Learning with your spouse: Does the similarity of spouse's occupation affect individual's earnings?

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Abstract

Starting from the intuition to explore the interaction between individuals' behavior and their intra-household situation, this paper focuses on a specific aspect of this interaction: whether individuals will benefit, in terms of work performance/individual earnings, from having a spouse who has similar occupation. Using PSID (2017) data to look at over 11,000 individuals living in the United States, covering their employment, income, wealth, marriage, education and other information in 50 years, this paper conducts an empirical analysis on adjusted Mincer wage model. I find out that couples with dissimilar knowledge and ability, similar skill are better matched, in a way that they help with the earnings of heads.

Keywords: intra-household interaction, individual earning, peer effect

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1 Introduction

In the modern labor market with the rising labor force attachment of women, dual-earner households have become more and more common, which makes studies on the intra-household conditions' effect or joint decisions increasingly relevant. Topics that fall into this field include joint migration decisions, marital stability, and labor market outcome brought by these topics. This paper empirically analyzes the relation between marriage, occupation and individual earnings. More specifically, the question I'm trying to answer here is how the similarity of spouse's occupation to head's occupation would influence earnings of head.

Previous literature finds evidence that individual's work performance or earnings would benefit from having a spouse. When it comes to having a working spouse, there are evidence saying both that individual earnings would benefit from or hurt by having a working spouse (Hotchkiss & Moore 1999, Becker (1973), Benham (1974)). Constructing variables using O*Net database sponsored by US Department of Labor/Employment and Train-ing Administration (USDOL/ETA), I managed to measure the occupation similarity between married couples. And by merging these variables with the Panel Study of Income Dynamics, my result suggests that there are three dimensions of occupation distance that relate to individual earnings. First, spouses whose occupational information reveals dissimilarity in terms of knowledge and ability are more likely to help with earnings. The knowledge-based and ability-based distance measures most likely capture the benefits from the intra-household specialization. This supports the old comparative advantage hypothesis. Second, spouses that are similar in terms of skills are more likely to help with heads wage. Skill similarity reveals the possibility of peer effect between couples.

This paper extends earlier ideas and analyses in the following ways. First, it provides further proof for the hypothesis that marriage enhances individuals' productivity. Moreover, it provides potential explanation on the actual mechanism of this enhancement. Second, the dimensions of occupations are relatively refreshing in the economic research. The computation work on getting the similarity score could contribute to future analyses in labor market and other fields. Finally, the result proves the peer effect and comparative advantage between couples. The model manage to prove the three dimensions of similarity have influence in different directions and magnitudes, and all in a significant level.

This paper provide a new insight into the mechanism underlying the interaction between household and individual activities.

The paper does not make causal claims about spouse's occupations and individual earnings, since the model does not simulate random assignment to spouses or their jobs, but it is defensible that occupational similarity measures contain information orthogonal to the other factors that might influence the labor market performance. The results of this paper should be read as adding explanatory power to empirical models, with the correlations signed as theory predicts.

The paper proceeds as follows. Section 2 reviews the existing literature on individual earnings, as well as the related literature on marriage-earnings relationship. Section 3 introduces the dataset I'm using and discusses the construction of occupational distance measures. Section 4 discusses the empirical model, and the empirical results are presented and discussed in Section 5. Section 6 concludes.

2 Related Literature

Analyzing individual earnings through the concept of "human capital" got popularized by the work of Gary Becker (1975), Jacob Mincer (1958), T.W. Schultz (1960). They assert that individual productive capacities are determined by individual stocks of productive attributes like skills, health, knowledge etc., and that investment decisions determine the evolutions of these stocks. With the term "capital" using, human is regarded as machine that needs investment to increase capacity to produce. Economists have done much work in the field of human capital. And in micro-level, literature can be classified into two groups: studies that focus on the influence of investment in human capital happens in early childhood, and the influence of adulthood investment/interaction with other activities. In the early development of human capital theory, economists tend to focus on investments in one type of skill, like Ben-Porath (1967) and Mincer (1974), while recent economics literature pioneered by James Heckman devotes attention to the fact that when parents and schools invest in the human capital of young persons, these investments create different types of skills and build on each other over time in complex ways (Cunha & Heckman 2007, Heckman et al. (2013), Deming (2009), Belfield et al. (2006), and Anderson (2008)).

Studies on adulthood investment mostly focus on skills and experience. Studies by Sumru Altug and Richard A. Miller (1998) and Ricardo Cossa et al. (1999) find a significant effect of past work experience on current wage earnings. Hansen and Imrohoroğlu (2009) studies two forms of skill accumulation in adult life: learning by doing and on-the-job training, and analyzed their different effect on labor supply and volatility of hours over life cycle. They found that introducing on-the-job training gives steady state and business cycle properties that are essentially identical to the case without skill accumulation. Learning by doing (LBD) has more significant effect on skill accumulation throughout an individual's working life.

Marriage as a probably most influential part to adulthood caught a lot of attention from labor economists. Generally, labor economists have long noted that married men earn substantially more per hour worked than men who are not currently married, these cross-sectional wage differentials persist when controls are introduced for education, race, region, age, or work experience, and even occupation and industry (Korenman & Neumark 1991). However, *"... the role of marriage in enhancing the earnings of male workers is still only dimly understood."*(Goldin 1990) One major hypothesis is that earnings differeentials between married men and single men result from productivity differentials: marriage per se makes workers more productive (Becker 1981, Becker (1985), Kenny (1983), and Greenhalgh (1980)); Another hypothesis attributes these differentials to employer favoritism (Hill 1979, bartlett1984wage), and a third to selection into marriage on the basis of wages or personal characteristics that are valued in labor markets (Becker 1981, Nakosteen & Zimmer (1987), and Keeley (1977)). Using data from a company personnel file that includes information on job grades and supervisor performance ratings, Korenman and Neumark (1991) provide greater support to the first hypothesis, that marriage enhances men's labor market productivity. Although the mechanism of this enhancement needs further evidence to prove, the selection of men into marriage on the basis of wages, wage growth, or other wage-enhancing characteristics receives little support as an explanation of the observed marital pay premiums. Focusing on self-employed individuals, Hundley (2000) used data from the National Longitudinal Study of the High School Class of 1972 and PSID data and proved that self-employed men's earnings increase with marriage and family size,

while organizationally employed workers' earnings exhibited a similar but less pronounced pattern. However, women's earnings decline with marriage, family size, and hours of housework. This implies the different roles of men and women in households. Hundley gets this conclusion that self-employed women and men specialized more intensively in housework and market work respectively because women tend to choose self-employment to facilitate household production, and men to achieve higher earnings. Hotchkiss and Moore (1999) provide support to this by proving that managers with working wives earn lower wages than their counter-parts with non-working wives using March 1993 Cureent Popilation Survey data. These papers serve as evidence for the first hypothesis by suggesting marriage enhances productivity because the specialization between husbands and wives increases their efficiency.

The last hypothesis in the above paragraph serves as one of the major hypotheses in this paper. Focusing on the question that how the interaction between working couples would influence individual's earning, previous literature have two major hypotheses. Some literature claim that the optimal pattern for pairing husbands and wives is negative sorting on wages because it maximizes the gains from specialization (Becker 1973). Benham (1974) argues that one spouse's earnings are enhanced by the knowledge of the other spouse, assuming that the other spouse has relevant knowledge.

This paper uses PSID data and occupation data to analyze the effect of intra-household interaction on individuals' productivity by focusing on couples that are both working in the market. Based on the features of the dataset, I managed to present proofs for both hypotheses by identifying different dimensions of occupations. The occupational similarity between couples can be divided into four dimensions, **ability**, **activity**, **skills**, and **knowledge**. Thus this paper extends earlier ideas and analyses in the following ways. First, it provides further proof for the hypothesis that marriage enhances individuals' productivity. Moreover, it provides potential explanation on the actual mechanism of this enhancement. Second, the dimensions of occupations are relatively refreshing in the economic research. The computation work on getting the similarity score could contribute to future analyses in labor market or other fields. Finally, the result proves the peer effect between couples in a certain level. The model manage to prove the four dimensions of similarity have in-

fluence in different directions and magnitudes, and all in a significant level. This paper provide a new insight into the mechanism underlying the interaction between household and individual activities.

3 Data

Two major datasets are used in this paper.

3.1 Panel Study of Income Dynamics

Begins in 1968, the Panel Study of Income Dynamics, PSID, is the longest running longitudinal household survery in the world (2017). It includes a nationally representative sample of over 18,000 individuals living in 5,000 families in the United States. Information on these individuals and their descendants has been collected by faculty at the University of Michigan continuously, including data covering employment, income, wealth, expenditures, health, marriage, childbearing, child development, philanthropy, education, and numerous other topics.

The core PSID sample consists of two independent samples: a cross-sectional national sample, known as the SRC (Survey Research Center) sample, and a national sample of low-income families, known as the SEO (Survey of Economics Opportunities) sample. My estimation sample only includes those individuals who are associated with families from the SRC.

The criteria that I use to construct the estimation sample are as follows, which is closely related to the method Gemici(2007) used. I follow heads of families from the start of their career through their last interview or until they are retired, depending on which event occurs first. There are about 11,000 heads in my sample (since female heads are a small part, I only focus on male heads). I follow the employment, occupation, wage and location histories of these heads and their wives during the course of their marriage.

PSID has detailed information on employment, earnings and total labor market experience of household heads and wives. I obtain individual's experience based on two major variables from the dataset: "How many years/months have you been doing your present

or most recent job?" and "In what year did you start your current or most recent job?". The acquireness of these two variables in different waves decide that I have to consider these two together. Since the first question is more related to my research focus, I use the answer to the second question as a supplement. I first generate the months of experience and then divide it by 12. For observation that has months of experience (which is recorded since 1994), I use the direct value from the dataset. For observation that lacks this value, beginning time of his current work is taken into account. For earnings I focus on hourly wages. And another important variable here is years of completed education. PSID has this information for all waves except for the year 1969. My strategy is to look at the values at 1970 and 1968, and then decide if 1969 has the middle value or same value as one of them. Other variables considered include: the amount of children in the household, age, and so on.

3.2 O*Net Database

The measure of distance between any two occupations we used comes from the O*Net 21.2 Database (National Center for O*NET Development n.d.), which is available to the public at no cost, is continually updated by surveying a broad range of workers from each occupation under the sponsorship of the US Department of Labor/Employment and Training Administration (USDOL/ETA). O*Net Data contains Content Model, which describes characteristics like knowledge, skills, abilities, activities and tasks for each occupation (under Standard Occupational Classification (SOC) code) and O*Net-SOC Taxonomy, a pectrum of occupations across the world. I use the O*Net Content Model in this study.

The **activities**, **abilities**, **knowledge** and **skills** files contain the variables I use to measure distance between occupations. More specifically, O*Net Content Model collect this data through their ongoing data-collection program, which involves survey and data analysis, and other federal agencies like the Bureau of Labor Statistics. For each occupation, there're 52 dimensions for abilities, 35 dimensions for skills, 33 dimensions for knowledge, and 41 dimensions for Activites (see Appendix). And for each dimension, there're two elements to describe its "meaning" to the occupation: *level* (0 to 7) and *importance* (1 to 7). The importance scale is accompanied by typical linear, numeric scale language, such as

"not important" and "extremely important". The level scale is accompanied by "anchors" that communicate what constitutes a minimal level of performance and what constitutes a sophisticated level. The idea of using this model comes from Kammen and Adams (2014), my calculation of distance between each pair of occupations would follow their methods and adjust for my research purpose:

For every occupation, I can generate a 4×1 vector for its four characteristics.

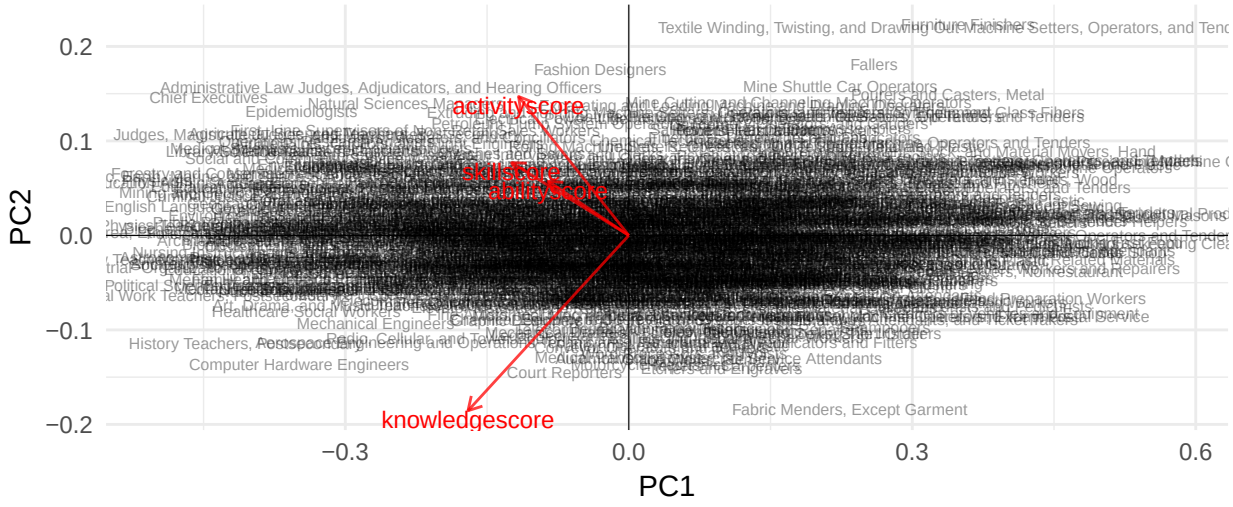
$$occ_i = \begin{bmatrix} ability_i \\ knowledge_i \\ skill_i \\ activity_i \end{bmatrix}$$

And for each entry in this vector (use ability as an example):

$$ability_i = \begin{bmatrix} ability_{i,1,level} \\ ability_{i,2,level} \\ \cdots \\ activity_{i,52,level} \end{bmatrix}^T \begin{bmatrix} ability_{i,1,importance} \\ ability_{i,2,importance} \\ \cdots \\ activity_{i,52,importance} \end{bmatrix} \frac{1}{\sum_{m=1}^{52} ability_{i,m,importance}}$$

Using PCA (Principal Component Analysis) on the four scores for each occupation, one could have a general idea about whether these dimensions are constructed in a way that's reasonable.

Fig. 1: Principal Component Analysis on the Four Dimensions of 648 Occupations



Thus the ability distance between two occupations are:

$$abilitydist_{i,j} = ||ability_i - ability_j||_2$$

3.3 Descriptive Statistics

The dataset I used to do analysis on combines PSID data and the Occupation Similarity Score Data I generated by the above method. These two dataset are linking together based on OCC 2000 (Census 2000 Occupational Code) for head and wife in the family. This operation itself limited my analysis to dual earner households. Summary statistics of key variables are presented in the table below.

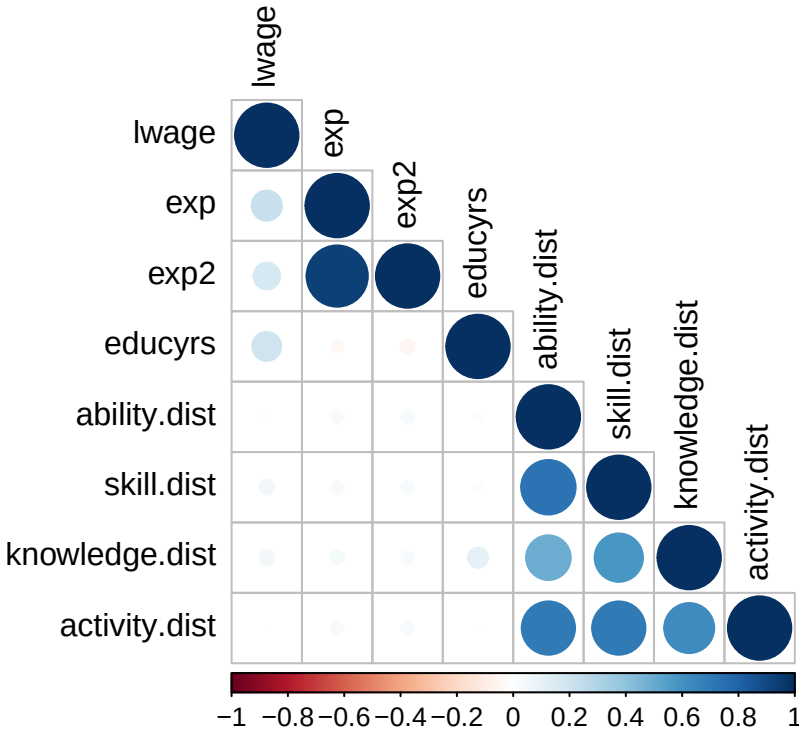
Table 1: Descriptive statistics

Statistic	N	Mean	St. Dev.	Min	Max
Log Wages	91,336	2.0900	0.9230	−3.0000	6.9100
Experience (Years)	188,241	6.2100	8.2100	0.0000	67.0000
Square of Experience	188,241	106.0000	255.0000	0.0000	4,489.0000
Years of Completed Education	129,198	13.3000	2.3600	1	17
Abilities Distance	28,368	0.2110	0.0785	0.0584	0.5150
Skills Distance	28,368	0.2500	0.0818	0.0644	0.5180
Knowledge Distance	28,368	0.4520	0.1260	0.1130	0.8940
Activities Distance	28,368	0.3230	0.0875	0.0992	0.6810

To see relationships between these variables, I generate a correlation plot (figure 2). From the plot one can tell, the added variables on occupational similarity are not correlated with variables in the original classic model. This promises the effectiveness of Mincer wage model (Mincer 1958). The four dimensions of occupation themselves are somewhat correlated to each other, which is inevitable considering how these variables are constructed. Occupations requirment on skill, knowledge, activity, and ability are generally related. However, the correlation is not very strong and from this and the principal component

analysis from figure 2, one could tell that knowledge is far from perfectly correlated to the others. This feature could help us identify the different influence of these four variables.

Fig. 2: Correlation Plot of Key Variables



4 Empirical Model

As an empirical analysis, this paper follows the classical wage model proposed by Mincer(1958). To focus on the interaction between individual and their spouse, I added four new variables regarding occupational similarity into the model. The basic Mincer eanings function is:

$$ln(W_j) = ln(W_{j,0}) + \beta_s S_j + \beta_{e1} experience + \beta_{e2} experience^2$$

Where j is individual j, W and S means wage and years of schooling respectively. And experience here is actually $(t - S)$, time after schooling. To conduct an empirical analysis focusing on occupational similarity, the equation becomes:

$$ln(W_{j,t}) = ln(W_{j,0}) + \beta_{s,j} S_{j,0} + \beta_{e1} experience + \beta_{e2} experience^2 + \overrightarrow{\beta}_{spouse} \overrightarrow{V}_{OccSim}$$

where $\overrightarrow{V}_{spouse}$ is a 4×1 vector of variables showing the four dimensions of spouses' occupational similarity.

5 Empirical Findings

There are two hypotheses that this study is trying to get a sense of:

1. The distance between couples' occupations is negative related to wage because this maximizes the gains from specialization.

2. The distance between couples' occupations is positive related to wage because this maximizes the gains from peer effect.

Due to the feature of the constructed dataset, I use three multilevel modeling methods: pooling, fixed effects, and random effects to conduct the empirical analysis. Table 2 presents the results.

First, results from all three models are very similar. After conducting tests for these three models individually and by pair, results show that fixed effect model are preferred in this case. From the result of fixed effect model, the variables from mincer equation are all significant and have plausible directions of effect as previous studies. Added variables on occupational similarities are also statistically significant except for acctivity distance. The whole model is working decently. This means occupational similarity between couples does have an effect, or rigorously correlation with the wage. However, one can tell the R^2 of the whole model is not very high which means this model can't explain wage entirely.

Second, the directions of the variables are showing some interesting facts: Ability and knowledge distance are showing negative correlation with wage, while skills are showing positive. My interpretation to this is that the effect for both hypotheses might arise together in this case. When couples share occupations that require similar skills, they're more likely to benefit from peer effect since skills are something they could learn together and help each other, and thus they can have higher earnings. In the other case, ability, including physical ability, cognitive ability and other information on individual's "existing" attributes before they get married or get a job, is less likely to show peer effect. These occupation dimensions can be seen as signals of individuals, when considering peer effect, we're thinking about if couples can share their "signals" together and thus learn together. In this sense, ability is

relatively hard to share and thus don't support the "peer effect" hypothesis. Knowledge can be interpreted in the same way that it's something fixed and hard to learn together (except for someone who works in knowledge-oriented fields). While this might be against our intuition, like we would think two economic PhDs might help each other's career better, for the limitation of the dataset, I couldn't actually capture whether couples are sharing knowledge in the same field. (The contruction of the similarity variables and the original data from O*Net determined that the knowledge score for economists, biologists, or other scholars, i.e. people have similar level in knowledge areas have similar score. Thus a both-economists couple has the same knowledge distance value as a economist-biologist couple.)

While the above interpretation sounds interesting, it's far away from being a rigorous discovery on the causality relationship between occupational similarity and individual earnings. By looking at dual-earner households and compare their similarity, one can only say it seems like high similarity in skills and low similarity in ability and knowledge are related to higher individual earnings. However, this result could serve as a baseline to build further study on.

6 Conclusions

When pop singer Paula Abdul and a cartoon cat depicting the male lead performed the song, "Opposites Attract" (1990), they were right and wrong about marriage. An idea as old as comparative advantage dictates that opposites attract in order to reap the greatest gains from specialization. My findings confrim that spouses with dissimilar knowledge and ability are better matched, in a way that they help with the earnings of heads. However, there's another mechanism that is showing influence here: peer effect. Spouses with occupations that require similar skills as heads makes heads better off because they could improve their work performance through learning or improving skills with their spouses.

Previous theoretical work by economists has predicted the findings in this paper – that specialization in disparate tasks generates marital gains, but similar skills are likely generate substantial marital gains as well. Taken as a whole, the results of this study empirically support each hypothesis. The reader should be cautioned that the results are only presenting the correlation here instead of saying the direct influence on earnings by

Table 2: Wage Model with Occupational Similarity: Dual Earner Households

	Dependent variable:		
	Hourly Wages (Log)		
	pooling	fixed	random
	(1)	(2)	(3)
Experience (Years)	0.049***	0.035***	0.046***
	(0.003)	(0.003)	(0.003)
Square of Experience	−0.001***	−0.0003**	−0.001***
	(0.0001)	(0.0001)	(0.0001)
Years of Education	0.096***	0.098***	0.103***
	(0.004)	(0.011)	(0.005)
Abilities Distance	−0.851***	−0.344*	−0.652***
	(0.162)	(0.189)	(0.160)
Skills Distance	1.380***	0.581***	1.060***
	(0.160)	(0.191)	(0.160)
Knowledge Distance	0.161*	−0.218**	−0.037
	(0.090)	(0.110)	(0.091)
Activities Distance	−0.619***	−0.272	−0.447***
	(0.153)	(0.175)	(0.149)
Constant	1.090***		1.090***
	(0.062)		(0.075)
Observations	11,289	11,289	11,289
R^2	0.113	0.074	0.284
Adjusted R^2	0.112	−0.470	0.284
F Statistic	205.000*** (df = 7; 11281)	81.700*** (df = 7; 7105)	641.000*** (df = 7; 11281)

Note: *p<0.1; **p<0.05; ***p<0.01

occupational similarity. The direct influence still need a lot of work done here to exclude other influential factors, which is also the major the limitation of this paper. Ideally, a good choice of instrumental variable could do the work but in this context the perfect instrumental variable remained unclear. Another limitation is the construction of similarity variables. Right now the Frobenius norm cannot identify the difference between people have similar level in one dimension.

Future work on this could focus on the major limitation I pointed out above. And the construction of similarity variables and scores for each occupation could be used in other related areas. As a important but not so well-defined component in labor market, variables regarding occupation could be well used in future studies.

7 Appendix

The following tables are generated from O*Net data (National Center for O*NET Development n.d.).

Table 3: Dimensions of Occupation - Ability

Ability	Ability	Ability
Category Flexibility	Visualization	Night Vision
Deductive Reasoning	Written Comprehension	Peripheral Vision
Flexibility of Closure	Written Expression	Sound Localization
Fluency of Ideas	Dynamic Flexibility	Speech Clarity
Inductive Reasoning	Dynamic Strength	Speech Recognition
Information Ordering	Explosive Strength	Visual Color Discrimination
Mathematical Reasoning	Extent Flexibility	Arm-Hand Steadiness
Memorization	Gross Body Coordination	Control Precision
Number Facility	Gross Body Equilibrium	Finger Dexterity
Oral Comprehension	Stamina	Manual Dexterity
Oral Expression	Static Strength	Multilimb Coordination
Originality	Trunk Strength	Rate Control
Perceptual Speed	Auditory Attention	Reaction Time
Problem Sensitivity	Depth Perception	Response Orientation
Selective Attention	Far Vision	Speed of Limb Movement
Spatial Orientation	Glare Sensitivity	Wrist-Finger Speed
Speed of Closure	Hearing Sensitivity	
Time Sharing	Near Vision	

Table 4: Dimensions of Occupation - Skill

Skill	Skill
Active Learning	Technology Design
Active Listening	Troubleshooting
Critical Thinking	Judgment and Decision Making
Learning Strategies	Systems Analysis
Mathematics	Systems Evaluation
Monitoring	Management of Financial Resources
Reading Comprehension	Management of Material Resources
Science	Management of Personnel Resources
Speaking	Time Management
Writing	
Coordination	
Instructing	
Negotiation	
Persuasion	
Service Orientation	
Social Perceptiveness	
Complex Problem Solving	
Equipment Maintenance	
Equipment Selection	
Installation	
Operation and Control	
Operation Monitoring	
Operations Analysis	
Programming	
Quality Control Analysis	
Repairing	

Table 5: Dimensions of Occupation - Knowledge

Knowledge	Knowledge
Administration and Management	Psychology
Biology	Public Safety and Security
Building and Construction	Sales and Marketing
Chemistry	Sociology and Anthropology
Clerical	Telecommunications
Communications and Media	Therapy and Counseling
Computers and Electronics	Transportation
Customer and Personal Service	
Design	
Economics and Accounting	
Education and Training	
Engineering and Technology	
English Language	
Fine Arts	
Food Production	
Foreign Language	
Geography	
History and Archeology	
Law and Government	
Mathematics	
Mechanical	
Medicine and Dentistry	
Personnel and Human Resources	
Philosophy and Theology	
Physics	
Production and Processing	

Table 6: Dimensions of Occupation - Activity1

Activity
Estimating the Quantifiable Characteristics of Products, Events, or Information
Getting Information
Identifying Objects, Actions, and Events
Inspecting Equipment, Structures, or Material
Monitor Processes, Materials, or Surroundings
Analyzing Data or Information
Developing Objectives and Strategies
Evaluating Information to Determine Compliance with Standards
Judging the Qualities of Things, Services, or People
Making Decisions and Solving Problems
Organizing, Planning, and Prioritizing Work
Processing Information
Scheduling Work and Activities
Thinking Creatively
Updating and Using Relevant Knowledge
Controlling Machines and Processes
Documenting/Recording Information
Drafting, Laying Out, and Specifying Technical Devices, Parts, and Equipment
Handling and Moving Objects
Interacting With Computers
Operating Vehicles, Mechanized Devices, or Equipment
Performing General Physical Activities
Repairing and Maintaining Electronic Equipment
Repairing and Maintaining Mechanical Equipment
Assisting and Caring for Others
Coaching and Developing Others

Table 7: Dimensions of Occupation - Activity2

Activity
Communicating with Persons Outside Organization
Communicating with Supervisors, Peers, or Subordinates
Coordinating the Work and Activities of Others
Developing and Building Teams
Establishing and Maintaining Interpersonal Relationships
Guiding, Directing, and Motivating Subordinates
Interpreting the Meaning of Information for Others
Monitoring and Controlling Resources
Performing Administrative Activities
Performing for or Working Directly with the Public
Provide Consultation and Advice to Others
Resolving Conflicts and Negotiating with Others
Selling or Influencing Others
Staffing Organizational Units
Training and Teaching Others

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