory internal reliability. Additional construct validity evidences of the EEDS as well

as its theoretical and practical implications were provided. The present study filled the gaps between traditional and contemporary expertise development theories, and the EEDS opens various new research and practical avenues in the field of employee expertise development.

Development of the Employee Expertise Development Scale (EEDS)

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Doctor of Philosophy

Development of the Employee Expertise Development Scale (EEDS)

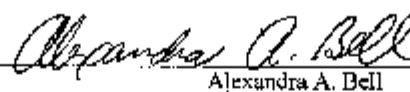
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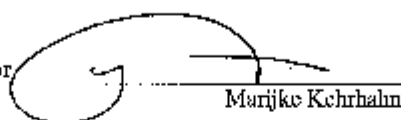
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Chapter One

Introduction

The 2012 ASTD State of the Industry Report indicates that more than \$156.2 billion was spent on employee learning and development by U.S. organizations in 2011. In spite of that, skills gaps among employees is an ongoing concern within organizations, which has serious implications such as lower productivity, lower efficiency, and missed opportunities for the organization (Miller, 2012). The respondents to ASTD's member survey indicate that the top ranked reason for the skills gap is that the skills of the current workforce do not match changes in company strategy, goals, markets, or business models (Miller, 2012). More recently, Accenture 2013 Skills and Employment Trends Survey also found that a skills gap is prevalent across various industries in U.S. (e.g., services, construction, retail, finance, insurance, real estate, etc.). Among 400 executives from large U.S. companies, nearly half of executives (46%) reported that the companies do not have the right skills to effectively implement the company's new strategies in the coming years (Smith, LaVelle, Marshall, & Cantrell, 2015). As such, addressing the skills gap is not merely a matter of employees acquiring skills in specific areas, but continually developing their expertise.

Considering the dynamic nature of expertise and emphasis on performance in the workplace, Herling (2000) defined human expertise as "displayed behavior within a specialized domain and/or related domain in the form of consistently demonstrated actions of an individual that are both optimally efficient in their execution and effective in their results" (p. 20). Kuchinke (1997) also used the term of employee expertise as a concept distinguished from traditional disciplines of expertise by its unique context of expertise development, that is, the workplace. These definitions are important in relation to broader social forces impacting the need for individuals to continue to develop expertise in the workplace. First, organizations are taking on flatter structures in order to adapt easily to a changing world.

Related to this is project- and team-based working is becoming a trend in the global economy (Guile, 2012), in which individuals have more opportunities to move horizontally (i.e., sideways) than vertically (i.e., hierarchical) across various boundaries (Arthur, Khapova, & Wilderom, 2005). Second, individual employees are less dependent on a single organization for job security in pursuing their career (Arthur et al., 2005; Tams & Arthur, 2010) and seek “job opportunities that go beyond the boundaries of single employment settings” (i.e., boundaryless career, Defillippi & Arthur, 1994, p. 116). Indeed, the average tenure of American workers was 4.6 years in 2012 (Hipple & Sok, 2013). Of the jobs that workers began when they were 40 to 46 years of age, 33% were held for less than a year, and 69% were held for less than 5 years (Hipple & Sok, 2013).

Now more than ever, employees must constantly develop their expertise so that their knowledge and skills are not just growing to meet the needs of the current job, but also so that expertise is transferable across jobs (Arthur et al., 2005; Tams & Arthur, 2010). It requires employees to be proactive and innovative in (re)defining and (re)developing their expertise (Grenier & Kehrhahn, 2008). Thus, individuals’ continuous learning and innovative adaptation to changes in diverse contexts characterizes the development of employee expertise (Herling, 2000).

Problem Statement

Qualitative researchers have investigated how employees develop expertise in the workplace (e.g., Eraut, 2004; Cheetham & Chivers, 2001; Goldman, 2008). These studies demonstrated that expertise development in the workplace is grounded in learning from and through experience that unfolds during one’s career trajectory. In line with this conclusion, Hall (2004) viewed a change in one’s career trajectory as a consecutive transition from one learning cycle to another. However, most qualitative empirical research is domain-specific in nature. There is relatively little research comparing the impact of those learning experiences

on expertise development across various industries or fields of professions. Highlighting a dearth of work in comparing professional development across various fields, Cheetham and Chivers (2001) emphasized the need to investigate the relative importance of various forms of learning activities across professions in developing expertise. To meet this need, they suggested employing quantitative tools such as a survey in investigating professional development.

From a more managerial perspective, researchers such as Swanson (1994) and Herling (2000) emphasized the necessity of measurements to quantitatively assess employees' expertise in order to monitor and improve individuals' expertise. In the course of continually developing expertise in the workplace, feedback is critical in that it can direct the course of individuals' efforts and align their expertise development in ways that benefit both the individual and the organization (Eraut, 2004). According to the Cornerstone On Demand Survey, however, 66% of employees said they haven't received useful feedback from their manager/employer (Haworth, 2012).

Another gap in conventional research on expertise in the workplace is lack of attention to the mechanism of expertise development. As mentioned earlier, expertise is often defined in regard to the level of performance at a certain point of time (i.e., superior performance, Ericsson, 2006; Herling, 2000). In fact, expertise development involves dynamic cognitive and social processes (i.e., deliberate practice, Ericsson, 2006; learning from others, Grenier, 2009) for continuous acquisition and/or organization of knowledge, skills, and other resources that construct one's expertise (Grenier & Kehrhahn, 2008; Kuchinke, 1997). If key dimensions of the expertise development process are elucidated and their scientific (i.e., reliable and valid) assessment becomes available, rich motivational and developmental feedback on employee expertise development can be offered to benefit both employees and organizations.

Indeed, a few instruments have been developed to assess various aspects of expertise in work settings, however, they have limitations in addressing dynamic characteristics of expertise development in modern workplaces. These instruments include the Professional Expertise Scale (Johanna & van der Heijden, 2000) that comprehensively addresses characteristics of experts' performance in modern workplaces (e.g., Growth and Flexibility), but does not address how individuals develop those characteristics of expertise. Another instrument is the Expertise Measurement (Mieg, 2009), which showed that for experts in practical work settings professionalism is an important dimension of expertise, as well as excellence in performance. However, founded on Ericsson's (1996) traditional theory of expertise development the items do not reflect the dynamic nature of expertise development in the workplace (e.g., growth beyond one's own field of expertise). Lastly, the Generalized Expertise Measure (GEM, Germain & Tejeda, 2012) is based on the dimensions of expertise perceived from other colleague employees' and supervisors' perspectives. The authors found people judge one's expertise level based on both objective quality standards (e.g., educational qualifications and training) and behavior characteristics (e.g., being charismatic and self-assured). Although the GEM admitted the existence of a socially constructed dimension of expertise, it did not address how various social contexts constitute the behavioral dimension of expertise. In short, these existing instruments did not take into account specific developmental processes of employee expertise development and underlying learning mechanisms, limiting their contributions to better understanding and facilitating individual employees' expertise development.

Given that employee expertise development is an ongoing developmental process and involves trans-contexts characteristics of experience that individuals can transfer and apply to new contexts, a new generation of assessment tool to better understand and promote expertise development is needed. Since individuals are developing expertise across multiple contexts,

an instrument is needed to assess and provide feedback longitudinally along an individual's employment in an organization, or across many employment situations, or one's career.

The challenge for adult educators in contexts of professional development, career counseling, and HRD is to identify a theoretically sound and standardized instrument to assess critical dimensions of individuals' development of expertise that can be applied to various fields of work and contexts. The instrument can contribute to advance expertise research by making it possible to quantify the phenomena of expertise development and finally reveal and verify complex relationships between relevant factors such as individual and social factors in a quantitative way. For employees, in addition to qualitative feedback, quantitative feedback accompanied by standardized norms (e.g., deviation from mean) based on data from a larger population, would provide a more reliable base to reflect and enhance their approach to expertise development. The purpose of this proposed study was to develop a quantitative instrument to operationally define and assess experiential dimensions of employee expertise development in ever-changing work contexts.

Conceptual Framework

Employee expertise development is of primary interest to human resource development (Herling, 2000; Torraco & Swanson, 1995). Although a conceptual understanding of employee expertise development is an imperative requirement for further research and HRD practice, little research has systematically investigated its conceptual and empirical foundations. In this section, I aim to suggest essential dimensions of employee expertise development. To this end, I first introduce mainstream expertise theories and studies as a solid foundation of employee expertise development. Next, in order to show the need for extending the mainstream perspectives, I describe changes in the workplace and relevant workplace learning theories with empirical evidence. Consequently, an emerging framework for employee expertise development will follow. A literature review revealed that

expertise development is a situated and dynamic process encompassing the following three important aspects: individual deliberate practice, work experience, and social relations. They are the foundations for the three dimensions of the EEDS that was developed from this study.

Psychological Perspectives of Expertise and Expertise Development

The definitions of expertise. The literature offered numerous and varied definitions and descriptions of expertise depending on disciplines (Glaser, Chi, & Farr, 1988; Farrington-Darby & Wilson, 2006; Feltovich, Prietula, & Ericsson, 2006; Herling, 2000; Kuchinke, 1997; Shanteau, 1992; Slatter, 1990; Swanson, 1994). In spite of the diversity of definitions, psychological perspective on expertise took the lead in revealing characteristics of expertise. Cognitive and experimental oriented researchers investigated underlying cognitive mechanisms of expert performance (Feltovich, Prietula, & Ericsson, 2006 for review). In addition, another mainstream research effort, the knowledge engineering theories of expertise, attempted to formulate experts' thinking process as an artificial intelligence model. The psychological approach to expertise has established commonly shared understanding of characteristics of an expert. Briefly summarized, experts have an extensive knowledge base, represent and organize the knowledge they have in qualitatively different ways, and efficiently apply relevant domain knowledge and strategies to problem solving situations (Chi, 2006; Feltovich, Prietula, & Ericsson, 2006; Herling, 2000). Expertise theory, to explain the underlying information processing mechanism of expertise, is still evolving. Psychological research has realized that there may be no fixed mechanism to execute expertise (Kuchinke, 1997). The knowledge engineering theories started to model expertise as distributed among many individuals (Slatter, 1990, cited from Herling, 2000). As Herling (2000) has noted, it becomes a common premise that expertise is not an absolute state, but rather a dynamic state. Nevertheless, research from the psychological perspective tends to assess expertise in the form of context-free performance (e.g., reproducibly superior

performance, Ericsson, 2006). On the contrary, literature from HRD is apt to define expertise in terms of satisfying organizational needs, and therefore, the assessment is exclusive to context. Given the competitive environment of organizations, excellence in a domain is what employees are expected to and need to achieve. But excellence should be redefined in the experts' relation to the workplace. As I cited in the introduction, Herling (2000) defined employee expertise as 'optimally efficient in their execution' indicating the excellence in expertise in a given situation and 'effective in their results' implying that surrounding conditions also define expertise (p. 20).

Psychological theories in expertise development. The study of expertise has generally been conducted based on two different assumptions: absolute approach vs. relative approach (Chi, 2006). These two approaches have different implications for studies on expertise development.

The absolute approach to expertise focuses on the impact of genetic inheritance in cognitive or physical abilities on expertise development. The underlying assumption is that innate talent or ability leads to exceptional performance, thus, only a small number of people can reach the greatest level of performance (Ackerman, 2014; Chi, 2006). Literature regarding the absolute perspective is targeted to investigate the developmental trajectory of truly exceptional people such as great composers in history or champions from world-level chess master competitions (for a review, Chi, 2006). This perspective emphasized individual differences in developing individual expertise (Ackerman, 1987, 1992; Kaufman, 2007). For example, Gobet and Campitelli (2007) found that variability on the number of hours of intense practice to achieve master level in chess were remarkable (e.g., min=3000 hr; max=23,600 in total practice hours). Campitelli and Gobet (2008) graphically showed that chess masters began to show higher performance ratings than experts in chess after the first 3 years of serious dedication to chess (i.e., 2257 vs. 2174). Until the 3rd year there were no

differences in accumulated hours of practice. Indeed, the figures showed that the expert group reported almost the same hours in group practice or slightly longer hours in individual practice. Based on these results, Campitelli and Gobet (2011) argued that some individuals (i.e., individuals in the master group) gained more benefit from practice than others.

Literature suggested general intelligence (Hambrick, Oswald, Altmann, Mainz, Gobet, & Campitelli, 2014), working memory (e.g., Hambrick & Mainz, 2011), or other innate physical ability (e.g., absolute pitch in music, Ruthsatz, 2014) as factors affecting those individual differences.

On the other hand, the relative approach to expertise is to study experts in comparison to relatively less experienced people (i.e., novice or intermediate) on a continuum of proficiency levels. This contrastive approach assumes that a majority of people can attain expertise through learning and the goal is to understand the developmental process in which a less skilled person becomes more skilled (Chi, 2006). According to this approach, differences in the amount of learning and practice can explain even the individual difference in expertise development among experts (Ericsson, 1998, 2006). Literature from this approach attempted to devise expertise development theories focused on the process of a physical or perceptual skill development.

Classical skill acquisition models assumed that the processes underlying everyday skill acquisition lead to the development of expertise (Fitts & Posner, 1967 cited from Feltovich, Prietula, & Ericsson, 2006; Kuchinke, 1997). According to this model, acquisition of automaticity in a skill proceeds in three stages: a) cognitive, b) associative, and c) autonomous. The first stage involves an initial cognitive representation of the skill and continues until people correctly perform the task without gross errors. In the second stage (associative), the learner performs the sequences of the procedure more smoothly and efficiently, detecting and eliminating any errors. In the final stage (autonomous), people can

correctly perform the action with a minimal amount of effort. However, at the autonomous stage, the individual cannot control the automatic process any more. More experience no longer contributes to further development of the skill or expertise, and people maintain a satisfactory level of performance.

In everyday skill acquisition, the goal is to reach the autonomous stage as rapidly as possible. In contrast, Ericsson (1998, 2006) argued that those who aim to become an expert counteract automaticity by developing more complex mental representations and maintaining conscious control on their performance. In this way, they remain within the cognitive and associative states. Through regular engagement in deliberate practice (Ericsson, 1998, 2006) that is specially designed practice to improve performance, an individual can make continuous breakthroughs in the process of expertise development, rather than conforming to the routine sequences of actions. According to Ericsson (1998, 2006), not mere experience, but only an extensive amount of deliberate practice, can lead to the superior performance of an expert. Since Ericsson, Krampe, and Tesch-Römer (1993) introduced the concept of deliberate practice and its effect on expertise development in music (i.e., violinists and pianists), the last two decades have seen research in diverse fields of expertise (e.g., professional writing, music, sports, chess) with solid evidence of the necessary role of deliberate practice (for a review, Ericsson, 2006). Most significantly, deliberate practice can provide a solid foundation for employees to achieve excellence beyond an acceptable level in their performance (Herling, 2000; Kuchinke, 1997).

However, recently meta-analysis studies argued that deliberate practice leaves the majority of variance in performance unexplained, indicating that deliberate practice is necessary, but not sufficient, in developing expertise. By including studies from chess and music, Hambrick, Oswald, Altmann, Meinz, Gobet, and Campitelli (2014) reported that, on average, deliberate practice explained only 34% of the variance in performance for chess and

30% for music after correcting for measurement error variance. Based on this result, the authors suggested that research is needed to investigate innate abilities to explain the rest of variance. However, it is premature to say that the unexplained variance of expertise development can be attributed to innate talent. Having included 88 studies from all major domains that have applied deliberate practice, Macnamara, Hambrick, and Oswald (2014) found that both domain and predictability of the task environment significantly moderated the effect of deliberate practice ($Q(4)=49.09, p<.001$; $Q(1)=20.49, p<.001$, respectively). By domain, the percentage explained by deliberate practice was 26% for games, 21% for music, 18% for sports, 4% for education, and less than 1% for professions (e.g., computer programming, piloting, soccer refereeing and insurance selling). By predictability of the task environment, deliberate practice explained 24% of variance in performance for activities high in predictability, 12% for activities moderate in predictability, and 4% for activities low in predictability. This result seemed to imply that deliberate practice had no meaningful contribution to expertise development in less predictable professions such as education or sales. However, in this study, the education domain included college students' based studies and, even in professional domain, only one study investigated more dynamic workplace expertise (i.e., insurance selling, Sonnentag & Kleine, 2000). Moreover, there was no clue about how uncertainty in such professions mediated the role of deliberate practice in expertise development. Needless to say, fundamental to understanding this result is to understand the dynamic contexts of less structured professions.

Further, other studies found that not only does the relative importance of deliberate practice vary depending on the domains, but also the best types of deliberate practice varied depending on domains. With a large scale chess player sample ($N=419$), recruited from four different countries from 1993 to 1999, Charness, Tuffiash, Krampe, Reingold, and Vasyukova (2005) reported cumulative hours of serious study alone was the single best

indicator of current chess skill ($\beta=.36$, $p<.01$) among various activities of deliberate practice (e.g., Tournament play, private instruction, group instruction). On the contrary, in Ward, Hodges, Starkes, and Williams' (2007) study on soccer players, weekly and accumulated hours spent in soccer team practice most consistently differentiated between skill groups across age cohorts (e.g., canonical correlation $r^2=0.76$, accuracy of group membership prediction= 94.9% for the older age group over 11 years old). Elite players also spent significantly more time in tactical and strategic decision making activities during team practices than sub-elite players ($d=0.68$, $p<0.001$). Moreover, Gruber, Degner, and Lehmann (2004) found that even within the music domain, there are considerable differences in deliberate practice across areas of music. Contrary to classical musicians, expert jazz guitarists highly valued hearing and analyzing the recording of famous musicians and had doubts about the value of formal training. Thus, Gruber et al. suggested that jazz musician teachers or coaches' contribution to an individual's expertise development is to expose students to a community of experts, instead of providing instruction.

In addition, Ericsson and his colleagues (1993) defined deliberate practice as a separate construct from a work activity (e.g., participating in a competition or a performance) or expertise-relevant but playful activities (e.g., listening music for a classic musician). However, participants in the previous two studies (Ward et al., 2007; Gruber et al., 2004) exhibited strong enjoyment in participation in many of deliberate practice activities, indicating a blurred boundary between deliberate practice and playful activity. In particular, for expert jazz musicians, deliberate practice seemed indistinguishable from enjoyment (i.e., playful activity) and professional reward (i.e., work related activity) (Gruber et al., 2004). In conclusion, considering the diversity in exhibiting deliberate practice across domains, as Ward et al. (2007) suggested, redefinition of deliberate practice is required to reflect the specific natures and contexts of the domain in question.

Taken together, recent studies on deliberate practice indicated that the limited concept of deliberate practice is not sufficient to explain variety in expertise development across different domains. The theoretical framework of expertise development should redefine the construct of deliberate practice depending on the contexts. Also, the relatively small amount of variance explained by deliberate practice implied that besides deliberate practice, other factors play important roles in expertise development. It is particularly true in employee expertise development given the dynamic nature of the surrounding environment under which employees execute their expertise. In the following sections, I first explore changes in the workplace that may contextualize the process of employee expertise development, and consequently introduce emerging theoretical frameworks in workplace learning and employee expertise development.

The Dynamic Contexts of the Workplace

Before exploring expertise development in the workplace, wider social and cultural contexts that influence employee expertise development need addressing.

In the early 1990s, the concept of boundaryless career emerged. Boundaryless career is defined as a sequence of career paths “that go beyond the boundaries of single employment settings” (DeFillippi & Arthur, 1994, p.307). Introducing the concept of the boundaryless career, Arthur (1994) pointed to three emerging changes in organizational careers; these are the increase of transient employment relationships, career pursuit as reputation-building and employability in industry fields, and the increasing prominence of the subjective over the objective career. These changes remain significant to today’s employees. Using cluster analysis with a sample of 272 temporary employees, Marler, Barringer, and Milkovich (2002) classified two different types of temporary workers: traditional temporaries (73.5%) and boundaryless temporaries (26.5%). Unlike traditional temporaries, boundaryless temporaries worked primarily in managerial, professional and technical occupations, which require a

higher level of education and expertise. More importantly, boundaryless temporaries showed different attitudes toward the organization from traditional temporaries. In spite of a higher level of satisfaction with work (regression coefficient = 0.38, $p < .01$), boundaryless temporaries did not show any significant difference in organizational commitment compared to traditional temporaries after controlling for age, education, and gender (regression coefficient = 0.13, $p > .05$). Also, boundaryless temporaries reported even lower scores in contextual performance (i.e., cooperative, citizenship behavior) after controlling for work satisfaction, age, education, and gender (regression coefficient = -0.31, $p < .01$). These results implied that boundaryless temporaries may have a more detached relationship with the organization or institutionalized standards. Other qualitative studies on boundaryless temporaries (e.g., highly skilled contractors, Barley & Kunda, 2006; interim managers, Inkson, Heising, & Rousseau, 2001) also revealed that this type of employees experienced a lack of organizational involvement and support. In addition, security and continuity in their job relied solely on individual resource (i.e., individual expertise or personal networks) and they underwent frequent evaluations in the market (Barley & Kunda, 2006). Thus, boundaryless professionals considered themselves as continual learners who make intensive and sustained effort to stay up-to-date rather than full-fledged practitioners. Knowledge and experience, accumulated through completing diverse assignments from different organizations, were their primary source of expertise development (Inkson, Heising, & Rousseau, 2001). The trajectory of individuals' career became a "credentialing process" in which individuals carefully arrange the learning opportunities to enhance their reputation and expertise (Barley & Kunda, 2006, p.52; Inkson, Heising, & Rousseau, 2001). Thus, self-directedness in career and expertise development was a marked characteristic of boundaryless temporaries (Inkson, Heising, & Rousseau, 2001).

However, recent studies have recognized that boundaryless careers are not context-

independent; rather they are constructed under wide contextual constraints and boundaries (Tams & Arthur, 2010). For example, in the study by Barley and Kunda (2006), IT contractors built their own communities or networks that provided technical and non-technical supports in order to supplement the limited availability of institutionalized resource (e.g., repository of skills accumulated in an organization). Further, by collaborating or being co-located with others in a particular industry field (e.g., Silicon Valley), individuals had a shared career defined by collectively pursued career opportunities through the co-evolving sequence of work collaboration by two or more career actors (Svejenova, Vives, & Alvarez, 2010).

Simultaneously, research in professional practice has provided more understanding of the changing nature of professional work and identity in the workplace. Fenwick, Nerland, and Jensen (2012) pointed out that professionals have experienced a shift in the organization of their work. In recent years, inter-professional work that requires collaborative practice among professionals from diverse areas of expertise has become an emerging trend in the global economy as a way of handling complex social needs in organizations. This inter-professional practice has brought about a recreation of the boundaries that define expert domains (Fenwick, Nerland, & Jensen, 2012). By using the concept of recontextualising, Guile (2012) explained the process in which professionals reorient themselves through inter-professional work. In collaborative practices, professionals are required to make their domain-specific knowledge and insights explicit to the other members they are working with in order to develop collective inferences in a team. This process of collective inference results in recontextualising of domain-specific knowledge and perspectives. By hearing explicit explanations and interpretations from members of diverse fields, individuals can infer the implications of new suggestions in relation to their own and others' professional forms of knowledge and perceiving.

Besides collaborations based on working relationships, social networks is an emerging topic in the workplace literature in that the characteristics and quality of social networks is one of critical determinants of one's career development trajectory. For example, in a study of 136 MBA graduates, Higgins (2001) found that the diversity of an individual's instrumental advice network (i.e., those who provide work-related resources) had a substantial direct effect on career change ($\beta=.30, p<.10$), but the diversity of individuals' psychological advice networks did not predict career change ($\beta=.12, p>.10$). Further, Higgins, Dobrow, and Roloff (2010) investigated the longitudinal influence of relational networks. In their 10-year longitudinal study with 136 young adults, they found that the strength of one's developmental networks is positively related to one form of psychological capital, optimism. They defined a person's developmental network as a set of people who take an active role in advancing that person's career by providing career or psychological support. Specifically, the amount of early developmental support (i.e., psychological support and career support) received by people in the initial two years after graduate school were associated with greater optimism eight years later ($B=5.80, p<.001$ for psychological support; $B=3.70, p<.01$ for career support). Similarly, increasing levels of psychological and career support over time predicted higher levels of optimism in the later career period ($B=38.63, p<.001$ for psychological support; $B=18.27, p<.01$ for career support). Although Higgins and colleagues focused on career development, altogether, their studies exhibited that some characteristics of social networks have stronger developmental value in one's career development and possibly expertise development as well.

Another aspect of a social network is the nature of connectedness or ties between individuals within the social network. Originally, Granovetter (1973, 1983) highlighted weak ties, which are based on infrequent and loose relationships between one another (e.g., acquaintances tie), in that weak ties have a strength in diffusion of information and resources.

Weak ties serve as a central bridge delivering diverse information and resource in sparse networks in which a few of individuals know one another while each of them may have their own social networks across different social systems. But, more recent studies (e.g., Burt, 2004; Obstfeld, 2005) recognized the unique advantages of different forms of social networks in achieving innovation. Sparse networks present opportunities for generating and regenerating new ideas, but pose greater obstacles to initiate implementation action. Conversely, dense networks in which individuals have strong ties (i.e., frequent and close relationship), provide optimal conditions for initiating coordinated action to implement new ideas due to the homogeneity of interests and perspectives among people who frequently interact with one another. Further, by conducting an ethnographic study in an engineering division of an automotive manufacturer, Obstfeld (2005) found that individuals' behavioral orientation toward social networks can mediate the effect of social networks. Innovative managers showed a behavioral orientation to connect and facilitate people in their social networks. They introduced disconnected individuals and created opportunities for new collaboration between individuals in the networks.

Relevant to the structural nature of social networks, another important issue is whether social networks are internal or external in nature. Wolff and Moser (2009) assessed six different networking behaviors of 235 employees from a wide range of industrial sectors in Germany. The six networking behaviors included building internal contacts, maintaining internal contacts, using internal contacts, building external contacts, maintaining external contacts, and using external contacts. The results showed that networking behaviors generally contribute to an employee's current salary and differential salary growth for 3 consecutive years (Δ Deviance =21.5, $p < .01$; Δ Deviance =13.3, $p < .05$, respectively). In particular, building internal contacts and maintaining external contacts were the most important predictors of concurrent salary, indicating relatively higher weight on external contacts

(Relative Regression Weight= 24%, $p < .05$; Relative Regression Weight= 45%, $p < .05$).

Maintaining internal contacts was the only significant indicator of salary growth (Relative Regression Weight= 49%, $p < .05$). Although causal effect was not established and they used salary as an indicate of performance measures, the results indicated the possibility that internal and external networking can play different roles in predicting employee's current performance and growth in performance.

This section presented an overview of how changes in social contexts influence the ways employees develop their expertise and careers. Boundaryless careers reflect that demands for continuous development of one's expertise are increasing and responsibility to develop one's expertise is shifting from an organization to an individual. Frequent inter-professional collaborations drive employees to redefine their boundary of expertise. Also, it was suggested that various attributes of social networks play different roles in the process of expertise development. In summary, these changes in workplace indicate that the developmental process of employee expertise should address how individual employees navigate the ever-changing social territory.

Workplace Learning as Situated Learning

Concurrent with the changes in the workplace mentioned in the previous section, the fundamental perspective of workplace learning has changed over the years. Until the early 1990s, workplace learning was conceptualized primarily as the acquisition of knowledge (Fenwick, 2008; Fenwick, Nerland, & Jensen, 2012). Knowledge was generally recognized as a stable entity that was validated by an authority from a particular profession or discipline (Guile, 2013). However, Lave and Wenger's (1991) situated learning theory argued that learning is a social phenomenon emerging through a person's legitimate peripheral participation in ongoing activities in a community of practice. This learning process is relational in nature and involves corresponding changes in a person's identity in the

community of practice. Incorporating the characteristics of situated learning, Lave and Wenger (1991) defined a community of practice as “a system of relationships between people, activities, and the world; developing with time, and in relation to other tangential and overlapping communities of practice” (p. 98). Wenger (1998, 2000) further explored dynamic operations of these relationships as rich sources of learning and knowing and identified three dimensions of the relationships. Members build up mutual relationships by doing things together (mutual engagement), cultivate a sense of joint enterprise to bind them together in practices, and lastly continue to develop over time a shared repertoire for their practice, including experiences, shortcuts, stories, tools, artifacts, symbols and etc. Thus, within communities of practice, expertise development of a novice/new comer follows learning trajectories moving from periphery participation to an idealized full participation in a community of practice.

However, as Wenger (1998) admitted, not all participants aim to or achieve full participation in a community of practice. For example, some people maintain at the periphery of the community voluntarily or not (i.e., marginal participation, Wenger, 1998), according to the interactions between the person and the workplace. The second criticism of communities of practice comes from a recognition of a recent phenomena that individuals are likely to be involved in multiple communities across organizational boundaries with more loose and individualized relations (Handley, Sturdy, Fincham, & Clark, 2006; Roberts, 2006). As Brown and Duguid (2001) argued, among these multiple communities, what binds various individuals and groups is practice rather than a membership of a community. For them, individuals participate in networks of practice rather than communities of practice, which incorporate various forms of groups from small tight-knit communities to extensive academic disciplines (Brown & Duguid, 2001). Another popular example of practice in groups comes from Lindkvist (2005) who introduced the concept of collectivities of practice that refers to

practice conducted within transient project groups. Unlike the emphasis on shared knowledge and coherent membership in communities of practice, collectivities of practice heavily depend on “individual knowledge, agency, and goal-directed interaction” (Lindkvist, 2005, p. 1200).

In terms of expertise development, in communities of practice, the relationship between newcomers and experienced members is quite unidirectional and learning mainly occurred on the newcomers’ side (Fuller, Hodkinson, Hodkinson, & Unwin, 2005). However, this is not necessarily the case. Fuller and colleagues (2005) showed that even the most experienced workers (i.e., a department head of music department) continue to learn after they obtain full membership in their respective workplaces, and interactions with newcomers (i.e., student teachers) can facilitate continued learning. This interactive learning between newcomers and experienced workers ultimately contributed to transforming and expanding the community of practice. Specifically, in cases where newcomers were experienced workers who had changed jobs, learning was more activated and further expanded the cross-boundaries of particular communities of practice. In addition, experienced experts do not always show excellent performance and can exercise immature reasoning depending on contexts (Bullough & Baughman, 1995; Orland-Barak & Yinon, 2005). In other words, as Grenier and Kehrhahn (2008) asserted in their Model of Expertise Redevelopment (MER), dynamic changes in the contexts put pressure on employees to continuously (re)develop and transform their expertise in order to enact legitimate expertise in the particular workplace.

In contrast to the monotonous path from a new comer to a full participant in communities of practice, Billett’s relational interdependency model (2004, 2008) reveals how individual learning processes unfold in idiosyncratic ways, as a result of interaction with particular workplace contexts. According to Billett (2004, 2008), workplace experiences are intentionally structured to maintain the continuity of the workplace or work practice. For

example, workplaces deliberately structure specific procedures of practice in a variety of ways, such as by providing modeling or guiding, assigning tasks, or placing individuals in particular positions. Billett called it affordances in a social setting. Particular expectations or norms in the workplace are general regulatory practices used to accomplish the intentions of the organization. Next, individuals' engagement is also intentional. Individuals deliberately choose to engage in practices in the ways that best serve their own preferences and goals, such as securing job opportunities or simply lessening workloads. That is to say, individuals react to the affordances of workplaces with different levels of agency. Similarly, affordances in a particular social setting are differentially exercised depending on the level of individual agency (Billett, 2004, 2008). In this way, the interdependency between a person and the workplace is individualized and relational.

In this framework, the value of work experience in expertise development can be dramatically different from individual to individual within the same workplace. For example, Smith's (2006) ethnographical study demonstrated while workers adapted to the work practices, the learning agenda was expanded and reprioritized in whatever direction was most consistent with workers' epistemological agencies at that moment. It is also not rare for workers to reject social affordances from the workplace. In Billett, Smith, and Barker's study (2005) with an IT helpdesk team, substantial opportunities for social engagement were afforded, but two of the 3 IT workers exhibited only peripheral participation in engaging in social events according to their different levels of preference and career interests (partial engagement vs. disengagement). According to the authors, this peripheral participation of team members conversely facilitated the self-directed problem solving culture of the team.

Employees can also go beyond the boundary of the workplace to fulfill their learning goals as maintaining continuity of the workplace. In Billett's case study (1999), a mechanic who chose to work in a small garage couldn't access the whole domain of automotive repairs.

However, as an owner of the garage he had more autonomy in using work time, and he could participate in the TAFE (Technical and Further Education) Environment outside of the workplace in order to access new techniques and equipment. Lastly, Billett and colleagues (2005) demonstrated how relational interdependency interacted with social changes outside of the workplace and individuals' personal work history. In the IT worker team case, rapid changes in software programs in today's technology environment altered the IT workers' daily practice and promoted their self-directed learning styles, and individuals' goals outside of the workplace (e.g., family issue or academic pursuits) constrained individuals' work practice within the workplace.

According to Billet's (2004, 2008) framework and case examples, the concept that work experiences are intentionally structured is tied to one important aspect of the definition of deliberate practice. In the previous section, I pointed out that only a few studies in the domain of employee expertise investigated deliberate practice. Thus, Billet's framework suggested two important questions in understanding employee expertise development. First, research needs to investigate the evidence of the existence of deliberate practice in this domain. Moreover, given the intentionality in both constructs, it is also important to investigate whether deliberate practice in employee expertise development exists separately from work experiences; if so, then in what respect do they contribute differently to employee expertise development?

Situated learning theories suggest a person's professional networks and work experiences are promising elements to explain employee expertise development. Communities of practice (Lave & Wenger, 1991) and recent studies show how an employee negotiates between various professional networks of practice and out of the workplace. Billet's (2004, 2008) framework highlighted the value of work experiences as a structured learning activity. In the next section, I introduce more comprehensive theoretical frameworks

in expertise development that attempt to explain how individuals define their expertise in social contexts and continue to develop their expertise by adapting to changes in the environment.

Emerging Theoretical Frameworks in Employee Expertise Development

Scholarship introduced in the previous section more generally conceptualized workplace learning. New theories of expertise development in the workplace emerged from those general workplace learning frameworks and against the restricted and context-free concepts of classical expertise development theories. Currently, emerging expertise models are emphasizing the social aspects of expertise and the dynamic alteration of boundary of domain of expertise.

First, Mieg (2006) coined the term relative experts. The term reflects the idea that “the level of knowledge and skill differs in our society, as well as the level of knowledge and skill necessary to serve a function in a context” (p. 745). Unlike the classic view of experts, Mieg’s framework is based on sociology and defines expertise in relationship to audience and the social functions in a particular context. The concept of relative experts is well reflected in Mieg’s comment: “almost anyone can – under certain circumstances- act as an expert” (p. 745). Empirical evidence (e.g., Bullough & Baughman, 1995; Orland-Barak & Yinon, 2005) supports this premise - there is contextual fluctuation in experts’ performances between the expert and novice level and a periodic alternation of the roles of experienced experts and novices in workplaces (e.g., Fuller, Hodkinson, & Unwin, 2005). Under this premise, it is important for experts to consistently redefine their role and identity against demands of the society that they belong to. Mieg (2006, 2009) defined this socially imposed function as the professionalism dimension of expertise. With a sociological perspective, this theory tried to explain the mechanism that professionals act to construct their professional identity and

practice in the society as a legitimate professional group, but did not address the process of expertise development at individual level.

As a comprehensive model in terms of expertise development, Grenier and Kehrnhahn (2008) developed the Model of Expertise Redevelopment (MER) in order to address the dynamic nature of expertise redevelopment in workplaces. While Mieg focused on people involved in executing expertise, the MER conceptualized expertise as a construct situated in broader contexts. They expanded the narrowly defined domain of expertise into Territory of Expertise that consists of three components of expertise: content, environment, and constituency.

Corresponding to the traditional concept of domain of expertise, content of expertise is the first element and refers to required knowledge and skills for an individual to manifest expertise. However, content of expertise is not static. What knowledge and skills, and the extent to which they are appropriate for an individual to function as an expert in a given situation, can change depending on surrounding contexts and those who are involved in the contexts. Thus, the second component of territory of expertise is environment which refers to “the locale a person operates within, together with its culture, organizational structure, and geographical location or layout” (p. 209). As a third component, constituency refers to “those groups that influence or are influenced by the individual” (p. 210). Since changes in any or all of the territory of expertise can occur at any level of expertise, it is not possible for an individual to follow a linear process to reach an end point by solely relying on an individual’s independent practice to acquire finite knowledge and skills (e.g., Dreyfus & Dreyfus, 1986; Ericsson, 1998, 2006). Rather, an individual moves across three different states of expertise development: a state of dependence, a state of independence, and a state of transcendence. Each of three progressive states of expertise reflects the degree to which an expert relies on “other people or sources for information” (p. 207).

The fundamental difference between the classical theory of expertise development and the MER is the central role of contexts in the MER. For example, Chi (2006) used that expert's context dependent judgment as a weakness in experts' performance. For example, expert physicians usually used context information in diagnosis (e.g., sex, age, previous diseases, occupation, drug use, and so forth), but Chi questioned the causal relation between the contextual information and the disease in question. However, according to MER, acquiring the contextual knowledge based on clinical practices constitutes clinician's expertise and is an essential element for an expert to function as an expert in the given contexts. Indeed, with the background information, expert physicians made 50% more accurate diagnoses than novices (Hobus, Schmidt, Boshuizen, & Patel, 1987 cited from Chi, 2006).

Taken together, Mieg's concept (2006) and MER (Grenier & Kehrhahn, 2008) theoretically define the domain of expertise and the roles of experts as ever-changing constructs influenced by social context and audiences who are embedded in certain social contexts. These constructivist models have practical implications for designing an instrument for assessing the process of employee expertise development. Specifically, the processes of social legitimization and continuous transformation of expertise are crucial for employee expertise development, and the corresponding dimensions of social processes need to be taken into account in addition to non-social dimensions of employee expertise development.

Pre-existing Measurements of Employee Expertise

In the domain of employee expertise, there are a few measurements to assess expertise. These instruments unveil the various aspects of employee expertise by defining items in terms of observable and measurable behaviors. In line with the literature review summarized in previous sections of this paper, these instruments speak to the need for social aspects of employee expertise development. Also, they provide identification and description

of these social dimensions. In this section, I will introduce three published measurements and briefly discuss them in terms of their implications for employee expertise development.

The first extensive instrument is Johanna and Van der Heijden's Professional Expertise (2000). This multi-dimensional measurement consisted of five sub-dimensions: knowledge, meta-cognitive knowledge, skills, social recognition, and growth & flexibility. This instrument covered important aspects that characterize experts and experts' performances, including cognitive (i.e., meta-cognitive knowledge), behavioral (i.e., knowledge and skills), social (i.e., social recognition) and even developmental dimensions (i.e., growth and flexibility) of employee expertise. However, the primary focus of this instrument is to identify an expert based on current level of performance. For example, the social recognition subscale mainly assesses individuals' current levels of recognition rather than interactive relationships with other peoples that can contribute to further advancing expertise (e.g., "I consider myself ... not at all-extremely...competent to convince colleagues about my ideas in a convincing manner"). Further, the construct of growth and flexibility assumed quite restricted boundaries of expertise in developing expertise rather than expanding or reorienting the boundaries of domain of expertise (e.g., "During that particular period, I ...never-very often...concerned myself with the latest developments in the domain of my work"). Lastly, the authors did not provide solid theoretical backgrounds that can systematically incorporate the five dimensions. Specifically, how these five cognitive and social dimensions contribute to the development of employee expertise is unclear. Subsequently, little implication for use of the instrument is available for employees for how they can further advance their strength and improve their weakness.

The second instrument is Mieg's (2009) expertise measurement. Originally this instrument was developed based on Ericsson's (2006) expertise theory and consisted of four subscales: 3 items on superior performance, 3 items on deliberate practice, 3 items on

cognitive adaptation, and 1 item on professional engagement. However, unexpectedly, empirical data analysis revealed two major latent constructs: one is excellence and another is professionalism. The excellence factor refers to reliably superior performance that experts show in representative tasks in their expertise domain. The excellence construct originally implied that social recognition in a professional community cannot reflect individuals' true expertise (Ericsson, 2006). However, Mieg's (2009) study revealed that professionalism, which refers to professionals' engagement in activities related to the profession (e.g., taking on responsibility for our discipline), is a crucial dimension of expertise. Mieg (2009) regarded professionalism as activity to develop the profession itself and aimed for professional excellence, which consequently (re)defines and guides the development of individual expertise. Thus, this dimension can be particularly important in newly emerging professions for which sets of performance criteria need to be newly set up (e.g., environmental expert services in Switzerland). In addition, Mieg asserted that professionalism reflects perceived social recognition of expertise and can be a more salient dimension of expertise from others' point of view. Since employee expertise does not have a well-established domain of expertise and continuously evolves along with social changes, the two factor structure of the expertise scale implies that the professionalism dimension of expertise can be another core dimension of employee expertise. However, because Mieg's scale (2009) was initially designed to assess expertise in terms of individual excellence, it did not fully address the professionalism dimension and under which conditions individuals can enhance this social dimension of expertise.

The last instrument is Germain and Tejeda's (2012) Generalized Expertise Measure (GEM). This instrument was developed based on experts' perspectives on what are unique characteristics of experts in their own workplaces. GEM found two dimensions of expertise using both exploratory factor analysis and confirmatory factor analysis. One dimension is

objective expertise and another is subjective expertise. The objective expertise assesses accredited qualifications (e.g., receiving necessary education). Meanwhile, the subjective expertise is characteristics of experts perceived by others (e.g., can assess if the situation is important; is self-assured; is charismatic), which is similar to the social recognition dimension of Johanna and Van der Heijden's (2000) expertise scale. Subjective expertise suggests that employee expertise can't be separated from social relations in which an expert is embedded, as constituency in the model of expertise redevelopment (Grenier & Kehrhahn, 2008) indicates. Since GEM is based on others' perspectives, it provides an opportunity for employees to examine their social status as an expert in the field of expertise from an angle which is different from their own. However, without revealing the developmental mechanism of subjective expertise, as the authors warned, it can misguide employees to manipulate their image rather than to improve their true capacity.

In conclusion, these measurements consistently demonstrated that employee expertise consists of both individual attributes (e.g., knowledge, skills, qualification, etc.) and socially constructed attributes (e.g., social recognition). These instruments revealed essential dimensions of employee expertise that employees have to promote in order to perform well as an expert in their field. Although knowing crucial dimensions of employee expertise is important to gain insights for employee expertise development, the dimensions are assessed in a more evaluative manner than a descriptive or informative manner by the existing expertise instruments. For example, in Mieg's (2009) expertise scale, Mieg regarded deliberate practice as one general dimension of individual excellence, but its specific role in the trajectory of expertise development is not reflected in the scale. Thus, items pertaining to deliberate practice (e.g., I always strive to improve my expertise in our discipline) did not assess the specific aspects of deliberate practice that employees actually carry out. Further, as explained in previous sections, knowledge and skills are embedded in work experience and

social interactions (e.g., collaborative work) in the workplace and acquiring necessary knowledge and skills may involve a complex process associated with various developmental resources and mechanisms. Therefore, there is still a need for the development of a new measurement that explores developmental dimensions of employee expertise. Having incorporated recent theories and evidences that I reviewed in previous sections, I will now suggest three potential constructs of employee expertise development.

Three Constructs of Employee Expertise Development

Engagement in deliberate practice (EDP). Since Ericsson (1996) theorized that experts' superior performance can be achieved only by extensively engaging in deliberate practice, solid evidence for the role of deliberate practice in most of domains has been published (Hambrick, Oswald, Altmann, Meinz, Gobet, & Campitelli, 2014; Macnamara, Hambrick, & Oswald, 2014). However, as discussed in the introduction of psychological theories in expertise development, few studies (Sonnentag & Kleine, 2000; Unger, 2006) have investigated deliberate practice in the domain of employee expertise development. Furthermore, there are controversies over the conceptualization of employees' deliberate learning activities.

Sonnentag and Kleine (2000) studied the impact of deliberate practice on 100 insurance agents' work performance in their daily work contexts. Even after controlling for work experience, such as years of experience or amount of cases handled, they found that the amount of current time spent on deliberate practice accounted for a statistically significant amount of variance in performance ($R^2 = .06, p < .05$). Unger (2006) also found that the amount of deliberate practice activities had a direct effect on entrepreneur knowledge (path coefficient = .73, $p < .01$) of 90 business owners and an indirect effect on business growth through entrepreneur knowledge (path coefficient = .26, $p < .05$). These results indicated that deliberate practice is an important dimension in explaining employee expertise development.

Nevertheless, research showed that it is not easy to decide and assess what kinds of activities embody deliberate practice in the workplace. In both studies, the authors defined deliberate practice as an activity performed on a regular basis with a primary goal of competency improvement. On the other hand, Mieg (2006) defined it as “striving to improve one’s expertise,” “ambitiousness,” and “absorbedness by one’s work” in his expertise scale applied to environmental professions in Switzerland. Doornbos, Bolhuis and Simons (2004), in modeling work-related learning, coined deliberate learning by emphasizing aims of learning, but not regular practice. In her qualitative study, Grenier (2009) described docents’ continuous involvement in extensive independent reading as self-directed learning. These different conceptual approaches, however, share some common themes. First of all, individuals perform the activities of deliberate practice with the primary goal of learning to improve their expertise beyond the expectation of the workplace. Also, these activities require a certain degree of intensity of attention and effort, even though the degree of regularity or intensity can vary depending on specific work contexts. Based on these commonalities, I will define deliberate practice in this study, as a learning activity aiming at improving expertise that is strategically and purposefully performed with certain intensity in terms of attention and/or effort regularity.

Due to the intentionality of learning, Engagement in Deliberate Practice (EDP) can have unique contributions to employee expertise development. Besides acquiring advanced skills and knowledge beyond immediate needs, individuals can develop a general and conceptual foundation of expertise (Billet, 1999; Grenier, 2009; Paloniemi, 2006). Simons and Ruijters (2001) insisted that individuals can critically reflect and link their learning from/through work to broader contexts by involving explicit learning activity to focus on concepts, ideas, research outcomes, and theories inside and outside the profession. In this way, deliberate practice can aid expertise to transfer across contexts (Cheetham & Chivers,

2001).

Developmental work experience (DWE). Whatever fields of expertise individuals pursue, the process of expertise development can be career-long engagement in ongoing goal-directed activity (Billett, 1999). In fact, the emerging theme in the previous review on the workplace learning and new theoretical frameworks in expertise development is that employee expertise development is situated in the work experiences. Particularly, Billett (2004, 2008) qualified work experiences as intentional and structured learning experiences.

Empirical studies have repeatedly reported that learning through/from work experience is a key mechanism of employee expertise development (e.g., Cheetham & Chivers, 2001; Dragoni, Oh, Vankatwyk, & Tesluk, 2011; Enos, Kehrhahn, & Bell, 2003; Grenier, 2009; Paloniemi, 2006). A meta-analysis study showed that the amount of work experience has moderate correlation with performance in general (the mean estimated population correlation, $M\hat{p} = .43$) (Quiñones, Ford, & Teachout, 1995). Dragoni, Oh, Vankatwyk, and Tesluk's study (2011) reported a combination of a variety in roles with amount of experience has stronger impact (7% of explained variance) than either years of work experience (4.1%) or times in a lead role (1.2%) in predicting strategic thinking competency of 703 executives. Sturman's (2003) meta-analysis study showed that the advantage of work experience on performance can change over time and according to job complexity. For high complexity jobs, years of experience consistently have a strong relationship to performance over the years (e.g., $r = .36$ for the sample with 15 years of experience on average); however, the relationship tends to weaken over time for low complexity jobs ($r = -.01$ for the sample with 15 years of experience on average).

Meanwhile, qualitative studies revealed the types of work experience have formative value in developing expertise, that is, Developmental Work Experience (DWE). Like deliberate practice, which is especially designed to enhance expertise, unique characteristics

of experiences that have significant developmental values may enhance expertise development (e.g., Cheetham & Chivers, 2001; Goldman, 2008). Goldman (2008) found that significance in size and complexity, proactivity, newness, regularity, and intensity of focus were the common characteristics of valuable experiences in developing strategic competence among 10 CEOs in the health care industry. In a mixed method study with 452 participants from 20 different professions, Cheetham and Chivers (2001) revealed that beneficial work experience embodied the stretching and challenging nature in achieving tasks. Despite the differences in fields of expertise, other researchers also reported similar findings, including: variety in experience (Paloniemi, 2006), taking on valuable and challenging tasks (Eraut, Maillardet, Miller, Steadman, Ali, Blackman, & Furner, 2004), dealing with abnormal work situation (Billet, 1999), and exploring new strategies to solve imminent problems in business (O'Shea & Buckley, 2010). In other words, newness, variability, and challenges in experience may be key characteristics of developmental work experience across studies.

DWE pushes individuals to move “out of your comfort zone to broaden your horizons” (van Winkelen & McDermott, 2010, p. 564), similar to the aims of deliberate practice. However, unlike designing deliberate practice, an individual is not the only intentional participant in learning. The workplace itself has its own purpose and goals (Billett, 2004, 2008). In other words, individuals can't obtain total control of learning embedded in work experiences in terms of learning goal, learning process, and learning outcomes (Doornbos, Bolhuis, & Simons, 2004). The primary goal of those developmental experiences is to accomplish a task, not to learn or practice targeted skills or knowledge. Learning from DWE is a byproduct of work and often implicit in nature (Marsick & Watkins, 2001). Through DWE, employees can enhance contents of expertise territory and better adapt to environment in the territory (Grenier & Kehrhahn, 2008) by learning situated knowledge. Also, work experience can guide individuals to focus on more relevant information and better understand

theoretical knowledge that they learned through formal education (Paloniemi, 2006). As such, newness and challenges in work experience characterize DWE. The unique value of DWE is in optimizing one's expertise in the workplace and directing further advances in expertise development.

Learning in professional networks (LPN). The literature review consistently demonstrated the importance of social relations in employee expertise development. In particular, changes in individuals' relationship to the communities of practice (Lave & Wenger, 1991) need to be properly addressed. In regard to this, more recent research has highlighted that employees participate in individualized interactions and practice across various professional networks to enhance their career and expertise (e.g., networks of practice, Brown & Duguid, 2001).

Gruber, Lehtinen, Palonen and Degner (2008) suggested assessing growth of social networks as an indicator of an individual's expertise development. In their qualitative study, Gruber et al. (2008) found that all three experts from different domains (e.g., a jazz musician, a scientist, a business consultant) made considerable efforts to build networks with other experts over time, in particular, at critical points in their career. Other researchers (Eraut, 2004; Grenier, 2009; van Winkelen & McDermott, 2010) in the field of workplace learning recognized prominent developmental values of participation in social contexts through individuals' professional networks both inside and outside the workplace that is, Learning in Professional Networks (LPN). For example, Eraut (2004) reported that three of 4 main types of work activity accounted for a very high proportion of the reported learning: participation in group activities, working alongside others, and working with clients. In developing docents' expertise, Grenier (2009) found that participants learned new approaches and information through observation, shadowing, and modeling and exchanged information with others. In van Winkelen and McDermott's study (2010), experts from various fields emphasized the

critical roles of being mentored or working with well-regarded experts in the process of being an expert.

Although a large portion of LPN can take place while doing work, it may involve a unique value in developing employees' expertise distinguished from DWE. Focusing on individuals' social network, Gruber and colleagues (2008) illuminated that people in a professional network, whom they called persons in shadow, play critical role in individuals' career-long engagement with deliberate practice. Persons in shadow can help to set a specific goal of deliberate practice at a particular point of time, guide/train the individuals, and co-construct excellence in performance along with the individuals, whether or not they have a formal role as a coach or a mentor. The facilitating role for deliberate practice is a relatively new aspect of developmental relations. Research regarding mentoring (e.g., Higgins, Dobrow, & Roloff, 2010; Higgins & Kram, 2001) have focused on mentors' developmental assistance for career (e.g., visibility, exposure, sponsorship and protection) and psychological (e.g., friendship, counseling, acceptance and confirmation, and sharing beyond work) support. Meanwhile, there are only few research on mentoring which have examined the relationship between mentoring and learning. In these studies, however, learning was about enhancing interpersonal skills to facilitate individuals' development (e.g., competencies of self-reflection, self-disclosure, etc.) (Lankau & Scandura, 2002; Pan, Sun, & Chow, 2011). This interpersonal skill learning is more associated with enhancing employees' psychological competency rather than developing expertise.

Additionally, developmental relations (e.g., mentoring, coaching, and apprenticeship) can vary extensively depending on the characteristics of the relations such as characteristics of interaction, purposes of interaction, and degree of structure. (D'Abate, Eddy, & Tannenbaum, 2003), which can have different developmental values. For example, Cheetham and Chivers's (2001) mixed study implemented a survey to 372 practitioners from 6

professions (i.e., dentistry, accountancy, the civil service, chartered surveying, the church, and training) to examine the contribution of various methods of informal learning on professional competence. They found that working with more experienced colleagues was one of the major influences ($M=3.93 \pm 0.11$, on 5 Likert scale), but mentor support ($M=3.11 \pm 0.28$) and the use of role models ($M=2.66 \pm 0.14$) were of relatively weak influence in terms of development of professional competence. In the same study, qualitative data analysis revealed that individuals' experience varied substantially (e.g., imposed mentoring vs. self-selected mentoring) even in the same form of developmental interactions. Also, closeness and intensity in interactions were characteristics of the successful relations (e.g., providing on-going feedback on how they were doing). Given this diversity in the form of developmental relations, it would be valuable to investigate what characteristics of developmental relation are more salient in developing employee expertise.

Another unique value of LPN resides in its potential to extend one's boundary of expertise in horizontal or sideways directions (Weisberg, 2006). In explaining his expansive learning theory, Engeström (2001) argued that the object of learning in the workplace is often not determined ahead of a learning activity. Rather individuals continuously construct and expand the object of learning based on collective interpretation and personal sense making, and societal transformation through participating in a collective activity. As a result of expansive learning, individuals can respond to the situation or problems in more enriched ways. In addition, studies emphasized the positive impact of boundary crossing on expanding knowledge and skills (Tynjälä, 2008). For example, external networks can facilitate the sharing of ideas and stimulating creative thinking (van Winkelen & McDermotts, 2010) and multi-disciplinary working can have individuals learn different ways of doing and thinking (Cheetham & Chivers, 2001; Collin & Valleala, 2005). As the Trio Model (Sheckley et al., 2007) and Eraut's workplace learning model (2004) put emphasis on feedback and supports

from environment, research introduced previously commonly demonstrated that LPN is a rich resource of feedback and supports in developing expertise.

In sum, scholarship around LPN implies that expertise development is not merely an accumulation of knowledge in a repository (an expert), but rather a continuous process of sharing and constructing knowledge among social networks (van Winkelen & McDermott, 2010). This continuous process can result in the creation of new knowledge and/or perspective changing, as well as knowledge acquisition through various forms of LPN.

Chapter Conclusion

In the problem statement, I proposed the need for the development of a new instrument reflecting the dynamic process of the development of employee expertise. A comprehensive literature review clearly showed that development of employee expertise is a multi-dimensional construct that involves both individual (e.g., deliberate practice) and social developmental processes (e.g., professionalism). Existing theories based on psychological principles, such as deliberate practice (Ericsson, 2006), are well-established foundations for explaining individual developmental process of expertise. However, conditions surrounding employee expertise indicate that even the process of individual development is socially constructed. In particular, the boundaries of employee expertise across organizations and fields are becoming increasingly blurred. Also, social networks become a crucial resource for, or mediator of, expertise development. In addition, situated learning theories in the workplace have highlighted the central role of work practice (e.g., networks of practice, Brown & Duguid, 2001) as a structured learning activity (Billet, 2004, 2008). Lastly, expertise (development) theories from a constructivist perspective (Mieg, 2006; Grenier & Kehrhahn, 2008) assert that the developmental process of individual expertise is more than simple acquisition of knowledge and skills established by others and involves the process of social legitimization of expertise through practicing expertise in particular contexts. Existing

instruments to assess employee expertise specified various non-social and social dimensions of employee expertise. Taken all together, an individual employee is expected to engage in numerous dynamic interactions among environment, work practice, and people surrounding employee expertise to develop his or her expertise. However, it is still unclear how an individual employee navigates the ever-changing territories of employee expertise, and which specific activities they participate in to develop expertise in the territories. Thus, I proposed three general dimensions of a developmental process of employee expertise: Engagement in Deliberate Practice (EDP), Developmental Work Experience (DWE), and Learning in Professional Networks (LPN). These serve as the three dimensions of the Employee Expertise Development Scale (EEDS) that this study developed. With this conceptual framework, I generated two research questions to guide the development of the EEDS:

Research Questions

RQ1: What are the general dimensions of employee expertise development?

RQ2: To what extent can the general dimensions of employee expertise development be confirmed across various work settings?

Chapter Two

Methods

This chapter presents methods used for development of the EEDS in order to address two research questions:

RQ1: What are the general dimensions of employee expertise development?

RQ2: To what extent can the general dimensions of employee expertise development be confirmed across various work settings?

Based on the extensive literature concerning expertise development and workplace learning, a construct model for employee expertise development was developed and its three dimensions include: Engagement in Deliberate Practice (EDP), Developmental Work Experience (DWE), and Learning in Professional Networks (LPN). This chapter explains the methodology for developing and validating an instrument to assess this construct model using an employee sample. It outlines the research design, participant characteristics, data collection procedure, data analysis procedure, and limitations of the methods used in the present study.

Research Design

In this study, I employed an exploratory sequential mixed methods design (Creswell, 2012) to answer the research questions because there is currently no instrument in the extant literature that assesses dimensions of employee expertise development. Initially, qualitative data was obtained to design the Employee Expertise Development Scale (EEDS) and subsequently the designed instrument was administered to additional sets of sample to quantitatively validate its construct validity.

Samples were recruited from any for-profit or non-profit organization that offers opportunities and resources in any forms for employee expertise development. This study consisted of four phases; qualitative data collection (Phase I), content validation (Phase II),

and two phases of quantitative data collection (Phase III and IV). The four phases are described in detail in the following sections.

Participants

The phase I qualitative study. I recruited 46 anonymous employees from for-profit business organizations and academic institutions. The participants held a bachelor's degree or higher and had at least 2 years of work experience after college graduation in their primary field of expertise (Table 1 & 2). Responses from 46 participants showed data saturation in terms of emerging themes. Approximately half of the participants were female (54.3%) and 76.1% of the participants had bachelor's or master's degree. Three major occupational categories of the participants were Computer, Engineering and Science occupations (21.7%), Education, Training, and Library occupations (19.6%), and Healthcare practitioners and Technical occupations (13.0%). Average professional tenure (years of experience) was 9.3 years. Means of self-rated performance using self-defined expertise as a reference and self-rated performance using objective criteria as a reference were respectively 7.8 and 8.3 on a 1 to 10-likert scale.

The phase II content validation. A content validation survey was initially distributed to 12 subject matter experts, and eight of them completed the survey. The eight experts held either a Ph.D. ($n = 7$) or Ed.D. ($n = 1$) and had expertise in adult/workplace learning or human resource development. All of them had experience in both practical and academic practices in relevant fields for at least 10 years.

Table 1

Participants' demographics by study phase

	Phase I ^b N=46	Phase III ^c N=272	Phase IV N=186	Sub-Total ^d N = 458
Variables	N (%)	N (%)	N (%)	N (%)
Recruit ^a				
Commercial online site	25 (54.3)	235 (86.4)	186 (100)	421 (91.9)
Personal networks	21 (45.7)	37 (13.6)	n/a	37 (8.1)
Gender				
Female	25 (54.3)	156 (57.4)	105 (56.5)	286 (56.7)
Male	21 (45.7)	113 (41.5)	81 (43.5)	215 (42.8)
Age				
23-29	n/a	31 (11.4)	32 (17.2)	63 (13.8)
30-44	n/a	101 (37.1)	68 (36.6)	169 (36.9)
45-60	n/a	106 (39.0)	74 (39.8)	180 (39.3)
Over 60	n/a	32 (11.8)	12 (6.5)	44 (9.6)
Ethnicity ^e				
Hispanic or Latino	n/a	14 (5.1)	14 (7.5)	28 (6.1)
American Indian or Alaska Native	n/a	0 (0.0)	1 (0.5)	1 (0.2)
Asian	n/a	21 (7.7)	17 (9.1)	38 (8.3)
Black or African American	n/a	14 (5.1)	15 (8.1)	29 (6.3)
White	n/a	211 (77.6)	132 (71.0)	343 (74.9)
Multiracial	n/a	6 (2.2)	7 (3.8)	13 (2.8)
Education				
Undergraduate degree	18 (39.1)	118 (43.4)	102 (54.8)	220 (48.0)
Some graduate school	3 (6.5)	31 (11.4)	15 (8.1)	46 (10.0)
Completed Master's Degree	17 (37.0)	88 (32.4)	57 (30.6)	145 (31.7)
Completed terminal degree (e.g., Ph.D., J.D., etc.)	8 (17.4)	33 (12.1)	12 (6.5)	45 (9.8)
Variables	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>	<i>M(SD)</i>
Years of Experience ^f	9.3 (8.3)	16.7(11.2)	13.8 (9.9)	15.5 (10.7)
Self-reported Performance ^g				
Expert-reference	7.8 (1.3)	7.9 (1.3)	7.8 (1.4)	7.9 (1.4)
Objective criteria	8.3 (1.3)	7.9 (1.5)	8.0 (1.4)	7.9 (1.5)

(Table continued)

Notes. a. See procedures section for details. b. In phase I, age and race/ethnicity information were not collected. c. There were two participants who missed all the demographic questions (total valid N for phase III = 270), although the two participants appropriately responded to the questions qualifying study participation. The number of participants who selected 'I prefer not to respond' was 1 (0.4%) for gender and 4 (1.5%) for race/ethnicity. d. I combined participants from phase III and phase IV. e. No response on both Native Hawaiian or Other Pacific Islander and other category in phase III and phase IV survey. f. A range of Years of Experience was 2~38 for phase I, 1~48 for phase III, and 1~45 for phase IV. g. Self-reported Performance variable is based on a 1 to 10-Likert scale (higher score indicate a higher level of

performance). Expertise-reference is a self-reported rating on an individual's current level of performance in terms of his/her own concept of expertise, while Objective criteria is a self-reported rating on an individual's current level of performance in terms of his/her supervisor's appraisal or a previous official performance appraisal in the workplace.

Table 2

Fields of expertise by study phase

	Phase I ^b N=46 N (%)	Phase III ^c N=272 N (%)	Phase IV N=186 N (%)	Total N=504 N (%)
Field of Expertise ^a				
Management occupations	5 (10.9)	23 (8.5)	20 (10.8)	48 (9.5)
Business and Financial Operations occupations	4 (8.7)	30 (11.0)	19 (10.2)	53 (10.5)
Computer, Engineering and Science occupations	10 (21.7)	46 (16.9)	31 (16.7)	87 (17.3)
Community, Social Service, Legal Arts, Design, Entertainment, Sports, and Media occupations	3 (6.5)	25 (9.2)	18 (9.7)	46 (9.1)
Education, Training, and Library occupations ^c	9 (19.6)	69 (25.4)	31 (16.7)	109 (21.6)
Healthcare practitioners and Technical occupations	6 (13.0)	13 (4.8)	9 (4.8)	28 (5.6)
Service occupations	2 (4.3)	19 (7.0)	14 (7.5)	35 (6.9)
Sales and related occupations	2 (4.3)	13 (4.8)	19 (10.2)	34 (6.7)
Office and Administrative Support occupations	4 (8.7)	18 (6.6)	13 (7.0)	35 (6.9)
Natural Resources, Construction, and Maintenance occupations	1 (2.2)	9 (3.3)	7 (3.8)	17 (3.4)
Production, Transportation, and Material Moving occupations	0 (0.0)	5 (1.8)	4 (2.2)	9 (1.8)
Military Specific occupations ^c	0 (0.0)	0 (0.0)	1 (0.5)	1 (0.2)

Notes. a. In order to reduce the number of fields, I re-categorized the fields of expertise using the Integrated Postsecondary Education Data System (IPEDS) of Human Resources (HR) occupational categories. IPEDS is a system of various surveys administered annually by the U.S. Department's National Center for Education Statistics (NCES). The IPEDS HR categories were revised to align with the 2010 Standard Occupational Classification (SOC) System in 2013. c. Education, Training, and Library Occupations and Military Specific Occupations followed the 2010 SOC system. b. In phase I, I used an open-ended question to ask participants' field of expertise and the responses were classified based on the same occupation categories (i.e., IPEDS HR) used for following study phases. c. Valid N = 270.

The phases III and IV quantitative studies. After reviewing the results of the phase I qualitative study, I modified the participant inclusion criteria for the quantitative data collection for phases III and IV. First, employees who work in the U.S. were exclusively recruited. Additionally, participants in the quantitative study were full-time employees in any for-profit or non-profit organizations who held a bachelor's degree or higher. Also, they had at least 1 year of work experience before, during, or after college graduation in their primary field of expertise. These inclusion criteria were used for the following reasons. Most of

participants in previous studies about expertise development in the workplaces were qualified professionals such as managers or engineers. Thus, in order to recruit a comparable sample to previous studies, academic degree (bachelor's degree or higher) was used as a proxy for determining the participant's qualification in her or his profession. Only full-time employees were included for subsequent phases because the full-time employment setting might be the most common and representative context of occupation- or profession-related expertise development. Plus, participants with at least one year of experience in one's field of expertise were considered because it may take some time (i.e., minimum one year) for one's expertise developmental process to be on track.

I recruited 329 participants for phase III, and 233 participants for phase IV. By reviewing the patterns of participant responses, I eliminated 57 (17.3%) participants from phase III and 47 (20.2%) participants from phase IV sample (see data collection procedures for detail). The rates of careless responses, such as endorsing the same rating category for the equal items worded in opposite direction, were higher than the rate 10% - 12% reported by Meade and Craig (2012) using an undergraduate sample. This difference can be attributable to the differences in participant recruiting methods (i.e., participants signed up for a study vs. participants from the online recruit site) and the specific method of detecting careless responses. Final data sets of 272 participants for phase III and 186 participants for phase IV were utilized for analysis. These final sample sizes met the Cattell's (1978) criteria for the minimum sample size for factor analysis, which is that the number of observations for each variable (N) needs to be at least 6 times greater than the number of variables (p) (i.e., $N \geq p \times 6$). In the present study, the number of the initial EEDS items (variables) was 46 and the number of the revised EEDS items (variables) was 30.

Demographic information of the participants of phases III and IV are respectively presented in tables 1 and 2. Slightly more female were recruited for both phase III (57.4%)

and phase IV (56.5). Approximately half of the participants fell in the age categories of 23-29 and 30-44 (48.5% for phase III and 53.8% for phase IV) and held an undergraduate degree (43.3% for phase III and 54.8% for phase IV). The majority of the participants were white for phase III (77.6%) and phase IV (71.0%). On average, years of work experience was 16.7 (SD=11.2) for phase III and 13.8 (9.9) for phase IV. In both samples, self-rated performance using self-defined expertise as a reference (M=7.9, SD=1.3 for phase III; M=7.8, SD=1.4 for phase IV) was comparable to self-rated performance using others' appraisal as an objective-reference (M=7.9, SD=1.5 for phase III; M=8.0, SD=1.4 for phase IV).

Also, demographic characteristics of the sample across phases III and IV were compared. Distribution of the gender, race/ethnicity, and age group in the phase III sample was not significantly different from the phase IV sample with $\chi^2(1, N=455) = .11$ ($p = .74$) for gender, $\chi^2(6, N=456) = 8.54$ ($p = .20$) for race/ethnicity, $\chi^2(3, N=456) = 5.97$ ($p = .11$) for age group. Distribution of the fields of expertise in the phase III sample was not significantly different from the phase IV sample with $\chi^2(9, N=456) = 9.60$ ($p = .38$). Phase III sample was not significantly different from the phase IV sample for either self-reported performance using expertise reference, $t(454) = .69$ ($p = .49$) or self-reported performance using objective criteria $t(454) = -.10$ ($p = .92$). However, distribution of education level in the phase III sample was significantly different from the phase IV sample with $\chi^2(3, N=456) = 7.95$ ($p = .047$). The phase III sample exhibited significantly longer years of experience than the phase IV sample, $t(454) = 2.80$ ($p < .01$). In conclusion, the phase III sample tended to have slightly longer years of experience and higher education level than the phase IV sample, but except for the two variables, both samples were quite comparable (See Tables 1 and 2).

Lastly, the EFA and CFA samples recruited in this study would be a legitimate representation of U.S. knowledge workers (e.g., professionals) in terms of demographic characteristics such as gender, ethnicity, and age. According to the 2013 statistics of U.S.

Equal Employment Opportunity Commission, professionals from private industry in U.S. composed of more females (53.38%) than males (46.62%), and white (73.57%) were majority in this group. In addition, the median age of the US labor force as of 2012 ranged from late thirty to early forty (Bureau of Labor Statistics, 2013).

Data Collection Procedures and Instrumentation

Phase I Qualitative study and initial item generation. As an exploratory sequential mixed methods design, the first step of this study was qualitative data collection using an online open-ended survey. This survey included six open-ended questions about how participants develop their expertise and several demographic questions (Appendix G). After initial IRB was approved, twenty-five participants were recruited through Amazon Mechanical Turk¹. To achieve maximum variation in the sample (Merriam, 2009), I also used a purposeful sampling approach (Creswell, 2012) by collecting data through my professional networks in and outside the University of Connecticut from April to June, 2014, until data saturation was achieved.

The next step in developing the EEDS was to operationalize the constructs by generating items. Based on the emerged themes and individuals statements from the phase I qualitative data (see analysis and result section for detail) along with a comprehensive literature review, I initially developed 88 items for the three constructs of the Employee Expertise Development Scale: Engagement in Deliberate Practice (EDP), Developmental Work Experience (DWE), and Learning in Professional Networks (LPN). In order to develop an item pool, I rephrased the line-by-line coding from the qualitative data into item stems and

¹ The Mechanical Turk is an Amazon.com-affiliated website that a researcher can recruit participants in return for small financial reward (e.g., 60 cents for completing a brief survey). Internet samples are shown to be more diverse than those from traditional methods, in regard to gender, socioeconomic status, geographic region, and age (Buhrmester, Kwang, & Gosling, 2011; Gosling, Vazire, Srivastava, & John, 2004). Moreover, empirical studies have shown that the data collected from internet is as much reliable as those collected in traditional method (Buhrmester, Kwang, & Gosling, 2011; Gosling, Vazire, Srivastava, & John, 2004).

created items from literature as well. In order to maximize variability in contents, I included rare responses from qualitative data and literature (e.g., “I make an effort to increase my professional reputation by presenting my ideas or accomplishments at meetings or in journals”), as well as responses reported in a higher frequency (e.g., “I take part in professional meetings, conferences/conventions, or webinars on a regular basis”) in the item pool. Although the specific experiences concerning the participants’ responses were asked for, these experiences were too concrete to properly represent the overarching features of the construct, particularly for the construct DWE (e.g., “due to a new website being introduced that lacked the encrypting ability of the previous website, we had to devise a new system for collecting applicant data that would support the privacy of social security number”). Thus, stems of items in DWE were more theoretically driven (e.g., “I experience a wide range of work situations”; “my work includes dilemmas or challenges”).

To minimize response bias due to social desirability, stems of items were designed to be action-oriented (e.g., “I *thoroughly examine* fundamental knowledge to get to the core of a matter”; “I *proactively modify* my work approach in order to develop the best practice”), instead of asking individuals’ willingness or intention to do those activities. After the generation of approximately 88 items, I had several discussions with other subject matter expert researchers on employee expertise to discuss the overall conceptualization of the constructs as well as the content of the individual items. Through the discussions, item wordings were revised and some items were omitted. Finally, 66 items were included in the content validation survey for phase II study.

Phase II content validation. Content experts were selected based on their fields of expertise and professional experiences in the given field. A content validation survey was administered to the eight content experts in either online survey or paper/pencil format. The content validation survey was designed to assess the relevance of the 66 EEDS items to the

three given constructs (Appendix H). Respondents were asked to judge items' relevance to one of the three construct and to report the degree of confidence in their judgment. Also, the content experts were asked to rate the degree of relevance of individual items to the given construct. Subsequently, qualitative feedback regarding the items was gained from the content experts. Based on the information, the 45-item version of the EEDS was created for the phase III (Appendix I); 14 items for EDP, 13 items for DWE, and 18 items for LPN (See the result section and table 5 & 6 for detail).

Phase III quantitative study. After IRB amendment² was approved, I recruited participants to collect data for exploratory factor analysis through SurveyMonkey website, UConn email listservs, and my personal networks for two weeks, from December 1 to December 15 in 2014. SurveyMonkey (<https://www.surveymonkey.com/>) provides an online survey platform and screened participant pool according to the inclusion criteria (for details, see the participant section). Small financial incentives³ were offered to the respondents in return for the completion of a survey. The survey for phase III study consisted of the 45 items of the EEDS, four demographic questions, two questions regarding self-reported performance (i.e., a self-reported performance with expertise reference, a proxy expertise criterion; a self-reported performance with objective reference, a proxy performance criterion), three questions regarding organizational characteristics (availability of developmental opportunities, accessibility of developmental opportunities, and organizational support in developing employee expertise), and one question about the personal motivation in developing expertise. The three organizational questions and one motivation question aim to

² IRB amendment included changes in methods recruiting participants (e.g., using the surveyMonkey website instead of the Mechanical Turk) and revision in a questionnaire used for data collection.

³ The author paid for the company service at the rate of 7.5 U.S. dollars per one participant. The service cost included incentives for the participants. The company, not the author, compensated participants who completed the survey, according to the company's internal policy.

assess workplace contexts that may affect employee's expertise development experience, assessed by the EEDS. The EEDS used a 7-point Likert scale. All other background questions, except for demographic ones, used a 10-point Likert scale.

In addition, in order to screen out careless responders, I utilized the response consistency approach. Meade and Craig (2012) introduced various ways to detect careless responders in self-reported surveys, and the response consistency method is one of the most popular methods. It compares an individual's responses to paired items that "are highly similar either based on their designed function (i.e., which construct the item was written to measure) or based on empirical correlations among items" (Meade & Craig, 2012, p. 339). If a respondent exhibits inconsistent responses across the paired items then the respondent can be considered as a careless respondent. Meade and Craig suggested that approximately one to three paired items in every 50-100 items would be used to detect careless respondents. In the present study, two consistency-checking items were included in the EEDS of 45 items. These consistency-checking items (#3 and #23; see Appendix I) asked the same contents of question phrased in an opposite way. Every respondent who endorsed ratings in the same direction to the two items in reverse direction was detected. Additional response pattern that was considered to be careless in the present study was the rating on four (indicating neither agree nor disagree on a 7-point Likert scale) for almost all of the EEDS items. By applying these screening criteria, 57 (17.3%) careless responses were rigorously omitted from the sample. After data cleaning, exploratory factor analysis and reliability analysis were conducted using data from 272 participants, and the EEDS was revised into a 30-item version for phase IV (for detail, see the data analysis section and results section).

Phase IV quantitative study. After the second IRB amendment that addressed changes in the EEDS items following EFA was approved, I recruited participants through SurveyMonkey site for one week, from February 6 to February 12 in 2015, using the same

inclusion criteria of phase III. Additionally, respondents who already participated in phase III were deliberately not allowed to participate in phase IV study. The survey used for phase IV included the revised version of the 30-item EEDS scale, which is resulted from exploratory factor analysis (for detail, see the result section) and the same ten background questions that I used for phase III (see Appendix J). Similar to the phase III survey, two response consistency-checking items, #3 and #19, were used and were of the same contents but worded in an opposite direction. All other subsequent procedures were the same with the phase III procedure. Using the same criteria with phase III, I eliminated 47 (20.2%) careless respondents from the obtained data. Data from 186 participants used for confirmatory factor analysis to address the second research question.

Data Analysis

Phase I qualitative study. The purpose of the qualitative data analysis was first to confirm the three dimensions emerged from literature review and found themes to characterize the three dimensions: Engagement in Deliberate Practice (EDP), Developmental Work Experience (DWE), and Learning in Professional Networks (LPN). Also, based on the emerging themes, phase I study aimed to generate items from individual statements of the data and literature. In order to develop themes, I applied a general inductive approach for analyzing qualitative data introduced by Thomas (2006). It is similar to the analysis strategies of Grounded Theory, but does not require two explicitly separate coding processes such as open coding and axial coding. Also, constant comparative analysis methodology was conducted (Merriam, 2009). I used line-by-line coding for closer examination of individual statements. Theoretical knowledge and the three-dimension-framework reviewed in the introduction were used to link categories that emerged from analysis. Data analysis concluded when data saturation was achieved, indicating that no new information emerged (Merriam, 2009).

Phase II content validation. For each item, I computed the percentage of correct item-construct categorization across the eight content experts. I also computed the means for the perceived certainty level in item-construct categorization and the perceived level of item-construct relevance only for the correctly categorized items. Recommendations of McCoach, Gable, and Madura (2013) were utilized as decision criteria (See the content validation result section for detail).

Phase III quantitative study. In this phase, I conducted Exploratory Factor Analysis (EFA) and reliability analysis. Factor analysis is a statistical method “to determine whether the internal structure of the instrument appears to be consistent with the hypothesized structure of the instrument” (McCoach, Gable, & Madura, 2013, p. 110). In particular, EFA explores the dimensionality (i.e., factor structure) of the EEDS by analyzing correlations among set of items. EFA was conducted using 272 participants who reliably completed the survey. Since the purpose of this analysis is to identify underlying constructs (latent variables) from the data, instead of simply reducing observed variables into smaller sets of variables, principal axis factoring (PAF) method was used to extract factors. It was expected that the three dimensions of the EEDS, all reflecting distinct, but closely related aspects of expertise developmental processes, are correlated to one another. Therefore, oblique rotation (direct oblimin) was utilized in order to allow correlations among the factors.

In order to examine each factor’s internal consistency reliability, I computed Cronbach’s alpha (1951). I also examined other item- and scale-level statistics (e.g., inter-item correlations, IICs). PASW (SPSS) 17 was used for EFA and reliability analysis.

Phase IV quantitative study. Confirmatory Factor Analysis (CFA) was followed using a new sample of employees (N = 186). CFA has several advantages over EFA (McCoach, 2002; McCoach, Gable, & Madura, 2013). First, in EFA, the researcher cannot control the linkage between indicators (items) and factors; however, in CFA, the researcher

can specify a priori an item to act as an indicator of only one factor. In addition, CFA permits empirical comparison the goodness of fit across several alternative models. Finally, CFA takes into account both model fit and parsimony by rewarding the most parsimonious model, if there are no statistical differences among the competing models.

Amos 17.0 was used to analyze the data. The CFA model was specified based on the four-factor structure emerged from EFA (see CFA result section for detail). Standard CFA procedure was used; each item is an indicator of only one factor; all factors are interrelated to each other; error terms are independent from each other. Maximum likelihood estimation was used for the CFA. Since the objective of CFA was to test how well the empirical data fits the hypothesized CFA model. McCoach (2002) introduced Kline's (1998) criteria to evaluate a priori CFA model; (a) all indicators specified to measure a common underlying factor should have relatively high structure coefficients on the corresponding factor (e.g., $> .60$); (b) estimated correlations between the factors should not be overly high (e.g., $> .85$). In addition, several model fit indices were used to evaluate the goodness of fit between the initial and respecified models. Since various elements, such as sample size, model complexity, and the number of indicators can differently affect fit indices, it is recommended to present model fit indices from multiple fit categories (e.g., absolute fit, incremental fit) (Hu & Bentler, 1999; McCoach et al., 2013). The Comparative fit index (CFI), the root-mean-square error of approximation (RMSEA), and the standardized root-mean-square residual (SRMR) were reported in this study. The chi-square statistics with its degrees of freedom was also reported. CFI was chosen, because they are incremental fit indices that measure proportionate improvement in fit of the specified model relative to a nested baseline model (Hu & Bentler, 1999). RMSEA and SRMR were chosen because they are absolute fit indices that assess the extent to which an a priori model reproduces the sample data and value of 0 indicates perfect fit. Hu and Bentler (1999) suggested that CFI values close to .95 indicate a relatively good fit

between the specified model and the observed data. CFI values below .90 indicate that the specified model does not fit to the data satisfactorily (McCoach et al., 2013), while CFI values of .90 or above is generally considered acceptable (Brown, 2006). RMSEA values of approximately .06 or below and SRMR values of approximately .08 or below indicate an acceptable level of fit (Hu & Bentler, 1999; McCoach et al., 2013). The chi-square test produces an overall measure of fit for the CFA model, but it is particularly sensitive to sample size. Therefore, a CFA model with a large sample may tend to have a statistically significant chi-square, “even if there is a trivial amount of data misfit” (McCoach et al., 2013, p. 148).

Also, parameters of the model, the residual matrix, and the standardized residual covariance matrix were examined to determine whether any paths need to be respecified and whether any items need to be eliminated to improve the model fit. Special attention was given to the items that indicated the hint of multidimensionality (i.e., cross-loading) at some degree in EFA results. These items were also detected to be problematic in terms of the standardized residual covariance (values over 2). Thus, I determined to eliminate these items from the initial model, rather than specifying additional paths or covariances between error terms to keep the construct model as brief as possible and to keep conceptual distinction across the factors. Finally, a revised model was tested using a standard CFA procedure and goodness of-fit indices were reported.

Using the final factor structure, an internal reliability statistics Cronbach’s alpha (Cronbach, 1951) were calculated using a combined sample ($N = 458$) that included both phase III sample ($N = 272$) and phase IV sample ($N = 186$).

In order to further examine the construct and criterion validity of the EEDS, I conducted additional analyses using the combined sample ($N = 458$). One-way ANOVA was conducted to test whether the differences in factor means across fields of expertise were

statistically significant. A Bonferroni adjustment (Dunn, 1961) was applied, given the number of tests conducted. In this study, the adjusted alpha was .0125 (i.e., typical p -value of significance / number of groups = $.05 / 4 = .0125$). Post hoc comparisons on the significant variables were performed using the Bonferroni method to control the overall significance level for comparisons made. Next, I conducted correlation analyses between four factors of the EEDS and other variables that might serve as potential criteria for expertise development and be related to the context of expertise development process (i.e., three organizational variables, motivation, years of experience, and two measures of self-reported performance). Finally, as a preliminary criterion validity analysis, I conducted a series of hierarchical multiple regression analyses to examine the extent to which each of the four factors of the EEDS explains employees' self-reported performance after controlling three organizational variables, years of experience, and motivation. Two self-reported measures of performance were used as a dependent variable in multiple regression analyses, respectively. Kuchinke (1997) argued that not only expertise, but also other contextual elements can affect an individual's level of performance. Thus, among two self-reported measures of performance, the self-reported performance using expertise-reference could be a more direct indicator of employees' expertise development than the self-reported performance using others' appraisal as objective-reference. I used enter method as variable entry method for the hierarchical multiple regression, because the enter method does not require the researcher to predict the relative importance of predictors in advance.

Chapter Three

Results

This chapter presents results of the study. First, two sections present the results of the phase I qualitative study and the phase II content validation, and describe dimensions of the initial EEDS that emerged from qualitative data and experts judgment. Then, Exploratory Factor Analysis (EFA) results are presented. These three sections focus on addressing the first research question: What are the general dimensions of employee expertise development? Subsequently, Confirmatory Factor Analysis (CFA) results are presented to address the second research question: To what extent can the general dimensions of employee expertise development be confirmed across various work settings? Also, I present results of the additional analyses to further examine the validity of the final EEDS. These results are relevant to the second research question.

Results of the Phase I Qualitative Study

The purpose of the phase I study was to confirm the general dimensions underlying expertise development experience based on literature reviews and to collect the participants' expressions for generating items of the EEDS. Three dimensions were derived from the literature review and they are: Engagement in Deliberate Practice (EDP), Developmental Work Experience (DWE), and Learning in Professional Networks (LPN). The themes emerged from 46 qualitative responses, and reflected essential aspects of each of the three dimensions: EDP, DWE, and LPN. The themes and excerpts are presented in Table 3.

Table 3

Sub-themes and excerpts from qualitative data

Dimensions	Themes	Excerpt from qualitative data
Engagement in Deliberate Practice	Aim to learn	“Rather searching a new method to meet an immediate need (related to daily work), I have been reading professional books with aims to expand my repertoire from long-term perspective.”

Dimensions	Themes	Excerpt from qualitative data
		"I volunteered as a group leader in a community setting group counseling...to develop a niche that will be quite unique to me."
	Practice and repetition	"'Practice what I preach' and ply my trade to stay sharp. Every freelance editing assignment gives me new opportunities to practice my trade and flex my 'writerly muscles' (much like an athlete would go to the gym)." "I do a lot of practices to refine my skill set... I can develop a sense of mastery by making trials and errors."
	Regular updating of knowledge and skills	"Strategic searching for published or online materials regarding my job can expand the resource pool for expertise development because they oftentimes offer information about who have been done and what have been done in regard to the expertise development (e.g., reference list of a published journal article)."
	Conceptual learning	"Graduate class in adult learning expanded and deepened my understanding of adult learning motivations, communities of practice, and how organizations work and learn." "To develop my expertise further, I'm interested in getting 'back to my roots' and teaching/reviewing expository writing for writers working on creative non-fiction."
	Reflection	"One may need separate time, other than work, for developing one's expertise to take enough time to speculate on one's job and how it can be done even better." "I attempt to apply newly learned skills and newly acquired knowledge to do my jobs. This is not easy but offers a lot of insight about the similarities and differences between prior and new skill set and knowledge."
Developmental Work Experience	Variation in work experience	"Most times my expertise is expanded through the necessity of carrying out a project, implementing a new functionality, researching possible solutions to problems that arise..." "I have recently begun developing our own website. We originally had a portion...website, but we felt it would be more effective and efficient to have our own separate URL."
	Holistic work experience	"The process of creating this new rubric gave me a deeper understanding of the new proficiency scale and a better understanding of all aspects of pronunciation." "Working more closely on projects from start to end, so I become more closely entwined with the key players and understand the goals, methods, and obstacles involved in making changes."
	Stretching work experience	"I am getting more involved in teaching at the university and will take advantage of opportunities to learn about teaching tools and tips that are available."

Dimensions	Themes	Excerpt from qualitative data
Learning in Professional Networks		“During the department hiring period, I conducted a few interviews and honed the skills I learned in the workshop.”
	Working with others	“Collaborative work with high school teachers through professional enhancement activities for one semester, renewed my insights on classroom dynamics and informed my teaching.” “I develop relationships with community leaders, with leaders and administrators in my organizations (mentors), with peers across my organization who have skills or experience that I don't.” “Colleagues, highly-regarded authors, and practitioners contribute regularly to my expertise through listening to the point of view of others and reflecting on ways to embed ideas and practices into my repertoire in a strategic fashion.”
	Specialized networking	“I would also like more frequent opportunities to network with people who are in a similar position, but work for other companies and industries.” “Being aware of from where and from whom I can get helpful information about doing my job when facing challenges works in favor of my job performance because it offers me the sense of self-efficacy.”
	Participation in professional communities	“Participation in two international conferences, provided opportunities for comparative educational exchanges with colleagues from numerous countries...” “Joined several new BOD for local non-profit community organizations: exposed me to key individuals who have political influence / community leaders, whom I can learn from as I hear how they use their knowledge and how they handle challenges.”
	Mentoring and feedback	“I have weekly update meetings with my supervisor and discuss my development needs constantly. He is very supportive to always look out for opportunities...I also ask for feedback from coworkers after a project is completed...” “So it is beneficial to bounce ideas off of more experienced co-workers on how to navigate tough scenarios.” “I have to get feedback upon my performance from other experts of the related areas... Whether I've been doing correctly or not can be reviewed and tips or suggestions for better performance...At the same time, I can give some feedback to other experts' work practices based on my own expertise. This helps me to refresh my own skills and knowledge.”

(Table continues)

Engagement in deliberate practice (EDP). Participants regularly engaged in purposeful learning activities with the primary goal of expertise development. These activities included both on-the-job and off-the-job learning experiences. Five themes emerged from the qualitative data: aim to learn, practice and repetition, regular updating knowledge and skills, conceptual learning, and reflection.

Aim to learn. Many of responses in EDP were deliberately planned learning activities. In addition, some responses were explicitly about the intentionality of learning. The phrases reflecting primary intentionality of learning included “set up goals” to improve specific skill sets (e.g., project management skills), involving “specifically targeted professional development”, “used off-time to study”, and “structure the learning logically”.

Employees tend to actively plan and organize their learning activities. Their learning activities extended far beyond simply meeting immediate needs in the current work situation as represented by the phrases like, “from long-term perspective” or “to develop a niche that will be quite unique to me”. The participants seemed to consider continuous development of expertise as a distinct concept or activity from daily activity to complete work tasks just sufficiently.

Practice and repetition. As one participant clearly described, the key characteristics of practice and repetition were involved with “a lot of practices to refine my skill set”, “greatly decrease the possibility of errors”, and aimed to gain “a sense of mastery” or “become proficient”. In this sense, the mechanism of repetitive practice resembles that of classical deliberate practices such as training physical or musical skills. One participant drew an analogy between work practice and athlete training by stating “flex my writerly muscles much like an athlete would go to the gym.” However, the manifestations of this theme varied, ranging from simple experience of trial and error to more sophisticated application of knowledge in new settings.

Regular updating of knowledge and skills. As the most frequently reported responses, this theme suggested that continuous updating of knowledge and skills might be the most critical element of employee expertise development. There were various ways to gain new knowledge as well as the source of knowledge, such as reading books or published journals, regularly attending webinars, and professional conferences using social media (e.g., through RSS or LinkedIn), and/or engaging colleagues or other experts from relevant fields of expertise. Many participants used an extensive range of resources outside the workplace, “to keep myself on track” with up-to-date trends or breakthroughs in the profession or market, rather than with ordinary changes in the workplace. As a matter of fact, this theme was often accompanied by the theme Conceptual Learning, suggesting procedural similarity of learning in general. Although some tended to rely more on workshops or training programs within their workplaces or organizations to meet immediate practical and organizational needs, these participants also valued information resources outside their workplace. For instance, one participant stated “It would be beneficial to receive training offered via other business professionals rather than trained in house staff.”

Conceptual and advanced learning. Seeking theoretical and conceptual knowledge and understanding was a unique aspect of EDP. Activities relevant to the theme of regular updates of knowledge and skills place more emphasis on keeping up with recent trends in the field. On the other hand, conceptual learning is more than an acquisition of a set of new knowledge and skills. Specifically, it involves the contemplation of fundamental and theoretical aspect of the knowledge relevant to advancing one’s expertise. For conceptual learning, the participants took advantage of learning from abstract theories or thoroughly examining advanced methods rather than from acquiring concrete knowledge or simple technology, and they sometimes went “back to my roots” rather than seeking new information. Many of the conceptual and advanced learning activities occurred in formal

learning settings (e.g., programs for degree or certificate), but what is more important about this theme than its contextual aspect is the theme's theoretical orientation for fundamental principles, laws, and rules connecting a particular set of knowledge or skills.

Reflection. Reflection refers to effortful cognitive and mental deliberation and reorganization of learned knowledge or skills. Although reflection was more commonly implied indirectly in activities reported by the participants, a few participants directly mentioned how they actively reflected on their work or used analytic reflection to develop expertise. For example, one participant pointed out reflection as a necessary element in employee expertise development by stating, "For developing one's expertise to take enough time to speculate on one's job." Another reported, "This is not easy but offers a lot of insight about the similarities and differences between prior and new skill set and knowledge."

Developmental work experience (DWE). Although separate themes were drawn to categorize participants' responses according to a salient feature, most of participants who reported DWE illustrated the whole work process in one or two examples in relation to DWE. Developmental work experience occurred in the process of accomplishing tasks in the workplace. These work experiences were usually associated with problem solving tasks. However, the intentionality is not necessarily salient to the themes categorized in the DWE dimension. One participant stated, "It is rare for me to purposefully take part in something for the sole purpose of expanding my expertise." In spite of its holistic nature, three prominent themes that characterized DWE emerged.

Variation in work experience. The variation in work experience theme refers to new work experiences that employees confront in their daily work contexts. Newness in work involved, for example, applying a new method to their work (e.g., Information Technology or a software), changes in work organization to improve the effectiveness of existing work system, and taking on a new contract with a new company. Participants had a variety of

learning opportunities while facing challenges like seeking out and reading documents, talking with colleagues or other experts, and trying out new solutions. However, the purpose of these activities was to complete assigned tasks rather than to advance one's expertise. Employees did not initiate their learning activities if it was not directly relevant to the tasks at hand. So, this variation in work experience theme is about the breadth and diversity of work experience with which one's expertise can be associated.

Holistic Work Experience. This type of work activity allows participants to experience a task from beginning to end or to manage a project as a whole. For example, participants led a team project, or took charge of developing a new work method that required integration of different types of knowledge and skills from various fields of expertise encompassing comprehensive work contexts (e.g., across several work systems or departments in the organization). Working at a higher position/rank does not ensure the holistic work experience. The holistic work experience helps one to get a big picture on task completion processes, which provides a deeper understanding of the complex and dynamic nature of how things need to be done in different work situations. It often extends employees' knowledge base to relevant fields of expertise beyond the ordinary boundary of his/her expertise.

Stretching Work Experience. Stretching work experience is associated with employees' involvement in a higher level of performance beyond one's current level of expertise. It seemed to be not limited to the boundary of usual work requirements in a current position or to one's field of expertise. As revealed in example excerpts in Table 3, the activities categorized in this theme tended to challenge participants to take a new role with an expectation to become a successful expert (e.g., "By succeeding with this...I hope to one day be an expert in developing...new techniques on a national and/or global scale"). In order to gain stretching work experience, participants needed to take advantage of opportunities

spontaneously occurring in their workplace. Participants reported that supervisor's supports and guidance helped them to find and take the opportunities. Although participants seemed to show proactive attitude or willingness in taking the opportunities, the activities occurred as a part of their work, and were not deliberately planned for expertise development. Rather, employees pursued these activities primarily for work accomplishment.

Learning in professional networks (LPN). Many participants reported interactive relations as a major source of their expertise development. Learning in professional networks was interrelated with several other learning activities categorized into EDP or DWE. Specifically, regular updating of knowledge and skills and holistic and stretching work experience categories were accompanied by LPN in many examples. Four themes emerged in this dimension: working with others, specialized networking, participation in professional communities, and mentoring and feedback.

Working with others. Participants frequently reported that they benefitted from others' knowledge and experience while they worked together. In particular, participants highly valued diverse perspectives, and levels and types of knowledge/skills. One participant reported, "My teammates are my best resource. They look at things from various angles with different perspectives." Although the closeness or intensity of collaborations has been reported occasionally in regard to the theme of working with others, the more important aspect was the quality/level of expertise of those who the participants collaborated with. However, this does not mean that employees purposefully chose with whom to collaborate because working relationships naturally emerged while doing work.

Specialized networking. While the theme of working with others relied more on spontaneous collaborations, participants purposefully and proactively sought out other experts inside and outside the organizational boundaries (e.g., sister institution or other company) when it came to specialized networking. They usually networked with "similarly

mindful professionals” and “swapped ideas on best practices and shared our successes and failures with one another.” In other words, specialized networking is based on exchanges of resources (e.g., knowledge, skills, or experience) between individuals who hold comparable positions or resources. Also, through specialized networking, they developed a mental map of who-knows-what (i.e., know-whom competencies, Defillippi & Arthur, 1994) in the profession. Besides the knowledge and experiences shared through specialized networking, specialized networking itself may be an important component of expertise, as one participant reported, “Being aware of from where and from whom I can get helpful information...offers me the sense of self-efficacy.”

Participation in professional communities. Participants attended meetings of various professional communities on a regular basis (e.g., professional conferences or seminars). By becoming a member of a particular community, they were able to get access to the resources exclusively available in the particular community. For example, they could initiate relationships with key people in the professional communities, learn some know-how accumulated by the community, and/or keep up with current trends through newsletters and conference agendas. Unlike specialized networking, which is based more on interpersonal relationships, collective interactions based on a formal membership is the key feature of the theme, participation in professional communities. In addition, it helped a participant to build up professional career expertise. Specifically, a participant reported, “it increased my professional reputation by presenting my research and it promoted my organization by increasing its exposure at a highly reputable conference.” Expertise development in this theme is not only associated with broadening one’s resources for expertise development, but also with getting recognition and functioning as an expert in the particular social contexts which can subsequently advance one’s professional excellence.

Developmental relationships and feedback. Developmental relationships refer to

employees' formal and informal instructive interactions with more experienced people of similar (e.g., colleagues) or higher position (e.g., supervisors). Developmental relationships were often accompanied by feedback on employees' expertise development over the long term. For example, participants openly discussed one's "developmental edge" with their supervisor. On the other hand, employees sought feedback in order to improve particular areas of performance or expertise. Participants obtained feedback on "how I could have tackled that problem more appropriately", or "whether I've been doing correctly or not." Regardless of how formal the meeting was, the interactions occurred frequently and were highly intensive and focused.

All the themes were categorized based on the underlying mechanisms and goals of the reported activities in regard to expertise development, instead of the idiosyncrasy and contextual specificity of the individual activity in order to increase generalizability of the analyzing themes (Yin, 2015). Therefore, the scope of the themes and the quality and quantity of examples supporting the themes were not strictly homogeneous. Nevertheless, the themes were carefully drawn to represent unique aspects of a set of specific behaviors for expertise development. At the same time, the themes were found to converge meaningfully to represent each of the corresponding three dimensions, namely, EDP, DWE, and LPN. It was concluded that the three dimensions are 3 general dimensions of the process of employee expertise developmental endeavor. These themes were used as a conceptual underpinning for item generation. The key characteristics of the themes and examples described in this section were reflected in item stems.

Results of Content Validation

The content validation survey aimed to obtain quantitative evidence on the relevance of the items to the initial constructs, as well as qualitative feedback on content adequacy and coverage from content experts. The content validation results are presented in the Tables 4

and 5. For each item, the percentage of correct item-construct categorization was computed. Also, means of the perceived certainty level in item-construct categorization and the perceived level of item-construct relevance were calculated only for the correctly categorized items.

Items remained: 1) if an item was categorized into the expected construct by more than 75% of the validators (six out of 8); 2) For correct classifications, if the average level of the perceived certainty in item-construct categorization was above 2 (out of 3) and if the average level of the perceived item-construct relevance was above 2.9. As exceptions, despite the fact that the original item # 13, # 27, and # 57 met only one of the 2 inclusion criteria, they were retained in order to cover the full range of content within the given constructs. Based on these criteria, 25 items were deleted from the initial item pool of 66. Among the remained 41 items, 21 items were slightly or moderately reworded for clarity in meanings. For the remaining 41 items, the average congruency percentage (i.e., the proportion of items rated to be congruent with the specifications of the construct) for all experts was 91% and the index of content validity (CVI, the proportion of items on an instrument that obtained a rating of *somewhat relevant* = 3 or *very relevant* = 4) was .88. These indexes indicated an acceptable degree of the content validity of the EEDS (McCoach et al., 2013). Based on qualitative feedback from the content validators, the initial items # 7 and # 9 were split into two different items (new items # 14 and # 24 for the original item #7; new items # 32 and # 35 for the original item #9). The new item # 38 was added to complement the content of the initial item # 37. The new item # 40 was added for the comprehensive representation of the content domain of the Learning in Professional Networks (LPN) construct. As a result, 45 items were retained for the quantitative pilot data collection; 13 items for DWE, 14 items for EDP, and 18 items for LPN.

Table 4

Item Structure and Content Validation Results

		% <i>Construct Agreement Certainty Relevance Decision</i>			
1. While doing my daily work, I can utilize different skills and knowledge.	1	100	2.8	3.1	R
2. I experience a wide range of work situations.	1	100	2.9	3.1	K
3. I utilize diversity of experience in the workplace.	1	100	2.8	3.1	R
4. My work includes conflicts and challenges.	1	100	2.8	3.3	R
5. I deal with uncertainty in doing my work.	1	87.5	2.1	2.7	D
6. My work requires integrating different approaches or perspectives.	1	100.0	2.8	3.4	R
7. I tackle complex tasks that require multiple skills and an overall understanding.	1	100.0	2.8	2.9	R
8. I take part in work projects from start to end.	1	87.5	2.7	2.9	K
9. My work includes multi-faceted experiences that involve multiple roles and responsibilities.	1	100.0	2.7	3.0	R
10. I have opportunities to debrief after completing a complex task in the workplace.	1	75.0	2.7	3.3	R
11. I take advantage of opportunities to learn new skills and knowledge by accepting new roles or assignments in my workplace.	1	50.0	3.0	3.5	D
12. I have opportunities to work at a higher level than my current position in my workplace.	1	100.0	2.5	2.9	R
13. I get involved in an innovative project to improve current work approaches in my workplace.	1	62.5	2.2	3.2	R
14. I implement new methods in doing my work.	1	62.5	2.6	2.8	D
15. I explore new strategies and solutions to solve current problems in my workplace.	1	62.5	2.8	3.2	D
16. I invest extra time and effort outside of work to develop my expertise.	2	75.0	3.0	4.0	K
17. I repeatedly utilize new knowledge or practice a new skill until I feel a sense of mastery.	2	100.0	3.0	3.9	K
18. I apply acquired knowledge and skills to relevant but new contexts.	2	62.5	2.4	3.6	D
19. I purposefully rotate different activities to increase my expertise.	2	87.5	2.9	3.6	R

		% <i>Construct Agreement Certainty Relevance Decision</i>			
20. I structure my approach to work in the way that improves a weak area in my expertise.	2	87.5	2.6	3.6	R
21. I proactively modify my work approach in order to develop the best practice.	2	100.0	2.8	3.6	K
22. I do cross training in other fields to become a well-rounded expert.	2	75.0	2.8	3.5	R
23. I participate in formal education for professional development.	2	50.0	3.0	3.3	D
24. I systematically study fundamental knowledge and skills beyond my immediate needs.	2	87.5	2.6	3.4	R
25. I systematically study advanced knowledge and skills beyond my immediate needs.	2	87.5	2.2	3.6	K
26. I assess what I am doing in my workplace in terms of theoretical principles or research findings.	2	75.0	2.0	3.0	R
27. I regularly update new content areas in my profession by reading journals, books, or online materials.	2	62.5	3.0	3.6	R
28. I regularly update my knowledge of the latest theoretical and practical breakthroughs in my field of expertise.	2	62.5	3.0	3.4	D
29. I consistently monitor other experts' activities through formal (e.g., publications, presentations) or informal channels (e.g., tweeting/blogging).	2	50.0	2.6	3.4	D
30. I explore new resources of knowledge and skills in my area of expertise.	2	87.5	2.8	3.6	K
31. I seek out new knowledge in my area of expertise.	2	87.5	2.4	3.6	K
32. I continuously assess pros and cons of my current practices.	2	87.5	2.6	3.4	K
33. I try to integrate what I have newly learned with my prior knowledge.	2	87.5	2.4	3.6	R
34. I analyze how others do their work.	2	50.0	1.8	3.0	D
35. I strategically organize new information in order to immediately apply it to my current work.	2	75.0	2.5	3.2	D
36. I seek out opportunities to present what I have learned in public forms such as manuals, presentations, or papers.	3	75.0	2.5	2.7	D
37. I work with (an) expert(s) who show(s) excellent performance.	3	87.5	2.7	3.0	R

		%			
	<i>Construct</i>	<i>Agreement</i>	<i>Certainty</i>	<i>Relevance</i>	<i>Decision</i>
38. I work with challenging colleagues who expand my thinking and performing.	3	87.5	3.0	3.7	K
39. I participate in cross-team or cross-professional projects and discussions.	3	62.5	3.0	3.2	D
40. I network with individuals in other business units within my corporation.	3	100.0	2.9	3.0	D
41. I develop working relationships with people who work beyond my area of expertise.	3	100.0	2.8	2.9	R
42. I seek advice from people outside my workplace.	3	87.5	3.0	3.1	D
43. I seek out opportunities to network with people who are in a similar position, but work for other companies or industries.	3	100.0	3.0	3.5	K
44. I make an effort to meet new groups of people to enrich my professional networks.	3	100.0	2.9	3.4	K
45. I am developing specialized channels to facilitate information exchange for myself.	3	87.5	2.6	3.1	R
46. I make an effort to maintain my professional networks.	3	100.0	3.0	3.1	D
47. I collaborate with a wide range of people such as colleagues, customers/clients, or people from other professions.	3	87.5	3.0	3.0	K
48. I am participating in working groups to collaborate on various works.	3	87.5	2.9	2.9	D
49. I have colleagues with whom I share learning experiences (e.g., co-researchers or co-developers of products or ideas).	3	100.0	2.9	3.5	K
50. I share knowledge and ideas with my colleagues in a pro-active manner.	3	100.0	2.9	2.9	D
51. I am asked for advice from colleagues in or outside of the workplace.	3	87.5	2.7	2.9	R
52. I speak with others to learn things not addressed in books.	3	87.5	3.0	3.1	R
53. I participate in discussions in professional communities through social media or public meetings.	3	100.0	3.0	3.3	K
54. I have frequent contact with more experienced people to discuss my performance.	3	87.5	3.0	3.7	K
55. I am closely guided by others with more expertise.	3	100.0	2.9	3.3	K
56. I actively seek opportunities to share my expertise in public.	3	87.5	2.9	2.6	D
57. I try to expose myself to the greater	3	87.5	2.9	2.7	R

		% <i>Construct Agreement Certainty Relevance Decision</i>			
business community.					
58. I seek out organizational resources for my development of expertise in a pro-active manner.	3	25.5	2.5	4.0	D
59. I make an effort to increase my professional reputation by presenting my ideas or accomplishments at meetings or in journals.	3	87.5	2.9	2.9	D
60. I attend annual conferences or conventions to expand my business network.	3	100.0	2.9	2.6	D
61. I take part in professional meetings, conferences/conventions, or webinars on a regular basis.	3	100.0	2.9	2.6	D
62. I seek feedback from my professional network in a pro-active manner.	3	100.0	2.5	3.5	K
63. I get feedback on my performance from other experts in related areas.	3	87.5	3.0	3.3	K
64. I give feedback to others' work practices based on my own expertise.	3	100.0	2.6	2.5	D
65. I seek out feedback about my general progress to inform my long-term performance.	3	62.5	2.6	3.0	D
66. I obtain feedback on my performance in a timely manner.	3	50.0	2.8	3.0	D

(Table continues)

Notes. Items in boldface indicate retained items (n = 45); Item numbers are from the content validation form; Construct 1=Developmental Work Experience (DWE), Construct 2=Engagement in Deliberate Practice (EDP; originally, Commitment in Deliberate Practice), Construct 3=Learning in Professional Networks (LPN); % agreement=the percentage of correct item categorization, Certainty=the mean of the perceived level of certainty in correct item-construct categorizations, Range of certainty=1~3, Relevance=the mean of the perceived level of item-construct relevance for correct item categorizations, Range of Relevance=1~4; K=Keep, R=Reword, D= Delete

Table 5

The EEDS Items: Original and Modified Versions

Item#*	Original Item Wording	Modified Item Wording (the final version)
Developmental Work Experience		
43	1. While doing my daily work, I can utilize different skills and knowledge.	While doing my daily work, I utilize different skills and knowledge.
11	2. I experience a wide range of work situations.	I experience a wide range of work situations.
39	3. I utilize diversity of experience in the workplace.	I deal with atypical situations in doing my work.
19	4. My work includes conflicts and challenges.	My work includes dilemmas or challenges.
33	6. My work requires integrating different approaches or perspectives.	To accomplish my work, I need to integrate different approaches.
14	7. I tackle complex tasks that require multiple skills and an overall understanding.	I tackle complex tasks that require an overall understanding.
23	7. I tackle complex tasks that require multiple skills and an overall understanding.	I tackle complex tasks that require advanced knowledge and skills.
29	8. I take part in work projects from start to end.	I take part in work projects from start to end.
37	9. My work includes multi-faceted experiences that involve multiple roles and responsibilities.	My work includes multi-faceted experiences.
34	9. My work includes multi-faceted experiences that involve multiple roles and responsibilities.	My work involves multiple roles and responsibilities.
2	10. I have opportunities to debrief after completing a complex task in the workplace.	I have opportunities to examine work process after completing a complex task in the workplace.
6	12. I have opportunities to work at a higher level than my current position in my workplace.	I take advantage of opportunities to work at a higher level than my current position in my workplace.

Item#*	Original Item Wording	Modified Item Wording (the final version)
8	13. I get involved in an innovative project to improve current work approaches in my workplace.	My work requires innovative practices.
Engagement in Deliberate Practice		
17	16. I invest extra time and effort outside of work to develop my expertise.	I invest extra time and effort outside of work to develop my expertise.
20	17. I repeatedly utilize new knowledge or practice a new skill until I feel a sense of mastery.	I repeatedly utilize new knowledge or practice a new skill until I feel a sense of mastery.
47	19. I purposefully rotate different activities to increase my expertise.	I purposefully rotate among different activities to increase my expertise.
22	20. I structure my approach to work in the way that improves a weak area in my expertise.	I structure my approach to work in ways that improve a weak area in my knowledge or skills.
9	21. I proactively modify my work approach in order to develop the best practice.	I proactively modify my work approach in order to develop the best practice.
24	22. I do cross training in other fields to become a well-rounded expert.	I educate myself in other relevant fields to strengthen my knowledge and skills.
5	24. I systematically study fundamental knowledge and skills beyond my immediate needs.	I thoroughly examine fundamental knowledge and skills to get to the core of a matter.
7	25. I systematically study advanced knowledge and skills beyond my immediate needs.	I systematically study advanced knowledge and skills beyond my immediate needs.
21	26. I assess what I am doing in my workplace in terms of theoretical principles or research findings.	I think through problems confronted in the workplace to deepen my theoretical understanding.
38	27. I regularly update new content areas in my profession by reading journals, books, or online materials.	I regularly read journals, books, or online materials related to my expertise.
36	30. I explore new resources of knowledge and skills in my area of expertise.	I explore new resources of knowledge and skills in my area of expertise.
3	31. I seek out new knowledge in my area of expertise.	I seek out new knowledge in my area of expertise.

Item#*	Original Item Wording	Modified Item Wording (the final version)
44	32. I continuously assess pros and cons of my current practices.	I continuously assess pros and cons of my current practices.
10	33. I try to integrate what I have newly learned with my prior knowledge.	I try to integrate what I have newly learned with my prior knowledge and skills.
Learning in Professional Networks		
40	37. I work with (an) expert(s) who show(s) excellent performance.	I seek out opportunities to work with one or more experts who show excellent performance.
45	37. I work with (an) expert(s) who show(s) excellent performance.	I try to model the high performance of outstanding experts in my professional network.
4	38. I work with challenging colleagues who expand my thinking and performing.	I work with challenging colleagues who expand my thinking and performing.
25	41. I develop working relationships with people who work beyond my area of expertise.	I develop working relationships with people who work outside my area of expertise.
13	43. I seek out opportunities to network with people who are in a similar position, but work for other companies or industries.	I seek out opportunities to network with people who are in a similar position, but work for other companies or industries.
26	44. I make an effort to meet new groups of people to enrich my professional networks.	I make an effort to meet new groups of people to enrich my professional networks.
27	45. I am developing specialized channels to facilitate information exchange for myself.	I am developing specialized channels to facilitate information exchange with other professionals.
28	47. I collaborate with a wide range of people such as colleagues, customers/clients, or people from other professions.	I collaborate with a wide range of people such as colleagues, customers/clients, or people from other professions.
41	49. I have colleagues with whom I share learning experiences (e.g., co-researchers or co-developers of products or ideas).	I have colleagues with whom I share learning experiences (e.g., co-researchers or co-developers of products or ideas).
30	51. I am asked for advice from colleagues in or outside of the workplace.	Individuals contact me inside or outside the workplace to ask for advice about work-related projects.

Item#*	Original Item Wording	Modified Item Wording (the final version)
12	52. I speak with others to learn things not addressed in books.	I speak with others to learn things not addressed in books, manuals, or on the Internet.
32	53. I participate in discussions in professional communities through social media or public meetings.	I participate in discussions in professional communities through social media or public meetings.
1	54. I have frequent contact with more experienced people to discuss my performance.	I have frequent contact with more experienced people to discuss my performance.
35	55. I am closely guided by others with more expertise.	I am closely guided by others with more expertise.
18	57. I try to expose myself to the greater business community.	I make an effort to engage in the greater professional community.
15	62. I seek feedback from my professional network in a pro-active manner.	I seek feedback from my professional network in a pro-active manner.
46	63. I get feedback on my performance from other experts in related areas.	I get feedback on my performance from other experts in related areas.
42	Added	My supervisor provides feedback on a regular basis to develop my expertise.

(Table continues)

Notes. *New Item number is for the pilot test of the EEDS; #16 and 31 are not included in this table. They are two reliability-checking questions and reverse-worded counterpart items of # 3 and #23 respectively.

Results of Exploratory Factor Analysis and Reliability Analysis

To determine the number of factors to extract, I used information from the parallel analysis (PA), minimum average partial (MAP) procedure, scree plot, and the magnitude of eigenvalues (McCoach et al., 2013). PA using PCA is considered to be the most accurate single indicator of the optimal number of factors to extract (Slocum-Gori & Zumbo, 2011), however, the recommendations for the most desirable methods are inconclusive. Thus, the results from various methods were jointly considered (McCoach et al., 2013). Kaiser's criterion (Kaiser, 1960) suggests extracting all factors with eigenvalue above or at 1.0 and the Kaiser's criterion suggested seven factors to retain. The scree test (Cattell, 1966), which is a visual analysis of the eigenvalues, reveals the point at which the drop of slope of scree plot ceases and flattens. This point indicates the number of factors to be retained. This method suggested five factors. The PA method (Fabrigar & Wegener, 2012) involves creating eigenvalues from a random dataset and compares them to the eigenvalues obtained from an observed sample dataset. The number of eigenvalues from the observed data that have larger values than the eigenvalues from the created random data indicates the number of factors to extract. I used O'Connor's (2000) macros in SPSS to conduct PA. In this study, PA using principal components analysis (PCA) indicated four factors to extract and PA using principal axis factoring (PAF) suggested seven factors to extract. The PA using PAF generally tends to overextract factors (McCoach et al., 2013). The MAP method (Velicer, 1976) conducts PCA and calculates the average of the squared partial correlations between each pair of items. The number of factors to extract is determined by the point where the smallest average of the squared partial correlations is obtained. By using O'Connor's (2000) macros in SPSS to conduct MAP, both original and revised MAP procedures (Velicer, Eaton, & Fava, 2000) indicated five factors to extract. Overall, various methods indicated that 4~7 factors can be extracted in this study. In order to explore the possibility of underextraction and

overextraction, I examined each of the pattern matrixes of 3, 4, 5, 6, and 7 factor solution respectively. The 3-factor solution returned the less clear pattern of item to factor loadings (e.g., cross-loading) and did not map with the originally hypothesized EEDS model based on the three constructs. On the other hand, the 4-factor solution generally aligned with the three constructs of the original EEDS model, although it was suggested that one of the constructs, LPN, needed to be broken into two factors. The 5-, 6-, and 7-factor solutions indicated overextraction, because the additional factors were not substantially loaded by items and thus, indicated no substantial theoretical value. Considering that the number of originally hypothesized construct dimensions of the EEDS was three and for the model parsimony, the 4-factor solution was thought to be most acceptable. The results with 4-factor solution are presented in the results section.

The results of 4-factor solution and reliability analysis were presented. Before conducting EFA, I reviewed descriptive characteristics of each item of the EEDS. Across the items, means ranged from 3.84 to 5.96 and standard deviations ranged from .92 to 1.79. Most of items indicated adequate range of mean and standard deviation. Item inter-correlations ranged from .07 to .77 without the indication of lack of item discrimination (i.e., $r \geq .85$). Also, none of the items was uncorrelated with all other correlations.

Extraction of the four factors yielded a Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy coefficient of .95, indicating that the correlations were appropriate for factor analysis (Lackey, Sullivan, & Pett, 2003). The Bartlett's Test of Sphericity coefficient (approximate chi-square) was 8328.45, which was statistically significant ($p < 0.001$) at 990 degrees of freedom. This indicated that the correlation matrix was not an identity matrix. All of the measures of sampling adequacy (MSAs) were above .80 (i.e., .83 to .97) in this sample, indicating each item was strongly related to other items in a given matrix. In addition, initial communalities (the portion of the total variance that is related to other variables) for each of

the items ranged from .44 to .78, indicating all items shared substantial variance with other variables in the instrument. The extraction communalities represent the proportion of variance in the item that is explained by the set of extracted factors, which ranged from .30 to .76 in this sample. All items showed adequate level of extraction communality (i.e., above .30).

Initial eigenvalues indicated that the 4-factor solution accounted for 56.45% of the total variance. After PAF extraction, the 4-factor solution explained for 52.41% of the common variance. Factor correlation matrix revealed that factors were correlated with each other at moderate level ($r_{F1,F2} = .49$; $r_{F1,F3} = .43$; $r_{F1,F4} = .58$; $r_{F2,F3} = .37$; $r_{F2,F4} = .37$; $r_{F3,F4} = .31$). These results supported the use of oblique rotation. At the same time, the level of correlations indicated that each factor has unique variance and the factors can be reasonably discerned.

Pattern coefficients are the partial standardized regression weights that measure the direct effect of the given factor on the given item after controlling for the other factor. On the other hand, structure coefficients are the simple bivariate correlations between the items and the factors. Although pattern matrix was primarily used for item selection, structural matrix was also reviewed to confirm the results. Pattern matrix is presented in Table 6 and structural matrix in Table 7.

Table 6

Pattern Matrix

Initial Item Const.		Factor			
		1	2	3	4
EDP	EEDS10. I integrate what I have newly learned with my prior knowledge and skills.	.727	-.143		.109
EDP	EEDS7. I systematically study advanced knowledge or skills beyond my immediate needs.	.708	.185		
EDP	EEDS17. I invest extra time and effort outside of work to develop my expertise.	.690	.216		
EDP	EEDS3. I seek out new knowledge in my area of expertise.	.686		.105	

Initial Const.	Item	Factor			
		1	2	3	4
EDP	EEDS5. I thoroughly examine fundamental knowledge to get to the core of a matter.	.651	-.117	.148	.167
EDP	EEDS9. I proactively modify my work approach in order to develop the best practice.	.631		.102	.142
EDP	EEDS38. I regularly read journals, books, or online materials related to my expertise. » (Reworded) I regularly read materials related to my expertise (e.g., books, journals, or online materials).	.568	.276		-.102
EDP	EEDS22. I structure my approach to work in ways that improve a weak area in my knowledge or skills.	.549			.214
EDP	EEDS36. I explore new resources of knowledge and skills in my area of expertise.	.548	.202		.150
EDP	EEDS24. I educate myself in other relevant fields to strengthen my knowledge and skills.	.529	.270		.179
DWE	EEDS6. I take advantage of opportunities to work at a higher level than my current position in my workplace.	.510	.183	.105	
DWE	EEDS23. I tackle complex tasks that require advanced knowledge and skills.	.460			.431
LPN	EEDS45. I try to model the high performance of outstanding experts in my professional network.	.457	.241	.101	
EDP	EEDS20. I repeatedly utilize new knowledge or practice a new skill until I feel a sense of mastery.	.457		.108	.306
EDP	EEDS44. I continuously assess pros and cons of my current practices.	.380		.105	.283
DWE	EEDS8. My work requires innovative practices.	.308		.195	.264
LPN	EEDS26. I make an effort to meet new groups of people to enrich my professional networks.		.781		.148
LPN	EEDS27. I am developing specialized channels to facilitate information exchange with other professionals.		.704	.154	.121
LPN	EEDS13. I seek out opportunities to network with people who are in a similar position, but work for other companies or industries.	.136	.652	.141	
LPN	EEDS18. I make an effort to engage in the greater professional community. » (Reworded) I engage in the greater professional community.	.337	.614		-.103
LPN	EEDS32. I participate in discussions in professional communities through social media or public meetings.	.138	.597		
LPN	EEDS28. I collaborate with a wide range of people (e.g., colleagues, customers/clients, or people from other professions).		.548		.407
LPN	EEDS25. I develop working relationships with people who work outside my area of expertise.		.468		.380
LPN	EEDS40. I seek out opportunities to work with one or more experts who show excellent performance.	.299	.417	.258	

Initial Const.	Item	Factor			
		1	2	3	4
LPN	EEDS15. I seek feedback from my professional network in a pro-active manner.	.133	.400	.275	.142
EDP	EEDS47. I purposefully rotate among different activities to increase my expertise.	.142	.280	.233	
LPN	EEDS42. My supervisor provides feedback on a regular basis to develop my expertise.			.816	
LPN	EEDS1. I have frequent contact with more experienced people to discuss my performance.	.180		.715	-.147
LPN	EEDS35. I am closely guided by others with more expertise.	-.104		.632	
DWE	EEDS2. I have opportunities to examine work processes after completing a complex task in the workplace.			.529	.148
LPN	EEDS4. I work with challenging colleagues who expand my thinking and performing.	.193		.497	.148
LPN	EEDS46. I get feedback on my performance from other experts in related areas.		.380	.495	
DWE	EEDS37. My work includes multi-faceted experiences.		.181		.785
DWE	EEDS34. My work involves multiple roles and responsibilities.				.770
DWE	EEDS43. While doing my daily work, I utilize different skills and knowledge.	.151			.641
DWE	EEDS19. My work includes dilemmas or challenges.				.612
DWE	EEDS11. I experience a wide range of work situations.			.251	.609
DWE	EEDS14. I tackle complex tasks that require an overall understanding.	.262			.532
DWE	EEDS39. I deal with atypical situations in doing my work.				.513
EDP	EEDS21. I think through problems confronted in the workplace to deepen my theoretical understanding.	.444			.491
DWE	EEDS33. To accomplish my work, I need to integrate different approaches.	.287			.451
DWE	EEDS29. I take part in work projects from start to end.	.138		.132	.450
LPN	EEDS30. Individuals contact me inside or outside the workplace to ask for advice about work-related projects. » (Reworded) I participate in work-related consultation across organizational boundaries.	.179	.245	-.120	.398
LPN	EEDS12. I speak with others to learn things not addressed in books, manuals, or on the Internet.	.252			.371
LPN	EEDS41. I have colleagues with whom I share learning experiences (e.g., co-researchers or co-developers of products or ideas).		.195	.216	.345

(Table continues)

Notes. Path coefficients below .10 were not presented in the table. The amount of Path coefficient below .1 was not reported. Principal Axis Factoring with a Direct Oblimin rotation was utilized. **Items in boldface** were retained for the next phase of study (i.e., CFA). EPD=Engagement in Deliberate Practice, DWE=Developmental Work Experience, and LPN=Learning in Professional Networks.

Table 7

Structure Matrix

Initial Const.	Items	Factor			
		1	2	3	4
EDP	EEDS7. I systematically study advanced knowledge or skills beyond my immediate needs.	.785	.528	.401	.437
EDP	EEDS3. I seek out new knowledge in my area of expertise.	.779	.431	.428	.497
EDP	EEDS10. I integrate what I have newly learned with my prior knowledge and skills.	.760	.289	.385	.508
EDP	EEDS5. I thoroughly examine fundamental knowledge to get to the core of a matter.	.754	.320	.435	.548
EDP	EEDS9. I proactively modify my work approach in order to develop the best practice.	.752	.388	.412	.537
EDP	EEDS36. I explore new resources of knowledge and skills in my area of expertise.	.750	.540	.393	.556
EDP	EEDS24. I educate myself in other relevant fields to strengthen my knowledge and skills.	.730	.566	.300	.561
EDP	EEDS17. I invest extra time and effort outside of work to develop my expertise.	.727	.506	.303	.381
EDP	EEDS22. I structure my approach to work in ways that improve a weak area in my knowledge or skills.	.720	.395	.403	.568
EDP	EEDS20. I repeatedly utilize new knowledge or practice a new skill until I feel a sense of mastery.	.685	.387	.403	.609
DWE	EEDS6. I take advantage of opportunities to work at a higher level than my current position in my workplace.	.672	.490	.405	.445
DWE	EEDS23. I tackle complex tasks that require advanced knowledge and skills.	.671	.310	.295	.669
LPN	EEDS45. I try to model the high performance of outstanding experts in my professional network.	.655	.526	.406	.451
EDP	EEDS38. I regularly read journals, books, or online materials related to my expertise.	.627	.502	.275	.319
EDP	EEDS44. I continuously assess pros and cons of my current practices.	.595	.342	.360	.541
DWE	EEDS8. My work requires innovative practices.	.569	.370	.428	.522
LPN	EEDS26. I make an effort to meet new groups of people to enrich my professional networks.	.511	.859	.367	.464
LPN	EEDS27. I am developing specialized channels to facilitate information exchange with other professionals.	.463	.797	.446	.421
LPN	EEDS18. I make an effort to engage in the greater professional community.	.594	.754	.377	.333
LPN	EEDS13. I seek out opportunities to network with people who are in a similar position, but work for other companies or industries.	.487	.752	.425	.317
LPN	EEDS40. I seek out opportunities to work with one or more experts who show excellent performance.	.634	.672	.552	.446

Initial Const.	Items	Factor			
		1	2	3	4
LPN	EEDS32. I participate in discussions in professional communities through social media or public meetings.	.412	.656	.292	.258
LPN	EEDS28. I collaborate with a wide range of people (e.g., colleagues, customers/clients, or people from other professions).	.399	.639	.247	.545
LPN	EEDS15. I seek feedback from my professional network in a pro-active manner.	.530	.621	.526	.455
LPN	EEDS25. I develop working relationships with people who work outside my area of expertise.	.451	.612	.301	.555
EDP	EEDS47. I purposefully rotate among different activities to increase my expertise.	.411	.457	.415	.316
LPN	EEDS42. My supervisor provides feedback on a regular basis to develop my expertise.	.260	.219	.770	.216
LPN	EEDS1. I have frequent contact with more experienced people to discuss my performance.	.374	.246	.726	.162
LPN	EEDS4. I work with challenging colleagues who expand my thinking and performing.	.516	.384	.645	.435
LPN	EEDS46. I get feedback on my performance from other experts in related areas.	.417	.569	.642	.283
DWE	EEDS2. I have opportunities to examine work processes after completing a complex task in the workplace.	.412	.304	.619	.372
LPN	EEDS35. I am closely guided by others with more expertise.	.199	.265	.615	.152
DWE	EEDS37. My work includes multi-faceted experiences.	.482	.437	.258	.813
DWE	EEDS34. My work involves multiple roles and responsibilities.	.415	.292	.196	.751
DWE	EEDS43. While doing my daily work, I utilize different skills and knowledge.	.521	.265	.318	.726
EDP	EEDS21. I think through problems confronted in the workplace to deepen my theoretical understanding.	.659	.295	.241	.697
DWE	EEDS14. I tackle complex tasks that require an overall understanding.	.583	.367	.267	.694
DWE	EEDS11. I experience a wide range of work situations.	.419	.322	.429	.665
DWE	EEDS19. My work includes dilemmas or challenges.	.392	.214	.182	.628
DWE	EEDS33. To accomplish my work, I need to integrate different approaches.	.549	.292	.288	.617
DWE	EEDS29. I take part in work projects from start to end.	.498	.369	.364	.604
LPN	EEDS12. I speak with others to learn things not addressed in books, manuals, or on the Internet.	.536	.351	.341	.568
DWE	EEDS39. I deal with atypical situations in doing my work.	.374	.280	.253	.566
LPN	EEDS30. Individuals contact me inside or outside the workplace to ask for advice about work-related projects.	.480	.437	.173	.555

Initial Items		Factor			
Const.		1	2	3	4
LPN	EEDS41. I have colleagues with whom I share learning experiences (e.g., co-researchers or co-developers of products or ideas).	.416	.416	.408	.501

(Table continues)

Notes. Principal Axis Factoring with a Direct Oblimin rotation was utilized. **Items in boldface** were retained for the next phase of study (i.e., CFA). EPD=Engagement in Deliberate Practice, DWE=Developmental Work Experience, and LPN=Learning in Professional Networks.

In order to determine which items to retain or eliminate from the EFA results, I followed McCoach et al.'s (2013) recommendations. To judge whether an item meaningfully contributes to the interpretation of the corresponding factor, ideally a pattern coefficient of an item should be equal to or greater than .40 and the item's factor loading should be equal to or greater than .50. To judge problematic multidimensionality, McCoach et al. (2013) introduced two different criteria. First, an item that has a loading greater than .40 on more than one factor should be eliminated. More conservatively, they recommended elimination of any item that has a loading of .30 or higher on more than one factor. Thus, every item was retained initially if its pattern coefficient in regard to its primary factor was over .50, and if the item was not loaded on factors other than its primary factor with the factor loading equal to or greater than .30 (Comrey & Lee, 1992; McCoach et al., 2013). According to these criteria, 27 items were initially retained from 45 total items. Then, contents of the excluded items were considered and 3 more items that met the minimum criteria explained above were additionally retained. No item was retained if an item has a loading of .40 or higher on more than one factor. Specifically, item #29 had a loading of .45 on the primary factor and .14 on the secondary factor. Item #30 had a loading of .398 (= .40) on the primary factor and .25 on the secondary factor. Item #18 was highly loaded on the primary factor with pattern coefficient of .61, but had pattern coefficient of .34 on the secondary factor, indicating multidimensionality. I reworded items #18, #30, and #38 in order to clarify the focus of the

item stem and to increase theoretical relevance to the corresponding construct (See Table 6; Note that the item number presented in this section was the item number used in the phase III survey). In total, 30 items were finally retained from 45 items. Among them, 2 items were slightly reworded (item #18 and item #38) and 1 item (item #30) was paraphrased for the clearer representation of the key concept.

In order to keep the scope of the EEDS comprehensive, I retained as many items as were met by the selection criteria. The retained items, except for the item #30, met the minimum selection criteria suggested by McCoach et al. (2013). There were several items with the possibility of multidimensionality besides the 3 reworded items (item #18, #30, and #38). Thus, more items that have potential risk of multidimensionality were identified. Specifically, there were items that had relatively lower path coefficient (e.g., below .50, items #29 and #30) on the primary factor, items that exhibited non-trivial factor loadings on the non-primary factor (e.g., factor loadings of .20 - .28, items #11, #14, #17, #18, and #22), and/or items that exhibited substantial factor loadings on more than two factors (e.g. items #24, #36, and #38). In short, items #14, #29, #17, #27, and #18 from EDP, item #15 from SN, items #10, #12, #21, and #22 from DWE were identified. As described earlier, I reworded some of these items with an expectation to alleviate the possibility of multidimensionality (item #18, #38) or content in an item that was not adequately reflecting the given construct (item 30). However, factor loadings can fluctuate more or less across different samples and the sample size used in this study ($n=278$) was relatively small considering the wide variety and extensiveness of employee population. Thus, it was thought to be safer to inspect these items for potential multidimensionality in the following CFA analysis rather than excluding them based solely on the result of the phase III study. These items were taken into account in the final item selection followed by the CFA results of the phase IV study. The following is a

detailed description of each factor and individual items retained in each factor (Table 9).

Internal consistency statistics is also provided (Table 8).

Table 8

Internal Reliability of four EFA factors (N=272)

Factor	Mean /SD	the variance of IICs	the standard deviation of the IICs	Cronbach's Alpha	95% interval
EDP	5.43 (.97)	.004	.063	.925	.911-.938
SN	4.56(1.31)	.006	.077	.887	.864-.907
FFI	4.53(1.23)	.004	.063	.809	.770-.842
DWE	5.62(.81)	.008	.089	.880	.858-.901

Note. EPD=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience.

Table 9

Factor name, definition, and number of items retained on each factor

Factor	# of items (total=30)	Factor name and brief description
Factor 1	11 (item 38 was reworded)	Engagement in Deliberate Practice (EDP) Individuals' engagement in activities that primarily aims to develop expertise with certain intensity in terms of attention and/or effort regularity.
Factor 2	5 (item 18 was reworded)	Strategic Networking (SN) Individuals' efforts to strategically develop professional networking in which individuals can learn some new practices and new perspectives, become aware of different kinds of knowledge and expertise.
Factor 3	5	Frequent and Focused Interactions (FFI) Frequent and focused social interactions aimed to develop expertise. These interactions can guide one's deliberate practice by providing a specific goal of deliberate practice at a particular point of time, guiding and/or training, co-constructing of excellence, and/or participating in critical reflection on current performance.
Factor 4	9 (item 30 was reworded)	Developmental Work Experience (DWE) Work experience that facilitates expertise development as a consequence, although the primary goal is to perform work, not to develop expertise.

(Table continues)

The first factor. Eleven items out of 16 items were retained on the first factor: items #3, #5, #6, #7, #9, #10, #17, #22, #24, #36, and #38. Among these, item #38 was reworded. Except for the item #6, which was originally hypothesized to represent DWE, all 10 items came from the hypothesized EDP construct. Thus, I named the factor 1 as Engagement in Deliberate Practice (EDP) as I originally conceptualized. Thus, the Engagement in Deliberate Practice factor consisted of 11 items. Using the eleven items, I conducted reliability analyses. The variance of the mean inter-item correlations (IICs) was less than .01 for EDP factor, which is preferable for reliability analysis (Table 8). The Cronbach's alpha if item deleted indicated that all items contributed to increasing the internal consistency of the EDP subscale. An internal reliability, as measured by Cronbach's alpha, was .93 with the 95% confidence interval ranging from .91 to .94 and the reliability of the factor 1 scale was satisfactory (McCoach et al., 2013). The factor 1 had a mean of 5.43 and a standard deviation of .97. An employee with a high score on EDP scale would make extensive efforts to develop and expand his/her knowledge and skills as a primary way of enhancing one's work-related expertise.

The second factor and the third factor. Items that came from the hypothesized LPN were divided into factors 2 and 3. Originally, I hypothesized that LPN can contribute to individuals' expertise development in two different ways. First, LPN contributes to extending individuals' boundary of expertise development through individuals' strategic networking or collaborations across boundaries of organizations or fields of expertise. Secondly, LPN directly contributes to the guidance and improvement of individuals' deliberate practice by closely interacting with challenging people or other experts. The former process corresponds to the second factor and the latter corresponds to the third factor.

Five out of 10 items were retained on the second factor: items #13, #18, #26, #27, and #32. Among them, item 18 was reworded to clarify meaning. All five items belonged to the

originally hypothesized LPN construct and represent individuals' efforts to strategically develop professional networks that might contribute to the extension of individuals' expertise. I named the second factor as Strategic Networking (SN). Using the five items, I conducted reliability analyses. The variance of IICs was less than .01 for this subscale (Table 8). The Cronbach's alpha if item deleted indicated that all items contributed to increasing the internal consistency of the SN subscale. An internal reliability, measured by Cronbach's alpha, was .887 with the 95% confidence interval ranging from .864 to .907, indicating good reliability. It had a mean of 4.56 and a standard deviation of 1.31. An employee with a high score on the SN scale would actively and strategically develop and participate in professional networks in which they can broaden and deepen their knowledge and experience.

Five out of 6 items were retained on the third factor: items #1, #2, #4, #35, and #42. Among these, four out of the 5 retained items originally belonged to the hypothesized LPN construct and item 2 was originally hypothesized to indicate DWE. The retained five items indicated more focused and frequent personal interactions aimed directly at enhancing one's expertise. Thus, I named this factor as Frequent and Focused Interactions (FFI). Using the five items, I conducted reliability analyses. The variance of IICs was less than .01 for FFI factor (Table 8). The Cronbach's alpha if item deleted indicated that all items contributed to increasing the internal consistency of this subscale. An internal reliability, measured by Cronbach's alpha, was .809 with the 95% confidence interval ranging from .770 to .842, indicating good reliability. It had a mean of 4.53 and a standard deviation of 1.23. An employee with a high score on the FFI subscale would have frequent and intensive interactions with more experienced people or challenging colleagues with an explicit expectation of expertise development.

The fourth factor. Nine out of 13 items were retained: items #11, #14, #19, #29, #30, #34, #37, #39 and #43. Among these, item #30 was reworded to clarify meaning. Except for

the item 30 (originally hypothesized to belong to LPN construct), all the eight items were hypothesized to belong to DWE construct. Thus, I named the fourth factor as Developmental Work Experience (DWE) as initially conceptualized. Using the nine items, I conducted reliability analyses. The variance of IICs was less than .01 for DWE factor (Table 8). The Cronbach's alpha if item deleted indicated that all items contributed to increasing the internal consistency of the DWE subscale. An internal reliability, measured by Cronbach's alpha, was .880 with the 95% confidence interval ranging from .858 to .901, indicating the subscale had good reliability. It had a mean of 5.61 and a standard deviation of .81. An employee with a high score on DWE scale would have complex work experiences that challenge and expand one's current level of expertise in and/or beyond the current workplace.

The Results of Confirmatory Factor Analyses

In phase IV, I conducted Confirmatory Factor Analysis (CFA) to determine how well the hypothesized factor model (i.e. the factor structure obtained from the EFA at the phase III study) fit a new sample of an employee population to address the second research question: To what extent can the general dimensions of employee expertise development be confirmed across various work settings?

The initial model of the CFA consisted of all 30 items selected from EFA. Following the standard CFA procedure, each question was specified a priori as an indicator for only one factor. Items #3(3⁴), #5(5), #6(6), #7(7), #8(9), #9(10), #14(17), #17(22), #18(24), #27(36), and #29(38) were specified as indicators of Engagement in Deliberate Practice (EDP). Items #10(11), #12(14), #16(19), #21(29), #22(30), #25(34), #28(37), #30(39), and #32(43) were specified as indicators of Developmental Work Experience (DWE). Items #11(13), #15(18), #19(26), #20(27), and #24(32) were specified as indicators of Strategic Networking (SN).

⁴ The item number in parenthesis is the item number used in phase III survey for EFA.

Items 1(1), 2(2), 4(4), 26(35), and 31(42) were specified as indicators of Frequent and Focused Interactions (FFI). Although the structure coefficients (path coefficients) for all of the indicators were statistically significant, the initial model did not exhibit acceptable fit to the data. The chi square statistics was statistically significant ($\chi^2 = 941.452$, $df = 399$) indicating the predicted values from the specified model significantly did not fit to the actual data. However, this test tends to produce significant chi-square with large sample sizes, even with a model having adequate fit (McCoach et al., 2013). The CFI was .833 which did not meet the criteria for satisfactory level of CFI equal or greater than .90 or .95 (Brown, 2006; Hu & Bentler, 1999; McCoach et al., 2013). Additionally, the RMSEA was .086 with 90% a confidence interval of .079 to .093 and the SRMR was .083, indicating the fit of the specified model to the observed data was not adequate (Hu & Bentler, 1999; McCoach et al., 2013). SRMR values of .08 or less and RMSEA values of .06 or less generally indicate an acceptable level of fit (McCoach et al., 2013). These results jointly indicated the need for the model respecification.

It is a common practice in CFA to modify certain aspects of the construct model (i.e., respecification) and use it as an alternative model of the original for goodness of fit comparison. In addition, relying on MacCallum's model generation strategy (1995), McCoach (2002) partly used CFA as a more exploratory strategy, rather than a strictly confirmatory approach. However, they also strongly warned that theoretical consideration should guide the respecification of CFA model. The model should not be modified simply to improve measures of fit (McCoach et al., 2013) because of the possibility of over-fitting to a particular dataset. In addition, McCoach et al. suggested specifying competing models a priori and evaluating those competing models, rather than fixing the hypothesized model multiple times and simply relying on modification indices. Thus, in this study, I first tried to

specify a priori competing model. To this end, I used information from EFA, as well as CFA results.

In CFA, examination of the structural coefficient, the correlation matrix, and the standard residual matrix informed that the relatively weak items in EFA were also problematic in the initial CFA model; item #12(14), #14(17), #17(22), #18(24), #21(29), #22(30), #29(38). Using the information from EFA, I examined CFA results with particular attention to those items identified to be at relatively higher risk of multidimensionality.

In the result of the initial CFA model, items #21 and #22 had relatively low structural coefficient (i.e., $< .60$, McCoach, 2002) as they were in EFA. Examination of the structural residual covariance matrix revealed that items #12, #14, #21, #22, and #29 were problematic, as each of these items had values over 2 with several other items (ranged from 2.134 to 3.624). Inspection of the correlation pattern among all variables revealed that items #17 and #18 were subject to multidimensionality. These two items were specified to represent the EDP construct, but the two items were correlated similarly with other EDP and non-EDP items. Specifically, items #17 and #18 respectively produced correlations of .60 and .59 with the DWE factor, .52 and .51 with the FFI factor, as well as .75 and .74 with the EDP factor which the two items were meant to represent.

In conclusion, item #14, #17, #18, and #29 from EDP and item #12, #21, and #22 from DWE were more likely to cause multidimensionality problem across samples (i.e., EFA sample and CFA sample). As mentioned earlier in the theoretical review, EDP and DWE can overlap in nature to a certain extent. In some domains of expertise, such as general employee expertise, the boundary between work and deliberate practice may not be as clear as it is in a more classical specific domain of expertise such as in the area of classical music (Sonnentag & Kleine, 2000). In terms of the scope of content, these items may represent the area that some characteristics of the EDP and DWE constructs overlap. Nevertheless, the degree of

multidimensionality can work against the validity of the EEDS. Also, interrelations among the EEDS factors were specified in the CFA model. Thus, I decided to exclude these items to create a revised CFA model. By omitting these 7 items, the revised CFA model included 23 items in total that loaded on the four factors (i.e., EDP, SN, FFI, and DWE subscales) and each factor included 5 to 7 items (figure 1, Table 10). Other than that, the original and revised CFA models were equivalent.

In sum, in the revised CFA model: items #3, #5, #6, #7, #8, #9, and #27 were specified to load on the EDP factor, items #11, #15, #19, #20, and #24 were specified to load on the SN factor, and items #1, #2, #4, #26, and #31 were specified to load on the FFI factor, and items #10, #16, #25, #28, #30, and #32 were specified to load on the DWE factor (figure 1).

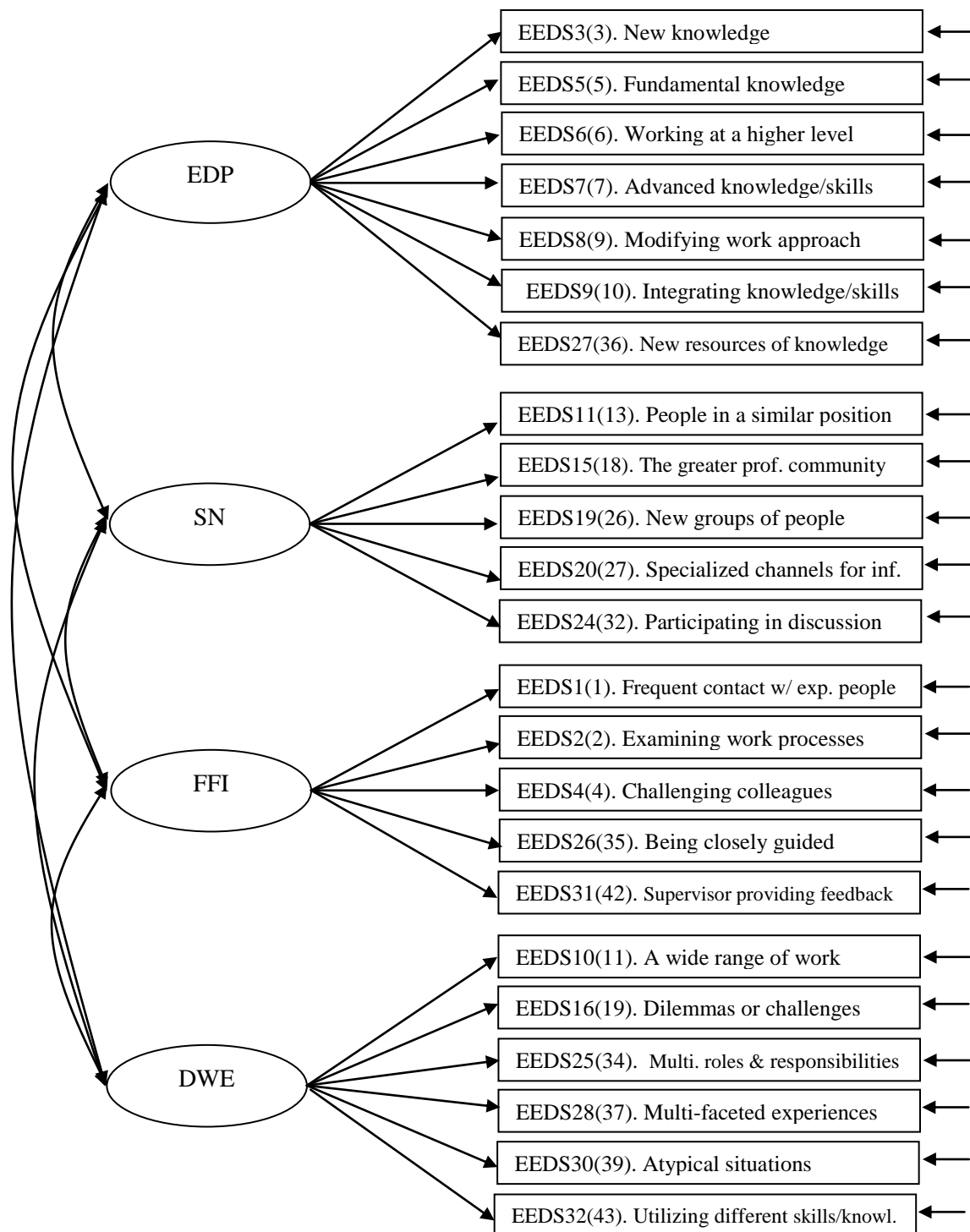


Figure 1. Revised CFA model: Final EEDS construct model. Item number came from the CFA(EFA) survey. EPD=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience.

The following are the results of the revised CFA model. All paths coefficients were statistically significant and ranged from .633 to .878, indicating that all items were substantially associated with the corresponding factors. In addition, all error variances were statistically significant (Appendix X), indicating that each item had some unique variance not explained by the factor and thus the factor and the item were not completely redundant. Estimated correlations among the factors ranged from .448 to .756 (Table 10). According to McCoach et al. (2013), the two factors that have a correlation greater than .85 are problematic in terms of discriminant validity, since these may measure the same underlying construct. The correlation value between EDP and DWE ($r = .756$) was relatively high, but indicated the two factors actually measured two related, but distinct underlying constructs.

Finally, the goodness-of-fit indices also indicated that this model had an acceptable level of fit. The CFI (CFI=.933) was greater than .90, indicating an acceptable fit (Brown, 2006; Hu & Bentler, 1999; McCoach et al., 2013). Additionally, the SRMR was = .066, indicating good fit of the model to the data (Hu & Bentler, 1999; McCoach et al., 2013) and the RMSEA was .06, with the 90% confidence interval ranging from .05 to .07, also indicating an acceptable fit (Hu & Bentler, 1999; McCoach et al., 2013). In this model, the chi square statistics was statistically significant (373.596, $df = 224$); however, this was most likely due to the sample size sensitivity problem ($N = 186$). Estimated correlations between factors were moderate to high level (Table 12). Examination of the structural coefficient, the correlation matrix, and the standard residual matrix exhibited in much better shape than the initial CFA model. As a result, the revised CFA model became the final CFA model. The four-factor structure depicted the final CFA model held for the employee population sampled in this study.

Table 10

Standardized Regression Weights

Item	Specified factor	Estimate
EEDS3(3). I seek out new knowledge in my area of expertise.	EDP	.747
EEDS5(5). I thoroughly examine fundamental knowledge to get to the core of a matter.	EDP	.744
EEDS6(6). I take advantage of opportunities to work at a higher level than my current position in my workplace.	EDP	.633
EEDS7(7). I systematically study advanced knowledge or skills beyond my immediate needs.	EDP	.697
EEDS8(9). I proactively modify my work approach in order to develop the best practice.	EDP	.655
EEDS9(10). I integrate what I have newly learned with my prior knowledge and skills.	EDP	.666
EEDS27(36). I explore new resources of knowledge and skills in my area of expertise.	EDP	.771
EEDS11(13). I seek out opportunities to network with people who are in a similar position, but work for other companies or industries.	SN	.733
EEDS15(18). I make an effort to engage in the greater professional community.	SN	.811
EEDS19(26). I make an effort to meet new groups of people to enrich my professional networks.	SN	.874
EEDS20(27). I am developing specialized channels to facilitate information exchange with other professionals.	SN	.823
EEDS24(32). I participate in discussions in professional communities through social media or public meetings.	SN	.658
EEDS1(1). I have frequent contact with more experienced people to discuss my performance.	FFI	.790
EEDS2(2). I have opportunities to examine work processes after completing a complex task in the workplace.	FFI	.751
EEDS4(4). I work with challenging colleagues who expand my thinking and performing.	FFI	.695
EEDS26(35). I am closely guided by others with more expertise.	FFI	.637
EEDS31(42). My supervisor provides feedback on a regular basis to develop my expertise.	FFI	.700
EEDS10(11). I experience a wide range of work situations.	DWE	.753
EEDS16(19). My work includes dilemmas or challenges.	DWE	.707
EEDS25(34). My work involves multiple roles and responsibilities.	DWE	.711
EEDS28(37). My work includes multi-faceted experiences.	DWE	.878
EEDS30(39). I deal with atypical situations in doing my work.	DWE	.683
EEDS32(43). While doing my daily work, I utilize different skills and knowledge.	DWE	.805

Notes. The item number in parenthesis is the item number used in phase III survey for EFA.

EPD=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience.

Table 11

Model fits of Competing CFA Models

	CFI	RMSEA (90% CI)	SRMR	Chi-square	df
The initial CFA model	.83	.086 (.079 to .093)	.083	941.45	399
The revised CFA model	.93	.060 (.049 to .071)	.066	373.60	224

Table 12

Estimated Correlations among factors (N = 186)

	EDP	SN	FFI
EDP	1		
SN	.533	1	
FFI	.514	.485	1
DWE	.756	.448	.537

Note. EPD=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience.

The Result of Reliability Analysis

Followed by the confirmation of the final factor structure and measurement model of the EEDS, I combined the EFA sample (phase III study) and CFA sample (phase IV study) to test the reliability of the four factors. The results were presented in Table 13. The EDP factor had 7 items and its internal reliability statistics Cronbach's alpha was .89 (95% confidence interval = .88 - .91), indicating good internal reliability. The EDP factor had a mean of 5.67 and a standard deviation of .89. The SN factor had five items and its internal reliability statistics Cronbach's alpha was .89 (95% confidence interval = .87 - .90), indicating good internal reliability. The SN factor had a mean of 4.58 and a standard deviation of 1.31. Finally, the FFI factor had five items and its internal reliability statistics Cronbach's alpha was .82 (95% confidence interval = .80 - .85), indicating good internal reliability. The FFI

factor had a mean of 4.69 and a standard deviation of 1.24. The DWE factor had 6 items and its internal reliability statistics Cronbach's alpha was .87 (95% confidence interval = .85 - .89), indicating good internal reliability. The DWE factor had a mean of 5.68 and a standard deviation of .90.

Table 13

Means, standard deviations, and internal reliability of the four factors of the final measurement model with the combined sample (N = 458)

	Number of items	Mean	SD	Cronbach's Alpha	95% CI
EDP	7	5.67	.89	.89	.88-.91
SN	5	4.58	1.31	.89	.87-.90
FFI	5	4.69	1.24	.82	.80-.85
DWE	6	5.68	.90	.87	.85-.89

Note. EPD=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience.

Results of the Additional Analyses for the Construct and Criterion Validity

In previous section, the statistical and structural validity of the EEDS were presented. This section provides preliminary evidences to establish the construct and criterion validity of the EEDS. The differences in dimensions of the EEDS by fields of experience, correlations among relevant variables, and predictive power with two expertise related criteria are presented.

Factor mean differences by fields of expertise. Means and standard deviations of the 4 factors by Fields of Expertise are presented in Table 14. These means by fields of expertise were analyzed using a one-way ANOVA to test where the differences in means were statistically significant (see Table 15). Due to a Bonferroni adjustment, the statistical significance was determined at adjusted alpha of .0125 (i.e., typical p -value of significance / number of groups = $.05 / 4 = .0125$) in ANOVA table. Post hoc comparisons on the

significant variables are presented in Table 16. Differences in the DWE factor were statistically significant across fields of expertise ($F_{(9,446)} = 3.27, p < .001$), with the employees from Community, Social Service, Legal, Arts, Design, Entertainment, Sports, and Media Occupations having the lowest scores ($M = 5.32$), which was significantly different from Service Occupations group having the highest scores ($M = 6.02$). Except for the DWE factor, there was no significant difference in means for EDP, SN, and FFI factors across fields of expertise. Overall, the results of ANOVA indicated that despite the variability in fields of expertise, employees tend to report a similar level of engagement in each of four constructs (factors) of the EEDS.

Table 14

Means and standard deviations of the four factors of the EEDS across fields of expertise (N = 456)

	EDP		SN		FFI		DWE		N
	M	SD	M	SD	M	SD	M	SD	
1. Management occupations	5.81	.87	4.71	1.41	4.92	1.19	5.94	0.67	43
2. Business and financial operations occupations	5.67	.98	4.34	1.50	4.75	1.14	5.42	1.11	49
3. Computer, Engineering, and Science occupations	5.65	.87	4.48	1.24	4.73	1.21	5.51	0.81	77
4. Community, Social Service, Legal, Arts, Design, Entertainment, Sports, and Media Occupations	5.47	.89	4.66	1.22	4.49	1.41	5.32	0.89	43
5. Service occupations	5.74	1.12	4.58	1.25	4.96	1.13	6.02	0.76	33
6. Education, training, and library occupations	5.81	.76	4.85	1.24	4.61	1.23	5.85	0.94	100
7. Healthcare practitioners and technical occupations	5.65	1.03	4.70	1.56	4.77	1.38	5.51	1.01	22
8. Sales and related occupations	5.77	.73	4.32	1.29	5.08	1.12	5.81	0.72	32
9. Office and administrative support occupations	5.32	1.00	4.04	1.21	4.14	1.42	5.60	0.97	31
10. Others	5.60	.82	4.78	1.28	4.64	1.01	5.86	0.77	26
Total	5.68	.89	4.58	1.31	4.70	1.23	5.68	0.9	456

Notes. Others category included Natural Resources, Construction, and Maintenance Occupations, Production, Transportation, and Material Moving Occupations, and Military Specific Occupations. EPD=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience.

Table 15

One-way ANOVA for testing differences in means of the four factors of the EEDS across fields of expertise (N = 456)

Variable		Sum of Squares	df	Mean Square	F	p
EDP	Between Groups	9.00	9	1.00	1.27	.251
	Within Groups	351.47	446	0.79		
	Total	360.48	455			
SN	Between Groups	24.59	9	2.73	1.61	.111
	Within Groups	759.10	446	1.70		
	Total	783.69	455			
FFI	Between Groups	21.61	9	2.40	1.60	.114
	Within Groups	670.55	446	1.50		
	Total	692.16	455			
DWE	Between Groups	22.84	9	2.54	3.27	.001*
	Within Groups	346.43	446	0.78		
	Total	369.28	455			

Notes. * indicates statistically significant at was .0125 level, applying a Bonferroni adjustment for a .05 level (i.e., typical p -value of significance / number of groups = $.05 / 4 = .0125$). EPD=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience.

Table 16

Bonferroni test for Post hoc Comparisons between Community, Social Service, Legal, Arts, Design, Entertainment, Sports, and Media Occupations and other fields of expertise for DWE (N=456)

Variable	Groups	Mean Difference	SE	p
DWE	4 and 1	-.620	.190	.053
	4 and 2	-.097	.184	1.000
	4 and 3	-.187	.168	1.000
	4 and 5	-.693*	.204	.033*
	4 and 6	-.527	.161	.051
	4 and 7	-.186	.231	1.000
	4 and 8	-.486	.206	.842
	4 and 9	-.275	.208	1.000
	4 and 10	-.537	.219	.653

Notes. * $p < .05$. DWE=Developmental Work Experience. Field of Expertise: 1=Management occupations, 2=Business and financial operations occupations, 3=Computer, Engineering, and Science occupations, 4=Community, Social Service, Legal, Arts, Design, Entertainment, Sports, and Media Occupations, 5=Service occupations, 6=Education, training, and library occupations, 7=Healthcare practitioners and technical occupations, 8=Sales and related occupations, 9=Office and administrative support occupations, 10=Others (See the note for table 14).

Correlations among four factors of the EEDS and other relevant variables. Table 17 shows the correlations among four factors of the EEDS and other variables related to the expertise development. Inter-correlations of the four EEDS factors ranged from .42 to .62. As expected, the EEDS factors were inter-related, but distinct. Years of Experience was not significantly correlated with EDP, SN, and DWE, indicating that these factors were not likely to be associated with any particular stage of expertise development. However, although the effect size was small, FFI exhibited statistically significant negative correlation with years of experience $r = -.10$ ($p < .05$), indicating employees with longer years of experience were less likely to involve FFI. Each EEDS factor had statistically significant positive correlations with three organizational variables (i.e., availability, accessibility, and organizational support), ranging from .33 to .60. In particular, FFI showed the highest correlations with the three organizational variables, ranging from .57 to .60. Additionally, each of four factors of the EEDS was moderately correlated with motivation, ranging from .39 to .57 ($p < .01$). These results indicated that 4 factors of the EEDS were significantly related to the variables that might influence the extent to which an employee participates in expertise development, but, were not redundant in assessing employee expertise development. Finally, factors were statistically significantly correlated with both self-reported level of performance with expertise reference (ranging .22 to .47) and self-reported level of performance with objective reference (ranging .24 to .43), indicating that 4 factors of the EEDS can be meaningfully associated with employee's level of expertise and performance.

Table 17

Bivariate Correlations for all participants (N=456)

	1	2	3	4	5	6	7	8	9	10	M	SD
1. EDP	1.00										5.67	0.89
2. SN	.559**	1.00									4.58	1.31
3. FFI	.498**	.435**	1.00								4.69	1.24
4. DWE	.620**	.433**	.417**	1.00							5.68	0.90
5. Years of Experience	.025	.032	-.104*	.058	1.00						15.50	10.74
6. Availability	.459**	.394**	.574**	.358**	-.006	1.00					6.43	2.31
7. Accessibility	.440**	.399**	.596**	.333**	.014	.881**	1.00				6.30	2.31
8. Organizational Support	.383**	.370**	.573**	.328**	-.031	.766**	.813**	1.00			6.46	2.32
9. Motivation	.524**	.390**	.455**	.387**	.047	.592**	.565**	.601**	1.00		7.08	2.23
10. Expertise-Reference	.470**	.287**	.215**	.388**	.141**	.293**	.292**	.297**	.454**	1.00	7.87	1.37
11. Objective-Reference	.427**	.242**	.256**	.371**	.080	.321**	.315**	.371**	.371**	.719**	7.94	1.46

Note: Total N=456 ** $p < .01$. * $p < .05$. EPD=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience. Expertise-reference = self reported performance using expertise-reference, Objective reference = self reported performance using object criteria as reference.

Results from hierarchical multiple regression analyses. I conducted a series of hierarchical multiple regression analysis to test the unique contribution of each of four EEDS factors in explaining the two self-rated level of performance over various organizational variables, years of experience, and motivation for expertise development. Specifically, the three organization related variables of availability, accessibility, and organizational support were introduced as independent variables at step 1 (Model 1). Two individual variables (years of experience and motivation) were introduced as an additional independent variable at step 2 (Model 2). Each of four EEDS factors was introduced as an additional independent variable at Step 3 (Model 3a - 3d, Table 18) and each of the self-reported performance variables was a dependent variable (Table 18 and 19). As a dependent variable, self-reported level of performance with expertise reference can be regarded as a proxy expertise criterion (Table

18) and self-reported level of performance with objective reference indicates employees' perception on their daily performance in the particular workplace.

First, the three organizational variables explained 9.9% of the variance in self-reported performance using expertise-reference (Model 1, Table 18). Years of experience and motivation significantly explained an additional 12.1% of the variance in self-rated expertise after controlling the three organizational variables (Models 2, Table 18). Models 3A, 3C, and 3D respectively indicated that EDP, SN, and DWE significantly and uniquely explained the variance of self-reported performance using expertise-reference after controlling the three organizational variables and two individual variables. The amount of uniquely explained variances in self-rated performance with expertise reference (i.e., R^2 changes) by EDP, SN, and DWE over other organizational variables, years of experience, and motivation were respectively 7.4%, 1.2%, and 4.9%. However, FFI did not significantly explain the additional variance in self-rated expertise beyond the three organizational variables, years of experience, and motivation. These results indicated the incremental predictive validity of each factor of the EEDS except for FFI. It needs to be noted that FFI was negatively correlated with years of experience, suggesting the possibility of the moderating effect of the years of experience on the FFI and self-reported performance using expertise-reference relationship.

Next, when the self-reported level of performance using others' appraisal as reference (i.e., objective reference) was used as a dependent variable, the incremental predictive validity of EDP and DWE were also confirmed, but SN and FFI did not add significant explained variance. The results were slightly different because of the relative emphasis on performance in the dependent variable. The three organizational variables explained 14.1% of the variance in self-reported performance with objective reference (Model 1, Table 19). Years of experience and motivation significantly explained an additional 3.8% of the variance in self-rated performance with objective reference after controlling the three organizational

variables (Models 2, Table 19). Models 3A, 3B, 3C, and 3D in table 19 respectively indicated that only EDP and DWE significantly and uniquely explained the variance of self-reported performance with objective reference after controlling the three organizational variables and two individual variables. The amount of uniquely explained variances in self-rated performance with objective reference (i.e., R^2 changes) by EDP and DWE over other organizational variables, years of experience, and motivation were respectively 6.8% and 4.9%, which were similar amounts of variance to explain self-rated performance with expertise reference. However, SN and FFI did not significantly explain the additional variance in the self-rated performance variable beyond the three organizational variables, years of experience, and motivation.

Table 18

Summary of hierarchical regression analysis for variables predicting self-reported performance using expertise-reference (N=456)

	Model 1			Model 2			Model 3A			Model 3B			Model 3C			Model 3D		
Variable	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β
Availability	.075	.057	.127	-.005	.054	-.009	-.040	.052	-.067	-.012	.054	-.021	-.006	.054	-.010	-.031	.053	-.052
Accessibility	.031	.063	.052	.029	.059	.050	-.001	.056	-.001	.017	.059	.029	.028	.059	.048	.030	.057	.050
Org. Support	.093	.046	.158*	.010	.045	.017	.033	.043	.056	.008	.044	.013	.009	.045	.016	.004	.043	.006
Years of Exp.				.014	.005	.111**	.014	.005	.111**	.014	.005	.109**	.014	.005	.112**	.013	.005	.099*
Motivation				.256	.033	.417**	.175	.034	.284**	.240	.034	.389**	.256	.034	.416**	.218	.033	.354**
EDP							.506	.074	.328**									
SN										.129	.048	.124**						
FFI													.006	.060	.006			
DWE																.373	.068	.245**
R^2	.099			.221			.294			.233			.221			.270		
<i>F</i> for change in R^2	16.572**			35.068**			46.928**			7.134**			.011			30.355**		

Notes. * indicated statistically significant at the $p < .05$. **indicated statistically significant at the $p < .01$ level. EDP=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience.

Table 19

Summary of hierarchical regression analysis for variables predicting self-reported performance using objective-reference (N=456)

	Model 1			Model 2			Model 3A			Model 3B			Model 3C			Model 3D		
Variable	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β	<i>B</i>	<i>SE B</i>	β
Availability	.077	.059	.122	.033	.059	.052	-.002	.057	-.004	.028	.059	.044	.029	.059	.046	.006	.058	.009
Accessibility	-.034	.065	-.053	-.036	.064	-.057	-.067	.062	-.106	-.045	.064	-.071	-.044	.065	-.070	-.036	.062	-.057
Org. Support	.202	.048	.320**	.156	.049	.248**	.180	.047	.286**	.155	.049	.246**	.151	.049	.240**	.150	.048	.238**
Years of Exp.				.011	.006	.079	.011	.006	.079	.011	.006	.078	.011	.006	.084	.009	.006	.067
Motivation				.144	.036	.220**	.060	.037	.092	.133	.037	.202**	.141	.037	.214**	.103	.036	.158**
EDP							.520	.081	.316**									
SN										.090	.053	.080						
FFI													.053	.066	.045			
DWE																.397	.074	.244**
R^2		.141			.179			.247			.184			.180			.228	
<i>F</i> for change in R^2		24.787**			10.203**			40.835**			2.845			.647			28.490**	

Notes. * indicated statistically significant at the $p < .05$. **indicated statistically significant at the $p < .01$ level. EPD=Engagement in Deliberate Practice, SN=Strategic Networking, FFI=Frequent and Focused Interactions, and DWE=Developmental Work Experience.

Chapter Summary

The two research questions addressed in this chapter were:

What are the general dimensions of employee expertise development?

To what extent can the general dimensions of employee expertise development be confirmed across various work settings?

Regarding the first research question, qualitative data analysis and content validation suggested three general dimensions of employee expertise development: Engagement in Deliberate Practice (EDP), Developmental Work Experience (DWE), and Learning in Professional Networks (LPN). EFA analyses were followed and the results exhibited that Learning in Professional Networks needed to be divided into two dimensions and four factor structure explained the data from an employee sample most efficiently. To summarize, the four factors were identified to be the fundamental dimensions of employee expertise development and they were Engagement in Deliberate Practice (EDP), Strategic Networking (SN), Frequent and Focused Interactions (FFI), and Developmental Work Experience (DWE). Based on the EFA results, 30 items were retained in the EEDS and Cronbach's alpha coefficients indicated that each of four EEDS factors had satisfactory internal consistency reliability.

Regarding the second research question, CFA was conducted and considering the possibility of multidimensionality for particular items and goodness of fit, the final measurement structure model for the EEDS included 23 items that were loaded on one of the four-factors. The CFA results exhibited an acceptable level of model fit to new employee sample data. This confirmed that the four dimensions of the EEDS can be generalizable to a sample of employees having different backgrounds. Results from the EFA, CFA, and reliability analyses confirmed that the four dimensions of the EEDS were statistically valid and robust. Additional correlation,

ANOVA, and hierarchical multiple regression analyses provided further evidence to the construct and criterion validity of the EEDS, and were in support of the second research question. Shortly speaking, the results indicated that the four dimensions of the EEDS can be applicable to different employee populations having various backgrounds (e.g., fields of expertise within employee expertise and years of experience). The four factors exhibited a meaningful pattern of correlations with various organizational and individual variables that are important in HRD research. Finally, except for FFI factor, the rest of the three EEDS factors (EDP, FFI, and DWE) significantly and uniquely predicted a self-reported performance with expertise reference (i.e., a proxy expertise criterion). EDP and DWE significantly and uniquely explained a self-reported performance with objective reference (i.e., a proxy performance criterion). These findings indicated that the four dimensions of the EEDS can be meaningful and practical constructs to assess employee expertise developmental process across various work settings. The newly developed EEDS is presented in Appendix K.

Chapter Four

Discussion

This study examined the underlying dimensions of the Employee Expertise Development Scale (EEDS) with an attempt to answer the following research questions:

What are the general dimensions of employee expertise development?

To what extent can the general dimensions of employee expertise development be confirmed across various work settings?

EFA results indicated a four-factor structure including Engagement in Deliberate Practice (EDP), Strategic Networking (SN), Frequent and Focused Interactions (FFI), and Developmental Work Experience (DWE). CFA results confirmed the adequacy of this four-factor structure with an additionally collected data set. Other preliminary analyses also provided further evidence on the construct validity of the four dimensions. The results advanced previous literature in numerous ways and offered implications for future research and educational practices in expertise development.

In response to the first research question, the implications of the four factors emerged from EFA and other related results are discussed in this chapter. Subsequently, discussion about the generalizability of the identified four factor solution of the EEDS is provided to address the second research question. Then, criterion related validity evidences and significance of the four dimensions are presented. More detailed description of the final items of the four EEDS dimensions is provided. Theoretical and practical significance and limitations of this study are discussed. As a conclusion of this section, recommendations for the future study are provided.

Emergence of the Four General Dimensions of the EEDS

Based on the qualitative data analysis and literature review, I originally hypothesized that

three constructs compose the EEDS, namely Engagement in Deliberate Practice (EDP), Developmental Work Experience (DWE), and Learning in Professional Networks (LPN). An adequate level of content validity was demonstrated for these three dimensions. However, EFA results suggested that the original LPN construct can be better represented by the two related, but distinct constructs, that is to say, Strategic Networking (SN) and Frequent and Focused Interactions (FFI). Consequently, the originally assumed EEDS model based on three constructs was restructured to four constructs. CFA confirmed the four constructs of the EEDS and they were: EDP, SN, FFI and DWE.

It is first notable that EDP was the primary factor in exploratory factor analysis. Judging from eigenvalues in exploratory factor analysis results, EDP explained 41.2% of the total variance in the items prior to rotation, compared with much smaller amount of variance explained by SN, FFI, and DWE (6.5%, 4.6%, and 4.1% respectively). A recent meta-analysis study (Macnamara, Hambrick, & Oswald, 2014) questioned the effect of deliberate practice in developing expertise for less predictable professions, such as education or sales. However, the present study showed that deliberate practice represented by the EDP factor of the EEDS was the most substantial construct of employee expertise development in the employee sample recruited the various occupation groups including educations and sales.

Second, the SN and FFI dimensions exhibited two different social learning mechanisms that mediate employees' expertise development in dynamic social environment. As addressed in the introduction, various workplace learning models such as situated learning theories (Billett, 2004, 2008; Lave & Wenger, 1991) and expertise development models (Grenier & Kehrhahn, 2008; Mieg, 2006) described how employees interact with surrounding contexts to enhance their expertise, but no theory clarified the concrete process of learning mechanism. The FFI dimension

reflects interpersonal learning processes among employees within a particular boundary of work settings, similar to the situated learning theories (Billett, 2004, 2008; Lave & Wenger, 1991) which focus on dynamics of interpersonal interaction within the workplace. Meanwhile, the SN dimension demonstrates the ways that employees extend their professional networks developing a variety of external social resources across boundaries of a particular expertise or workplace (Brown & Duguid, 2001). Thus, the SN dimension can represent a process to build up employees' social recognition and professionalism as suggested in the expertise scales mentioned in the introduction (Germain & Tejeda, 2012; Johanna & van der Heijden, 2000; Mieg, 2009).

Lastly, although research on the workplace learning (e.g., Billet, 2004, 2008; Goldman, 2008; Paloniemi, 2006) emphasized the role of work experience in developing employee expertise, the present study found that although DWE is a meaningful dimension for employee expertise development, the relative influence of DWE was shown to be not as great as expected. As the last factor identified from the exploratory factor analysis, DWE explained 4.1% of the total variance of the items prior to rotation. This may be attributable to the employees' tendency to place more emphasis on their intentional efforts than the given work conditions, partly reflected by DWE, in developing their expertise. In fact, individual efforts are more salient to employees themselves (Mieg, 2009) and the EEDS is based on employees' self-report elevating the chance of greater variances in responses to employees' intentional efforts. In addition, in line with the findings of previous qualitative research (e.g., Goldman, 2008; Cheetham & Chivers, 2001), the EEDS showed that variability and challenging natures of work experience are critical attributes of DWE that make employees work at the edge of their current expertise. Due to the challenging characteristics that overlap with EDP, DWE had the strongest correlation with EDP

($r=.62$) among other factors in the EEDS, but the moderate correlation indicated that DWE is distinct from EDP.

In the subsequent analyses, mild to moderate correlations between the four dimensions of the EEDS and other relevant variables (i.e., availability, accessibility, organizational support, motivation for development) were observed indicating discriminant validity of the EEDS constructs. In other words, the dimensions of the EEDS were associated with, but meaningfully distinct from, the constructs like organizational affordances and individual motivation. Existing theories on learning in the workplace explained expertise development in terms of the characteristics of work contexts and individual attributes. For example, according to Billett (2004), the extent to which learning occurs in the workplace is determined by interdependency between affordances and individuals' intention to learn. Eraut (2004) also pointed out general factors affecting learning in a wide range of the work contexts, including learning factors (i.e., challenge and value of the work, feedback and support, and confidence and commitment) and three contextual factors (i.e., allocation and structuring of work, encounters and relationships with people at work, and expectations of each person's role, performance and progress). However, these theories have not paid much attention to the specific ways individuals interact and behave in relation to these learning and contextual factors to develop their expertise (Eraut, 2004). The exploratory factor analysis results and the discriminant validity evidence indicated that the four dimensions of the EEDS address this gap and specified a concrete behavioral process of learning in consideration of the interplay between general learning and environmental factors.

The Generalizability of the Four Dimensions of the EEDS

In order to address the second research question, "To what extent can the general

dimensions of employee expertise development be confirmed across various work settings?”, CFA and other preliminary analyses were conducted. CFA analysis confirmed that the four-factor structure was adequate to an employee sample ($N = 186$) which was different from the sample used for EFA ($N = 272$). However, seven originally assumed items were eliminated following the CFA in order to reduce the possibility of multidimensionality across four factors (four items from EDP and three items from DWE). Many of the widely accepted organizational constructs such as performance (Richard, Devinney, Yip, & Johnson, 2009) and learning (Akgün, Lynn, & Reilly, 2002) are multidimensional. Likewise, the present study empirically demonstrated that the construct of employee expertise development is multidimensional meaning that “several distinct but related dimensions [were] treated as a single theoretical concept” (Edwards, 2001, p. 144). Multidimensional constructs can be theoretically more useful by representing complex phenomenon as a whole (e.g., Hanisch, Hulin, & Roznowski, 1998), but critics question the conceptual ambiguity of general constructs (e.g., Johns, 1998). This gap can be addressed by incorporating the comprehensiveness of multidimensional constructs along with the specificity and precision of the dimensions that comprise the construct (Edwards, 2001). Indeed, items that indicated higher risk of multidimensionality in CFA were lacking in content specificity and eliminated from the final EEDS (e.g., I structure my approach to work in ways that improve a weak area in my knowledge or skills; I educate myself in other relevant fields to strengthen my knowledge and skills). As a result, each dimension of the EEDS became conceptually clearer such that each dimension constituted more coherent items closely representing the dimension’s core attributes.

Furthermore, the present study preliminarily examined the extent to which the four dimensions of the EEDS can be generalized to various employee populations in terms of years of

experience and fields of expertise. The correlation analysis results indicated that all EEDS dimensions, except for FFI, had no significant relation to years of experience. The results indicate that EDP, SN, and DWE measure qualitatively different and more generalizable aspects of employee expertise development as distinguished from simple accumulation of daily experience measured by time such as years of experience. However, FFI had a statically significant and negative relationship with years of experience, but the effect size of the relationship was weak ($r = -.10, p < .05$). The weak, but significant, negative correlation indicates that employees who have longer years of experience are less likely to engage in a variety of Frequent and Focused Interactions (FFI).

Although years of experience are not a significant determinant in employee expertise development in general, employees may have unique developmental needs at particular stage of career development trajectory. For example, focused supports and guided practice such as mentoring or coaching, which two items of FFI are associated with, are more likely to be dominant in earlier stages of expertise development in organizations (Glaser, 1996; Higgins, 2001). During later stages of development, mutual exchange of information and knowledge sharing may be more dominant in developmental relationships (Goldman, 2008; Gruber et al, 2008). Thus, while new comers may engage in developmental relationship with a variety of colleagues regardless of the rank or years of experience, experienced employees may tend to focus on the relationships with colleagues who have a comparable rank or position with them, indicating that experienced employees may engage in only certain types of FFI.

However, distinguishing experienced employees (a full-fledged one) from less experienced employees is somehow arbitrary, and can bring to a new challenge in developing employees' expertise. In general, expertise research found a "10 year-rule" in becoming an

expert in various domains of expertise (Chase & Simon, 1973; Ericsson, Krampe, & Tesch-Römer, 1993). Chase and Simon (1973) first reported that chess players reach a master level after 10,000-50,000 hours of practicing chess (3.5 to 17 years, eight hour a day). Ericsson et al. (1993) showed that the “10-year rule” to reach a superior level of expertise (e.g., a world-class musician or chess player) was common in different areas of expertise, including music, sports, games, and the medical diagnosis. Mieg (2009) also found that ten environmental professions recruited in the study reached the mean level of excellence at about 9.7 years of practice. However, the same study (Mieg, 2009) reported that the mean years of practice remarkably varied across professions. Specifically, chemists and economists reached the mean level of excellence much earlier (after 2.0 years and 6.2 years, respectively) than environmental engineering (13.6 years). The variability of years of practice to reach an excellent level of expertise needs to be considered for different employee groups. Additionally, Mieg (2009) found that professionals’ excellence curve, a longitudinal trends of expertise level of a profession, oscillated around every five years. Thus, the relationship between FFI and years of experience can be more complicated than it looks, calls for the need for future studies on how FFI operates at different stage of expertise development across various groups of employees.

Another issue to consider in figuring out the meaning of FFI is the changes in the today workplace. Due to the rapid and dynamic change in territories of expertise today, employees constantly face the needs for redevelopment of existing expertise across one’s entire working life (Grenier & Kehrhahn, 2008). In fact, organizations recently have begun to capitalize on younger and junior employees’ expertise on emerging trends or use of technology to fill gaps in senior employees’ expertise (e.g., reverse mentoring, Murphy, 2012). Similarly, as a way to distribute employees’ specialized expertise/experience among members, human resource management

encourages employees to educate or train other colleagues (i.e., peer mentoring, Bryant, 2005). Despite the negative correlation between FFI and years of experience, these new approaches in human resource development practice indicate that FFI can be applicable to experienced employees who are continuously encountering developmental expectations from their work. In particular, the boundary between newcomers and veterans are blurred for professionals in knowledge intensive fields of expertise, and they often participate in a community to learn particular technical knowledge and skills (Lankau & Scandura, 2002). Overall, despite the limitation of FFI, the four dimensions of the EEDS can be considered to be general dimensions constituting expertise development of employees across varying years of experience.

Subsequently, generalizability of the EEDS across fields of expertise was examined. ANOVA results indicated that only DWE among the four dimensions of the EEDS had statistically significant mean differences across fields of expertise. Since DWE is more related to work characteristics, it would be possible that DWE varies depending on a particular field of expertise. However, these significant differences were limited to two occupation groups. In specific, among all the post-hoc comparisons, only the difference in DWE between the lowest DWE mean group (Community, social service, legal, arts, design entertainment, sports and media occupations group, $M=5.32$, $SD=0.89$) and the highest DWE mean group (service occupations group, $M=6.02$, $SD=0.76$) was statistically significant (Mean difference $=-.69$, $SE=.20$, $p < .05$). No other mean comparison was statistically significant. In addition to the relatively low correlations between DWE and three organizational variables, the results suggested that DWE is a central component that employees from most occupations in knowledge-intensive industries need to pursue for the development of expertise, like other dimensions of the EEDS (i.e., EDP, SN, and FFI).

The generalizability of the EEDS may reflect the emerging changes in employees' attitude towards the concept of expertise. For advocates of expansive and horizontal views of expertise (Engeström, 2004; Fuller & Unwin, 2004; Hodkinson & Hodkinson, 2004), experts in today's workplace are the people who create new patterns of activity to meet radical and discontinuous changes in the work context. This radical perspective redefined expertise as a transformative process reconstructing meaning of the context rather than continual and progressive improvement of performance based on acquisition of knowledge (Engeström, 2004). New approaches to expertise development inevitably require a consistent approach to the way work is organized, that is to say, an expansive framework to workforce development that, by definition, "enriches and extends an individual's learning territory" (Fuller & Unwin, 2004, p. 141). Fuller, Unwin, Felstead, Jewson, and Kakavelakis (2007), in their case study across three different types of industry, demonstrated that through extensive participation in the productive process, even relatively lower skilled employees, such as the van drivers working for a food processing industry, continuously constructed their expertise vital for everyday survival. Thus, from the viewpoint of expansive learning, the degree of generalizability of four dimensions of the EEDS may depend more on the view of expertise adopted by employees and the broader contexts in which a profession is embedded, rather than a particular field of profession itself.

Criterion Validity and Significance of the Four Dimensions of the EEDS

Criterion-related validity was also examined using final items confirmed by CFA. Regression analysis showed that all the dimensions of the EEDS except for FFI significantly predicted a self-reported performance with expertise reference (i.e., a proxy expertise criterion) after controlling for three organizational variables and one motivation variable. Furthermore, EDP and DWE significantly and uniquely explained self-reported performance with objective

reference (i.e., a proxy performance criterion). Specifically, EDP explained more variance of the two self-rated performance variables (7.4% for the expertise reference and 6.8% for the objective reference) than the other three EEDS constructs after controlling for three organizational variables and one motivation variable. In addition to the fact that EDP was the first factor extracted from EFA, the regression analysis result substantiated the predominant role of EDP in employee expertise development over other dimensions of the EEDS. Thus, as Ericsson (2006) asserted, it is evident that deliberate practice is not only a key factor for the development of specific skills, but also a general mechanism of expertise development that can be applied to various expertise domains. In van de Wiel, Szegedi, and Weggeman's study (2004), the time that top professionals like organizational consultants spent on deliberate practice (e.g., reading scientific literature and teaching) to keep their expertise up-to-date was two times longer than their less successful colleagues with comparable years of experience. The deliberate practice activities assessed in the study of van de Wiel et al. (2004) were well matched with the activities represented in EDP in the EEDS.

DWE was also a significant predictor explaining 4.9% of variance of a self-reported performance with expertise reference and 4.9% of variance of a self-reported performance with objective reference. However, the amount of explained variances was smaller than EDP. By comparing experience based learning with deliberate practice in the workplace, Day (2010) argued that having an explicit learning target during deliberate practice is more effective in expertise development. This is because work experience often focuses on improving performance rather than expertise, while the learning target is not always clear. In fact, in the present study, DWE seemed to be more sensitive to predicting employees' performance than expertise development. Although DWE was the last factor extracted from EFA in the EEDS, it

was the second strongest variable (following EDP) to predict the self-reported employees' performance variables after controlling other relevant organizational and motivation variables. Indeed, DWE items represented the importance of the work conditions (e.g., variations in works and roles and responsibilities) rather than particular work related actions initiated by employees. The roles employees take in the workplace, and the ways to organize work can determine the degree to which employees engage in DWE. Eraut (2004) clarified that the allocation and structuring of work can determine the extent to which employees can access challenging and meaningful work experiences. Goldman (2008) found that becoming a CEO itself expedited CEOs' expertise development. For example, by becoming a CEO, individuals can participate in tasks significant in size and complexity such as broadening the span of one's control in work responsibilities and completing a complex project to work for at least one year. Nevertheless, it is noteworthy that in spite of the expected relationship between DWE and structure of work, DWE had the lowest correlations among the four EEDS factors with three organizational variables and they ranged from .33 to .36 ($p < .01$). The results imply that DWE is not simply an artifact of the contexts of organization alone. Employees' initiative to seek out a position or challenging task (i.e., becoming a CEO), and value that the person imposes on such tasks, can determine the extent to which an employee can be exposed to and take advantage of DWE (Eraut, 2004; Goldman, 2008). Thus, DWE might reflect employees' continuous negotiation between their individual agency and workplace affordances (Billett, 2004).

SN significantly explained 1.2% of variance of a self-reported performance with expertise reference, but did not explain unique variance of a self-reported performance with objective reference over other control variables. Although the explained variance was small, it is worthwhile to mention that SN significantly predicted a proxy expertise criterion, but not a proxy

performance criterion. This result suggests that, as previously mentioned, SN in the EEDS may be a developmental process more relevant to the social and relational aspects of employee expertise and can be better understood from others' perspectives. Thus, SN may be a more meaningful predictor for a socially oriented performance indicator like leadership. In fact, even the proxy expertise criterion was an employees' subjective perception regarding their performance level based upon their own concept of experts in their field, and thus the explained variance may be significant, but small. Professionals are more likely to attribute their expertise or performance to their own efforts or ability (Mieg, 2009). For instance, in the self-reported expertise measure, deliberate practice was the central determinant of a social dimension of expertise (i.e., professionalism, Mieg, 2009). On the contrary, in the measure of expertise assessed by others, socially managed behaviors (e.g., being charismatic) were the key determinant of a social dimension of expertise (i.e., subjective dimension of GEM, Germain & Tejeda, 2012). Thus, the results regarding SN need to be reexamined using socially oriented expertise criteria.

FFI did not explain any additional variance of the two employee's performance indicators after controlling for other variables. However, it should not be interpreted that FFI is not a meaningful construct of employee expertise development. This could be because FFI is more about the developmental process of expertise than the level of expertise itself. Thus, the relationship between FFI and performance can be indirect and other variables can mediate the relation. For example, FFI was the only variable to have a significant negative correlation with years of experience, which was a significant variable to explain the variance of performance. Additionally, among the four dimensions of the EEDS, the FFI showed the strongest correlations with three organizational variables such as availability, accessibility, and organizational support,

which in total explained a substantial amount of variance of employees' perceived performance (i.e., 9.9% of variance of a self-reported performance with expertise reference and 14.1% of variance of a self-reported performance with objective reference). The strong correlation indicated that FFI may be more dependent on the contexts of a particular workplace or organization than any other dimensions of the EEDS. Indeed, literatures on perceived organizational support (e.g., Kurtessis, Eisenberger, Ford, Buffardi, Stewart, & Adis, 2015; Hayton, Carnabuci, & Eisenberger, 2012) have suggested that employees tend to identify role-related actions of their supervisors or colleagues with the organization itself, and thus they are more likely to perceive all the supports and help from their colleagues as the organizational support as a whole.

Another possible reason that FFI was not a significant predictor of performance measures is a mismatch in assessing constructs. Due to the common problem of multidimensionality of organizational constructs, researchers agree that predictors (e.g., FFI) should be comparable with outcomes (e.g. performance) at the level of abstraction (Edwards, 2001; Schmidt & Kaplan, 1971). In the present study, two performance variables (i.e., a proxy expertise criterion and a proxy performance criterion) were measured by asking an overall level of an employee's performance. On the other hand, FFI in the EEDS measures specific interactions that may be more effective in improving specific areas of expertise. This may especially be the case for more experienced employees, since they already established certain level of expertise and may want to further advance more focused domains of their expertise (Grenier, & Kehrhahn, 2008; Murphy, 2012).

Lastly, SN ($M=4.58$, $SD=1.31$) and FFI ($M=4.69$, $SD=1.24$) tended to have lower means than EDP ($M=5.67$, $SD=.89$) and DWE ($M=5.68$, $SD=.90$), indicating that employees engaged

less in SN and FFI than in EDP and DWE. The weak effect sizes of SN and FFI in prediction of perceived performance may be partly due to a lower level of employees' engagement in these dimensions. SN and FFI are based on mutual interaction and they cannot be solely determined by one side of the interaction, individual employees. However, literatures suggest that employees' engagement in SN and FFI can be improved through an education about the value and role of SN and FFI in developing employee expertise. For instance, experts who participated in a study by Gruber et al. (2008) reported that they recognized the value of relationships with other experts at the beginning of their career, and thus became very active in cultivating the relationships over their careers. Research on developmental relations (e.g., coaching, Bryant, 2005; Ladyshevsky, 2010) also suggested that training on the process of developmental relationships is critical in successful relationships.

Description of the Final Items of the EEDS

Through EFA and CFA, 23 items loaded on each of four correlated dimensions were finally retained in the EEDS. In this section, I discuss the notable features of the final items that determine the developmental value of each dimension by jointly considering the findings in the present study and previous literature.

Engagement in deliberate practice (EDP). The contents of the final EDP items in the EEDS generally concur with the extant theoretical findings of deliberate practice and at the same time revealed new aspects of deliberate practice in the workplace. The final seven items of EDP included seeking out knowledge, thoroughly examining fundamental knowledge, taking advantage of working at a higher level, systematically studying advanced knowledge or skills, proactively modifying work approach, integrating knowledge and skills, and exploring new resources of knowledge and skills.

The most stand-out characteristic of the final EDP items is that the majority of employees' deliberate practice (i.e., 4 out of 7 items) aimed to enhance individuals' cognitive resources, such as acquiring new knowledge or knowledge source and developing advanced knowledge structure. This finding concurs with the definitions of experts from psychology literature characterizing experts as having an extensive knowledge base and different ways in organizing the knowledge (Chi, 2006; Feltovich, Prietula, & Ericsson, 2006). Also, a predominant focus on advanced knowledge in the EEDS may reflect the characteristics of employees recruited in this study who mostly worked in knowledge intensive services (e.g., health, education, business, technology, research, etc., Fauth, Bevan, & Mills, 2009). In such occupations, knowledge is capital for employees to be successful in the workplace and secure their career (Collins & Smith, 2006). For example, in a study by Unger, Keith, Hilling, Gielnik, and Frese (2009), knowledge mediated the relationship between deliberate practice and performance in a small business management field (Standardized path coefficient from deliberate practice to entrepreneurial knowledge = .64, $p < .01$; Standardized path coefficient from knowledge to business growth = .28, $p < .05$). Similarly, by using a sample of various professionals, Germain and Tejeda (2012) found that the first sub-scale of the GEM (Generalized Expertise Measure), objective expertise, pertained to items to assess an expert's knowledge in a formal manner (e.g., 'has knowledge specific to field of work', 'has education necessary', 'has knowledge about field', 'has the qualifications required', 'trained', and 'conducts research'). In addition, Johanna and Van der Heijden's (2000) professional expertise scale also included both knowledge and skill relevant sub-scales.

In particular, a theme of conceptual learning emerged in EDP dimension from the qualitative data analysis of the present study, and key phrases regarding conceptual and advanced

knowledge were retained in the final items of EDP (“I thoroughly examine fundamental knowledge to get to the core of a matter” and “I systematically study advanced knowledge and skills beyond my immediate needs”). In fact, this is supported by others who contend that updating core knowledge is gaining more value in the modern workplace. For instance, Pang, Chua, and Chu (2008), conducted a qualitative study on employees’ continuous learning with 72 employees from various fields of Hong Kong industry (e.g. financing, insurance and business services, community, social and personal services, technology, manufacturing, etc.). 53% of the employee participants emphasized the particular value of upgrading core and technical knowledge related to their jobs rather than peripheral skills in strengthening their expertise. This type of learning activities occurred out of the workplace. A case study by Fuller and Unwin (2004) also found that lack of off-the-job-learning restricted employees’ expertise development, suggesting that theoretical learning is necessary for expanding a person’s experience-based learning (Simons & Ruijters, 2001). The items of EDP do not limit relevant learning activities in the boundary of the workplace, and qualitative data in the present study showed that employees utilized materials like internet and books, as well as other educational institutions and various professional organizations, for EDP.

Further, Simons and Ruijters (2001) insisted that conceptual or theoretical learning is not a simple process of passive encoding of fragmented concepts, rather a deliberate process requiring intensive cognitive efforts to critically reflect and integrate concepts and theories. Three of 7 items in EDP represent this cognitive demanding nature of conceptual learning (“thoroughly examine”, “systematically study”, and “integrate what I have newly learned with my prior knowledge and skills”). Ericsson (2006) argued that what distinguishes deliberate practice from other playful work-related activities or mindless routine performance is “the

requirement for concentration” (p. 692), which can systematically modify one’s underlying cognitive mechanisms to performance improvement (Ericsson, 2006). Sonnentag and Kleine (2000) categorized the same types of developmental activities (e.g., exploring new strategies and consulting colleagues) into supportive activities to accomplish tasks or deliberate practice according to whether or not an employee invests conscious (i.e., explicitly aimed to learn) and consistent (i.e., regular) efforts in performing the activity. The result demonstrated that only deliberate practice statistically significantly explained an additional 6% of variance in performance ($p < .05$). In contrast, the amount of time spent on supportive activities did not provide additional explanation in performance variance. Similarly, although both EDP and DWE shared some common feature such as engaging in non-routine, challenging experiences, and showed significant correlation ($r=.52, p<.01$), the regression analyses results of the present study indicated predominance of EDP over DWE in prediction of employees’ performance ($R^2_{\text{EDP}}=7.4\%, R^2_{\text{DWE}}=4.9\%$) and a proxy expertise criterion ($R^2_{\text{EDP}}=7.4\%, R^2_{\text{DWE}}=4.9\%$). The findings echo the argument of Ericsson (2006) suggesting that it is not time/experience per se, but conscious focus on what to learn and how to learn, which can lead to meaningful advancement in performance, which EDP, but not DWE, explicitly addresses in the final items. Thus, the final items of EDP represent the similarity of EDP and the original concept of Ericsson’s (2006) deliberate practice in terms of cognitive efforts.

The final items of EDP did not directly represent repetition of practice that is necessary to attain reliable performance of newly acquired skills (Ericsson, 2006). Rather, continuous and proactive engagement in learning is more apparently reflected by the EDP final items. For example, formal and conceptual learning activities often continue over several years. In the qualitative portion of the present study, participants reported that they participate in a graduate

degree program or formal qualification courses for “future promotion” or “to be an expert” in a particular area. Similarly, in Pang et al.’s study (2008), more than half of 72 employee interviewees reported that they had been engaged in professional and self development over the years in anticipation of future usefulness of the learning activities (i.e., taking course and training outside work for 36%, engaging in other forms of continuous learning for 15%, and preparation for 8% of participants).

As such, persistent engagement in EDP is proactively planned for future. Five out of 7 EDP items are related to the proactive engagement in learning. Three items explicitly represented proactivity using item stems, such as “take advantage of opportunities to work at a higher level”, “study...beyond my immediate needs”, and “proactively modify my work approach.” Additionally, two items pertain to “seek out new knowledge” and “explore new resources of knowledge and skills.” These learning activities are neither reactive to work demands nor spontaneously occur by doing work. Rather, employees proactively explore/plan them or take the opportunities with a primary aim to advance current levels of expertise. Proactively focusing on learning processes is one of the characteristics of developing experts (Zimmerman, 2006). Although persistency and proactivity reflected in EDP represent a developmental process of expertise, it is also a motivational process of expertise development. In fact, in the present study, EDP showed the largest correlation with motivation for development among the four dimensions of the EEDS ($r=.52, p<.01$). In a similar vein, King, Currie, Bartlett, Strachan, Tucker, and Willoughby (2008) showed that motivation for development was a major difference between professionals who develop expertise quickly and those who showed delayed development of expertise after several years.

In summary, the final items of EDP represent knowledge-focused, cognitively effortful,

and persistent and proactive learning processes. Although the cognitively demanding nature of EDP is similar to Ericsson's (2006) concept of deliberate practice, emphasis on persistent and proactive learning instead of repetitive practice is a new feature of EDP. The definition of deliberate practice in the EEDS was modified and extended to reflect the nature of employee expertise as suggested by Ward et al. (2007). In today workplaces, employee expertise requires continuous reconstruction and extension of knowledge beyond the simple acquisition of previously established knowledge and skills (Engeström, 2004; Van Winkelen, & McDermott, 2010).

Strategic networking (SN). The SN dimension of the EEDS assesses the extent to which an employee strategically initiates and cultivates developmental networks (i.e., seeking for networks outside an organization, engaging in greater professional communities, seeking for new contacts, expanding specialized information exchange channels, and participating in discussions in professional communities). As modified approaches to communities of practice (Brown & Duguid, 2001; Handley et al., 2006; Roberts, 2006) indicate, the final items of the SN dimension demonstrate that employees build professional networks across various communities to enhance their expertise. Individual agency plays a central role to establish professional networks by identifying and leveraging mutual interests among individuals involved in the networks (Lindkvist, 2005). Furthermore, the items revealed critical characteristics of networking for employee expertise development, which were not addressed in previous expertise or social network research, or were underexplored.

First, items of SN indicate that employees seek diversity in networks by contacting people out of their own social systems/boundaries such as other companies or industries, greater professional communities, and/or other professionals. Network diversity is a critical indicator in

social network theory (Burt, 2004; Granovetter, 1973, 1983) and the concept of boundary crossing has been used to assess it. For example, Higgins and Kram (2001) defined network diversity as the number of different social systems where the relationships in one's networks emerge from. Diversity in networks is considered as an important indicator of redundancy in flow of information provided by one's network (Burt, 2004; Granovetter, 1973, 1983; Higgins & Kram, 2001). By networking across heterogeneous and broad social systems, employees are able to get access to new resources or information that are not present within their familiar boundaries of social systems. In fact, qualitative data collected from phase I of the present study showed that employees enriched their expertise through diverse networks (e.g., "being aware of from where and from whom I can get helpful information about doing my job...offers me the sense of self-efficacy" and "participation in two international conferences, provided opportunities for comparative educational exchanges with colleagues from numerous countries..."). Also, the SN dimension in the present study had a moderate level of correlation with the EDP ($r = .56, p < .01$), which assesses intentional activities to enhance one's expertise. By regarding the SN dimension as a proxy of network diversity, it can be inferred that employees utilized network diversity in order to enhance their expertise. A more direct support of the value of network diversity in expertise development can be found from the study of Eby, Butts, and Lockwood (2003). They examined the relationships among DeFillippi and Arthur's (1994) three competencies: knowing-why, knowing-whom, and knowing-how (i.e., career/job related skills). Knowing-whom includes experience with a mentor (yes/no), and two different network diversity variables (i.e., breadth of networks within the organization and breadth of networks outside of the organization). Internal networks and external networks were significantly correlated with career/job related skills ($r = .27, .39, p < .05$, respectively for internal and external networks). However, caution is required

for causal inference on the relationships between network diversity and expertise (development).

Second, items of the SN dimension in the EEDS indicated that shared practice becomes a foundation to build and maintain professional networks in terms of expertise development (Brown & Duguid, 2001; Lindkvist, 2005). The importance of shared practice is well portrayed in the following SN item: “I seek out opportunities to network with people who are *in a similar position*, but work for other companies or industries.” Additionally, two out of 5 items in this dimension are based on reciprocal interactions that share some common experiences: “specialized channels to facilitate information exchange” and “participate in discussions in professional communities.” Similarly, entrepreneurs who participated in Jack’s (2005) ethnographic study highly appreciated the value of relations with other entrepreneurs in the same industry who compete against each other and at the same time work together to complement each other. SN in the EEDS places more emphasis on the shared practice than general theories of social networks. In social network research, networking operates as a conduit to mediate new information, and thus network diversity is exclusively valued (Burt, 2004; Granovetter, 1973, 1983; Higgins & Kram, 2001).

However, the relative dependency on shared practice in SN in the EEDS suggests that the SN dimension is not a simple mechanism to connect people, but a learning mechanism to incorporate new knowledge into ones’ expertise. For example, a participant in phase I of the present study stated, “Colleagues, highly-regarded authors contribute regularly to my expertise through....reflecting on ways to embed ideas and practices into my repertoire in a strategic fashion.” According to Brown and Duguid (2001), shared practice is key to the successful transfer of knowledge across individuals or different communities. If relevant practice is not

accompanied by explicit knowledge (e.g., rules and principles), meaningful learning cannot occur. In other words, people cannot use the knowledge or take an action based on it.

Lastly, SN in the EEDS is a mechanism to develop social aspects of employee expertise such as social recognition and professionalism that are acknowledged in the expertise scales mentioned in the introduction section (i.e., Germain & Tejeda, 2012; Johanna & van der Heijden, 2000; Mieg, 2009). Specifically, in the SN dimension, three items are related to employees' efforts and activities to extend their boundaries of professional engagement: "to engage in the greater professional community", "to meet new groups of people to enrich my professional networks", and "participate in discussions in professional communities." It was generally recognized that social networks can provide opportunities to enhance one's access and exposure to the target profession (Higgins & Kram, 2001). Similarly, through the Strategic Networking (SN) activities, employees can be admitted and recognized as an expert by other people from various professional communities (Grenier & Kehrhahn, 2008; Mieg, 2006). In addition, those who have higher social recognition in a field are more likely to devote to professional engagement (i.e., professionalism), and professionalism may become more salient in one's professional life as an individual advances to a more higher-level and influential position (Mieg, 2009). Professionalism implies that employees may be more active in SN as their performance level or seniority in a profession advances forward (Mieg, 2009).

On the contrary, Dobrow and Higgins (2005), in their longitudinal study with 136 MBA graduates, found that an increase in developmental network density (i.e., a opposite concept to network diversity) during the first two years significantly and negatively predicted the clarity of professional identity five years later ($\beta = -1.22, p < .01$) after controlling for other relevant variables such as years of work experience or job type. This result indicated that rich

developmental networks are more important in earlier stage of one's career. Unlike the previous findings (e.g., Mieg, 2009; Dobrow & Higgins, 2005), the present study found that SN in the EEDS had almost zero correlation with years of experience ($r = .03, p > .05$). It does not necessarily mean that the SN dimension and years of experience are unrelated, because the relationship can be non-linear (e.g., U shape relationship). Given the various attributes of SN in the EEDS, it may be possible that employees can take different levels of benefits from SN activities across different phases of expertise development.

In summary, SN in developing expertise shares important attributes of general social networks to enhance one's career development, such as network diversity and extending employees' professional boundary. However, unlike social network theory, SN in the EEDS indicates that shared practice is a foundation in networking for expertise development. These characteristics suggest that SN in the EEDS is more about deliberate and purposive learning processes rather than the mechanism of simply connecting people.

Frequent and focused interactions (FFI). All the final items of FFI are based on close and intensive interpersonal interactions with others (i.e., "have frequent contact with more experienced people", "to examine work processes after completing a complex task", "work with challenging colleagues", "am closely guided by others", and "My supervisor provides feedback on a regular basis"). D'Abate, Eddy, and Tannenbaum (2003) argued that developmental value in various developmental relations (e.g., mentoring or coaching) can be expected when those who involve in the relations have frequent and focused interactions with one another, which is what FFI indicates. Goldman's (2008) qualitative study supported the developmental value of intensive interpersonal contacts. Goldman found that participants' developmental relations were effective only under particular circumstances. Specifically, mentoring was beneficial only when

participants were in frequent contact with their mentor(s) and received immediate feedback from the mentors. The interactions with intellectually challenging colleagues were either informal or formal, but always one-on-one. In other words, focused contact between individuals represented in the items of FFI is key to directing participants to expand thinking or find out their own solutions (Chivers, 2003).

Four out of 5 items of FFI explicitly focuses on learning process (e.g., “to discuss my performance”, “to examine work processes”, “am closely guided”, “provide feedback...to develop my expertise”). Although it is possible that employees unconsciously learn from experts’ knowledge or behaviors while interacting with experts (Cheetham, & Chivers, 2001), elevated consciousness can facilitate more systematic and organized in-depth learning process and therefore consciousness is critical in developing employees’ expertise (Klein, 1997; Ross, Shafer, & Klein, 2006). In other words, FFI is not a spontaneous interpersonal learning process that can occur without employees’ intention. Actually, in the present study, FFI had the second strongest correlation with motivation for development ($r=.46$, $p<.01$) followed by EDP.

Plus, FFI can occur across broader groups of people than other formal developmental relations such as mentoring and coaching. Specifically, FFI is relevant to diverse groups of people who vary in organizational hierarchy, type of job/task, and level of expertise. Subsequently, the various groups of people can contribute differently to the development of employee expertise. For example, a supervisor as a representative of the organization (Hayton, Carnabuci, & Eisenberger, 2012; Ladyshevsky, 2010) may have more formal relations with an individual than colleagues and can cultivate the subordinate’s expertise in relation to the organization’s long-term goals. Also, employees can benefit from interacting with their colleagues with similar years of experience who are more experienced in a specific field or who

have more tacit knowledge on work process in the workplace due to having longer years of experience (Paloniemi, 2006). Likewise, an employee can take different advantages from the diverse developmental relations in FFI.

With these characteristics, FFI can stimulate various learning processes that also interact with other dimensions of the EEDS. First, FFI provides exceptional conditions to foster deliberate practice (Gruber et al., 2008; Gruber, Jansen, Marienhagen, & Altenmueller, 2010). Close and strong ties, which are the basis of FFI, are recognized as a vehicle for transferring particular knowledge and information that cannot be easily shared without interpersonal trust and frequent contacts (Jack, 2005). In other words, intimate and trustworthy relationship-based FFI facilitates better understanding of the person's needs and learning style. Consequently, employees are more likely to gain timely and individually tailored feedback about their performance over different phases of expertise development. It has been well known that the effectiveness of workplace learning (Eraut, 2004) and deliberate practice depends on the quality and meaningfulness of feedback provided (Ericsson, 2008). Indeed, the item of FFI related to close guidance of other experts resembles the role of a coach or teacher in a conventional form of deliberate practice (e.g., "I am closely guided by others with more expertise" and "My supervisor provides feedback on a regular basis to develop my expertise"). Also, one's professional and expert resources are more likely to be shared with others through strong ties which are based on the personal understanding and trust (Jack, 2005). For example, people with more expertise who involve in FFI would willingly share their own knowledge, skills, personal knowhow, and their own networks that can serve as breakthroughs for extant deliberate practice, leading to a significant advancement of expertise development (Cheetham & Chivers, 2001; Gruber et al., 2008). Indeed, the present study showed that FFI had stronger correlation with EDP ($r=.50$,

$p < .01$) than SN ($r = .44$, $p < .01$) despite that FFI and Strategic Networking (SN) were divided from Learning in Professional Networks (LPN).

Another important role of FFI activities is to engage both parties in constructive reflection (Cheetman & Chivers, 2001; Chivers, 2003; Klein, 1997). Not only during but also before and after the FFI interaction, employees can engage in in-depth reflection on their current performance. For example, preparation for supervisory meetings was often initiated for planning better performance (i.e., Watson & Williams, 2004) or for seeking new opportunities for learner's deliberate practice (Klein, 1997). Klein (1997) insisted that reflection on experience (i.e., reviewing prior experience) enables rare but valuable experiences (e.g., a tournament game) to be re-used to enrich learners' mental model of the situation. More specifically, chess masters often deliberately reflect on previous performance as part of their deliberate practice (Klein, 1997). Furthermore, as the final items of FFI represented, participating in reflection with an expert might be a critical mechanism for employees to learn to think like experts (Ross, Shafer, & Klein, 2006). When mentees' challenges in a particular situation were out of scope of mentors' previous experiences, mentors were driven to reflect on their existing expertise and adapt it to the new situation by reorganization and reinterpretation, which will lead to the expansion of mentors' expertise boundaries (and probably mentees' expertise too) (Orland-Barak & Yinon, 2005). Cheetham and Chivers (2001) revealed that reflections were more effective when carried out in more systematic forms such as debriefing, team based approach, and peer review. Although the items in this dimension seem to cover quite a broad range of reflective interactions from informal contacts (e.g., working with challenging colleagues) to formal meetings (e.g., regular discussion with a supervisor), frequent and focused contact may contribute to the development of more structured and systematic inquiry to elicit constructive

reflection (Orland-Barak & Yinon, 2005; Van Winkelen & McDermott, 2010).

Although it was discussed previously, it would be interesting to consider the fact that the FFI had a relatively low mean ($M=4.7$, $SD=1.2$ on the 7-Likert scale) and a weak but significant negative correlation with years of experience ($r=-1.0$, $p<.05$) here again. The results suggest that as individuals attain expertise, an independent and self-regulated approach might dominate employees' expertise development (Zimmerman, 2006). However, by doing that, employees might be less likely to participate in constructive reflection. Chivers (2003) reported that about 20% of the sample of 80 professionals from various professions did not reflect on a regular basis. Moreover, less than half of the 80 professionals reported that reflection leads to the advancement in their performance. Even experienced experts did not always reflect on their concurrent level of expertise and performed in reference to the superficial similarity of the situation and their successful previous experience (Orland-Barak & Yinon, 2005). The final items of FFI represent various ways to facilitate reflective learning at all stage of expertise development that experienced employees might overlook.

In short, the final items of FFI demonstrated close and intensive interpersonal interactions with people who have diversity in expertise and experience. This attribute of FFI has unique developmental value in employee expertise by facilitating deliberate practice and constructive reflection.

Developmental work experience (DWE). The six final items of DWE exhibit newness in experience such as “a wide range of work situations”, “dilemmas and challenges”, “multiple roles and responsibilities”, “multi-faceted experiences”, “atypical situations”, and “utilize different skills and knowledge.” Previous research supported the value of exposure to a rich array of work experiences in developing expertise and challenges embedded in those experiences

(Billett, 2004; Goldman, 2008; Grenier, 2009). As Paloniemi (2006) found, DWE cannot be successfully performed with an automated daily work process and thus requires on-going changes in one's ways of doing things. New aspects of work can provide an opportunity to apply new knowledge or skills and guide what knowledge is important to learn, which can be associated with activities represented in the items of EDP (e.g., "I seek out new knowledge in my area of expertise" and "I integrate what I have newly learned with my prior knowledge and skills").

Although newness is dominant in the final items of DWE, the items indicate that newness of work experience is embedded in the contexts of everyday work as being reflected by phrases such as "while doing my daily work" and "in doing my work." Goldman (2008) found that employees' general work experience was the most beneficial to their expertise development when new experiences were coupled with regularity in their daily work contexts. Regularity allows individuals to be proficient in the task. Billet (1999) described this developmental process as "ongoing and repeated involvement with normal and abnormal (p. 35)" work situations. In fact, the qualitative data in the present study showed that the most challenging tasks reported in the data were a long-term project (e.g., a year-long) or a participant's major task during a certain period of time, which allow the employee to be an expert on the task.

Second, two of 6 final items of DWE are closely associated with holistic learning opportunity (e.g., "My work involves multiple roles and responsibilities" and "My work includes multi-faceted experiences"). The qualitative responses from phase I of the present study showed that employees enhance their expertise through the holistic work experience to deal with complicated interconnected issues and to develop the big picture about why and how things operate in a particular context. One participant in the present study reported, "Working...on

projects from start to end, so I become...entwined with the key players and understand the goals, methods, and obstacles involved in making changes.” The comprehensiveness is quite a unique aspect of DWE compared to EDP. Specifically, EDP requires planned and focused effort to hone a targeted area of expertise. On the other hand, DWE seems to aim to bring various aspects of one’s expertise together to the relevant work contexts.

Drawing on Gestalt theories (e.g., Clarke & Fraser, 1984; Lewin, 1935), Cheetham and Chivers (2001) stressed that comprehensive and holistic learning from experience has unique value in developing proper mental patterns and structures that enable employees to perform with their full potential in natural settings. Employees develop ability to see the situation as an integrated whole, rather than a set of fragmented parts. Indeed, holistic and intuitive understanding on a particular situation or complex problems distinguished an expert from a novice (Dreyfus & Dreyfus, 1986; Orland-Barak, & Yinon, 2005). In addition, by crystallizing an integrated solution for issues extended from previous experience, employees are more likely to transform their previous concepts and methods into qualitatively different ones (Engeström, 2004). Participants in the present study described the transformational process, by stating “this (learning from work experience) opens my thinking for future projects”, and “By succeeding with this and building on that experience...be an expert in developing new...techniques...”

Lastly, it is noteworthy to mention that the EEDS does not take into account whether employees intentionally design DWE for expertise development or spontaneously involve in DWE embedded in their broader work situations. Rather, the items of DWE are simply about the current characteristics of employees’ work contexts. According to the results from regression analyses in the present study, DWE did not seem to be utilized for its potential in developing employee expertise. Qualitative data in the present study suggested that employees’ orientation

to the activities may play a role in mediating the developmental value of DWE. For example, some participants from the phase I qualitative study of the present research explicitly mentioned what they learned from implementing a challenging task, while others connected their work experiences with future promotion (“This has expanded my expertise specifically by increasing my knowledge of the functions and capabilities of the database ...” vs. “I would like to continue to get more real-world experience so that I will be able to move up in the corporate hierarchy”). In other words, employees can take advantage of DWE in terms of expertise development, as long as they challenge themselves to extend their current knowledge and work methods to address unfamiliar aspects of the challenging work situations. On the other hand, some employees may overlook new learning opportunities in DWE by concentrating on performance improvement (Day, 2010). For the latter, DWE might be of minimum benefit.

In short, the final items of DWE showed the values of newness and holistic nature of experience for expertise developmental processes. New aspects of work experience can stimulate various applications of current expertise or acquisition of new expertise. Comprehensive and holistic experience helps employees to recognize complex patterns in a situation. The developmental value of DWE may vary depending on an employees’ orientation in implementing DWE.

Theoretical Implications

A key contribution of the present study is the theoretical advancement of the constructs of employee expertise development and empirical validation of the constructs measurement. Although the expertise of the organization's human resources has been recognized as one of the most important factors contributing to the organization's growth, profits, and lasting value (Herling, 2000; Torraco & Swanson, 1995), there is still paucity of the conceptual understanding

of employee expertise development (Grenier, & Kehrhahn, 2008) and employee expertise in general (Herling, 2000). Moreover, discrepancies in theoretical backgrounds between classical expertise development study and employee expertise development research are significant. The present study attempted to address these gaps by integrating various theoretical frames to define the dynamic aspects of employee expertise development and develop the EEDS.

One of conflicting issue in employee expertise development was the applicability of the theory of deliberate practice to employee expertise development. In fact, deliberate practice, a well-established theory on expertise development, has been rarely applied to research on employee expertise development. A few exceptions exist (see Sonnentag & Kleine, 2000; Unger, 2006), but the operational definition of deliberate practice remains at the theoretical level and tends not to reflect diversity in deliberate practice in developing employee expertise. Moreover, the construct of deliberate practice seemed to be overlooked in the more workplace-oriented research. Instead of deliberate practice, relevant but different concepts such as self-directed learning (e.g., Grenier, 2009) or deliberate learning (Doornbos et al., 2004) are used to describe a broader range of learning activities that require employees' conscious intention to learn. However, these constructs are too broad to specify the concrete learning activities that are more critical to the development of employee expertise. Due to the heterogeneity in the concepts related to deliberate practice across different studies, it is difficult to clearly understand how deliberate practice operates specifically in the process of employee expertise development and surrounding contextual factors contributing to the differential manifestations of the role of deliberate practice. On the contrary, development of the EEDS revealed that cognitive efforts, persistence, and proactivity are critical attributes of deliberate practice in employee expertise development, which can be folded into the original characteristics of deliberate practice. Also,

these attributes of deliberate practice assessed by the EEDS help distinguish between the original definition of deliberate practice and other broader constructs (e.g., deliberate learning). Indeed, it was previously recommended that the definition of deliberate practice in consideration of fields of expertise be refined (Ward et al., 2007). The improved construct of deliberate practice in the EEDS (i.e., conceptual clarity and specificity) would help future research to bridge the research on employee expertise development with the rich knowledge accumulated from the mainstream expertise development research. For example, deliberate practice research in the classical field of expertise has revealed the associated longitudinal changes in the brain (Hill & Schneider, 2006). This kind of new research paradigm can offer meaningful insights to understand the cognitive adaptation of adults when they continuously learn or practice, which can lead to frame new promising hypotheses on adulthood learning in future studies (Merriam, Caffarella, & Baumgartner, 2007). New findings regarding deliberate practice in the field of employee expertise would contribute particularly to the better understanding of how complex and dynamic social contexts affect the structure and effect of deliberate practice.

Similarly, some qualitative research (e.g., Grenier, 2009; Gruber et al., 2008) has shown that social learning based on interpersonal relationships was unique in expertise development in natural settings. However, no specific construct has been presented thus far to describe this unique aspect of employee expertise development. The development of the EEDS refined social activities for developing employee expertise into two relevant concepts, Strategic Networking (SN) and Frequent and Focused Interactions (FFI). Although mentoring and coaching are popular interpersonal practices for personal growth in organizational contexts, most of them focus on the learning needs of the new employees in organizations. This indicates that the need for continuous expertise development for all employees of varying years of experience or career

stage have not been addressed despite expertise development being an important issue not only for novice, but also for experienced employees (Grenier, & Kehrhahn, 2008; Lankau, & Scandura, 2002). The present study provided preliminary evidence for the generalizability of SN and FFI. Further study is needed to apply SN and FFI to different employees groups who have various ranks and career needs and it would shed light on the overlooked socially constructed (re)developmental process of senior employees' expertise. Moreover, it was mentioned earlier in the discussion section that knowledge accumulated in social network theory research can enrich understanding on the role of employees' professional network in developing expertise.

Also, this study revealed somewhat unexpected findings regarding the role of DWE in terms of the predominant emphasis on work experience in workplace learning, which calls for further investigation of the role of DWE. As previously discussed, future research could investigate the relative importance of DWE on different outcomes of employee development such as expertise, performance, and socialization in the organization. Since DWE did not show stronger correlation with three organizational variables related to expertise development than other dimensions of the EEDS, it would be interesting to explore the relationship between DWE and broader organizational environment such as expansive vs. restrictive learning environment on DWE (Fuller & Unwin, 2004).

Next, the current study suggested that employee expertise development should be an important topic to be studied in adult education. The dimensions of the EEDS such as EDP and SN attend to the fact that the development of employee expertise requires employees to go beyond one's typical boundary of work and professional interpersonal connections throughout their professional lives. This indicates that employees are lifelong adult learners rather than temporary learners belonging to a particular organization. In contrast to the primary focus on the

professional elite and organizational growth in HRD, adult education had an emphasis on the marginalized learners and individual growth (Watkins & Marsick, 2014). With this different lens, adult education scholars can examine the generalizability of the EEDS across diverse adult populations. It also needs to be examined what characteristics of adult learners (e.g., self-directedness and cognitive development) can facilitate or limit employees' participation in the four different aspects of expertise developmental processes, represented by the four dimensions of the EEDS.

In addition, the responsibility for expertise development tends to shift from organizations to an individual employee in today's workplace (Pang et al., 2009). Thus, self-directedness or self-regulation may be a prerequisite for the development of employee expertise. Although self-directedness is an important topic in HRD research and practice, employees' self-directedness in HRD context is more likely to be circumscribed by the organization's needs. Specifically, organizational goals can be prioritized over one's developmental goals in HRD contexts and organizational resources can only be used for organizational goal related developmental activities. Self-directedness theory from an adult education perspective can be more promising to reveal its relationships with employee expertise development because of the broader range of referents (Jacobs, 2014). For example, Ericson (2006, 2008) emphasized self-directedness in experts' development. Specifically, Ericson (2006, 2008) argued that once a person reaches expert level, the person internalizes earlier deliberate practice with a more experienced person such as a coach or teacher, and comes to plan his/her deliberate practice and monitor her/his own performance with a more critical perspective. However, most employees do not reach expert level when they begin their work, and thus may not develop a well-established self-regulatory process (Zimmerman, 2006). The present study showed that other dimensions of the EEDS,

except the Frequent and Focused Interaction (FFI) dimension, are not necessarily associated with other experts' support or guide. Thus, a person's ability to properly plan and monitor one's own developmental process can be critical for advancing one's expertise. Future research utilizing overarching adult learning theories such as self-directedness (e.g., Personal responsibility orientation model, Brockett & Hiemstra, 1991; Garrison's model, Garrison, 1997) and adult development (e.g., a level-of-consciousness model, Kegan, 1994; Age-graded model, Levinson & Levinson, 1996) can fill this gap between classical expertise development and employee expertise development.

Lastly, as the first measurement assessing the development of employee expertise, the EEDS has an important implication for the advancement of research methods in employee expertise research. Richard, Devinney, Yip, and Johnson (2009) discussed the appropriate ways to address multidimensional construct and recommended the reliance on strong theories both for the nature of the measurement construct and the nature of measures. The present study developed the EEDS constructs based on comprehensive HRD and educational theories and followed robust psychometric procedures for instrument development. By adopting a mixed method approach, which has gaining increasing popularity in organizational research (Cameron & Molina-Azorin, 2011), the EEDS attempted to scrutinize the complicated and dynamic processes of employee expertise development based on extant expertise-related theories, qualitative interview data, and quantitative data. In such ways, methodologically solid constructs of employee expertise development were obtained through the triangulation with the multisource data. In fact, Creswell (2012) stated that mixed methods design allows the most complete analysis on complex phenomena of interests.

Practical Implications for Human Resource Development and Adult Education

In spite of the importance of development of employee expertise in HRD practice, there is a dearth of practical tools and well-established guidance for how practitioners can contribute to employees' expertise development. The EEDS can be used as a formative and feed-forward tool in the workplace and in diverse workforce development contexts. There are several practical benefits of the EEDS for various stakeholders who are interested in employee's expertise development, including employees, HRD practitioners, and adult educators.

First, the EEDS can quantify one's relative strength and weakness in regard to the employee expertise developmental processes. It can also provide objective indicators on the individuals' relative standings on the four dimensions of the EEDS, by comparing an individual's scores with the means and standard deviations from this study based on 458 knowledge workers. For example, a HRD practitioner can implement the EEDS as planning employee development programs. As a result, the practitioner can compare employees' EEDS scores to the means calculated from a general employee sample (i.e., the mean presented in the present study). If one gets a relatively lower or higher score on a particular EEDS dimension, relevant research findings, such as the results from the present study, can be jointly considered to understand the exact meaning of the score. For instance, a low score in DWE indicates that employees may experience a lack of challenges in their work due to simple and repetitive tasks, or their insensitivity to potential learning opportunities (e.g., applying the same routine process to new situations). HRD Practitioners can apply job-assignments strategy or initiate both formal and informal seminar(s) for new work approaches or methods. A low score in FFI can be considered in relation to the employee's seniority or years of experience (i.e., new comers vs. experienced employees). According to the interpretations of the score, the practitioner can

suggest modifying employees' work organization (e.g., job enrichment, Hackman & Oldham, 1976) or plan an appropriate developmental intervention (e.g., a reversed-coaching program for a senior employee who gained a low score in FFI). Furthermore, the results can be used to build a synergistic team in which employees with different strengths and weaknesses in terms of expertise developmental process can benefit each other through an optimized social learning (Bandura, 1977). For instance, practitioners can consider employees' EEDS profiles as one element of diversity, when they form an action learning team that consists of four to eight members with various backgrounds and work experiences (Freedman, 2012).

Second, the EEDS is its use as a score profile. Specifically, although the means of four dimensions of the EEDS are not statistically different, the typical profile of the scores on the four dimensions of the EEDS can vary depending on fields of expertise or fields of industry. For example, service occupations in this study showed relatively higher level of DWE, moderate levels of EDP and FFI, and relatively lower level of SN. Similarly, a particular organization or a work team can demonstrate its unique profile of the EEDS which can be calculated by averaging scores across individuals within an organization or a work team. HRD practitioners can use this information to strategically design an industry- or work team-specific training programs for expertise development such as peer-coaching program or cross-functional training.

Next, practitioners can use the EEDS as a formative assessment tool to facilitate learning culture in the workplaces and enhance general developmental practices for employees. In order to optimize the effectiveness of assessments and subsequent feedback, researchers (Smither, London, & Reilly, 2005; Tillema, 2001) consistently recommended that HRD practitioners should cultivate an organizational culture to support use of feedback for development and to set the goals for reflection and learning before implementing assessments. Nevertheless, in reality,

most of assessments in the workplace have focused on the employee's job performance in terms of how he/she meets immediate needs of the organization (Beausaert, Segers, Fouarge, & Gijsselaers, 2013). It is easily assumed that feedback can automatically stimulate employees' development and subsequently, improved performance. However, this is not the case. For example, HR practitioners expect that substantial improvement in performance would follow multisource feedback such as 360 degree feedback. On the contrary, researchers (e.g., Smither, London, Reilly, 2005) found that the effect of multisource feedback on performance improvement is generally small, indicating that no substantial learning occurs after receiving feedbacks. As another example, unlike multisource feedbacks, personal development plans (PDPs) was primarily suggested as a tool for stimulating employees' learning and development (Beausaert, Segers, & Gijsselaers, 2011). However, PDP presents an overview of the competencies that employees have demonstrated in the past and they are planning to develop in the future. PDP offers a snapshot on the competencies without addressing the developmental process of the competencies and has limited influence on stimulating employee's future learning and development (Beausaert, Segers, Fouarge, & Gijsselaers, 2013). In contrast, many of the EEDS items reflect a learning goal orientation (VandeWall, Cron, & Slocum, 2001) which refers to the desire to develop competence by expanding one's knowledge and skills and mastering challenging situations. Thus, employees are more likely to willingly take the EEDS which is less judgmental and managers could gain insights in which areas their employees may need supports and how to engage the employees in more reflective conversations.

Fourth, when an employee development practice such as mentoring or coaching is used in combination with the EEDS, the dimensions and items of the EEDS can stimulate reflection and discussion from both sides of employees and managers. For example, mentors who understand

the importance of SN can more effectively support social networking activities for their mentees (Gubbins & Garavan, 2009). FFI could be informative for both parties who are involved in any sort of mentoring or coaching relationship, by stimulating the mentor or the coach to reflect on their own approach to the mentee who took the EEDS. In this way, the EEDS can feed-forward employees' future growth unlike other assessment practice in organizations (Beusaert, Segers, Fouarge, & Gijssels, 2013).

Finally, developmental activities represented in the EEDS are not restricted within the boundaries of the organization and the EEDS can be used across various learning settings at work. The term workforce development indicates “any one of a relatively wide range of national and international policies and programs related to learning for work” (Jacobs, 2014, p.15) and it becomes popular among education practitioners, policy makers, and researchers alike. In response to broader societal needs, workforce development should connect individual, organizational, and societal interests for their synergistic efficacy. Similarly, the EEDS demonstrated that the development of employee expertise can be optimized only when individual, organizational, and societal resources are jointly incorporated. Thus, the EEDS can be used more effectively in the broader context of workforce development that stimulates collaboration between adult education and human resource development (Jacobs, 2014). The EEDS introduces various developmental activities across its four dimensions. Incorporating them with the principals of adult education (e.g., six principals of andragogy, Knowles, 1980; staged self-directed learning, SSDE, Grow, 1991, 1994) can effectively motivate adults to learn continuously.

Limitations

Items of the EEDS were generated from the qualitative study based on a limited number

of participants and literature review, and generalizability can be questioned (Creswell, 2012).

However, this study is the first of its kind exploring the key aspects of the processes of expertise development in the workplace. Instead of looking at the expertise itself, the sample was carefully selected to ensure the saliency of the general expertise development process. Also, subject matter experts from education and psychology disciplines were invited to rigorously validate the content of the themes drawn from the qualitative data. To assess the trustworthiness of this study, I addressed various validity and reliability issues. Although this study adopted a mixed method approach, the emphasis was on the quantitative study. Conceptual structure of the expertise development initially driven from the qualitative study was quantitatively validated.

Nevertheless, there are limitations in the qualitative study in terms of credibility, consistency, and transferability (Merriam, 2009). With a post-positivistic view of research, I used the online survey to collect qualitative data. In this way, I could minimize my subjectivity in collecting data and increase the possibility of replicability of the study findings (i.e., consistency). However, lack of the richness and thickness of collected data would limit the extent to which the data captures reality of the phenomenon (i.e., credibility), and can be applied to other situations (transferability). To maximize credibility of qualitative data, I triangulated qualitative data with thorough and comprehensive literature reviews. I used various empirical data and theories from literatures as a data source to generate items of the EEDS since this is a widely accepted way of generating items (McCoach et al., 2013). To enhance transferability, I also tried to obtain maximum variation in the sample by recruiting participants both through an online-site and off-line networks until themes were saturated (Merriam, 2009).

In regard to the quantitative portion, since the purpose of this study was to develop a measurement instrument, construct validity was central (Moss, 1992). Construct validity refers to

“the validity of inference about the higher constructs that represent sampling particulars” (Shadish, Cook, & Campbell, 2002, p. 38). Specifically, it is about whether the instrument represents what it aims to represent (i.e., the four dimensions of the EEDS). Validity inquiry requires various types of validity evidences. In this study, content validity was established based on eight content experts’ judgment. The majority of them have been working in academic settings, thus the lack of practitioners’ view in the content validation process can limit the generalizability of the contents. However, the eight content experts were recruited from various fields relevant to employee expertise and have worked with employees and field practitioners through out their careers.

In this study, the validity for internal structure of the EEDS was statistically established through EFA and CFA. Four constructs of the EEDS represented well the underlying dimensions of the EEDS across two different employee samples. By using online samples, both samples exhibited diversity in demographics. However, although the number for sampling met the minimum level of adequacy, the sample size for both EFA and CFA were relatively small compared to the extensive variety in employee populations. Participants volunteered to participate in this study for a small monetary reward and most of participants were recruited through online networks. Due to this limitation, the results of this study (e.g., the instrument) should be generalized with caution to other employee groups and situations beyond those conditions covered by this study. In addition, since I eliminated some items from initial CFA model, cross-validation of the final CFA model with another employee sample is desirable to reconfirm the appropriateness and generalizability of the four-factor structure of the EEDS with the final items.

Finally, it is necessary to provide additional validity evidences to support that the

proposed factors (scales) actually measure the constructs (dimensions) of interest by analyzing the relationship of the EEDS to external variables (e.g., scales from other known instruments, other external criteria, McCoach et al., 2013, Messick, 1989; Moss, 1992). Raykov and Marcoulides (2011, p.8, as cited in McCoach et al., 2013) also argued that “Construct cannot be defined only in terms of operational definitions but also must demonstrate relationships (or lack thereof) with other constructs and observable phenomena.” In this study, I presented additional validity evidence in that measures from the EEDS demonstrated theoretically expected patterns of external relationships to organizational variables, individual variables, and self-reported performance measures as external criteria. However, each of those external variables was measured using a single question that was created for this study and self-reported. Thus, the results need to be replicated using well-established measures to assess the same external variables. In spite of the methodological limitation, the additional validation evidences provided various implications for future research.

Even with these limitations, I believe the EEDS would open various new research avenues in the field of employee expertise development. It is noteworthy to mention that establishing construct validity is “an *ongoing process* of testing hypotheses regarding both internal and external response-data relationships” (McCoach et al., 2013, p. 210). Thus, the construct validity of the EEDS needs to be further examined by additional studies.

Recommendations for Future Research

This section presents several suggestions for future research. First, by utilizing the paradigm of deliberate practice (Ericsson, 2006), future research can investigate immediate and long-term changes in employees’ expertise and relevant mechanisms (e.g., a cognitive structure, Ericsson, 2006) in relation to EDP dimension to get practical implications for the design of

expertise development programs in an organization. Second, future study can empirically examine the suggested relationships among the concepts from a social network theory and the two attributes of deliberate interpersonal relations in the EEDS, reflected by SN and FFI dimensions. Next, quantitative research to explore which variables mediate the relationship between DWE and development of employee expertise is needed to clarify the developmental mechanisms, as these potential mediation relationships were partly suggested by the present study's qualitative research.

Moreover, research on how to apply the EEDS as part of human resource development practices across various employee populations would provide richer implications for each dimension of the EEDS. Future studies can be conducted to develop a more comprehensive norm for the EEDS by utilizing data from larger employee populations. The extensive data set would provide more reliable scores for across individual comparison. Possibly, a set of multiple norms for different demographic characteristics (e.g., gender, occupational tenure, type of task/job) can be provided for more fair score comparison. Adult educators can research how adult learners' characteristics such as self-directedness (Knowles, 1984) and diversity in cognitive development (Kegan, 1994) influence the ways employees participate in the four dimensions of the EEDS.

In order to enhance the construct validity of the EEDS further, the following research can be implemented as the next step of this study. First, since the EEDS seeks for general dimensions of employee expertise development processes, the degree of generalizability of the EEDS using measurement invariance approach (MI) (Vandenberg, & Lance, 2000) can be examined across various employee populations. MI at each item- and measurement construct-level can reveal the potentially different implications of the EEDS across various employee groups and this would help better suit the use of the EEDS to different employee groups and contribute to the

advancement of theories on employee expertise development. To properly study multidimensional constructs like employee expertise development, it is recommended to conduct triangulation with multiple measures to decrease the impact of measurement error and enhance construct validity (Richard, Devinney, Yip, & Johnson, 2009). Although there is no other instrument to measure expertise development at this point, scales to assess workplace learning (e.g., a scale for learning conditions, Kyndt, Dochy, & Nijs, 2009) can be alternatively used to examine discriminant validity of the EEDS. In the future, it would be needed to develop another measurement to assess different aspects of employee expertise development with different theoretical frameworks. Finally, it would be promising to examine the relationship between the four general dimensions of the EEDS and field-specific developmental activities such as a new IT system development (for IT engineers) and customer consulting (for insurance agents).

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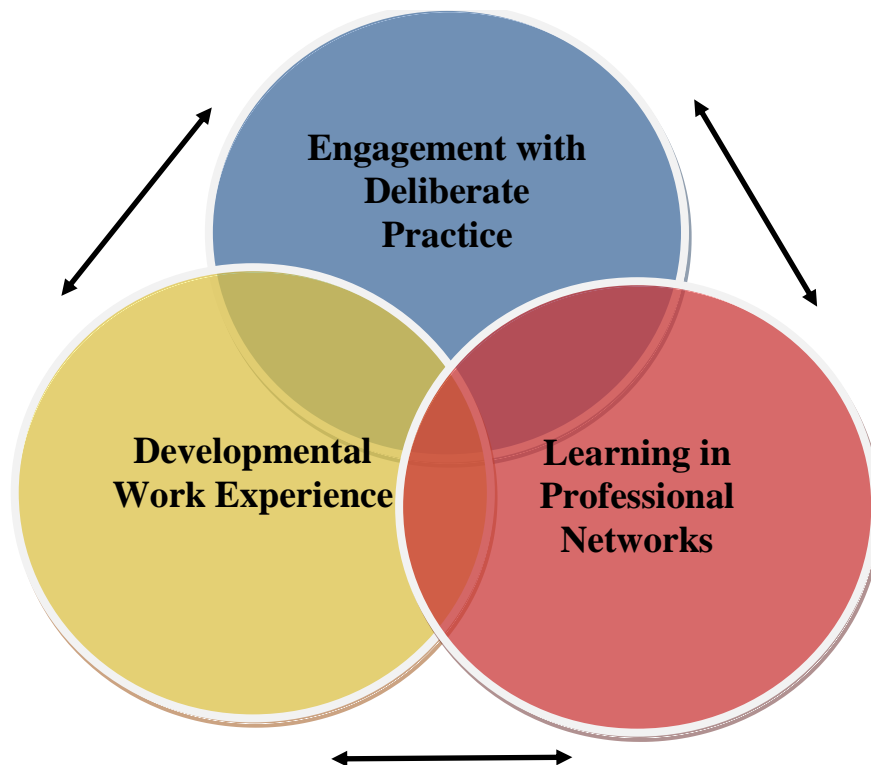
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Appendix A

Employee Expertise Development Concept Map

- Planned learning activities with primary goal of learning (Sonnentag & Kleine, 2000)
- Repetition & Practice, professional reading, formal education (Cheetham & Chivers, 2001; Grenier, 2009; Paloniemi, 2006)
- Bettered knowledge and skills to superior level beyond meeting immediate needs in the workplace (Ericsson, 1996; Mieg, 2006); Established a general and conceptual knowledge (Billet, 1999; Doornbos, Bolhuis, & Simons, 2004)



- Learning as a by-product of work; incidental, implicit, holistic learning (Marsick & Watkins, 2001)
- Amount and complexity of work (Sturman, 2003); developmental experience characterized by significance in size, complexity, proactivity, newness, regularity, and intensity of focus (Goldman, 2008; Paloniemi, 2006)
- Improving proficiency of skills (Billet, 1999), adapting knowledge to environment in territory (Grenier & Kehrhahn, 2008)
- Situated learning (Lave & Wenger, 1991)
- Participation in group activities, working alongside others, and working with clients (Eraut, 2004); learning from well-regarded experts (van Winkelen & McDermott, 2010)
- Expertise as a continuous sharing and constructing knowledge among social networks (van Winkelen & McDermott, 2010); Individual's deliberate practice determined by 'Person in Shadow' (Gruber et al., 2008); Expansive learning across boundaries (Engeström, 2001; Weisberg, 2006)

Appendix B

Invitation for Online Participants

Employee Expertise Development Survey

Do you want to share your experiences developing expertise in your field? You do not have to be considered an “expert” in your field—just on your way to developing your expertise.

I am currently conducting a study of factors related to how employees develop expertise in the ever-changing workplace. If you are an employee in the US who is currently working full-time in any for-profit or non-profit organization, has at least a bachelor’s degree, and has at least one year of work experience before, during, or after college graduation, I would like to invite you to participate in this online survey.

Your participation in this study will involve answering 57 questions in an online survey regarding your experiences in developing expertise in your profession, as well as several demographic questions. This should take approximately 10 to 15 minutes of your time. Your responses will be kept anonymous. As a thank you for completing all the questions in the survey, the company (the name of company) will deposit the designated amount of monetary reward to your account. I would appreciate any and all assistance.

More information and the survey can be found at:

https://uconn.co1.qualtrics.com/SE/?SID=SV_6Fq6J09hu6TLD1P

IRB Protocol Number: X14-061

For more information, contact: Yujin Kim at yujin.kim@uconn.edu

Thank you for your interest.

Appendix C
Invitation for non-paid participants recruited through public listservs

Employee Expertise Development: Human subjects requested

Do you want to share your experiences developing expertise in your field? You do not have to be considered an “expert” in your field—just on your way to developing your expertise.

If you are a full-time employee in the US who has at least a bachelor’s degree, and has at least one year of work experience before, during, or after college graduation, I would like to invite you to participate in this online survey. The survey asks you to assess your experience in developing expertise in the ever-changing work contexts.

Your participation will require answering 57 questions regarding your experiences in developing expertise in the workplace, as well as several demographic questions. This should take approximately 10 to 15 minutes of your time. Your participation will be anonymous and you will not be contacted again in the future.

More information and the survey can be found at:

https://uconn.co1.qualtrics.com/SE/?SID=SV_6Fq6J09hu6TLD1P

If you have any questions, please feel free to contact me, Yujin Kim, at yujin.kim@uconn.edu or the faculty advisor Dr. Robin Grenier at (860) 486-9201.

Thank you for your interest.

IRB Protocol Number: X14-061

For more information, contact: Yujin Kim at yujin.kim@uconn.edu

Appendix D
Personal Invitation Email

Greetings,

I am currently conducting a study about employees' experiences developing expertise in their profession as part of my dissertation. If you are an employee in the US who currently works full-time in any for-profit or non-profit organization, has at least a bachelor's degree, and has at least one year of work experience before, during, or after college graduation, I would like to invite you to participate in this online survey. You do not have to be considered an "expert" in your field—just on your way to developing your expertise.

Your participation in this study will require answering 57 questions regarding your experiences developing expertise in your profession and several demographic questions. This should take approximately 10 to 15 minutes of your time. Your responses will be kept anonymous. I would much appreciate any and all assistance and be happy to answer any questions that you may have.

Please forward this email to other individuals you think may be interested in completing the survey. Thank you for your interest and support.

Information and the survey can be found at:

https://uconn.co1.qualtrics.com/SE/?SID=SV_6Fq6J09hu6TLD1P

IRB Protocol Number: X14-061

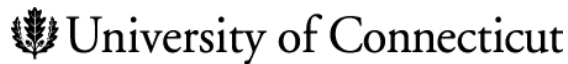
Regards,

Yujin Kim, Ph.D candidate

Adult Learning Program
Department of Educational Leadership
Neag School of Education
University of Connecticut

Appendix E**Information Sheet for Paid Participants****(Will be inserted before the first page of the online survey)**

Information Sheet for Employees' Expertise Development in the workplace

**Principal Investigator: Robin Grenier, Ph.D.****Student: Yujin Kim, Ph.D Candidate****Title of Study: Development of Employee Expertise Development Scale**

If you are an employee who is currently working full-time in any for-profit or non-profit organization, has at least a bachelor's degree, and has at least one year of work experience before, during, or after college graduation, you are invited to participate in this online survey regarding employees' experiences developing expertise. I am a graduate student at the University of Connecticut, and am conducting this survey as part of my dissertation. I am interested in finding out about the types of experiences that play a critical role in employees' development of expertise in the ever-changing work contexts. For this survey, you do not have to be considered an "expert" in your field—just on your way to developing your expertise.

Your participation in this study will require completing the following survey. This should take approximately 10 to 15 minutes of your time. Your participation will be anonymous and you will not be contacted again in the future. If you are participating in this study as a qualified online participant, you will receive a small amount of monetary reward after the student investigator reviews the reliability of your response. We believe this survey does not involve any risk to you. Although you may find it interesting to participate in this study, there will be no direct benefit to you from your participation.

You do not have to be in this study if you do not want to be. You do not have to answer any question that you do not want to answer for any reason. I will be happy to answer any questions you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact Yujin Kim, the student investigator, at yujin.kim@uconn.edu or the faculty advisor, Robin Grenier at (860) 486-9201. If you have any questions about your rights as a research participant you may contact the University of Connecticut Institutional Review Board (IRB) at 860-486-8802. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

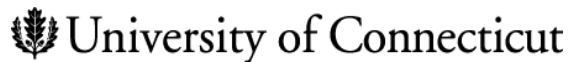
This study was approved by the UConn IRB, Protocol # X14-061.

Please click 'I agree' to proceed to the survey. Thank you.

I agree

Appendix F**Information Sheet for Non-paid Participants****(Will be inserted before the first page of the online survey)**

Information Sheet for Employees' Expertise Development in the workplace

**Principal Investigator: Robin Grenier, Ph.D.****Student: Yujin Kim, Ph.D Candidate****Title of Study: Development of Employee Expertise Development Scale**

If you are an employee who is currently working full-time in any for-profit or non-profit organization, has at least a bachelor's degree, and has at least one year of work experience before, during, or after college graduation, you are invited to participate in this online survey regarding employees' experiences developing expertise. I am a graduate student at the University of Connecticut, and am conducting this survey as part of my dissertation. I am interested in finding out about the types of experiences that play a critical role in employees' development of expertise in the ever-changing work contexts. For this survey, you do not have to be considered an "expert" in your field—just on your way to developing your expertise.

Your participation in this study will require completing the following survey. This should take approximately 10 to 15 minutes of your time. Your participation will be anonymous and you will not be contacted again in the future. You will be not paid for being in this study in response to this invitation. We believe this survey does not involve any risk to you. Although you may find it interesting to participate in this study, there will be no direct benefit to you from your participation.

You do not have to be in this study if you do not want to be. You do not have to answer any question that you do not want to answer for any reason. I will be happy to answer any questions you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact Yujin Kim, the student investigator, at yujin.kim@uconn.edu or the faculty advisor, Robin Grenier at (860) 486-9201. If you have any questions about your rights as a research participant you may contact the University of Connecticut Institutional Review Board (IRB) at 860-486-8802. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

This study was approved by the UConn IRB, Protocol # X14-061.

Please click 'I agree' to proceed to the survey. Thank you.

I agree

Appendix G
Survey Questions for the qualitative data collection study

Qualification Questions*Your Current Educational and Employment Status*

I am 23 years old or older:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I have earned at least an undergraduate college degree:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I have at least 2 years of experience (including this year) in my field of work since earning my college degree:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I am currently employed in:

☐ a for-profit business or organization

☐ an academic institution

☐ neither a for-profit business or academic institution (skip logic to not-eligible and thank you for your interest)

Expertise Development Experience

This survey will ask you to describe your experience in developing expertise in the workplace. Please respond to the following questions about your professional expertise within your CURRENT PRIMARY position.

1. In what areas do you have expertise? Describe your particular areas of expertise in the workplace.
2. Including this year, how many years have you worked in your field of work?
3. How do you define “experts” in your field? What indicators do you think are critical to define experts or expert’s performance in the workplace in your field?

Please reflect on your work-related experience with regard to developing or expanding your expertise to answer the next three questions.

4. Describe at least three things you have done over the past 12 months to develop or expand your expertise in the workplace or out of the workplace.
5. How do you find resources and support to develop or expand your expertise?
6. In order to develop your expertise further, what other experience or activities do you want to have or ideas do you want to implement?

Background Information

1. Gender
 - a. Female
 - b. Male
2. Education Level (select highest level)
 - a. Undergraduate degree from college or university
 - b. Some graduate school
 - c. Completed Master's Degree
 - d. Completed terminal degree: Ph.D, J.D., M.D., Ed.D., etc.
3. Based upon your own definition of experts in your field that you provided above, rate yourself on a scale of 1-10 in terms of your job performance over the last year. (More points indicate a higher degree of performance.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10
4. Based upon an official performance appraisal measure in your workplace, rate yourself on a scale of your job performance over the last year. If your workplace does not have any performance appraisal measure, how do you think your supervisor would rate your job performance over the last year on the following scale? (More points indicate a higher degree of performance.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

Appendix H

Content Validation Survey

As an “expert” in the area of developing employee expertise, you have been chosen to help validate the items on the following ‘Employee Expertise Development Scale.’ I would greatly appreciate your assistance in deciding whether each item on the survey measures what it is suppose to be measuring.

General Instructions

The enclosed survey asks you to evaluate how relevant the items are of the content domain of a “Employee Expertise Development.” That is, to what extent do you think that each question on the survey measures how employees develop their expertise in the context of work. Because employee expertise development is comprised of several different constructs, you are asked to indicate which construct the item measures. While *Developmental Work Experience*, *Commitment to Deliberate Practice*⁵, and *Learning in Professional Networks* are not only construct included in the content domain (developing employee expertise), they are the ones to be focused on for this measure. In addition to quantitative judgment, you are asked to evaluate the overall comprehensiveness of the entire measure by adding, deleting, or commenting on items to make improvements. On the following two pages, you will find definitions and brief explanation of the constructs and more detail about the rating tasks. Please begin by familiarizing yourself with each construct as well as the definition. You may remove the following two pages for reference as you complete the survey.

Additional information regarding the Employee Expertise Development Scale (EEDS)

Target Population: The participant for this study will be full-time employees who are currently developing their expertise in various domains of expertise through working career in any for-profit or non-profit organization. Specifically, these employees have at least a bachelors’ degree and have at least one year of work experience before, during, or after college graduation.

General instruction of the item stems: This survey will ask you to indicate your agreement with a series of statements relating to the Development of Employee Expertise. Please respond to the following statements about your current experience or experiences during the prior year,

⁵ The name of *Commitment in Deliberate Practice* (CDP) was changed as *Engagement with Deliberate Practice* (EDP) after the completion of the planned content validation. In the content validation form, it had its original title, *Commitment in Deliberate Practice* (CDP).

according to the scale provided (7-Likert scale: 1=strongly disagree/7=strongly agree).

Constructs and Conceptual Definition:

I. Developmental Work Experience

Developmental Work Experience refers to work experience that facilitates expertise development as a consequence, although the primary goal is to perform work, not to develop expertise. These experiences are often demanding and challenging, which result in stretching a person's level of expertise. The unique characteristics of this construct over ordinary working experience include significance, proactivity, newness, and intensity of focus. The most important factor is newness or variety in experience. Developmental work experiences are significant in size and complexity and require workers' initiative and focused efforts.

II. Commitment in Deliberate Practice

Commitment in Deliberate Practice refers to individual commitment in activities that primarily aims to develop expertise. *Deliberate practice* in this scale can be defined as a learning activity aiming at improving expertise, which needs to be systemically performed with certain intensity in terms of attention and/or effort regularity. Workers intentionally select activities that help them to refine their skills and acquire new knowledge with a primary goal of learning. Although these activities typically require persistent and focused efforts of participants and adjustment based on reflection/feedback on the process, external feedback or planned regularity targeted to a specific deliberate practice activity does not always accompany those activities.

III. Learning in Professional Networks

Learning in Professional Networks refers to development of expertise in social participation within professional communities such as a work community or a professional community (e.g., formal professional organizations or informal relational networks with professions). These social interactions that an individual participates in can guide one's deliberate practice by providing a specific goal of deliberate practice at a particular point of time, guiding and/or training, and/or co-constructing of excellence. Also, individuals can learn some new practices and new perspectives, become aware of different kinds of knowledge and expertise, and gain some sense of other people's tacit knowledge.

Rating Tasks:

- A. Please indicate the **construct** that each statement best fits by circling the appropriate numeral.

I = Developmental Work Experience

II = Commitment in Deliberate Practice

III = Learning in Professional Networks

O = None of the above

- B. Please indicate the **certainty** of your placement of the statement into a construct by circling the number that best fits.

1 = Not very sure

2 = Pretty sure

3 = Very sure

- C. Please indicate how **relevant** you feel each item to be for the construct by rating it.

1= Not relevant

2= Slightly relevant

3= Somewhat relevant

4= Very relevant

- D. Comments:

In addition to quantitative judgment, please evaluate the appropriateness of each item stem by adding, deleting, or commenting on items to make improvements. For example, are the instrument items clearly worded and unambiguous? Are they appropriate for experienced employees? Do you have any suggestions for improving the item stems?

Employee Expertise Development Scale (for the content validation)

	Construct I, II, III, O	Certainty 1, 2, 3	Relevance 1, 2, 3, 4
1. While doing my daily work, I can utilize different skills and knowledge. Comments:	I II III O	1 2 3	1 2 3 4
2. I experience a wide range of work situations. Comments:	I II III O	1 2 3	1 2 3 4
3. I utilize diversity of experience in the workplace. Comments:	I II III O	1 2 3	1 2 3 4
4. My work includes conflicts and challenges. Comments:	I II III O	1 2 3	1 2 3 4
5. I deal with uncertainty in doing my work. Comments:	I II III O	1 2 3	1 2 3 4
6. My work requires integrating different approaches or perspectives. Comments:	I II III O	1 2 3	1 2 3 4

[illegible]

12. I have opportunities to work at a higher level than my current position in my workplace. Comments:	I II III O	1 2 3	1 2 3 4
	Construct	Certainty	Relevance
13. I get involved in an innovative project to improve current work approaches in my workplace. Comments:	I II III O	1 2 3	1 2 3 4
14. I implement new methods in doing my work. Comments:	I II III O	1 2 3	1 2 3 4
15. I explore new strategies and solutions to solve current problems in my workplace. Comments:	I II III O	1 2 3	1 2 3 4
16. I invest extra time and effort outside of work to develop my expertise. Comments:	I II III O	1 2 3	1 2 3 4
17. I repeatedly utilize new knowledge or practice a new skill until I feel a sense of mastery. Comments:	I II III O	1 2 3	1 2 3 4

18. I apply acquired knowledge and skills to relevant but new contexts. Comments:	I II III O	1 2 3	1 2 3 4
	Construct	Certainty	Relevance
19. I purposefully rotate different activities to increase my expertise. Comments:	I II III O	1 2 3	1 2 3 4
20. I structure my approach to work in the way that improves a weak area in my expertise. Comments:	I II III O	1 2 3	1 2 3 4
21. I proactively modify my work approach in order to develop the best practice. Comments:	I II III O	1 2 3	1 2 3 4
22. I do cross training in other fields to become a well-rounded expert. Comments:	I II III O	1 2 3	1 2 3 4

23. I participate in formal education for professional development. Comments:	I II III O	1 2 3	1 2 3 4
24. I systematically study fundamental knowledge and skills beyond my immediate needs. Comments:	I II III O	1 2 3	1 2 3 4
	Construct	Certainty	Relevance
25. I systematically study advanced knowledge and skills beyond my immediate needs. Comments:	I II III O	1 2 3	1 2 3 4
26. I assess what I am doing in my workplace in terms of theoretical principles or research findings. Comments:	I II III O	1 2 3	1 2 3 4
27. I regularly update new content areas in my profession by reading journals, books, or online materials. Comments:	I II III O	1 2 3	1 2 3 4

<p>28. I regularly update my knowledge of the latest theoretical and practical breakthroughs in my field of expertise.</p> <p>Comments:</p>	<p>I II III O</p>	<p>1 2 3</p>	<p>1 2 3 4</p>
<p>29. I consistently monitor other experts' activities through formal (e.g., publications, presentations) or informal channels (e.g., tweeting /blogging).</p> <p>Comments:</p>	<p>I II III O</p>	<p>1 2 3</p>	<p>1 2 3 4</p>
	Construct	Certainty	Relevance
<p>30. I explore new resources of knowledge and skills in my area of expertise.</p> <p>Comments:</p>	<p>I II III O</p>	<p>1 2 3</p>	<p>1 2 3 4</p>
<p>31. I seek out new knowledge in my area of expertise.</p> <p>Comments:</p>	<p>I II III O</p>	<p>1 2 3</p>	<p>1 2 3 4</p>
<p>32. I continuously assess pros and cons of my current practices.</p> <p>Comments:</p>	<p>I II III O</p>	<p>1 2 3</p>	<p>1 2 3 4</p>

33. I try to integrate what I have newly learned with my prior knowledge. Comments:	I II III O	1 2 3	1 2 3 4
34. I analyze how others do their work. Comments:	I II III O	1 2 3	1 2 3 4
35. I strategically organize new information in order to immediately apply it to my current work. Comments:	I II III O	1 2 3	1 2 3 4
	Construct	Certainty	Relevance
36. I seek out opportunities to present what I have learned in public forms such as manuals, presentations, or papers. Comments:	I II III O	1 2 3	1 2 3 4
37. I work with (an) expert(s) who show(s) excellent performance. Comments:	I II III O	1 2 3	1 2 3 4

38. I work with challenging colleagues who expand my thinking and performing. Comments:	I II III O	1 2 3	1 2 3 4
39. I participate in cross-team or cross-professional projects and discussions. Comments:	I II III O	1 2 3	1 2 3 4
40. I network with individuals in other business units within my corporation. Comments:	I II III O	1 2 3	1 2 3 4
	Construct	Certainty	Relevance
41. I develop working relationships with people who work beyond my area of expertise. Comments:	I II III O	1 2 3	1 2 3 4
42. I seek advice from people outside my workplace. Comments:	I II III O	1 2 3	1 2 3 4

43. I seek out opportunities to network with people who are in a similar position, but work for other companies or industries. Comments:	I II III O	1 2 3	1 2 3 4
44. I make an effort to meet new groups of people to enrich my professional networks. Comments:	I II III O	1 2 3	1 2 3 4
45. I am developing specialized channels to facilitate information exchange for myself. Comments:	I II III O	1 2 3	1 2 3 4
46. I make an effort to maintain my professional networks. Comments:	I II III O	1 2 3	1 2 3 4
	Construct	Certainty	Relevance
47. I collaborate with a wide range of people such as colleagues, customers/clients, or people from other professions. Comments:	I II III O	1 2 3	1 2 3 4

48. I am participating in working groups to collaborate on various works. Comments:	I II III O	1 2 3	1 2 3 4
49. I have colleagues with whom I share learning experiences (e.g., co-researchers or co-developers of products or ideas). Comments:	I II III O	1 2 3	1 2 3 4
50. I share knowledge and ideas with my colleagues in a pro-active manner. Comments:	I II III O	1 2 3	1 2 3 4
51. I am asked for advice from colleagues in or outside of the workplace. Comments:	I II III O	1 2 3	1 2 3 4
	Construct	Certainty	Relevance
52. I speak with others to learn things not addressed in books. Comments:	I II III O	1 2 3	1 2 3 4

53. I participate in discussions in professional communities through social media or public meetings. Comments:	I II III O	1 2 3	1 2 3 4
54. I have frequent contact with more experienced people to discuss my performance. Comments:	I II III O	1 2 3	1 2 3 4
55. I am closely guided by others with more expertise. Comments:	I II III O	1 2 3	1 2 3 4
56. I actively seek opportunities to share my expertise in public. Comments:	I II III O	1 2 3	1 2 3 4
57. I try to expose myself to the greater business community. Comments:	I II III O	1 2 3	1 2 3 4
	Construct	Certainty	Relevance
58. I seek out organizational resources for my development of expertise in a pro-active manner. Comments:	I II III O	1 2 3	1 2 3 4

59. I make an effort to increase my professional reputation by presenting my ideas or accomplishments at meetings or in journals. Comments:	I II III O	1 2 3	1 2 3 4
60. I attend annual conferences or conventions to expand my business network. Comments:	I II III O	1 2 3	1 2 3 4
61. I take part in professional meetings, conferences/conventions, or webinars on a regular basis. Comments:	I II III O	1 2 3	1 2 3 4
62. I seek feedback from my professional network in a pro-active manner. Comments:	I II III O	1 2 3	1 2 3 4
63. I get feedback on my performance from other experts in related areas. Comments:	Construct I II III O	Certainty 1 2 3	Relevance 1 2 3 4

64. I give feedback to others' work practices based on my own expertise. Comments:	I II III O	1 2 3	1 2 3 4
65. I seek out feedback about my general progress to inform my long-term performance. Comments:	I II III O	1 2 3	1 2 3 4
66. I obtain feedback on my performance in a timely manner. Comments:	I II III O	1 2 3	1 2 3 4

Now think about the following questions in regard to the survey. Feel free to write your comments in the space provided, as well as on the survey items themselves.

- Do you have any suggestions regarding the definition of any of the constructs?

- Do the items appear to cover the full range of content within each construct? Do you have any suggestions for improving content coverage?

- Do you have any suggestions for items that you would add? (Remember that you can comment here or write directly on the relevant survey items.)

- Please feel free to add any additional thoughts or comments below.

Thank you for your time and assistance!

Appendix I

Survey Questions for the phase III study

Qualification Questions

Your Current Educational and Employment Status

I work in US.

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I am 23 years old or older:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I have earned at least an undergraduate college degree:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I am currently a full-time employee in any for-profit or non-profit organization:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I have at least 1 year of experience (including this year) in my primary field of expertise before, during, or after college graduation:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

The Employee Expertise Development Scale

This survey will ask you to indicate your agreement with a series of statements relating to the Development of Employee Expertise. Please respond to the following statements about your current experience or experiences during the prior year, according to the scale provided (7-Likert scale: 1=strongly disagree/7=strongly agree). Please note that a few questions will intentionally recur with slightly different nuances.

1. I have frequent contact with more experienced people to discuss my performance.

☐ 1 (strongly disagree) ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 (strongly agree)

2. I have opportunities to examine work processes after completing a complex task in the workplace.

☐ 1 (strongly disagree) ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 (strongly agree)

3. I seek out new knowledge in my area of expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

4. I work with challenging colleagues who expand my thinking and performing.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

5. I thoroughly examine fundamental knowledge to get to the core of a matter.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

6. I take advantage of opportunities to work at a higher level than my current position in my workplace.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

7. I systematically study advanced knowledge or skills beyond my immediate needs.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

8. My work requires innovative practices.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

9. I proactively modify my work approach in order to develop the best practice.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

10. I integrate what I have newly learned with my prior knowledge and skills.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

11. I experience a wide range of work situations.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

12. I speak with others to learn things not addressed in books, manuals, or on the Internet.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

13. I seek out opportunities to network with people who are in a similar position, but work for other companies or industries.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

14. I tackle complex tasks that require an overall understanding.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

15. I seek feedback from my professional network in a pro-active manner.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

16. (Reliability question 1)⁶. I have *never* sought out new knowledge in my area of expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

17. I invest extra time and effort outside of work to develop my expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

18. I make an effort to engage in the greater professional community.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

19. My work includes dilemmas or challenges.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

20. I repeatedly utilize new knowledge or practice a new skill until I feel a sense of mastery.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

21. I think through problems confronted in the workplace to deepen my theoretical understanding.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

22. I structure my approach to work in ways that improve a weak area in my knowledge or skills.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

23. I tackle complex tasks that require advanced knowledge and skills.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

24. I educate myself in other relevant fields to strengthen my knowledge and skills.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

25. I develop working relationships with people who work outside my area of expertise.

⁶ In the online survey that participants take, it will not be indicated which question is a reliability question.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

26. I make an effort to meet new groups of people to enrich my professional networks.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

27. I am developing specialized channels to facilitate information exchange with other professionals.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

28. I collaborate with a wide range of people (e.g., colleagues, customers/clients, or people from other professions).

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

29. I take part in work projects from start to end.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

30. Individuals contact me inside or outside the workplace to ask for advice about work-related projects.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

31. (Reliability question 2). I always avoid complex tasks that require advanced knowledge and skills.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

32. I participate in discussions in professional communities through social media or public meetings.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

33. To accomplish my work, I need to integrate different approaches.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

34. My work involves multiple roles and responsibilities.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

35. I am closely guided by others with more expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

36. I explore new resources of knowledge and skills in my area of expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

37. My work includes multi-faceted experiences.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

38. I regularly read journals, books, or online materials related to my expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

39. I deal with atypical situations in doing my work.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

40. I seek out opportunities to work with one or more experts who show excellent performance.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

41. I have colleagues with whom I share learning experiences (e.g., co-researchers or co-developers of products or ideas).

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

42. My supervisor provides feedback on a regular basis to develop my expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

43. While doing my daily work, I utilize different skills and knowledge.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

44. I continuously assess pros and cons of my current practices.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

45. I try to model the high performance of outstanding experts in my professional network.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

46. I get feedback on my performance from other experts in related areas.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

47. I purposefully rotate among different activities to increase my expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

Background Information Part I: Job related information

This section will ask a few background questions in regard to your expertise and organization.

1. ⁷Which of the following best describes your field of expertise?

- ☐ Management occupations
- ☐ Business and financial operations occupations
- ☐ Computer and mathematical occupations
- ☐ Architecture and engineering occupations
- ☐ Life, physical, and social science occupations
- ☐ Community and social services occupations
- ☐ Legal occupations
- ☐ Education, training, and library occupations
- ☐ Arts, design, entertainment, sports, and media occupations
- ☐ Healthcare practitioners and technical occupations
- ☐ Healthcare support occupations
- ☐ Protective service occupations
- ☐ Food preparation and serving related occupations
- ☐ Building and grounds cleaning and maintenance occupations
- ☐ Personal care and service occupations
- ☐ Sales and related occupations
- ☐ Office and administrative support occupations
- ☐ Farming, fishing, and forestry occupations
- ☐ Construction and extraction occupations
- ☐ Installation, maintenance, and repair occupations
- ☐ Production occupations
- ☐ Transportation and material moving occupations
- ☐ Military specific occupations
- ☐ Other (Please specify)

2. Including this year, how many years have you worked in your field of work? ____

⁷ I used the Standard Occupational Classification (SOC) System that the United States government has established to classify occupations (U.S. Department of Labor, 2000).

3. Please indicate the extent to which **your workplace** represents each of the statements regarding opportunities for expertise development.

1) A range of opportunities to develop expertise are **available** for an individual employee in my workplace. (More points indicate a higher degree of availability.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

2) A range of opportunities to develop expertise are **accessible** to an individual employee in my workplace. (More points indicate a higher degree of accessibility.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

3) My organization systematically **supports** an individual employee's expertise development. (More points indicate a higher degree of support.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

4. Please indicate the extent to which you are **motivated** to develop your expertise in your current field of work. (More points indicate a higher degree of motivation.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

5. Based upon **your own concept of expertise** in your field, rate yourself on a scale of 1-10 in terms of your job performance over the last year. (More points indicate a higher degree of performance.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

6. Based upon **an official performance appraisal measure in your workplace**, rate yourself on your job performance over the last year. If your workplace does not have any performance appraisal measure, how do you think your supervisor would rate your job performance over the last year on the following scale? (More points indicate a higher degree of performance.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

Background Information Part II: Demographic information

This section will ask you a few questions regarding your personal background. Please select the option that best describes you.

Gender

- a. Female
- b. Male

Education Level (select highest level)

- a. Undergraduate degree from college or university

- b. Some graduate school
- c. Completed Master's Degree
- d. Completed terminal degree: Ph.D, J.D., M.D., Ed.D., etc.

Age

- a. 23-29
- b. 30-44
- c. 45-60
- d. Over 60

Race/Ethnicity

- a. Hispanic or Latino
- b. American Indian or Alaska Native
- c. Asian
- d. Black or African American
- e. Native Hawaiian or Other Pacific Islander
- f. White
- g. Multiracial
- h. Other (Please specify)

Appendix J

Survey Questions for phase IV study

Qualification Questions

Your Current Educational and Employment Status

This survey is a revised version of the Employee Expertise Development Survey (EEDS) that was implemented on December 2014. Did you take the Employee Expertise Development Survey last December?

☐ Yes, I took the EEDS on December, 2014. (skip logic to not-eligible and thank you for your interest)

☐ No, I didn't. This is my first time to take the EEDS.

I work in the US.

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I am 23 years old or older:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I have earned at least an undergraduate college degree:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I am currently a full-time employee in any for-profit or non-profit organization:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

I have at least 1 year of experience (including this year) in my primary field of expertise before, during, or after college graduation:

☐ Yes ☐ No (skip logic to not-eligible and thank you for your interest)

The Employee Expertise Development Scale

This survey will ask you to indicate your agreement with a series of statements relating to the Development of Employee Expertise. Please respond to the following statements about your current experience or experiences during the prior year, according to the scale provided (7-Likert scale: 1=strongly disagree/7=strongly agree). Please note that a few questions will intentionally recur with slightly different nuances.

1. I have frequent contact with more experienced people to discuss my performance.

☐ 1 (strongly disagree) ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 (strongly agree)

2. I have opportunities to examine work processes after completing a complex task in the workplace.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

3. I seek out new knowledge in my area of expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

4. I work with challenging colleagues who expand my thinking and performing.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

5. I thoroughly examine fundamental knowledge to get to the core of a matter.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

6. I take advantage of opportunities to work at a higher level than my current position in my workplace.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

7. I systematically study advanced knowledge or skills beyond my immediate needs.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

8. I proactively modify my work approach in order to develop the best practice.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

9. I integrate what I have newly learned with my prior knowledge and skills.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

10. I experience a wide range of work situations.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

11. I seek out opportunities to network with people who are in a similar position, but work for other companies or industries.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

12. I tackle complex tasks that require an overall understanding.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

13. I have *never* sought out new knowledge in my area of expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

14. I invest extra time and effort outside of work to develop my expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

15. I engage in the greater professional community.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

16. My work includes dilemmas or challenges.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

17. I structure my approach to work in ways that improve a weak area in my knowledge or skills.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

18. I educate myself in other relevant fields to strengthen my knowledge and skills.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

19. I make an effort to meet new groups of people to enrich my professional networks.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

20. I am developing specialized channels to facilitate information exchange with other professionals.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

21. I take part in work projects from start to end.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

22. I participate in work-related consultation across organizational boundaries.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

23. I always *avoid* opportunities to meet new groups of people to enrich my professional networks.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

24. I participate in discussions in professional communities through social media or public meetings.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

25. My work involves multiple roles and responsibilities.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

26. I am closely guided by others with more expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

27. I explore new resources of knowledge and skills in my area of expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

28. My work includes multi-faceted experiences.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

29. I regularly read materials related to my expertise (e.g., books, journals, or online materials).

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

30. I deal with atypical situations in doing my work.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

31. My supervisor provides feedback on a regular basis to develop my expertise.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

32. While doing my daily work, I utilize different skills and knowledge.

__1(strongly disagree) __2 __3 __4 __5 __6 __7 (strongly agree)

Background Information Part I: Job related information

This section will ask a few background questions in regard to your expertise and organization.

1. ⁸Which of the following best describes your field of expertise?

- ☐ Management occupations
- ☐ Business and financial operations occupations
- ☐ Computer and mathematical occupations
- ☐ Architecture and engineering occupations
- ☐ Life, physical, and social science occupations
- ☐ Community and social services occupations
- ☐ Legal occupations
- ☐ Education, training, and library occupations
- ☐ Arts, design, entertainment, sports, and media occupations
- ☐ Healthcare practitioners and technical occupations
- ☐ Healthcare support occupations
- ☐ Protective service occupations
- ☐ Food preparation and serving related occupations
- ☐ Building and grounds cleaning and maintenance occupations
- ☐ Personal care and service occupations
- ☐ Sales and related occupations
- ☐ Office and administrative support occupations
- ☐ Farming, fishing, and forestry occupations
- ☐ Construction and extraction occupations
- ☐ Installation, maintenance, and repair occupations
- ☐ Production occupations
- ☐ Transportation and material moving occupations
- ☐ Military specific occupations
- ☐ Other (Please specify)

2. Including this year, how many years have you worked in your field of work? ____

⁸ I used the Standard Occupational Classification (SOC) System that the United States government has established to classify occupations (U.S. Department of Labor, 2000).

3. Please indicate the extent to which **your workplace** represents each of the statements regarding opportunities for expertise development.

1) A range of opportunities to develop expertise are **available** for an individual employee in my workplace. (More points indicate a higher degree of availability.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

2) A range of opportunities to develop expertise are **accessible** to an individual employee in my workplace. (More points indicate a higher degree of accessibility.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

3) My organization systematically **supports** an individual employee's expertise development. (More points indicate a higher degree of support.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

4. Please indicate the extent to which you are **motivated** to develop your expertise in your current field of work. (More points indicate a higher degree of motivation.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

5. Based upon **your own concept of expertise** in your field, rate yourself on a scale of 1-10 in terms of your job performance over the last year. (More points indicate a higher degree of performance.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

6. Based upon **an official performance appraisal measure in your workplace**, rate yourself on your job performance over the last year. If your workplace does not have any performance appraisal measure, how do you think your supervisor would rate your job performance over the last year on the following scale? (More points indicate a higher degree of performance.)

__1 __2 __3 __4 __5 __6 __7 __8 __9 __10

Background Information Part II: Demographic information

This section will ask you a few questions regarding your personal background. Please select the option that best describes you.

Gender

- c. Female
- d. Male

Education Level (select highest level)

- e. Undergraduate degree from college or university
- f. Some graduate school
- g. Completed Master's Degree
- h. Completed terminal degree: Ph.D, J.D., M.D., Ed.D., etc.

Age

- e. 23-29
- f. 30-44
- g. 45-60
- h. Over 60

Race/Ethnicity

- i. Hispanic or Latino
- j. American Indian or Alaska Native
- k. Asian
- l. Black or African American
- m. Native Hawaiian or Other Pacific Islander
- n. White
- o. Multiracial
- p. Other (Please specify)

Appendix K

The Employee Expertise Development Scale

This survey will ask you to indicate your agreement with a series of statements relating to the Development of Employee Expertise. Please respond to the following statements about your current experience or experiences during the prior year, according to the scale provided:

1=*Strongly Disagree*, 2=*Disagree*, 3=*Somewhat Disagree*, 4=*Neither Agree Nor Disagree*, 5=*Somewhat Agree*, 6=*Agree*, 7=*Strongly Agree*

#	Item	1	2	3	4	5	6	7
1	I seek out new knowledge in my area of expertise.	1	2	3	4	5	6	7
2	I thoroughly examine fundamental knowledge to get to the core of a matter.	1	2	3	4	5	6	7
3	I take advantage of opportunities to work at a higher level than my current position in my workplace.	1	2	3	4	5	6	7
4	I systematically study advanced knowledge or skills beyond my immediate needs.	1	2	3	4	5	6	7
5	I proactively modify my work approach in order to develop the best practice.	1	2	3	4	5	6	7
6	I integrate what I have newly learned with my prior knowledge and skills.	1	2	3	4	5	6	7
7	I explore new resources of knowledge and skills in my area of expertise.	1	2	3	4	5	6	7
8	I seek out opportunities to network with people who are in a similar position, but work for other companies or industries.	1	2	3	4	5	6	7
9	I make an effort to engage in the greater professional community.	1	2	3	4	5	6	7
10	I make an effort to meet new groups of people to enrich my professional networks.	1	2	3	4	5	6	7
11	I am developing specialized channels to facilitate information exchange with other professionals.	1	2	3	4	5	6	7
12	I participate in discussions in professional communities through social media or public meetings.	1	2	3	4	5	6	7
13	I have frequent contact with more experienced people to discuss my performance.	1	2	3	4	5	6	7

#	Item	1	2	3	4	5	6	7
14	I have opportunities to examine work processes after completing a complex task in the workplace.	1	2	3	4	5	6	7
15	I work with challenging colleagues who expand my thinking and performing.	1	2	3	4	5	6	7
16	I am closely guided by others with more expertise.	1	2	3	4	5	6	7
17	My supervisor provides feedback on a regular basis to develop my expertise.	1	2	3	4	5	6	7
18	I experience a wide range of work situations.	1	2	3	4	5	6	7
19	My work includes dilemmas or challenges.	1	2	3	4	5	6	7
20	My work involves multiple roles and responsibilities.	1	2	3	4	5	6	7
21	My work includes multi-faceted experiences.	1	2	3	4	5	6	7
22	I deal with atypical situations in doing my work.	1	2	3	4	5	6	7
23	While doing my daily work, I utilize different skills and knowledge.	1	2	3	4	5	6	7

Note. #1~#7: Engagement in Deliberate Practice, #8~12: Strategic Networking, #13~#17: Frequent and Focused Interactions, and #18~#23: Developmental Work Experience.