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Original Article

Perceived Mastery of Work among Shift Workers in the Norwegian Offshore Petroleum Industry

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Abstract. This study investigated associations between individual and work-related factors and perceived mastery of work among offshore shift workers. 2,406 employees of a Norwegian petroleum company were invited to participate. A web-based survey was used and 1336 completed questionnaires were returned (56%). Mastery of work was assessed using QPS Nordic Mastery Scale and the results were compared with a sample from the QPS Nordic study. Individual factors adjusted for were age, gender, marital status and personality. The following work-related factors were included: demands, control, support, night work and shift work home interference. Female offshore shift workers reported higher levels of perceived mastery of work compared with women in the comparison sample. The following variables were independently associated with perceived mastery of work: female gender (β=0.10, *p*=0.008), decisional demands (β=0.13, *p*<0.001), control (β=0.05, *p*=0.009), social support (β=0.07, *p*<0.001), shift-work locus of control (β=0.04, *p*=0.005) and neuroticism (β=–0.29, *p*<0.001). Post hoc analyses showed no sex differences in perceived mastery in two separate work positions on the platforms. Work-related variables and personality explained 55% and 45% respectively of the total variance (R^2=0.22) explained by the final model. Female petroleum offshore workers reported somewhat higher levels of mastery of work than their male colleagues, however, this may be due to different work positions. Work-related factors accounted for about half of the explained variance and decisional demands, control and support remained statistically significant after controlling for personality.

Key words: Demand control support, Night work, Shift work home interference, Shift-work locus of control, Neuroticism

Introduction

Workers in the Norwegian petroleum industry are located on sea-based installations far from their homes, where they are exposed to the risk of accidents[1, 2] and they work long day and night shifts[3–5]. However, it is known that this is a select group of workers, who benefit from relatively favorable incomes and long periods away from work[3]. Mastery of work refers to an individual's perception of the desirable outcome of his or her effort at work. As with all subjective reports, the mastery of work depends on individual and work-related factors. Mastery of work likely has an impact on health and well-being, although little empirical evidence is available to support this hypothesis[6]. Nevertheless, the concept of mastery of work is associated with the health and safety of workers[7]

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and is also considered important for their production efficiency[8]. Mastery itself has been studied in other areas, such as bullying[9], education[10], and disability[11]. However, the concept of mastery of work has received little attention in the occupational health literature, although there are some exceptions[12–14]. To the best of our knowledge the current study is the first to investigate the mastery of work in the offshore petroleum industry. Indeed, there are few published studies on the factors that promote mastery of work.

We assumed that offshore employees must be able to tolerate or cope with shift work to experience mastery of work. Nevertheless, it is important to differentiate between ways of coping and mastery. Coping describes how an individual meets and responds to challenges at work, whereas mastery of work may be defined as an individual's perception that his or her efforts produce a desirable outcome[15]. However, being able to cope with or tolerate shift work will affect the individual's perception of mastery of offshore work. Therefore, the factors explored in the current study were all variables that could be associated with tolerance of shift work.

Various factors are related to mastery of work. Some studies have found that older shift workers cope with shift work as well as or better than younger workers[16, 17], although most studies have suggested the opposite, i.e., that ageing workers are less tolerant of shift work than younger workers partly because the elderly need more time to entrain their internal circadian rhythm to work schedule[18–20]. The elderly can however be more tolerant to sleep disturbance in terms of performance; the young are more vulnerable to sleep disturbance although the reason is still unknown[21]. These disparities in the literature suggest that the association between age and mastery of work requires further investigation, including among offshore petroleum workers. Gender also may be associated with mastery of shift work. Men tend to tolerate shift work better than women, who may report more sleepiness and fatigue[18], possibly because of physiological factors or the fact that women have greater domestic obligations[19]. Therefore, it would be useful to control for work home interference in a study of gender effects on the mastery of shift work. Interestingly, in a previous study, we identified more distress in men than in women among Norwegian offshore petroleum workers[4], which suggest a greater tolerance of such work among women.

Perceived mastery of work among offshore shift workers could also be influenced by work-related factors such as demands, control and support. According to the job demand control support model, feelings of mastery and coping may be reduced in jobs that combine high demands with low decision latitude (or control)[22]. By contrast, an active job situation with high demands and high control for an extended period of time is associated with the experience of mastery, which may also inhibit the perception of job stress[23]. And in this sense it may also induce well-being in workplaces[24]. The social support of co-workers and supervisors should also be considered[25, 26]. Furthermore, it has been argued that the degree of agreement between demands and performance, and the quality of feedback on performance or behavior may determine an individual's perception of mastery[15]. Therefore, we expected that high demands, high control and a high degree of social support from leaders and co-workers would be positively associated with perceived mastery of work among the offshore employees.

Furthermore, shift work and night work in particular may be associated with mastery. In the Norwegian offshore petroleum industry, tours of duty are normally limited to a maximum of 2 weeks of 12 h shifts, which are followed by a period of shore leave, that commonly last for 4 wk[3, 4, 27]. Extended work shifts may increase fatigue[28–30]. Therefore we expect that night work would be associated with lower perceived mastery of work.

To determine the importance of work-related factors compared with person-related and individual factors, we investigated the relative impact of individual factors on the perceived mastery of work. Several studies of personality and shift work have shown that individual factors such as locus of control[18, 25, 31–34] and neuroticism[18, 35] may be important for tolerating shift work. Previous studies suggest that people with a high internal locus of control initiate more self-regulatory efforts at controlling problems related to shift work, although there is a lack of studies on how locus of control is related to mastery of work. Nevertheless, we expected a high internal locus of control to be associated with high scores for the perceived mastery of work. We also expected that the personality trait neuroticism would be associated with lower levels of perceived mastery of work. An additional reason for considering this variable was to control for negative work perceptions (negative affectivity). Therefore, controlling for this variable may increase the generalisability of other self-reported and work-related inventories[36].

Based on this background, we addressed the following three objectives. (1) This study investigated the levels of perceived mastery of work using a large sample of offshore petroleum workers, which were compared with

those of a representative sample of other employees. (2) This study also investigated whether age, gender and work-related factors were associated with the perceived mastery of work, after controlling for individual factors such as internal locus of control and personality. (3) The relative impacts of these individual and work-related factors were also studied to identify possible measures that may enhance and promote the perceived mastery of work.

Subjects and Methods

Sample of offshore petroleum workers

All 2,406 employees of a large Norwegian oil and gas company (19% women and 81% men), who worked offshore during a 2-wk period in August 2006 were invited to participate in the study. The research design used a web-based questionnaire, which was developed by researchers at the National Institute of Occupational Health, Norway[3, 4]. The entire eligible sample had web access on the offshore installations. Data were collected within a 2-wk period during August 2006. Completed questionnaires were received from 1,336 employees (17% women and 83% men), giving a total response rate of 56%. The largest group of male workers was found in the job category described as *process*(n=393, 35%), followed by *mechanical*(n=138, 12%), *automation*(n=122, 11%) and *crane-lift-deck*(n=110, 10%). The largest group of female workers was employed in *canteen*(n=97, 43%), and the second largest group of women worked in *process*(n=54, 24%). The remaining categories held less than 10% of the employees. Analysis of the non-responders indicated that slightly more men completed the questionnaire, giving a non-response bias towards women.

Comparison sample

The General Nordic Questionnaire for Psychological and Social Factors at Work (QPS Nordic) covers the essential psychological and social factors at work[15]. The validation of the QPS Nordic questionnaire used data collected from a reference panel that represented workers from organizations in several work sectors, i.e., public services, health sector, private services and manufacturing in Denmark, Finland, Sweden and Norway. Data were collected in 1997 (n=1015; 63% women, and 37% men) and 1998 (n=995; 60% women, and 33% men)[15]. The validation of the QPS Nordic Questionnaire is one of few studies concerning mastery of work. Even though the QPS sample is somewhat different from our sample, it is useful to describe how mastery of work is distributed in a normal working population, and how the offshore workers score on the mastery scale compared to the QPS reference panel.

Dependent variable: Perceived mastery of work

The QPS Nordic includes psychological and social factors related to well-being and health at work[15]. Two factors in particular may be important for the perception of mastery: (1) the degree of harmony between perceived demands and performance and (2) the quality of feedback received on performance. Because perceptions of demands and performance are important for judging whether one's own outcome is satisfactory, individual perceptions of mastery and sources of feedback need to be recorded[6]. Thus, the validated mastery of work evaluation scale contains four questions: "Are you content with the quality of the work you do?", "Are you content with the amount of work that you get done?", "Are you content with your ability to solve problems at work?", "Are you content with your ability to maintain a good relationship with your co-workers at work?" These questions have five response categories, ranging from very seldom or never (1) to very often or always (5)[15]. Perceived mastery of work was constructed as the mean score of the four questions. The Cronbach's alpha for our sample was 0.73.

Independent variables

Demographics. Information about gender and age was provided by the company. Participants were asked to state their marital status and the answers formed two categories: (1) married/partner/cohabiting and (2) single (see Table 1 for more details).

Demands, control and support

This study used the QPS Nordic scales of job demands (Cronbach's alpha=0.64) that measure both quantitative demands and decisional demands, control of work pacing (Cronbach's alpha=0.81) and a scale related to social support from colleagues and leader. A factor analysis examined the factor structure of these questions and found that support from colleagues and from a leader loaded onto the same factor, rather than two factors as was expected. Therefore, this was treated as a single factor in subsequent analyses (Cronbach's alpha=0.86). The questions in the support scale were transformed from general support to shift-work support. This was achieved simply by adding the term "shift work" to the questions. All scales had five response categories, ranging from very seldom or never (1) to very often or always (5). The mean scores were calculated for each of these scales.

Table 1. Number, percentage, min-max range, mean and standard deviation for the independent variables

		N	%	Min- max	Mean	SD
Age group		1,336			45.05	9.55
	20–29	85	6		24.64	2.74
	30–39	275	21		35.24	2.61
	40–49	499	37		44.45	2.88
	50–59	415	31		54.08	2.84
	≥60	62	5		60.97	1.15
Gender	Women	224	17			
	Men	1,112	83			
Marital status	Married	1,134	89			
	Single	144	11			
Work-related factors	Quantitative demands	1,295		1.5–5	3.28	0.59
	Decisional demands	1,295		1–5	3.52	0.64
	Control	1,138		1–5	3.31	0.79
	Support	982		1–5	3.43	0.89
	Day work	656	49			
	Shift schedules including night work	680	51			
	Shift work home interference	1,253		1–5	2.59	0.85
Individual factors	Shift-work locus of control	1,158		1–6	4.21	1.01
	Neuroticism	1,201		1–4	1.90	0.47

Night work

The most frequent working pattern on Norwegian petroleum installations is 2 wk offshore, alternating with 4 wk of shore leave, and the standard shift duration is 12 h[3, 4, 27]. Because of the period with shore leave, all participants in this study were considered shift workers. Participants were asked to specify the type of shift rotation they worked. Based on the responses, a variable was constructed with two categories: day work (0) and a shift schedule including night work (1).

Shift work home interference

Two questions were derived from the Standard Shift-work Index, which addressed the effect of shift work on social and domestic life[37]. The respondents were asked: "In general, to what extent does working shifts cause problems with your social life?", and "In general, to what extent does working shifts cause problems with your domestic life?". We used a five-point Likert scale, ranging from never (1) to always (5). Correlation analysis indicated that the two questions could be treated as one, so subsequent analyses used a mean score of these two questions (r=0.77, Cronbach's alpha=0.87).

Shift-work locus of control: Work subscale

The shift-work locus of control scale is an internally oriented measure that positions respondents on a continuum ranging from a low to high shift work-specific internal locus of control[32]. In this study, we used the following two items from the work dimension: (1) "It is my own behavior which determines my job performance when I work shifts" and (2) "When working shifts I am responsible for the quality of my work performance". These questions had six response categories that ranged from strongly disagree (1) to totally agree (6). The Cronbach's alpha for our sample was 0.62.

Neuroticism

Neuroticism was measured using five items from the Eysenck Personality Inventory[37, 38]. Each question had four answer categories that ranged from almost never (1) to almost always (4). A scale was constructed using the mean score of the five neuroticism items (Cronbach's alpha=0.74).

Statistical analyses

We used the Student's *t* test and Cohen's d to compare the means and effect sizes of the levels respectively. Blockwise linear regression analyses with a forced enter strategy were used to analyze the variables and their relative impact on the perceived mastery of work. We used the explained variance (adjusted R^2) to evaluate the relative influence of each block. First, we included a block of demographic parameters (age, gender and marital status).

Table 2. Correlation matrix showing Pearson correlations between the independent variables

	1.	2.	3.	4.	5.	6.	7.	8.
1. Quantitative demands	1							
2. Decisional demands	0.35**	1						
3. Control	–0.26**	–0.29**	1					
4. Support	–0.12**	–0.17**	0.19**	1				
5. Night work	–0.13**	0.17**	–0.23**	–0.15**	1			
6. Shift work home interference	0.17**	0.19**	–0.16**	–0.27**	0.16**	1		
7. Locus of control	–0.11**	–0.11**	0.18**	0.23**	–0.19**	–0.31**	1	
8. Neuroticism	0.10*	0.12**	–0.16**	–0.25**	14**	0.39**	–0.21**	1

*Correlation is significant at the 0.01 level; **. Correlation is significant at the 0.001 level (2-tailed).

We then included two blocks of work-related factors (block two: quantitative demands, decisional demands, control and social support; block three: night work and shift work home interference) and finally a block of personality factors (locus of control and neuroticism). All independent variables were normally distributed and the residuals were normally distributed for the dependent variable. Estimates used are unstandardised betas. We used a significance level of $p<0.05$ (95% confidence interval). Table 2 provides a correlation matrix showing Pearson correlations between the independent variables.

Ethics

All respondents' names and personal identification numbers were omitted, ensuring the research data were anonymous. This study was conducted in accordance with the World Medical Association Declaration of Helsinki and with permission from the Data Inspectorate of Norway.

Results

The mean level of perceived mastery of work in this study was 3.99 (SD=0.43). The level was 4.08 (SD=0.44) among women and 3.97 (SD=0.42) among men ($t=3.17$, $p=0.002$; Cohen's d=0.26).

Comparison with the QPS Nordic reference panel

The mean level of mastery in the QPS reference group was 3.94 (SD=0.54)[15]. This was a significantly lower level than in our sample ($t=2.64$, $p=0.005$; Cohen's d=0.10). The mean among women in the comparison group was 3.94 (SD=0.53) with 3.93 (SD=0.56) among men[15]. Thus, the women in our sample reported higher levels of perceived mastery than women in the QPS reference dataset ($t=3.35$, $p<0.001$; Cohen's d=0.29), although there was no significant difference with respect to the men.

Univariate analysis

The univariate associations between the independent variables and perceived mastery of work are shown in Table 3. The significant associations were: being female (β=0.11, $p=0.003$), quantitative demands (β=–0.06, $p=0.008$), decisional demands (β=0.05, $p=0.011$), control (β=0.07, $p<0.001$), support (β=0.13, $p<0.001$), night work (β=–0.05, $p=0.035$), shift work home interference (β=–0.12, $p<0.001$), internal locus of control (β=0.09, $p<0.001$) and neuroticism (β=–0.36, $p<0.001$).

Multivariate analysis

In the first model (see Table 3), female gender was significantly associated with perceived mastery of work (β=0.09, $p=0.018$). The adjusted R^2 was 0.003. In the second model, female gender remained significant (β=0.10, $p=0.009$) as were all variables in block 2: quantitative demands (β=–0.06, $p=0.010$), decisional demands (β=0.12, $p<0.001$), control (β=0.07, $p<0.001$) and support (β=0.11, $p<0.001$). The adjusted R^2 for this model was 0.09. In the third model, the significant variables were female gender (β=0.09, $p=0.015$) quantitative demands (β=–0.05, $p=0.036$), decisional demands (β=0.14, $p<0.001$), control (β=0.06, $p=0.001$), support (β=0.09, $p<0.001$) and shift work home interference (β=–0.10, $p<0.001$). The adjusted R^2 for this model was 0.12. In the fourth and final model, the significant variables were female gender (β=0.10, $p=0.008$), decisional demands (β=0.13, $p<0.001$), control (β=0.05, $p=0.009$) support (β=0.07, $p<0.001$), locus of control (β=0.04, $p=0.005$), and neuroticism (β=–0.29, $p<0.001$). The adjusted R^2 for this final model was 0.22. We computed the interactions between gender and each of the significant variables and found that none was significant.

Since the sample was skewed with respect to sex and work positions, we did post hoc regression analyses in order to check the role of some work positions. When we

Table 3. Associations between individual factors, work-related factors and perceived mastery of work (dependent variable) using a linear regression (estimates are unstandardised betas)

Blocks entered in the multivariate analyses (forced entry)	Univariate analysis		Model 1 (adjusted R^2=0.003)		Model 2 (adjusted R^2=0.09)		Model 3 (adjusted R^2=0.12)		Model 4 (adjusted R^2=0.22)	
	Crude beta	95%CI	Adjusted beta	95%CI	Adjusted beta	95%CI	Adjusted beta	95%CI	Adjusted beta	95%CI
Block 1:										
Age	0.003	–0.02 to 0.03	0.01	–0.02 to 0.04	0.02	–0.01 to 0.04	0.02	–0.01 to 0.04	0.02	–0.01 to 0.04
Gender (1=male 2=female)	0.11**	0.04 to 0.17	0.09*	0.02 to 0.17	0.10**	0.03 to 0.18	0.09*	0.02 to 0.17	0.10**	0.03 to 0.17
Single marital status	0.05	–0.03 to 0.13	–0.01	–0.09 to 0.08	–0.03	–0.11 to 0.06	–0.03	–0.11 to 0.06	–0.03	–0.10 to 0.05
Block 2:										
Quantitative demands	–0.06**	–0.10 to –0.02			–0.06*	–0.11 to –0.02	–0.05*	–0.11 to –0.004	–0.04	–0.09 to 0.01
Decisional demands	0.05*	0.01 to 0.09			0.12***	0.08 to 0.17	0.14***	0.09 to 0.18	0.13***	0.09 to 0.17
Control	0.07***	0.04 to 0.11			0.07***	0.04 to 0.11	0.06**	0.03 to 0.10	0.05**	0.01 to 0.08
Support	0.13***	0.10 to 0.16			0.11***	0.08 to 0.14	0.09***	0.06 to 0.12	0.07***	0.04 to 0.10
Block 3:										
Night work	–0.05*	–0.11 to –0.004					–0.01	–0.07 to 0.05	0.02	–0.04 to 0.07
Shift work-home interference	–0.12***	–0.15 to –0.09					–0.10***	–0.13 to –0.06	–0.03	–0.06 to 0.01
Block 4:										
Locus of control	0.09***	0.06 to 0.11							0.04**	0.01 to 0.07
Neuroticism	–0.36***	–0.41 to –0.31							–0.29***	–0.34 to –0.23

selected both process work and canteen workers and did multiple regressions in only these two samples separately, we found no effect of gender. Therefore, the gender effect in the total sample may be confounded by work position.

Discussion

The levels of mastery of work among offshore petroleum workers were significantly higher than those in a representative sample of Scandinavian workers. This was particularly applicable to female offshore workers. The major findings of the current study were that work-related variables (decisional demands, control of work pacing and support) and female gender were independently associated with perceived mastery of work, even after controlling for night work, shift work home interference and personality (locus of control and neuroticism). The work-related variables and personality variables explained 55% and 45%, respectively, of the total variance in the final adjusted model.

In this study, the offshore shift workers managed their situations well and they reported a relatively high degree of perceived mastery of work. Female workers were significantly associated with perceived mastery of work in the final model of the multivariate analyses, although the effect size was rather small. Women reported a higher degree of perceived mastery than men in our sample; this level was also higher compared with women in the QPS reference sample. Interestingly, the women in our sample still reported higher levels of mastery after we adjusted for work home interference, night work and neuroticism. This may reflect the fact that the female offshore workers constitute a select group. Offshore workers are selected with respect to their health, and we previously identified lower levels of mental distress among women compared with men in this offshore group[4]. However, better health would not necessarily affect their experience of mastery. Our findings support a hypothesis that female offshore petroleum shift workers experience higher levels of mastery of work compared with their male colleagues. This may be a result of their initial selection and continued employment[39]. Furthermore, the gender differences may be related to the different types of work men and women do in offshore installations: the majority of women worked with canteen whereas most men held more industrial positions. In the current study, 43% of the women worked with canteen. This position may be less demanding, and there was no difference between the genders in this work position sample, and neither in another selected sample (process). This actually point to no gender effect when position is controlled for. However, it may also imply type II errors with respect to gender and larger sample studies that control for work position is needed.

In terms of work-related variables, it was novel to find that decisional demands, control of work pacing and support at work were all associated with the perceived mastery of work, even after we controlled for individual variables, night work and shift work home interference. This model is not typically controlled for individual variables such as personality and, to the best of our knowledge, the model has never been applied to studies of perceived mastery of work. Our findings also support the validity of the demand control model with respect to shift work. Work-related variables explained almost half of the total explained variance in our model. However, quantitative demands were not associated with the mastery of work after controlling for individual variables (Table 2). This agrees with a prospective study of nurses' aides, which also found no interaction between mastery of work and the level of job demands[12]. To the best of our knowledge, only one other study supports the demand control model in the offshore petroleum industry[40].

That there was no effect of age may indicate effective recruitment and/or self-selection, because the offshore workers comprise a group of people of all ages that coped well with their situation. By contrast, other studies have found greater age to be negatively correlated to mastery[11, 41]. Older employees may cope less well with shift work compared with younger employees[18–20] and we assumed that this would affect their experience of mastery. However, offshore work requires certain experience, skills and competence, all of which are dependent upon age, and these factors may have promoted perceived mastery. Thus, two possible mechanisms may be working in opposite directions, thereby leading to no effect in the analysis.

In a previous study, we found that shift work home interference was the strongest predictor of mental distress among offshore workers[4]. In the current study, we found that shift work home interference was significantly associated with perceived mastery of work in model 3, although the effect disappeared after controlling for individual factors in the final model. Therefore, the perception of shift work causing problems with family and social life was highly dependent on individual factors, i.e., shift-work locus of control and neuroticism. This agreed with previous studies that have shown a link between personality and perceived work stress[31, 39, 42].

To some extent, the perceived mastery of work is the

opposite of perceived work stress and our study also showed that individual factors played an important role in this respect. Thus, a high level of shift-work locus of control and a low level of neuroticism were significantly and independently associated with perceived mastery of work. This outcome matched our expectations[18, 31, 35]. Neuroticism was the strongest predictor in our analysis, which together with shift-work locus of control explained almost half of the total explained variance in our final model.

Strengths and weaknesses

This was a fairly large study and, to the best of our knowledge, the first study of mastery of work among offshore petroleum workers. An important strength of this study was that we controlled for neuroticism in the final regression model, which can be a problem in self-reported stress research[36]. This increased the validity of other significant self-reported variable factors because individuals other than the most vulnerable reported significant effects of demands, control and support on their perceived mastery of work. There was a relatively modest response rate and a gender bias towards lower response rates among women, which could have influenced our findings because the non-responders may have experienced lower perceived mastery.

Conclusions

In this study, female offshore shift workers reported a relatively high degree of perceived mastery of work compared with the QPS reference panel, while the women in our sample of offshore workers also reported higher levels than men. The latter may be caused by different work positions of men and women on the platforms. Work-related factors contributed to slightly more than half of the explained variance, even when we controlled for personality. The most important work-related factors supported the demand control model, also after we controlled for personality factors, night work, and shift work home interference. Therefore, this model appears to be valid for poor mental and physical health, and also for positive aspects of work, such as the perceived mastery of work. Furthermore, this model is highly applicable to offshore petroleum shift workers.

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