

Evaluation of Task Characteristics Measurement for Job Design in Simulated Nursing Practice

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Background: Task design is considered essential to the effective testing of individual clinical competencies in simulated clinical nursing practice. The present study is a response to the need to measure task characteristics of job design in simulated clinical nursing practice, as such research is lacking.

Objectives: The aims of this study were to explore the reliability and factorial validity of the five-factor measurement of task characteristics in simulated nursing practice, as well as to test and verify the relationships that comprise the latent factor structure of the task characteristics construct.

Designs: This is a quantitative and correlational study.

Methods: Participants were 223 nursing students who completed objective structured clinical examination (OSCE). The Task Characteristics Measurement Scale was used to examine students' perceptions of task evaluation as related to that examination. The second-order factor model of the Task Characteristics Measurement Scale was tested using confirmatory factor analysis (CFA) techniques. We also analyzed the correlations among the subdimensions of the Task Characteristics Measurement Scale through structural equation modeling approach.

Results: The Task Characteristics Measurement Scale of clinical nursing tasks was found to have suitable reliability and internal validity. All five dimensions had high internal consistency coefficients. CFA of the second-order model conclusively demonstrated good factorial validity (root mean square error of approximation [RMSEA] = 0.074). In addition, a test of the correlations of the five dimensions of task characteristics, which comprise the structural model of the variables, indicated good fit of the data. Overall, task variety, task autonomy, task identity, and task significance explained 29.5% of the variance of feedback from job.

Conclusion: The findings supported the Task Characteristics Measurement Scale as a reliable and valid instrument for nursing students tested in a simulated clinical setting. This model provides nursing educators with a means to assess the task design of clinical examinations, allowing them to redesign or improve the test task characteristics.

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Key words: Confirmatory factor analysis, simulation, structural equation modeling, test, task characteristics.

Introduction

A meta-analysis of the literature on work design indicates that it has a large impact on worker attitudes and behaviors.^[1] Nursing job characteristics are quite diverse due to the complexity of diseases and treatments, and work design influences the quality of patient care. Humphrey et al. determined that there is a need for empirical research on work design as related to nursing programs and practice.^[1] With the development of medical technology and disease complications, the task characteristics of nursing have been a focus of attention in the hospital setting.^[2-6] There is little research, however, on the use of assessment instruments on nursing students or the assessment of task characteristics on nursing school clinical practice examinations. Thus, the aim of this study was to explore the factorial validity of the five-factor Task Characteristics Measurement Scale in simulated nursing practice. This measurement tool has the potential to provide nursing educators and clinical teachers with a means to assess students' task characteristics in simulated clinical practice, as well as to improve or facilitate the testing of job design.

Background

The Job Characteristics Model and Job Diagnostic Survey

Hackman and Oldham developed a theoretical model (Job Characteristics Model [JCM]) and designed the Job Diagnostic Survey (JDS) to assess core job dimensions, critical psychological states, and job outcomes.^[7] The five core job dimensions are task variety, task autonomy, task identity, task significance, and feedback from job. The three critical psychological states are experienced meaningfulness of the work, experienced responsibility for the outcomes of the work, and knowledge of results of the work activities. Hackman and Oldham also proposed that these critical psychological states are created by the presence of the five core job dimensions.^[7] As such, the five core job dimensions play a crucial role in the JCM. More recently, Morgeson and Humphrey advanced a comprehensive work design model and developed the Work Design

Questionnaire (WDQ), which is a modification of the JCM.^[8] The concept of autonomy was expanded to include three interrelated aspects: (a) work-scheduling autonomy, (b) decision-making autonomy, and (c) work-methods autonomy. Each dimension of their model is defined below.

- Task variety is the degree to which individuals require being engaged in different skills or activities.
- Task autonomy is the degree of individual freedom to make decisions about and engage in independent work and includes work-scheduling autonomy, decision-making autonomy, and work-methods autonomy.
- Task identity is the degree to which individuals can finish an entire task, that is, doing a job from beginning to end with a visible outcome.
- Task significance is the degree to which the job has a substantial impact on the lives or work of other people.
- Feedback from job is the degree to which one carries out the activities required by the job; this provides information on how well a practitioner is performing.

Application of the JDS to nursing

Many affective factors related to task characteristics have been investigated, including motivation,^[2,3] job satisfaction,^[2] distress and job-related well-being,^[4-6] and burnout.^[9] To ensure patient safety and to control the quality of teaching and practice, nursing education has gradually shifted to clinical simulation centers. In Taiwan, before practice in an actual hospital, some nursing schools test students' clinical competencies using objective structured clinical examination (OSCE). The OSCE provides an opportunity for students to demonstrate their competence in a variety of simulated conditions.^[10,11] Students move between stations, at specific time intervals, on the command of a bell, and engage in a variety of tasks.^[12] In the OSCE, clinical job design and task characteristics are crucial. A reliable and valid assessment Scale for measuring student performance of "task characteristics" in simulated clinical settings is needed.

Student learning of nursing skills is built on

task completion and correctness. Design needs to be based on clinical nursing practice. Such a task characteristics measurement instrument is not only useful for assessing student performance in simulated clinical setting, but also for helping teachers examine whether task design meets the learning needs of nursing students.

Hypotheses

In this study, the reliability and factorial validity of the five-factor measurement of task characteristics were examined (Figure 1). Research has shown that all of the variables in the Task Characteristics Measurement Scale have causal correlations, with feedback from job as an outcome.^[13] Hackman and Oldham noted that knowledge of the result increases for jobs with high level of feedback.^[7] Thus, we also tested the conceptual model (Figure 2). Our hypotheses were as follows:

Hypotheses 1a: Task variety is positively related to task autonomy.

Hypotheses 1b: Task variety is positively related to task significance.

Hypotheses 1c: Task variety is positively related to task identity.

Hypotheses 2a: Task autonomy is positively related to task significance.

Hypotheses 2b: Task identity is positively related to task significance.

Hypotheses 3a: Task autonomy is positively related to feedback from job.

Hypotheses 3b: Task significance is positively related to feedback from job.

Hypotheses 3c: Task identity is positively related to feedback from job.

Methods

Procedure and participants

A quantitative correlation study design was employed to collect task characteristics data from two target populations of nursing students. One sample was drawn from a nursing college in southern Taiwan and the other from a medical university in central Taiwan. A total of 226 nursing students participated in the OSCE and were invited to complete the Task Characteristics Measurement

Scale between January and February 2016. All research questionnaires were administered in class, and a total of 223 participants voluntarily completed the questionnaire, for a response rate of 98.67%.

Instruments

The evaluation of task characteristics involved 24 items taken from the Work Design Questionnaire: Traditional Chinese Version (TC-WDQ)^[14] translated from Morgeson and Humphrey's (2006) WDQ.^[8] We used this Task Characteristics Measurement Scale to assess students' reactions after completing skills testing. As noted above, the five dimensions of task characteristics are task variety, task autonomy (work-scheduling autonomy, decision-making autonomy, and work-methods autonomy), task identity, task significance, and feedback from job. Item responses were made on a 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Ethical considerations

We invited students who had completed the clinical examination to fill out the Task Characteristics Measurement Scale. We explained that their results would remain anonymous and would not influence their test score. After the researcher described the purpose and content of the questionnaire, students were asked to complete it. Participation was voluntary. This study was conducted following approval from the Chung-Shan Medical University Human Research Ethics Committee review board.

Data analysis

SPSS 20.0 was used to perform descriptive statistical analysis (i.e., means, standard deviations, and Cronbach's alphas). LISREL Version 8.52 program with maximum-likelihood (ML) method was used for confirmatory factory analysis (CFA).^[15] Six indices were considered in the evaluation of model fit: normed chi-square (χ^2/df ratio; below 5.0 for a good fit), root mean square error of approximation (RMSEA; value <.08), normed fit index (NFI), comparative fit index

Table 1. Descriptive Statistics for the Overall Items and Convergent Validity and Reliability of Measurement Model

Dimension	Item	Mean	SD	Estimate	t-value	p	Cronbach's alpha
Autonomy	1	3.28	.94	0.46			0.92
	2	3.35	1.00	0.51	6.87	***	
	3	3.35	.96	0.63	6.80	***	
	4	3.47	.90	0.69	7.19	***	
	5	3.35	.96	0.74	7.22	***	
	6	3.24	.92	0.80	7.54	***	
	7	3.34	.91	0.74	7.46	***	
	8	3.38	.89	0.76	7.46	***	
	9	3.44	.92	0.78	7.50	***	
Task variety	10	3.63	.92	0.61			0.89
	11	3.72	.92	0.76	10.67	***	
	12	3.48	.96	0.82	11.00	***	
	13	3.65	.95	0.86	11.42	***	
Task significance	14	4.33	.73	0.59			0.88
	15	4.24	.76	0.67	13.18	***	
	16	4.02	.89	0.67	11.76	***	
	17	3.96	.79	0.54	10.16	***	
Task identity	18	3.82	.94	0.54			0.83
	19	3.59	.97	0.70	7.98	***	
	20	3.67	.97	0.86	8.78	***	
	21	3.76	.88	0.68	8.34	***	
Feedback from job	22	3.84	.81	0.67			0.87
	23	3.89	.81	0.58	7.96	***	
	24	3.93	.80	0.56	7.73	***	

*** $t > 3.29$, $p < .001$.

(CFI), incremental fit index (IFI), and relative fit index (RFI). Values of at least 0.90 for NFI, CFI, IFI, and RFI were considered a good fit.^[16] We also performed partial least squares structural equation modeling (Smart/PLS-SEM v. 2.0) with bootstrapping (PLS-SEM) to test the conceptual model and hypotheses.^[17]

For the sample size estimate, we conducted G*Power for power analyses (i.e., input parameters set to two-tailed, effect size (f^2) = 0.10, α error

probability = 0.05, and power = 0.95) for the multiple regression model. Results of power analyses indicated the need for a sample size of 132. In addition,, Hair, Hult, Ringle, and Sarstedt suggested that, when the maximum number of independent variables is five for PLS-SEM, 147 samples are needed to achieve a statistical power of 80% for detecting R^2 values of at least 0.10 (with a 5% probability of error).^[18] In this study, data from 223 participants was analyzed, meaning the sample

Table 2. AVE, CR, and Correlations for Latent Factors of the Task Characteristics

Dimension	AVE	CR	1	2	3	4	5
1. Autonomy	0.62	0.94	0.79				
2. Task variety	0.73	0.92	0.34	0.85			
3. Task significance	0.65	0.88	0.18	0.40	0.81		
4. Task identity	0.73	0.92	0.38	0.18	0.38	0.85	
5. Feedback from job	0.80	0.92	0.32	0.20	0.35	0.49	0.89

Note. Square roots of the AVE are shown in parentheses.

power was adequate.

Results

Descriptive statistics for item analysis

From participants' profiles mean age was 20.72 (SD = 1.58). Most of the participants (87.89 %) were female. In Table 1, the values of the items from the measurement model are presented. In this study, Cronbach's alphas for task variety, task autonomy, task identity, task significance, and feedback from job were all greater than 0.70. Thus, internal consistency of each measurement construct was achieved.^[19]

Confirmatory analysis of a higher-order construct for the Task Characteristics Measurement Scale

oCFA was performed to test the quality and adequacy of the measurement model, as well as its second order, for the Task Characteristics Measurement Scale. Reliability and convergent and discriminant validities of the multi-item construct measures were examined.

Internal consistency reliability and validity

Convergent validity is determined by the reliability of each construct and the average variance extracted (AVE) of each construct. As shown in Table 1, each item has a factor loading greater than 0.5 (except Item 1), with AVE between 0.62 and 0.80, which is consistent with Anderson and Gerbing's recommendation.^[20] Thus, the indicator variables in this study have

good convergent validity. Moreover, the composite reliability (CR) of each construct was greater than 0.70. The square root of the AVE, as shown in Table 2, indicates that each value is greater than the intercorrelations of the construct with other constructs in the model, which is in keeping with the criterion for discriminant validity proposed by Hair et al.^[18]

Second-order CFA

As presented in Table 2, significant correlations were found among the latent constructs of task autonomy, task variety, task identity, task significance, and feedback from job. The significant positive correlations ranged from 0.18 to 0.49 ($p < .05$), and all correlation coefficients were lower than 0.70, indicating that the five latent constructs are related, without the presence of multicollinearity.^[16, 21] Therefore, it was necessary to conduct second-order CFA.

Next, we tested the second-order hierarchical model. Initially, CFA did not support the fit indices ($\chi^2/df = 779.29/247 = 3.16$, RMSEA = 0.102, NFI = 0.89, CFI = 0.92, IFI = 0.92, and RFI = 0.87). The order of the modification indices suggested that the error covariance be set to free between two items, such as Items 2 and 3, Items 16 and 17, Items 3 and 4, Items 23 and 24, and Items 1 and 2. Figure 1 shows the second order task characteristics. Selected statistics for the final overall model indicated acceptable fit of the measurement model. The data fit included chi-square value/df = 546.28/242 = 2.257, NFI = 0.92, CFI = 0.96, IFI = 0.97, RFI = 0.91, and RMSEA = 0.074 (90% CIs [0.065; 0.082]). All estimates and standardized factor loadings (Figure 1) were significant and above 0.4 on hypothesized

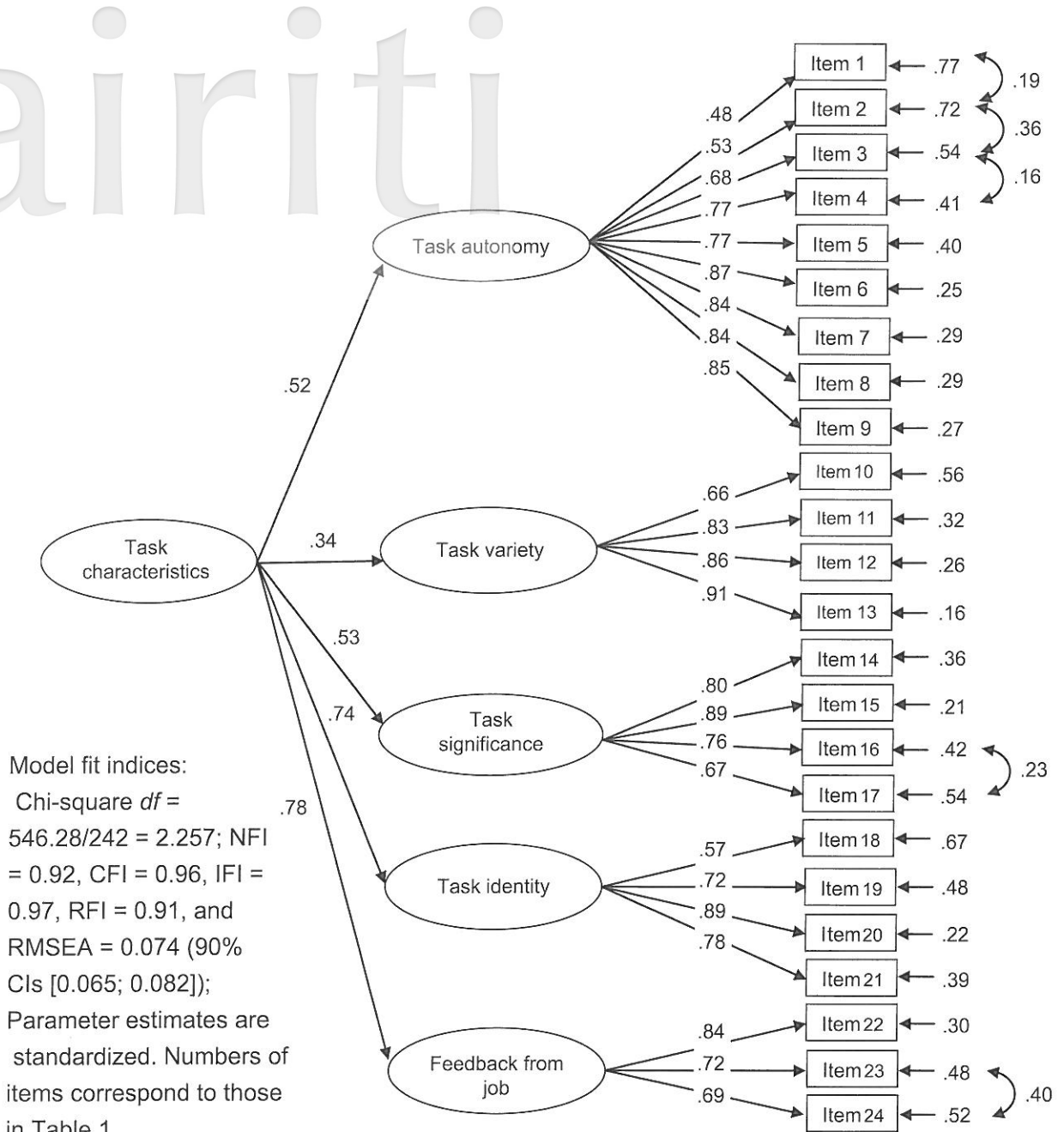


Figure. 1 Second-order Model of the Task Characteristics Measurements Scale

latent factor.

Hypotheses testing

As shown in Figure 2, the structural model of variables for task characteristics was a good fit with the data. The standardized path coefficients and p-values of the associations indicated that task variety has positive effects on task autonomy ($\beta = 0.31, t = 4.61, p < .001$), task significance ($\beta = 0.37, t = 6.07, p < .01$), and task identity ($\beta = 0.17, t = 2.42, p < .05$). In addition, task identity affected task significance ($\beta = 0.30, t = 6.09, p < .001$), but task autonomy did not ($p > .05$). Finally, task autonomy, task significance, and task identity had positive effects on feedback from job ($\beta = 0.14, t = 2.73, p < .01$; $\beta = -0.20, t = 3.44, p < .001$; $\beta = 0.36, t = 6.39, p < .001$). Thus, Hypotheses 1a, 1b, 1c, 2b, 3a, 3b, and 3c were supported. Overall,

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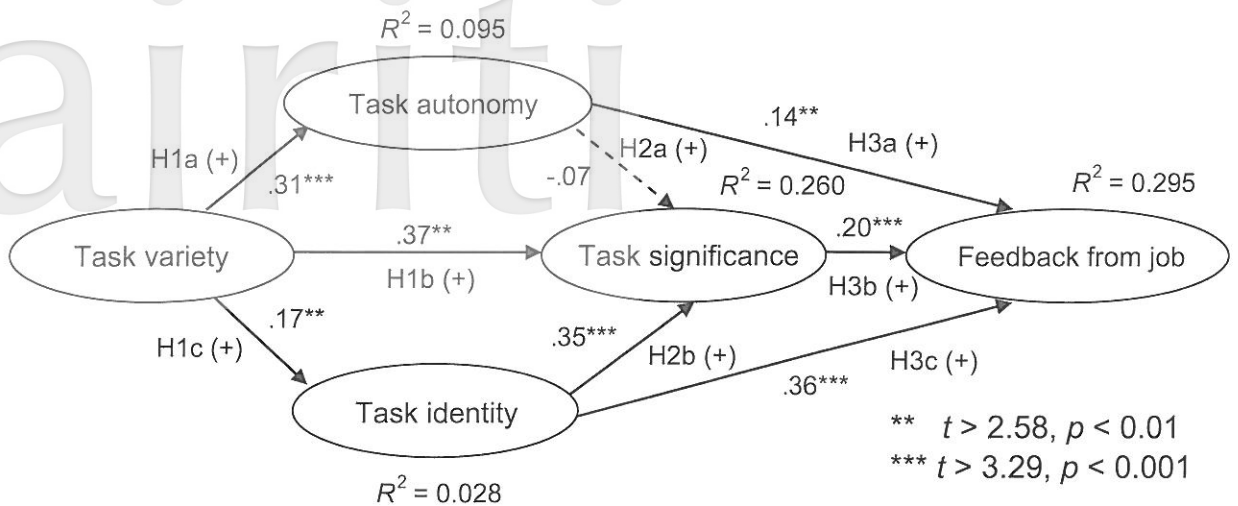


Figure. 2 Results of Research Model and Hypotheses Testing

task variety, task autonomy, task identity, and task significance explained 29.5% of the variance in feedback from job. Task variety and task identity also jointly explained 26.0% of the variance in task significance. Additionally, task variety contributed 9.5% of the variance in task autonomy and 2.8% of the variance in task identity.

Discussion

All subscales had adequate internal reliability coefficient estimates (0.83–0.92).^[19] Thus, we conducted CFA to test the latent construct and the discriminant validity of the Task Characteristics Measurement Scale. The results showed that the intercorrelations among the latent construct of Task Characteristics Measurement support the discriminant validity of these dimensions.^[18]

In this study, second-order CFA showed that five factors (task autonomy, task variety, task significance, task identity, and feedback from job) contributed to overall task characteristics. This final version of TC-WDQ contained 24 items and the five competencies corresponded closely with the competencies of the JCM.^[7] Outcomes have been consistent across different populations, such as nurses in an oncology nursing setting and employees from various businesses.^[13, 22] In addition, the Task Characteristics Measurement Scale is suited to assessing student perceptions of task evaluation in terms of the OSCE in the nursing

school setting. As such, we recommend that researchers and teachers utilize the measure for clinical skill examinations. In addition, more work is needed to replicate the findings and to assess the task design of clinical skill examinations in other nursing schools.

In this study, we analyzed the correlations among the subdimensions of the Task Characteristics Measurement Scale through an SEM approach, with feedback from job on the Task Characteristics Measurement Scale as outcome, as suggested by Charalambous et al.^[13] Students perceived that task autonomy and task identity depended on task variety. These results were consistent with those of a previous study that revealed that nurses perceive skill variety to have positive effects on autonomy and task identity.^[13] In our study, students engaged in a variety of skills or activities, had the freedom to make decisions about and engage in independent work, and were able to perform a job from beginning to end with a visible outcome.

Students also responded that task significance depended on the task variety, task autonomy, and task identity. This result indicated that student engagement in a variety of skills or activities and the opportunity for autonomy to finish an entire task increase student perceived self-competence, which has a substantial impact not only on nursing students' competence, but also on the quality of patient care. Overall, they perceived task variety and the opportunity for autonomy to complete tasks

as meaningful and valuable to their learning.

Further analysis showed that students who perceived higher levels of task autonomy, task significance, and task identity on clinical skills examination received more positive feedback from job. The results indicated that, in terms of the variables that influence students' reaction to feedback from job, the order is task identity, task significance, and task autonomy. In this study, task autonomy did not have a significant effect on task significance. This result is inconsistent with that of Charalambous et al., who showed that task significance is significantly and positively related to task autonomy.^[13] One potential reason for this discrepancy is that our study was conducted in a simulated clinical center, whereas Charalambous et al.'s study was conducted in an actual hospital setting. In the simulation center, all tasks were assigned; thus task autonomy's influence on task significance was small.

Conclusion

In sum, our results indicated suitable reliability and internal validity of the Task Characteristics Measurement Scale. Nursing care tasks are quite varied. To allow simulated clinical skills examination to approximate the actual clinical setting, task variety is useful. Variety allows the learner to schedule the order of the tasks and complete the entire task, which signals his/her autonomy in task completion.^[18] In addition, students who perceive task variety are likely to experience greater meaningfulness in performing the task. These factors, combined with task autonomy, task identity, and task significance, can affect students' reactions to feedback from job.

Limitations

Notwithstanding these contributions, this study has some limitations, which should be addressed. First, as most participants were female, the study findings cannot be generalized to the broader population of male nursing students. Although the number of male nursing students has increased,

they still represent a small fraction of nursing students in Taiwan. Thus, we recommend that further research include more nursing schools as a means to increase the number of males in the nursing student sample. Another consideration is cultural differences. Nevertheless, the Task Characteristics Measurement Scale has shown good reliability and validity in different professional populations in a variety of countries. However, the construct correlation model of the Task Characteristics Measurement Scale needs further replication in different cultures and among male nursing students.

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