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The Nature and Outcomes of Work: A Replication and Extension of Interdisciplinary Work-Design Research

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Research into the changing nature of work requires comprehensive models of work design. One such model is the interdisciplinary framework (M. A. Campion, 1988), which integrates 4 work-design approaches (motivational, mechanistic, biological, perceptual–motor) and links each approach to specific outcomes. Unfortunately, studies of this framework have used methods that disregard measurement error, overlook dimensions within each work-design approach, and treat each approach and outcome separately. This study reanalyzes data from M. A. Campion (1988), using structural equation models that incorporate measurement error, specify multiple dimensions for each work-design approach, and examine the work-design approaches and outcomes jointly. Results show that previous studies underestimate relationships between work-design approaches and outcomes and that dimensions within each approach exhibit relationships with outcomes that differ in magnitude and direction.

Recent economic, technological, and social developments have fundamentally changed the nature of work. For example, the U.S. economy has shifted from manufacturing to services, creating a transition from manual labor to work that relies on cognitive and interpersonal skills (Howard, 1995). Likewise, computerized systems and equipment have universally transformed work activities (Adler, 1992) and enabled employees to physically remove themselves from traditional workplaces (Feldman & Gainey, 1997). Relationships between employers and employees have also been redefined, with long-term employment replaced by frequent job changes and transient contractual relationships (Cappelli, 1997; Hall, 1996).

The changing nature of work has renewed research interest in the meaning of work and its consequences for employees and organizations (Hall, 1996; Rousseau, 1997). One particularly promising stream of research is based on the interdisciplinary framework developed by Campion and colleagues (Campion, 1988; Campion & McClelland, 1991, 1993; Campion & Thayer, 1985). This framework integrates work-design approaches from multiple disciplines, including organizational psychology, industrial engineering, biomechanics, and ergonomics. The interdisciplinary framework offers two major strengths for research into the changing nature of work. First, by integrating multiple approaches to work design, the interdisciplinary framework provides a rich, comprehensive perspective for capturing the varied forms and meanings of work. Second, the interdisciplinary framework underscores fundamental tensions in the design of work. For example, work designed to maximize efficiency may create jobs that are narrow and unenriched, thereby reducing employee satisfaction and motivation (Campion, 1988). By recognizing these tensions, researchers and practitioners are better able to identify work-design arrangements that optimize outcomes that are relevant to both employees and organizations.

Although the interdisciplinary framework holds great promise for research into the nature of work, studies based on this framework have three important shortcomings. First, these studies have used methods that disregard error in the measurement of work and its outcomes. As a result, reported relationships between work and outcomes are biased. This bias may be considerable, given the amount of measurement error often found in studies of the interdisciplinary framework (e.g., Campion, 1988; Campion & McClelland, 1993). Second, relationships between work and outcomes have been examined in piecemeal fashion as simple bivariate correlations. This procedure is inconsistent with the integrative character of the interdisciplinary framework, which suggests that work and its outcomes should be viewed holistically. Moreover, treating each approach to work design separately creates omitted-variable problems (James, 1980), which may further bias reported relationships between work and outcomes. Third, each approach within the interdisciplinary framework contains multiple work-design dimensions. For example, the approach drawn from organizational psychology comprises at least five core dimensions (Hackman & Oldham, 1980). Nonetheless, studies of the interdis-

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ciplinary framework represent each work-design approach as a single score.

Dimensions within the work-design approaches of the interdisciplinary framework were examined by Edwards, Scully, and Brtek (1999), who derived and tested alternative hierarchical factor structures of the Multimethod Job Design Questionnaire (MJDQ; Campion, 1988), the measure of work design used in studies of the interdisciplinary framework. Edwards et al. (1999) identified several dimensions corresponding to each work-design approach and recommended respecifying the MJDQ to capture these dimensions. To date, the factor structures for the MJDQ derived by Edwards et al. (1999) have not been replicated in an independent sample, nor have the work-design dimensions they identified been linked to outcomes specified by the interdisciplinary framework.

The purposes of this study are twofold. First, we assess the generalizability of the factor structures for the MJDQ derived by Edwards et al. (1999) using an independent sample obtained by Campion (1988). Second, we reanalyze data from Campion (1988) to assess the relationships between the respecified MJDQ and outcomes, using analytic procedures that account for measurement error and accommodate all work-design dimensions and outcomes simultaneously. Thus, this study constructively replicates (Lykken, 1968) and extends the work of Edwards et al. (1999) and Campion (1988). It contributes to research on the meaning and measurement of work by assessing the generalizability of the MJDQ factor structures developed by Edwards et al. (1999). This study also contributes to research relating work design to outcomes by testing these relationships in a multivariate model that controls for measurement error and captures multiple dimensions for each work-design approach of the interdisciplinary framework.

Overview of the Interdisciplinary Work-Design Framework

The interdisciplinary framework was developed by Campion and Thayer (1985), who conducted a comprehensive review of the organizational psychology, industrial engineering, human factors, and sociotechnical literatures. From this review, Campion and Thayer (1985) identified 700 job-design rules, consolidated these rules into 70 categories, and wrote a principle that summarized the rules within each category. These principles were then organized into four major approaches to work design. The *motivational* approach encompasses job enrichment, job enlargement, and sociotechnical systems (Cherns, 1976; Hackman & Oldham, 1980; Steers & Mowday, 1977) and emphasizes the motivating characteristics of work. The *mechanistic* approach comprises industrial engineering and scientific management (Barnes, 1980; Maynard, 1971; Salvendy, 1978; Taylor, 1911) and focuses on task specialization, work simplification, and repetition. The *biological* approach is derived from biomechanics, work physiology, and ergonomics (Astrand & Rodahl, 1977; Grandjean, 1980; Tichauer, 1978) and focuses on physical task requirements and environmental factors (e.g., noise, temperature). Finally, the *perceptual–motor* approach includes human factors engineering, perceptual and cognitive skills, and information processing (Fogel, 1967; McCormick, 1979; Welford, 1976) and emphasizes work characteristics that accommodate the mental and physical limitations of workers.

Campion and Thayer (1985) argued that each work-design approach emphasizes different outcomes. The motivational approach focuses on affective and attitudinal reactions such as work satisfaction and intrinsic motivation, as well as on certain behavioral outcomes (e.g., absenteeism, turnover, performance). In contrast, the mechanistic approach targets efficiency, flexibility, and employee utilization levels. The biological approach emphasizes worker comfort in terms of reduced physical strain, effort, fatigue, and health complaints. Finally, the perceptual–motor approach focuses on reliability as manifested by error rates, accidents, and worker reactions to facilities and equipment.

The interdisciplinary framework highlights two tensions in the design of work. First, some work-design approaches advocate principles that may contradict those of other approaches. For example, the mechanistic and perceptual–motor approaches recommend work that is simplified and minimizes mental demands, whereas the motivational approach argues for work that is complex and challenging (Campion, 1988). Second, work-design approaches intended to enhance certain outcomes may be detrimental to other outcomes. For instance, work designed according to the motivational approach may require extensive training, which can reduce human resources utilization levels and hamper efficiency (Campion & Thayer, 1985). These tensions underscore the importance of studying work from a holistic perspective that is sensitive to potential trade-offs among work-design approaches.

Research on the Interdisciplinary Framework

Initial research on the interdisciplinary framework was reported by Campion and Thayer (1985), who used the original 70-item MJDQ to obtain analyst ratings of 121 jobs. Measures of satisfaction, efficiency, comfort, and reliability for each job were collected from job incumbents, supervisors, and archival records. Each work-design approach correlated positively with its expected outcome (i.e., motivational with satisfaction, mechanistic with efficiency, biological with comfort, perceptual–motor with reliability). However, the perceptual–motor approach exhibited a higher positive correlation with efficiency than with reliability. Additional positive correlations emerged between the motivational approach and comfort and between the mechanistic approach and reliability. Evidence for tensions among work-design approaches was also found, in that the motivational approach was negatively related to the mechanistic and perceptual–motor approaches. Furthermore, the motivational approach correlated negatively with efficiency and reliability, and the mechanistic approach correlated negatively with satisfaction.

Subsequent studies have used the revised 48-item version of the MJDQ (Campion, 1988), which contains modified instructions for self-report ratings by job incumbents and excludes items that were redundant or applied only to certain jobs (e.g., manufacturing). Campion (1988) obtained results that generally replicated those of Campion and Thayer (1985), although the negative correlations indicative of tensions among the work-design approaches were smaller in the Campion (1988) study. Similar results were found in a two-wave quasi-experiment by Campion and McClelland (1991, 1993), although correlations were weaker than in previous studies (Campion, 1988; Campion & Thayer, 1985) for the mechanistic approach and efficiency and for the perceptual–motor approach and reliability. Moreover, contrary to previous studies, Campion and McClelland (1991, 1993) found that the motivational approach was positively rather than negatively related to efficiency and that the perceptual–motor approach was weakly related to efficiency and positively related to satisfaction and comfort. These inconsistencies may be partly due to slight modifications of the MJDQ and outcomes measures used by Campion and McClelland (1991, 1993). Further studies have found meaningful relationships between the MJDQ scales and other variables such as compensation levels, ability requirements, and mental load (Campion, 1989; Campion & Berger, 1990; Campion & McClelland, 1991, 1993).

Limitations of Research on the Interdisciplinary Framework

As we noted previously, research into the interdisciplinary framework has three key shortcomings. First, previous studies have used methods that disregard measurement error for the work-design approaches and outcomes. Although the motivational, biological, and perceptual–motor scales have exhibited internal consistency reliabilities in the .70s and .80s, the mechanistic scale has yielded reliabilities as low as .39 (Edwards et al., 1999). Reliabilities for the outcome measures have been as low as .69 for satisfaction, .64 for efficiency, .43 for comfort, and .60 for reliability (Campion, 1988; Campion & McClelland, 1991, 1993; Campion & Thayer, 1985). These reliabilities indicate that reported relationships between the work-design approaches and outcomes may be severely biased. For instance, Campion (1988) reported a correlation between the biological approach and comfort of .48. After attenuation due to measurement error has been corrected, this correlation increases to .79. Similarly, on the basis of ratings from job analysts, Campion and Thayer (1985) reported a correlation of −.77 between the motivational approach and efficiency. After correction for attenuation, this correlation becomes −.96. These results suggest that taking measurement error into account may substantially alter conclusions regarding the relationships between the work-design approaches and outcomes.

Second, studies have focused on bivariate relationships between work-design approaches and outcomes, thereby disregarding correlations among the work-design approaches and among the outcomes. In some studies, these correlations have been substantial. For example, job analyst ratings using the 48-item MJDQ have yielded correlations between the mechanistic and perceptual–motor approaches ranging from .72 to .88 (Campion, 1988; Campion & McClelland, 1991). Correlations between these approaches have been somewhat smaller for self-report ratings, ranging from .32 to .50 (Campion, 1988; Campion & McClelland, 1991; Edwards et al., 1999). Nonetheless, these correlations are sufficiently large to introduce omitted-variable bias when these work-design approaches are analyzed separately (James, 1980). Correlations among the efficiency and reliability outcome measures have ranged from .58 to .81 for analyst ratings and from .20 to .34 for self-report ratings. Although analyzing correlated outcomes separately does not introduce bias, it creates redundancy and may inflate Type I error rates (Dwyer, 1983).

Third, each approach within the interdisciplinary framework consists of multiple work-design dimensions that are conceptually distinct. For example, the motivational approach includes skill variety, task identity, task significance, autonomy, feedback, and dealing with others (Hackman & Oldham, 1980; Sims, Szilagyi, & Keller, 1976). The mechanistic approach encompasses dimensions such as specialization, simplification, repetition, mechanization, and economy of movement (Barnes, 1980; Maynard, 1971; Salvendy, 1978; Taylor, 1911). Likewise, the biological and perceptual–motor approaches each contain multiple dimensions that describe distinct aspects of work (Campion & Thayer, 1985). Collapsing these dimensions into a single score for each work-design approach renders the interpretation of the approaches ambiguous. Moreover, dimensions contained within each approach may exhibit different relationships with outcomes. For instance, the task simplicity and specialization dimensions of the mechanistic approach may relate differently to efficiency, in that the former implies little training, whereas the latter may entail costly in-depth training. Therefore, distinguishing among the multiple dimensions within each work-design approach may clarify the meaning of each approach and reveal important relationships between the dimensions of each approach and outcomes.

Dimensions within the work-design approaches underlying the MJDQ were examined by Edwards et al. (1999), who tested the original four-factor model proposed by Campion (1988; Campion & Thayer, 1985) and two additional models, including a 13-factor model derived from separate factor analyses of items from each work-design approach and a 10-factor model obtained by analyzing all 48 items from the four approaches collectively. For both of these models, first-order factor structures were compared with second-order structures that assigned the first-order factors to second-order factors representing general work-design approaches, including those proposed by Campion and others derived empirically. Edwards et al. (1999) ultimately recommended a 10-factor first-order model that included feedback, skill, and rewards from the motivational approach, task simplicity and specialization from the mechanistic approach, physical ease and work conditions from the biological approach, and work scheduling, ergonomic design, and cognitive simplicity from the perceptual–motor approach. Although these 10 factors could be arranged within the four original work-design approaches, the factors were best represented by a simple first-order structure, as opposed to a second-order structure that treated the four work design-approaches as higher order factors. Although Edwards et al.'s (1999) study clarified the factor structure of the MJDQ, their results have not been cross-validated in an independent sample, nor have the 10 factors they obtained been examined in relation to outcomes indicated by the interdisciplinary framework.

The Present Study

The present study addresses the aforementioned shortcomings by reanalyzing data from Campion (1988). Our analyses incorporate measurement error for the job-design approaches and outcomes by using structural equation modeling with latent variables. Relationships among the job-design approaches and among the outcomes are taken into account by incorporating these variables into a single structural model. We also represent multiple dimensions within each work-design approach by applying the 10-factor model developed by Edwards et al. (1999). As a precursor to these analyses, we cross-validate the factor analytic results of Edwards et al. (1999) using the Campion (1988) data, thereby assessing the generalizability of these results.

Method

Sample

Data were obtained from Campion (1988), who distributed surveys to 16 randomly selected incumbents in each of 92 different jobs in a manufacturing and development site of a large electronics company. A total of 1,024 surveys were returned, yielding a response rate of about 70%. Jobs held by respondents included managerial (17%), professional (27%), technical (20%), manufacturing (22%), and administrative (14%). Response rates were somewhat higher for professional jobs (80%) than for manufacturing jobs (53%).

Measures

Work-design approaches. The four work-design approaches were measured using the 48-item self-report version of the MJDQ. Of the 48 items, 18 represented the motivational approach, 8 assessed the mechanistic approach, 10 referred to the biological approach, and 12 tapped the perceptual–motor approach. Respondents rated the extent to which each item described their work, using a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Outcomes. Outcome measures included satisfaction (six items), efficiency (five items), comfort (four items), and reliability (five items). The satisfaction items described job satisfaction, job involvement, and intrinsic motivation. The efficiency items referred to training and experience requirements. The comfort items assessed physical well-being, including fatigue, aches, and pains. Finally, the reliability items measured work load and the likelihood of errors. Respondents rated each item on a 5-point scale, with higher scores indicating more favorable outcomes.

Treatment of Missing Data

Of the 1,024 surveys returned, 463 had missing data on at least one work-design or outcome item. Hence, listwise deletion of cases with missing data would have yielded a sample size of 561. Although listwise deletion is widely used, other procedures for handling missing data are available that retain statistical power and provide more accurate estimates of population parameters (Little & Rubin, 1987; Roth, 1994). One simple but effective procedure is regression imputation, in which values for missing data are estimated on the basis of scores from related variables without missing data. Regression imputation is particularly appropriate when variables with and without missing data are at least moderately correlated and the sample size is large (Roth, 1994).

For each item, missing data were imputed using other items from the same scale. Scores were imputed only for respondents who had complete data on at least 80% of the scale items (Roth, 1994). For example, scores were imputed for items on the biological scale only for respondents with complete data on at least 8 of the 10 biological items. This criterion increased the likelihood that imputed scores would be based on items and respondents relevant to the score in question. This imputation procedure yielded sample sizes of 885 for the work-design items and 788 for the combined work-design and outcome items. These sample sizes produced ratios of cases to parameters of at least 4.80:1 for all analyses, thereby approaching or exceeding the 5:1 ratio suggested by Bentler and Chou (1987) for latent variable modeling. These sample sizes also provided estimates of statistical power exceeding .99 for tests of model fit (MacCallum, Browne, & Sugawara, 1996). Our samples differed somewhat from those analyzed by Campion (1988), who used pairwise deletion when estimating correlations for the work-design approaches and outcomes.

Analyses

Two sets of analyses were conducted. First, we tested the factor models examined by Edwards et al. (1999). These models included (a) a 4-factor model based on Campion (1988) in which each factor corresponded to a work-design approach, (b) a 13-factor model in which factors were derived separately for each work-design approach, and (c) a 10-factor model developed by combining all 48 items from the four work-design approaches. For the 13-factor and 10-factor models, we tested first-order factor structures as well as second-order structures that organized the first-order factors under 4 second-order factors representing the original work-design approaches. We tested these models to determine whether the 10-factor first-order model chosen by Edwards et al. (1999) would emerge as superior in an independent sample. All models were tested using confirmatory factor analysis with maximum likelihood estimation, as implemented by LISREL 8.30 (Jöreskog & Sörbom, 1993).

Second, we estimated structural equation models relating the work-design approaches to the four outcomes. Two models were estimated, one using 4 exogenous latent variables corresponding to the original 4-factor MJDQ model and another using 10 exogenous latent variables representing the 10-factor model recommended by Edwards et al. (1999). Both models used 4 latent endogenous variables representing the four outcome measures. In addition, both models included correlations among the exogenous variables and among the residuals for the 4 latent endogenous variables.

We evaluated model fit using the root-mean-square error of approximation (RMSEA; Steiger, 1990) and the comparative fit index (CFI; Bentler, 1990). The RMSEA estimates the discrepancy per degree of freedom between the original and reproduced covariance matrices in the population. RMSEA values up to .05 indicate close fit, and values up to .08 represent reasonable errors of approximation in the population (Browne & Cudeck, 1993). We report point estimates as well as 90% confidence intervals for RMSEA, thereby permitting tests of close fit and not-close fit (MacCallum et al., 1996). The CFI represents the relative improvement in fit of the target model over a null model in which all observed variables are uncorrelated (Bentler, 1990). The CFI is independent of sample size (Gerbing & Anderson, 1993) and has an expected value of 1.00 when the estimated model is true in the population. Although standards for indices such as the CFI are difficult to establish (Marsh, Balla, & McDonald, 1988), values of .90 or higher are generally interpreted as adequate fit (Bentler & Bonett, 1980). We also tested item loadings, factor correlations, and structural paths for the models estimated.

Results

Cross-Validation of the MJDQ Factor Models

Table 1 reports fit statistics for the factor models examined by Edwards et al. (1999). To facilitate comparison, we report statistics for these models for both the Campion (1988) data and the Edwards et al. (1999) data. Consistent with Edwards et al. (1999), the 4-factor model exhibited very poor fit with the Campion (1988) data, as indicated by a CFI of .63 and a RMSEA of .107. The 13-factor and 10-factor first-order models yielded much better fit, with CFI values approaching .90 and RMSEA values of .058 and .066, respectively. Both of these models also fit significantly better than their hierarchical counterparts, which assigned each first-order factor to one of 4 second-order factors corresponding to the four work-design approaches, $\Delta\chi^2(59, N = 885) = 1{,}537.32$ for the 13-factor model, and $\Delta\chi^2(29, N = 885) = 786.32$ for the 10-factor model, both $ps < .001$. However, 90% confidence intervals for the RMSEA values from these models fell above .05, thereby rejecting the hypothesis of close fit and failing to reject the hypothesis of not-close fit (MacCallum et al., 1996). On the other hand, these confidence intervals both fell below .08, meaning the models met a criterion indicating reasonable errors of approximation in the population (Browne & Cudeck, 1993).

Table 1
Fit of Factor Models for the Multimethod Job Design Questionnaire (Campion, 1988)

Model	*k*	*df*	Campion (1988) data χ^2	CFI	RMSEA	90% CI	Edwards et al. (1999) data χ^2	CFI	RMSEA	90% CI
4-factor	48	1074	7,959.21	.63	.107	.105, .109	5,607.22	.59	.110	.108, .122
First-order 13-factor	44	824	3,077.65	.87	.058	.056, .060	2,386.23	.85	.058	.055, .061
Hierarchical 13-factor	44	883	4,614.97	.79	.077	.075, .079	3,088.95	.79	.069	.067, .072
First-order 10-factor	35	515	2,375.08	.87	.066	.063, .069	1,411.10	.89	.056	.053, .059
Hierarchical 10-factor	35	544	3,161.40	.81	.080	.078, .083	1,815.13	.84	.066	.063, .070
Reduced first-order 10-factor	33	450	1,770.16	.90	.058	.056, .061	1,239.43	.90	.055	.051, .059

Note. N = 885 for the Campion (1988) data; N = 602 for the Edwards et al. (1999) data. The number of items in each model is indicated by k. All chi-square values are statistically significant at $p < .001$. RMSEA values reported here for the Edwards et al. (1999) data are slightly higher than those originally reported by Edwards et al. (1999) because of changes in the calculation of RMSEA from LISREL Version 8.14 to Version 8.30. CFI = comparative fit index; RMSEA = root-mean-square error of approximation; 90% CI = 90% confidence interval for the RMSEA, as reported by LISREL.

Further inspection of the 13-factor first-order model revealed that 3 factors did not achieve discriminant validity, as evidenced by factor correlations with 95% confidence intervals that included 1.00. This problem did not occur for the 10-factor model. However, this model contained 2 items (i.e., Item 15 on the Skill factor, Item 16 on the Rewards factor) that exhibited low loadings on their assigned factors (.38 and .30, respectively) along with modification indices that suggested loadings on alternative factors that would be substantially larger than those on the assigned factor. Deleting these items improved model fit, producing a CFI of .90 and a RMSEA of .058. Moreover, dropping these items increased reliabilities from .78 to .80 for the skill scale and from .64 to .69 for the rewards scale. These 2 items also had low primary loadings in the Edwards et al. (1999) data (.30 and .36, respectively) but did not produce expected loadings on alternative factors that were as high as those for the Campion (1988) data. Nonetheless, supplemental analyses of the Edwards et al. (1999) data indicated that deleting these items slightly improved model fit (see Table 1) and increased reliabilities from .80 to .83 for the skill scale and from .76 to .78 for the rewards scale. These results were consistent with the content of the items, which did not fit well with the other items on the associated factors. Regarding the rewards factor, Item 15 describes pay compared with job requirements and with similar jobs, whereas the remaining items refer to intrinsic (i.e., nonmonetary) rewards such as achievement, accomplishment, and advancement. These intrinsic rewards better represent the motivational work-design approach from which the Rewards factor was derived. For the Skills factor, Item 16 represents access to information required to perform the job, whereas the other items describe knowledge and skill dimensions and thus serve as better indicators of the intended factor. Therefore, on the basis of both empirical and conceptual grounds, we eliminated these 2 items from further analyses.

Reanalysis of Relationships Between Work-Design Approaches and Outcomes

To facilitate comparisons with Campion (1988), Table 2 reports descriptive statistics, reliability estimates, and correlations for the four original work-design approaches and outcomes. Scale correlations below the diagonal closely parallel those reported by Campion (1988) based on pairwise deletion of missing data. However, the reliabilities of .53 and .73 for the mechanistic and perceptual–motor scales were lower than the values of .64 and .85 reported by Campion (1988). In contrast, reliabilities for the satisfaction, efficiency, comfort, and reliability scales were higher than the values of .75, .64, .43, and .60, respectively, reported by Campion (1988). Factor correlations above the diagonal show that correcting for measurement error increased the correlations among the work-design approaches, often to a considerable extent. For example, the correlation between mechanistic and perceptual–motor approaches increased from .42 to .83. Correlations between the work-design

Table 2
Descriptive Statistics, Correlations, and Reliabilities for the Original Work-Design Approaches and Outcomes

Approach and outcome	*M*	*SD*	1	2	3	4	5	6	7	8
1. Motivational	2.35	0.55	(.87)	−.54**	.16**	−.35**	*.78***	−.50**	.15**	−.14**
2. Mechanistic	3.24	0.52	−.17**	(.53)	−.09*	.83**	−.35**	*.85***	−.09*	.47**
3. Biological	2.44	0.72	.24**	−.12**	(.84)	−.22**	.14**	−.17**	*.76***	.03
4. Perceptual–motor	3.09	0.50	.03	.42**	.22**	(.73)	−.21**	.71**	−.14**	*.50***
5. Satisfaction	2.33	0.69	*.65***	−.09**	.14**	.03	(.84)	−.34**	.03	−.05
6. Efficiency	3.27	0.90	−.34**	*.52***	−.14**	.46**	−.26**	(.78)	−.13**	.40**
7. Comfort	2.24	0.88	.20**	−.10**	*.47***	.15**	.06	−.07**	(.67)	.25**
8. Reliability	2.95	0.85	−.05	.28**	.12**	*.43***	−.09**	.38**	.27**	(.72)

Note. N = 788. Scale correlations are reported below the diagonal; factor correlations are reported above the diagonal. Scale reliabilities (Cronbach's alphas) are reported in parentheses along the diagonal. Correlations between work-design approaches and their corresponding outcomes are in italics.
* $p < .05$. ** $p < .01$.

approaches and outcomes also became notably larger, as illustrated by the increase from .52 to .85 for the correlation between the mechanistic approach and efficiency.

Table 3 reports descriptive statistics, reliability estimates, and correlations for the 10 revised work-design dimensions and the outcomes. Results for the 10 work-design dimensions generally corroborate those reported by Edwards et al. (1999). These results shed light on the correlations among the work-design approaches reported by Campion (1988). For example, the negative correlation between the motivational and mechanistic approaches is largely due to a negative relationship between skill and task simplicity. Analogously, the positive correlation between the mechanistic and perceptual–motor approaches is driven by a shared emphasis on simplified work. Moreover, the motivational and perceptual–motor approaches were unrelated in the Campion (1988) study, whereas Table 3 reveals a substantial negative relationship between the skill and cognitive simplicity dimensions of these two approaches. Table 3 also indicates that the mechanistic scale exhibits low reliability because it subsumes two negatively correlated dimensions, task simplicity and specialization. Finally, Table 3 shows that the relationships between the four work-design approaches and outcomes are attributable to specific work-design dimensions. For instance, the positive relationship between the perceptual–motor approach and reliability is due to cognitive simplicity, and the positive relationship between the mechanistic approach and both efficiency and reliability is due to task simplicity. Correcting for measurement error increases the absolute magnitudes of these relationships and further isolates specific work-design dimensions that explain the correlations reported by Campion (1988).

Finally, Table 4 reports analyses of relationships between work design and outcomes. For purposes of comparison, we report results for the four original work-design approaches as well as the 10 revised work-design dimensions. Results for the original work-design approaches follow a clear pattern in which each approach is most strongly related to its corresponding outcome. However, the relationship between the perceptual–motor approach and reliability did not reach statistical significance. These results also show that the positive relationship between the perceptual–motor approach and efficiency disappears when the other three work-design approaches are controlled and measurement error is taken into account. The fit of this model was poor, $\chi^2(2182, N = 788) = 10{,}485.84$, CFI = .66, RMSEA = .087, 90% confidence interval for RMSEA = .086, .089, as would be expected on the basis of the poor fit of the four-factor work-design model.

Relationships for the four work-design approaches were clarified by the revised 10-factor model. Specifically, the relationship between the motivational approach and satisfaction is due almost entirely to rewards, and the relationship between the mechanistic approach and efficiency is driven by task simplicity. The relationship between the biological approach and comfort is attributable to physical ease and, to a lesser extent, work scheduling. Finally, whereas reliability was unrelated to the perceptual–motor approach when treated as a single factor, it was related to the cognitive simplicity dimension of this approach. Reliability was also positively related to work scheduling and negatively related to work conditions. Overall, the model exhibited reasonable fit, $\chi^2(1234, N = 788) = 4137.96$, CFI = .85, RMSEA = .057, 90% confidence interval for RMSEA = .055, .058, although the fit of this model was somewhat worse than that for the 10-factor work-design model because of misfit introduced by the factor structure for the four outcomes.

Discussion

This study provides a constructive replication and extension of previous research on the interdisciplinary work-design framework (Campion, 1988; Campion & Thayer, 1985; Edwards et al., 1999). Our results lend support to the generalizability of the findings reported by Edwards et al. (1999) regarding the factor structure of the MJDQ. Specifically, we found that the 4-factor model corresponding to the original work-design approaches identified by Campion and Thayer (1985) exhibited very poor fit. Much better fit was provided by 10-factor and 13-factor models that differentiated dimensions within each work-design approach. However, the 13-factor model produced an inadmissible solution, as indicated by three factor correlations that approached or exceeded unity. Thus, the 10-factor model recommended by Edwards et al. (1999) emerged as superior. Nonetheless, for both the Campion (1988) and Edwards et al. (1999) samples, the fit and interpretation of this model improved by dropping one item each from the skill and rewards dimensions of the motivational approach. We also tested models that subsumed specific work-design dimensions under second-order factors corresponding to the four work-design approaches, but these models received little support. These results indicate that the four work-design approaches should be viewed not as constructs that account for relationships among specific work-design dimensions but instead as categories that organize these dimensions according to their conceptual origins (Edwards et al., 1999).

Our results also extend those of previous studies of the interdisciplinary framework (Campion, 1988; Campion & McClelland, 1991, 1993; Campion & Thayer, 1983). Unlike earlier studies, our study applied methods that take into account measurement error and correlations among the work-design approaches and outcomes. In addition, we examined relationships for specific dimensions contained within each work-design approach. We found that relationships among the work-design approaches were driven by associations among specific dimensions. For example, previous research has reported that the mechanistic approach is positively related to the perceptual–motor approach and negatively related to the motivational approach. Our results show that these relationships are due to dimensions pertaining to the skill requirements of work, in that the motivational approach entails skill development, whereas the mechanistic and perceptual–motor approaches emphasize work simplification and deskilling. These conflicting objectives regarding skill characterize a fundamental tension among these three work-design approaches. Our results also reveal a tension within the mechanistic approach, which contains two dimensions (i.e., task simplicity, specialization) that are negatively related. Apparently, task specialization may require depth in particular skills, which runs counter to the objectives of work simplification.

Our results also indicate that relationships between the work-design approaches and outcomes are attributable to specific work-design dimensions. Factor correlations showed that all dimensions of each work-design approach were related to the outcome corre-

Table 3
Descriptive Statistics, Correlations, and Reliability Estimates for the 10-Factor Model and Outcomes

			Motivational			Mechanistic		Biological			Perceptual–motor		Outcome			
Dimension and outcome	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Feedback	2.35	0.72	(.71)	.30**	.78**	.22**	−.05	.09*	.15**	.22**	.27**	.06	*.55***	−.03	.13**	.13**
2. Skill	2.00	0.77	.28**	(.83)	.67**	.33**	−.80**	.10**	.23**	.01	−.29**	−.58**	*.61***	−.70**	.08**	−.34**
3. Rewards	2.56	0.83	.53**	.56**	(.69)	.29**	−.41**	.13**	.29**	.16**	.05*	−.25**	*.81***	−.40**	.15**	−.04
4. Specialization	2.40	0.89	.20**	.24**	.18*	(.74)	−.21**	−.19**	−.07	−.03	−.15**	−.08*	.25**	*−.18***	−.12**	−.05
5. Task simplicity	3.75	0.91	−.04	−.65**	−.31**	−.12	(.77)	−.08**	−.20**	.12*	.48**	.80**	−.36**	*.86***	−.10**	.42**
6. Physical ease	2.15	1.06	.08	.10*	.13**	−.17**	−.08	(.94)	.53**	.42**	.21**	−.25**	.12**	−.16**	*.73***	.00
7. Work conditions	2.49	0.83	.12	.18**	.25**	−.06	−.15**	.42**	(.66)	.59**	.23**	−.22**	.23**	−.26**	*.55***	.01
8. Work scheduling	2.65	0.87	.12	.01	.11**	−.01	.05	.27**	.34**	(.42)	.27**	.14**	.06	.16**	*.54***	.61**
9. Ergonomic design	2.63	0.67	.22**	−.18	.07	−.11	.33**	.20**	.26**	.19**	(.71)	.39**	.00	.46**	.14**	*.25***
10. Cognitive simplicity	3.98	0.84	.06	−.50**	−.19	−.02	.67**	−.21**	−.12	.11	.31**	(.88)	−.21**	.70**	−.17**	*.50***
11. Satisfaction	2.34	0.69	*.43***	*.54***	*.58***	.21**	−.27**	.10	.18**	.01	.05	−.15**	(.84)	−.34**	.03	−.05
12. Efficiency	3.28	0.90	−.03	−.55**	−.30**	*−.11*	*.68***	−.14*	−.17**	.09	.33**	.58**	−.26**	(.78)	−.13**	.40**
13. Comfort	2.23	0.86	.17**	.08	.20**	−.05	−.08	*.42***	*.34***	*.27***	.13*	−.05	.06	−.07	(.67)	.26**
14. Reliability	2.94	0.84	.12*	−.30**	.04	−.02	.37**	.01	.03	.42**	*.22***	*.48***	−.09	.38**	.27**	(.72)

Note. $N = 788$. Scale correlations are reported below the diagonal; factor correlations are reported above the diagonal. Scale reliabilities (Cronbach's alphas) are reported in parentheses along the diagonal. Correlations between work-design dimensions and their corresponding outcomes are in italics.
$^{*}p < .05$. $^{**}p < .01$.

sponding to that approach. However, the correlation between efficiency and the specialization dimension of the mechanistic approach was negative rather than positive, suggesting that specialization may require functional or technical training that hampers efficiency. Analyses that treated all work-design dimensions and outcomes simultaneously indicated that when other dimensions were controlled, each outcome was related to specific dimensions within its corresponding work-design approach. Specifically, satisfaction was related to the rewards dimension of the motivational approach, efficiency was related to the task simplicity dimension of the mechanistic approach, comfort was related to the physical ease and work scheduling dimensions of the biological approach, and reliability was related to the cognitive simplicity dimension of the perceptual–motor approach. These results point to critical dimensions within each work-design approach that explain unique variance in each outcome. Reliability was also positively related to work scheduling and negatively related to work conditions, two dimensions of the biological approach. This pattern was not evident in previous studies that collapsed these dimensions into a single score.

Although dimensions pertaining to skill (i.e., skill, task simplicity, cognitive simplicity) exhibited strong bivariate correlations with outcomes, these dimensions had weak relationships with outcomes in the structural equation model. These discrepant results are partly due to the fairly large correlations among these dimensions, in that controlling for any two dimensions substantially reduces the likelihood that the third dimension will explain unique variance in an outcome. We examined this conjecture using supplemental analyses that assigned the skill, task simplicity, and cognitive simplicity factors to a second-order general skill factor and modeled the relationship of this factor and the remaining seven work-design dimensions with the outcomes. The general skill factor was negatively related to efficiency and reliability, consistent with the factor correlations for the skill, task simplicity, and cognitive simplicity dimensions. Similarly, although all three motivational dimensions were strongly correlated with satisfaction, only the rewards dimension was related to satisfaction in the structural model, partly because of the fairly high correlations between rewards and the remaining two motivational dimensions.

The results of this study suggest several directions for future research into the nature and outcomes of work. First, the 10-factor work-design model yielded several improvements over the 4-factor model, and further improvements may be obtained from more comprehensive measures of work. For example, the feedback, skill, and reward dimensions of the motivational approach may be supplemented by measures of autonomy, task identity, and task significance (Hackman & Oldham, 1980). These dimensions are each described by single MJDQ items, but these items were excluded from the 10-factor model, because a factor cannot be meaningfully represented by a single item. By supplementing these items, autonomy, task identity, and task significance dimensions may be added to the 10-factor model. Similar procedures may be used to add dimensions that are relevant to the other work-design approaches. Moreover, dimensions beyond those identified by the four work-design approaches may become relevant as work continues to evolve, and measures of such dimensions should be developed accordingly. Second, the outcomes of the interdisciplinary framework may be elaborated. For instance, satisfaction may

Table 4
Structural Equation Models Relating Work Design to Outcomes

Work-design dimension	Outcomes: Satisfaction	Efficiency	Comfort	Reliability
	Original 4-factor model			
Motivational	*.84***	−.04	.00	.10
Mechanistic	.12	*.81***	−.13	.23*
Biological	.01	−.09**	*.77***	.11**
Perceptual–motor	−.02	.01	.14	*.38*
R^2	.62**	.73**	.58**	.29**
	Revised 10-factor model			
Motivational				
Feedback	*−.23*	.10	.04	−.17
Skill	*.15*	.04	−.18	−.33
Rewards	*.95***	−.19	.02	.33
Mechanistic				
Specialization	.02	*−.02*	.00	−.02
Task simplicity	.11	*.74***	−.22	−.13
Biological				
Physical ease	.06	−.12*	*.59***	−.08
Work conditions	.02	−.19*	*.10*	−.41**
Work scheduling	−.10	.21*	*.25***	.84**
Perceptual–motor				
Ergonomic design	−.02	.14*	−.05	*.03*
Cognitive simplicity	.08	−.08	.05	*.26**
R^2	.69**	.79**	.62**	.66**

Note. $N = 788$. For all rows except those labeled R^2, table entries are standardized coefficients from structural equation models in which the latent endogenous variables were satisfaction, efficiency, comfort, and reliability and the latent exogenous variables were either the four work-design approaches or the 10 work-design dimensions. Coefficients linking work-design approaches or dimensions to their corresponding outcomes are in italics.
$^* p < .05$. $^{**} p < .01$.

be differentiated according to facets of work (Ironson, Smith, Brannick, Gibson, & Paul, 1989), and comfort may encompass multiple aspects of mental and physical well-being (Andrews & Robinson, 1991). Finally, individual differences may be added as moderators of the relationship between work and outcomes (Hackman & Oldham, 1980) or as criteria by which the fit between the person and work environment is assessed (Dawis & Lofquist, 1984; Edwards, Caplan, & Harrison, 1998).

Several limitations of this study should be noted. First, the Campion (1988) data were collected over a decade ago from a single organization. Different results may be obtained from data drawn from different organizations, job groups, cultures, and time frames. These concerns are assuaged somewhat by the similarity between our results and those reported by Edwards et al. (1999), who used data collected more recently from a different organization with a different distribution of job types. Second, the data were collected using a cross-sectional design, which precludes causal inferences regarding the effects of work-design dimensions on outcomes. Thus, we cannot rule out the possibility that the outcomes experienced by respondents inadvertently influenced their descriptions of work characteristics. Third, the data were obtained through self-report, which may have inflated correlations among the study variables. This concern is lessened somewhat by the variability of the obtained correlations, which ranged from large negative to large positive values and included many values near zero. Finally, the maximum likelihood estimation procedures we used rely on the assumption of multivariate normality, which was not met by the Campion (1988) data. Consequently, the parameter estimates we obtained were unbiased, but the standard errors and chi-square values may have been inflated (Satorra, 1990). Unfortunately, the samples we used were not sufficiently large to use estimation methods that allow for deviations from multivariate normality (Browne, 1984).

As the nature of work continues to evolve, further research is needed to understand the meaning and outcomes of work. This study replicates and extends previous research based on the interdisciplinary work-design framework. Our results corroborate previous research that identified multiple dimensions within the work-design approaches of the interdisciplinary framework. We also found that these dimensions demonstrated meaningful relationships with outcomes, and these relationships clarified and elaborated findings from previous studies of the interdisciplinary framework. Future research should supplement the work-design dimensions and outcomes of the interdisciplinary framework and incorporate individual differences that may influences relationships between work dimensions and outcomes. Future research should also examine the nature and outcomes of work in different organizations, job groups, cultures, and time frames, thereby identifying similarities and differences in work across settings and eras.

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