

# Mental Ability and Psychological Work Performance in Chinese Workers

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**Abstract:** This study was to explore the relationship among mental ability, occupational stress, and psychological work performance in Chinese workers, and to identify relevant modifiers of mental ability and psychological work performance. Psychological Stress Intensity (PSI), psychological work performance, and mental ability (Mental Function Index, MFI) were determined among 485 Chinese workers (aged 33 to 62 yr, 65% of men) with varied work occupations. Occupational Stress Questionnaire (OSQ) and mental ability with 3 tests (including immediate memory, digit span, and cipher decoding) were used. The relationship between mental ability and psychological work performance was analyzed with multiple linear regression approach. PSI, MFI, or psychological work performance were significantly different among different work types and educational level groups ( $p < 0.01$ ). Multiple linear regression analysis showed that MFI was significantly related to gender, age, educational level, and work type. Higher MFI and lower PSI predicted a better psychological work performance, even after adjusted for gender, age, educational level, and work type. The study suggests that occupational stress and low mental ability are important predictors for poor psychological work performance, which is modified by both gender and educational level.

**Keywords:** Work ability, Mental health, Occupational stress, Psychological work performance, Chinese workers

## Introduction

There have been growing concerns over recent decades that the experience of stress at work has an adverse effect on workers' health and safety. With the on-going social and economic transitions and increasing social competition in China, more and more Chinese workers have been suffering from occupational stress<sup>1</sup>. It has been reported that about 44.5% of urban residents in China are experiencing stress and 21.7% are having psychological disorders<sup>2</sup>.

Mental ability represents a person's "brain power" in different aspects of competency, including verbal, mathematical, spatial, and logical reasoning, which is one of the most important components of functional abilities for a worker, especially mental worker, to perform work tasks. It has been suggested that workers' physical and mental health, and work ability change with age and disease conditions, irrespective of gender and occupation<sup>3-5</sup>.

Occupational psychological stress, on the other hand, is an emotional response that occurs when there is a conflict between job demands or pressures, and control or decision latitude in meeting those demands on a worker<sup>6</sup>. It is

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considered as one of the major risk factors for workers' health and work ability<sup>7,8</sup>). Occupational stress has been found to be responsible in part for a series of adverse health problems, such as cardiovascular disease<sup>9, 10</sup>), musculoskeletal disorders<sup>11, 12</sup>), mental disorders<sup>13</sup>), and to be associated with development of behavioral disease risk factors including smoking and alcohol drinking<sup>14-16</sup>). Recent studies have also showed that occupational stress has negative effects on the mental health of Chinese workers<sup>17, 18</sup>). It was reported that overtime work could result in impaired cognitive performance in the areas of attention and executive function<sup>19</sup>).

Nowadays, researches who are interested in mental ability have been limited to childhood intelligence<sup>20, 21</sup>), and few previous papers addressed the relationship between social skill, work performance and mental ability<sup>22, 23</sup>). The reality is that the relationship between mental ability and occupational stress among workers and how mental ability affects psychological work performance remain unclear. To provide more information and understanding of this issue, we conducted the current cross-sectional study among Chinese workers. The specific aims of this study are to explore the situation of mental ability, occupational stress, and psychological work performance among these workers, and to examine the relationship between mental ability and psychological work performance.

## Subjects and Methods

Study subjects were selected from Guanghan in Sichuan province, China, which is a medium-sized city of county-level with a population of more than half a million. A random cluster sampling technique was adopted. All factories and schools in this city were initially coded, and subsequently a random sample of subjects selected from a machine factory with 62 registered workers, a chemical factory with 280 workers, and a school with 158 teachers and assistant staffs. Workers who had retired and were on sick leave for over one year were excluded. The statutory age for retirement in China is 60 yr old for male and 55 yr old for female, however one man aged 62 yr and one woman aged 56 yr who remained working were included in the study.

A total of 490 questionnaire forms were returned out of 500 sent, giving a 98% response rate. Two percent of sampled workers (10 of 500) being absent from work due to illness were excluded. After excluding another 5 people with uncompleted questionnaires, 485 workers were included in the final analysis, consisting of 317 males (with an average age of 47.5 yr old, ranging from 33 to 62) and 168 females (with an average age of 44.0 yr old, ranging from 39 to 56).

The workers were classified into 3 work type groups: 148 (37.9%) manual workers, 187 (38.6%) mental workers, and 114 (23.5%) manual and mental combined workers, respectively, according to Chinese Occupational Classification

Of 485 analyzed workers, 29.1% reported they had to slow down their pace of work or change the nature of their work because of ill health, and 16.5% reported they were absent from work at least once due to health problems during the past 12 months.

Occupational Psychological Stress was examined using the Occupational Stress Questionnaire (OSQ Chinese version)<sup>24</sup>), which is considered as a reliable method to monitor occupational stress<sup>25</sup>). The Chinese version of OSQ is widely used and proved to have good validity and reliability<sup>26-28</sup>). Sleep behavior, emotional reaction, and physical symptoms were also examined using this questionnaire, and Psychological Stress Intensity (PSI) was obtained (score sum of items of psychological stress) as an integrated criterion of Occupational Psychological Stress. The range of PSI score was from 0 to 40, from no stress to excessive stress. In addition, psychological work performance was obtained from 11 items in OSQ, including reaction ability, attention, comprehensive ability, and observational ability, with scores ranging from 11 to 55, indicating from poor to good work performance.

Mental Ability was examined by using a battery of tests (including immediate memory, digit span, and cipher decoding)<sup>29</sup>), measuring the following primary mental abilities: verbal comprehension, word fluency (anagrams), mathematical operations, spatial visualizations and mental transformation, associative memory, perceptual speed, and reasoning. The 3 scores of scales were integrated and transformed to one figure, which is Mental Functional Index (MFI)<sup>30</sup>). The range of MFI score varied from 3 to 9, indicating from poor to good mental ability.

The questionnaires were administered and mental ability tests were conducted midway in the work shift. Four hundred and sixty seven workers (96.3%) were examined at noontime and another 18 workers (3.7%) in the afternoon. Training was given to all investigators, and questionnaire and measure tools were standardized and adjusted. Before the survey was begun, investigators explained the aims, significance, and contents of the survey to the workers. The informed consent forms were given to workers along with questionnaires, and both were self-administered. For some workers with low educational level, interviewers would help them to overcome problems or confusion they had in reading and understanding the questionnaires, but refrained from

making any suggestive answers. The measurement of mental ability was conducted uniformly in a dedicated single room.

The data stratified by age, gender, work type, and educational level were analyzed using the ANOVA (Analysis of Variance) method. To identify factors that might modify or confound MFI and the association between MFI and psychological work performance, multiple linear regression analysis was employed. The variables of work type and educational level were recoded into dummy variables, in which the value of "0" represents manual worker or low educational level. MFI and psychological work performance were outcome variables respectively, whereas PSI, sex, age, educational level, and work type were treated as independent variables. Statistical analyses were performed using SPSS package (version 11.5).

## Results

There were no significant differences for PSI among the gender groups or age groups ( $p > 0.05$ ), however differences were observed among educational levels and work types. Those who received the lowest education demonstrated higher PSI scores than the others with higher educational level, and manual workers demonstrated higher scores than mental workers (Table 1).

MFI score was significantly higher in women than in men, and psychological work performance, by contrast, showed a higher score in men (Table 2). MFI was significantly different among educational level and work type groups, namely, highest in the high-educated group and mental workers, lowest in the low-educated group and manual workers. Likewise, higher educated and mental workers gained significantly higher scores of psychological work performance.

Tables 3 and 4 showed the results of multiple linear regression analysis of MFI and psychological work performance respectively. Collinearity diagnostic test showed no multicollinearity among these variables, nor between educational level and work type.

Gender, age, educational level, and work type are the factors related to MFI ( $r = 0.549$ ) (Table 3), in which female, younger age, higher educational level, and mental work type were independently related to higher scores. A negative association between PSI and MFI suggested that workers with higher PSI have poor MFI, though the difference was not significant ( $p = 0.129$ ).

Furthermore, PSI, MFI, gender, and educational level were significantly associated with psychological work performance ( $r = 0.548$ ) (Table 4). Male and higher

**Table 1. PSI by sex, age, educational level and work type**

Categories	N (%)	PSI*	$p^{**}$
Gender			0.220
Male	317 (65)	14.3 ± 6.4	
Female	168 (35)	15.1 ± 6.2	
Age group			0.160
<45 yr	253 (52)	15.0 ± 6.6	
≥45 yr	232 (48)	14.2 ± 6.0	
Educational level			0.006
Primary school or below	127 (26)	15.6 ± 7.3	
High school	276 (57)	14.7 ± 6.0	
College or above	82 (17)	12.8 ± 5.7	
Work type			<0.001
Manual work	184 (38)	15.8 ± 7.0	
Mental work	187 (39)	13.5 ± 5.7	
Combined work	114 (24)	14.4 ± 6.0	

\*Mean and standard deviation are indicated. \*\*Using ANOVA method.

educational level were positively related to psychological work performance. Higher PSI and lower MFI, however, were contributing factors to poor psychological work performance ( $p < 0.001$ ), after controlling for other factors.

## Discussion

In this study, mental workers and those with a higher educational level exhibited less stress than manual workers or those with a lower educational level. This result differs from studies in the USA<sup>31)</sup> but is in accord with studies in China<sup>2)</sup> and Japan<sup>32)</sup>. In the present study, 62% of mental workers ( $n = 115$ ) and 88% of high-educated workers ( $n = 72$ ) worked in the primary and junior middle school. Since these people were virtually guaranteed with life-time employment and stable income, it is not surprising that they exhibited less occupational stress. By comparison, manual workers who had a low educational level were more prone to face laid-off and unemployment, and to less secure living. In addition, a poorer work environment, fewer opportunities for self-development, and less scope for self-determination in their work conditions might also contribute to the increased experience of occupational stress for these workers.

Furthermore, both mental workers and workers with a higher educational level had higher mental ability than manual workers and those with a lower educational level. Generally speaking, workers who received higher education had more opportunities to be employed in mental work. 94.1% of the mental workers were at median or high educational level in this study, which implied that educational level also contributed to the variety of mental ability among

**Table 2. MFI and psychological work performance\* by sex, age, educational level, and work type**

Categories	N	MFI	<i>p</i> **	Psychological work performance	<i>p</i> **
Gender			0.003		0.002
Male	317	6.0 ± 1.2		37.8 ± 6.9	
Female	168	6.3 ± 1.2		35.8 ± 6.5	
Age group			0.307		0.051
<45 yr	253	6.2 ± 1.2		36.5 ± 7.2	
≥45 yr	232	6.0 ± 1.3		37.7 ± 6.3	
Educational level			<0.001		<0.001
Primary school or below	127	5.2 ± 1.1		34.4 ± 8.1	
High school	276	6.3 ± 1.1		37.3 ± 6.2	
College or above	82	7.0 ± 1.0		40.9 ± 4.4	
Work type			<0.001		<0.001
Manual work	184	5.6 ± 1.2		35.5 ± 7.9	
Mental work	187	6.6 ± 1.1		39.0 ± 5.3	
Combined work	114	6.0 ± 1.3		36.7 ± 6.5	

\*Mean and standard deviation are indicated. \*\*Using ANOVA method

**Table 3. Factors related to MFI**

Factors	Beta	<i>p</i> *
PSI	-0.06	0.129
Female	0.10	0.015
Age	-0.19	<0.001
Educational level		
High school	0.36	<0.001
College or above	0.49	<0.001
Work type		
Combined work	0.07	0.091
Mental work	0.19	<0.001

\*Using multiple regression analysis. The variables of educational level and work type were recoded into dummy variables, taking “Primary school or below” and “Manual work” as reference groups.

**Table 4. Factors related to psychological work performance**

Factors	Beta	<i>p</i> *
PSI	-0.40	<0.001
MFI	0.17	<0.001
Female	-0.15	<0.001
Age	-0.04	0.368
Educational level		
High school	0.11	0.035
College or above	0.17	0.005
Work type		
Combined work	0.01	0.762
Mental work	0.04	0.441

\*Using multiple regression analysis. The variables of educational level and work type were recoded into dummy variables, taking “Primary school or below” and “Manual work” as reference group.

different work type groups. The multiple regression analysis indicated that lower educational level could be one of the risk factors for depressing mental ability, after adjusting for age, gender, PSI, and work type. Conversely, higher educational level contributed to better mental ability, for the latter may have benefits from frequent stimulation of brain function. Previous study also suggested that social engagement and intellectual stimulation played a key role in maintaining cognitive health and preventing mental ability decline<sup>33</sup>. Age was another important related factor for mental ability, which was possibly related to the increase in

diseases and weakening functional ability, including impairment of manual and mental health with aging.

Interestingly, this study observed close connections of mental ability and occupational stress, as indicated by MFI and PSI respectively, to psychological work performance. Workers with good mental ability demonstrated better psychological work performance, strengthening abilities such as reaction, attention, memory, adaptability, reasoning, and observation at work. Ferris GR *et al.*<sup>21</sup>) found that the relationship between work performance and social skill were stronger among workers with high mental ability. Schmidt

FL *et al.*<sup>22)</sup> also reported that mental ability predicted work performance and did so better than any other ability, trait, or disposition and better than job experience. Although occupational stress is the most relevant risk factor to psychological work performance in this study, mental ability can affect worker's psychological work performance greatly, because those with low mental ability demonstrated poor psychological work performance.

Higher PSI level was significantly associated with poorer psychological work performance. As has been documented, experiencing occupational stress can modify psychological functioning and also the way workers feel, think and behave<sup>34)</sup>. As occupational stress increases, workers may perform poorly at work. Higher or excessive chronic stress may lead to psychological overload and fatigue<sup>35)</sup>. Experiencing stress, while reducing a sense of well-being, would likely contribute to the development of physical and psychological disorder in the long-term. Tuomi *et al.*<sup>36)</sup> also found that work ability and the mental well-being of employees were decreased most if opportunities for self and work development were likewise reduced, and if mental and manual work demands were increased. de Jonge *et al.*<sup>37)</sup> reported that employees with excessive work stress had poor psychological and physiological health. In our study, 23.5% of investigated workers had suffered from psychological complaints, namely, depression, anxiety, insomnia etc in the past 12 months. The prevalence was higher in workers suffering from high occupational stress (high PSI scores) than in others who had lower stress. When workers with psychological complaints were excluded in analyzing workers' mental ability and psychological work performance, we obtained similar results (data not shown). After adjusting for confounding factors of age, educational level, and work type, occupational stress was showed to be a risk factor of poor psychological work performance, which could subsequently lead to absenteeism, long-term sickness, and early retirement<sup>38)</sup>.

Several methodological limitations in this study are needed to mention. Firstly, this study is of cross-sectional study design. It was not able to provide evidence on how occupational stress and mental ability affect psychological work performance. A follow-up study will be needed to address this issue. Secondly, the coverage of work types was limited, and the sample size was somewhat small. Although in agreement with previous study in China, the results may change with the rapid changing society of the country. To control the quality of investigation, all investigators were strictly trained and uniform methods were used throughout the study. The majority of the subjects kept

a constant job type, with the exception of two workers who changed their work from manual work into combined work, and one worker from combined work into mental work during the previous five years. Therefore job change could not be a major source of misclassification.

In conclusion, the results of this study suggest that occupational stress and low mental ability are important predictors for poor psychological work performance, which is modified by both gender and educational level.

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