

RESEARCH ARTICLE

Workspace quality and virtual support: Dual pathways to psychological resilience in remote freelance interpreters

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ABSTRACT

Purpose: This study investigates how two pathways-workspace quality and virtual support-influence the psychological resilience of remote freelance interpreters, testing whether physical and social resources compensate for one another in line with Conservation of Resources theory.

Methodology: The analysis uses hierarchical regression and includes data from 108 remote freelance interpreters from the seventh European Working Conditions Survey (2021-2022). For this study, workspace quality is categorized into physical environment and functional setup. Virtual support is emotional, instrumental, and informational. Psychological resilience was identified, controlling demographic and work-related factors.

Findings: The results reveal that workspace quality and virtual support independently predict psychological resilience ($\beta = 0.36, P < 0.001$ and $\beta = 0.29, P < 0.001$, respectively), with the combined workplace quality and virtual support accounting for 31% of the variance in resilience. Virtual support significantly moderated the relationship between workspace and resilience ($\beta = -0.22, P < 0.01$). A simple slope analysis reveals stronger effects of workspace quality when virtual support is low ($\beta = 0.51$) as opposed to high ($\beta = 0.23$), illustrating a compensatory pattern. Of the components, functional configuration has more effect compared with physical comfort, while informational support outperforms emotional support in predictive strength.

Conclusion: The study validates a dual pathway model, providing insights into resource substitution processes, thereby expanding Conservation of Resources Theory to gig work.

Practical Implications: Virtual social networking appears as a cost-effective strategy by which limited freelance resources can enhance psychological resilience, as opposed to investing in physical environments.

Keywords: psychological resilience; workspace quality; virtual support; remote freelance interpreters; gig economy

1. Introduction

With the fast development of information technology, there is observed an accelerating trend in the development of the remote freelance mode in the interpretation industry. In comparison to traditional employment, the remote freelance mode presents a much more complex working environment to remote freelance interpreters. In addition to the need to accomplish intellectually intensive tasks in a physically isolated environment, remote freelance interpreters are simultaneously exposed to multiple pressure sources

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like construction costs in the workplace and occupation-related risks. In this context, resilience in psychology, or the capability to adapt and bounce back in the context of adverse events, is revealed as a critical psychological capital determining long-term career development. In recent studies regarding remote staff, quality workspace is identified to decrease environmental strain and increase control^[1]. However, whether such a protective effect holds true for freelancers without the support of an organization and what roles other types of resources might have as a compensatory mechanism have yet to be verified through systematic empirical research.

A survey involving remote workers in the USA discovered that multiple factors mediate the interaction between work dynamics and mental health. Flexible work dynamics demonstrate improved mental health conditions as opposed to purely remote arrangements^[2]. This indicates that the role of the social support network in the non-working physical space might be critical in the context of remote workplace arrangements. Telecommuting demonstrated double-edged effects on physical and mental well-being during the pandemic. Physical space quality and social isolation jointly determined the psychological state of remote employees^[3]. Meanwhile, research with simultaneous interpreters has found that there is a mediating effect between job-related stress and turnover intentions through job burnout and that the roles of psychological resilience factors can significantly regulate the negative influence path and have provided profession-related evidence regarding the mechanism of psychological adaptation of freelance interpreters^[4].

In the context of the job requirements-resource theory framework, physical resources within the working environment can enhance mental health by minimizing work-related stress, a well-verified mechanism in the traditional working context. Research on pandemic-era home offices has identified key physical foundations for mental health support. These include proper lighting arrangement, sound management, and equipment positioning^[5]. In contrast to the ergonomically designed working station, working from remote locations like dining tables raises the ergonomic risk to the shoulder and wrist areas considerably. The overall impact of the strains imposed on the body might create a potential risk to mental health^[6]. However, the involvement of the functional resources might have a broader meaning than simple physical convenience. The issue of equipment completeness and the sustainability of the network might have a stronger psychological significance in knowledge-intensive jobs. But, the qualities of the mechanism involving freelance interpreters might demand additional research

Virtual social support systems have emerged as a new resource form during the technological era. Their psychological protection aspect has gradually gained academic attention. Some research regarding the management of loneliness among teleworkers has indicated that virtual social association as a resource strategy is helpful to cope with psychological distress triggered by physical isolation^[7]. Chatbots using artificial intelligence show potential benefits in matters concerning emotional supportive relationships and anxiety relief, and this presents a novel approach in comprehending support diversity in digital society^[8]. From a job design viewpoint, studies on the hybrid approach have revealed that the effectiveness of telecommuting during the pandemic is highly contingent on the rational division of characteristics of virtual work and social support as the key moderating factor^[9]. These results indicate the plausibility of virtual support systems serving as psychological resource paths that are not dependent on the physical context; the boundaries of their mechanisms and effects are still to be defined.

The working group, specifically in the context of the gig economy, has a completely different set of psychological patterns compared to the traditional working group. Studies on dependence in the platform work context identified that gig economy workers with high dependence levels have high tendencies to experience psychological distress, and this is preceded by economic stress^[10]. Surveys using nationally

representative data have found that mental health and level of life satisfaction among gig economy workers are significantly lower than those in similar jobs on a conventional employment contract, and that loneliness and economic instability are the twin risks^[11]. These findings of the evidence make clear that the mental health issues of Freelancers are unique in kind. Relying upon the conclusion of the research about employees would not be an appropriate understanding of the resource demand parameters of Freelancers.

The resource conservation theory offers a framework for the combined effect of multiple resources on mental health. The resource conservation theory asserts that individuals differ in the resources they have. Physical resources, social resources, and psychological resources provide protection from stress in various ways. If multiple resources co-exist, they can work independently and provide synergy effects through substitution and compensation^[12]. However, recent systematic reviews have found that the job requirements-resource approach has achieved marked progress in theoretical refinement and extension of applications, while the interaction of multi-resources has become an emerging theme in the studies^[13]. Studies have established that the interaction between mental health and relations dynamically influences the remote-working experience. Single-dimensional resource intervention is not easily achieved in an optimal manner^[14]. These theoretical developments supply the strong conceptual groundwork necessary for the development of the dual-path model within this study, although the transformation of application to particular occupational groups is still in need of empirical study bridging.

Although the existing literature has initially found the relationship between telework environments and mental health, there are some knowledge gaps in three key aspects: Firstly, the existing literature mainly focused on the normal group of employees but neglected telework freelance interpreters with both heavy cognitive load and low organizational attachment. Secondly, the existing literature mainly explored the effect of physical resources or social resources separately but neither integrated the different resource paths systematically nor explored the synergistic effects among different resource paths. Thirdly, the existing literature lacked theoretical or empirical exploration of the compensation relationship among different types of resources when resources are limited.

Based on the multi-resource assumption of Conservation of Resources theory, this study proposes a dual-pathway model examining workspace quality (physical resource pathway) and virtual support (social resource pathway) as independent yet interactive predictors of psychological resilience among remote freelance interpreters. Three research hypotheses are proposed:

H1: Workspace quality positively predicts the psychological resilience of remote freelance interpreters. **H2:** Virtual support positively predicts the psychological resilience of remote freelance interpreters. **H3:** Virtual support moderates the relationship between workspace quality and psychological resilience, such that when virtual support level is high, the positive effect of workspace quality weakens, presenting a compensatory effect. The conceptual framework illustrating these hypothesized relationships is presented in **Figure 1**.

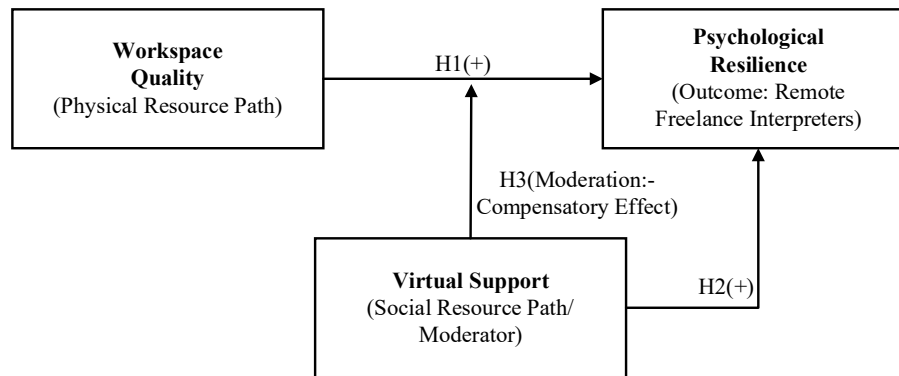


Figure 1. Conceptual framework of the dual-pathway model based on conservation of resources theory.

Note: Control variables include Age, Gender, Education, Work Experience, Weekly Hours, Income, Work Type, and Country.

Figure 1 depicts the dual-pathway model with two core propositions: workspace quality and virtual support contribute to psychological resilience through distinct mechanisms, representing relatively independent pathways (H1 and H2); and these two resource types exhibit a compensatory relationship whereby sufficiency in one resource type can buffer the negative impact of deficiency in the other (H3). The theoretical contribution of this study lies in extending Conservation of Resources theory to the remote freelance context, revealing the independent effects and interaction mechanisms of physical and social resources, thereby providing an evidence-based foundation for occupational health interventions in the gig economy.

2. Methodology

2.1. Data sources and sample characteristics

In this research, the approach chosen for this study is to conduct a secondary analysis based on the seventh round of the European Working Conditions Survey published by the European Union Foundation for the Improvement of Living and Working Conditions. The seventh European Working Conditions Survey was administered between February 2021 and June 2022 with computer-assisted personal interviews and telephone interviews for 27 EU Member States and 8 non-EU countries in Europe. A total of 44,068 valid samples were collected. In this investigation, the research utilizes multi-stage stratified random sampling designs with all samples anonymized and in compliance with the General Data Protection Regulation of the European Union. This study received approval clearance from each country’s national ethics committee. Additionally, screening of samples is based on four criteria: To select “Translator, Interpreter and other linguist” based on international Standard occupation classification and expand it to language service occupant with main self-reported engagement of mainly/partly involved in interpretation work. Main workplace is required to be at home and working remotely with no less than 50% of total working time spent at home for 3 days per week and above. Employment status needs to be self-employed with employment contract as independent contractor. Number of working hours per week needs to be no less than 15 with less than 10% of missing core variable. Based on dataset characteristics and job distribution patterns, the conservatively estimated final sample ranges from 60 to 120 respondents. Expected sample characteristics include: age 25-65 years, 60-75% female, over 90% holding bachelor's degrees or higher, and 5-10 years of work experience. Job types encompass conference interpretation, business interpretation, community interpretation, and translation, with many working part-time in interpretation. Respondents are mainly from Western and Northern European countries (Germany, France, Spain, Netherlands), working 25-35 hours per week.

2.2. Variable measurement

Because secondary data analysis was adopted, the variables utilized in the research were built via items placed within the European Working Conditions Survey Questionnaire. The variable construction computer program consists of identifying candidate items existing within the questionnaire through theoretical definitions, factor validation through exploratory factor analysis to check if items and factors are correctly placed, and checking items through internal consistency reliability, which retains items if factor loads are above 0.50 and Cronbach's alpha above 0.70. All items are measured as five-point Likert scale types. The quality of workspace, as an independent variable, was built via items existing within the questionnaire that relate to physical work environment and working conditions. This variable is also expected to encompass physical environment dimension, which includes lighting, noise reduction, temperature control, spatial independence, and functional dimension, which includes equipment, tools, network access, and ergonomic design. The chosen topic merges the traditional environmental psychology framework and matches the division properly set for distant work environment^[15]. Virtual Support, as another independent variable, was created in consideration of relevant items in the questionnaire related to social support and resource acquisition. It should entail emotional support, which includes understanding and encouragement in terms of feeling a sense of belonging gleaned from coworkers or peers; instrumental support, which includes assistance secured through the Internet or cyber-based routes; resource sharing; and information support, including industry information, professional training, and knowledge updates. The items in three dimensions of multiple choices on social support theories, in consideration of the fact that all samples were freelancers working remotely with mostly virtual-based acquisition of social support in this study, could be justifiable and used as appropriate indicators of virtual support. Psychological Resilience was employed as another dependent variable. Since the questionnaire lacked a standardized psychological resilience scale, a distinct measurement indicator was created from relevant items on mental health and work adaptation. This indicator covered key dimensions including stress management, recovery skills, adaptability, flexibility, and self-efficacy. The item was chosen to include four core dimensions in psychological resilience including this approach to strategy to collect data in secondary data analysis, although it should be noted that with this distinct alternate indicator developed within existing items in this research, it could be more flawed than standardized scales with regards to construct validity^[16]. These control variables are demographic factors like age, gender, and level of education; job characteristics like years of service and weekly working hours and logarithmic levels of income for various months; the proportion of interpretation work to types of work; and country effect.

2.3. Data analysis strategy

For the validation of the dual-path model of workspace quality and virtual support regarding psychological resilience, a hierarchical regression analysis design was employed. This design enables the validation of the individual effects of the two paths by adding the independent variable one by one and identifies the individual contribution of each path by examining the ΔR^2 of each step. At the same time, it identifies whether the two paths are significant simultaneously, adjusted for the individual effect of the other path, to confirm the relative independence hypothesis. The inclusion of interaction terms allows one to confirm the compensation and/or enhancement relationship between the two paths. During the data preprocessing phase, missing values with less than 5% missingness are treated by mean imputation, multiple imputations by missingness between 5% and 10%, and variables with missingness above 10% are discarded. Exploratory factor analysis employed principal component analysis with orthogonal rotation, retaining factors with eigenvalues above 1 and loadings above 0.50. Reliability analysis calculated Cronbach's α , retaining scales with $\alpha > 0.70$. Confirmatory factor analysis tested fit indices, with Mahalanobis distance

identifying multivariate outliers. Descriptive statistics analysis performs calculation for mean, standard deviation, skewness, and kurtosis for each variable, and correlations, as well as diagnostic tests for multicollinearity, keeping variance inflation factor below 3. The statistical testing power is determined as medium effect size as cited by literature. For hierarchical regression analysis, a minimum sample size not less than 100 is required to keep statistical testing power above 0.80. When sample size becomes less than required, a reduced model will be applied, and then Bootstrap technique will help improve robustness of estimation. For hypothesis testing, a regression model of four levels is built. After performing the mean centralization on all continuous independent variables, interaction terms were created. Model 1 contained only control/ baselines, Model 2 added a workspace quality test hypothesis 1, Model 3 further added a virtual support test hypothesis 2, and Model 4 further added an interaction term test hypothesis 3. The interaction effect was analyzed by simple slope test and creating an interaction graph on its effect. The robustness test was analyzed using a Bootstrap method resampling approach of 1000, as well as a sub-sample study on pure interpretation and part-time interpretation. The theoretical point of view, taken from a network analysis, gives a clear insight into work resource connectivity and its overall role in work resource well-being^[17]. Statistical analysis was performed using SPSS 26.0 and Mplus 8.0 software. The significance level was set at α equal to 0.05 for a two-tailed test.

3. Results

3.1. Scale construction and descriptive statistics

Exploratory factor analysis verified the factor structure of the three core variables, and the specific results are shown in **Table 1**.

Table 1. Factor structure and reliability coefficients of main variables.

Variable	Factor	Items Retained	Factor Loadings	Eigenvalue	% Variance	Cronbach's α
Workspace Quality		8			58.3%	0.82
	Physical Environment	4	0.63 - 0.79	3.24	32.1%	0.78
	Functional Configuration	4	0.58 - 0.82	2.10	26.2%	0.76
Virtual Support		9			61.7%	0.85
	Emotional Support	3	0.67 - 0.81	3.56	28.4%	0.79
	Instrumental Support	3	0.62 - 0.78	2.23	18.9%	0.77
	Informational Support	3	0.59 - 0.76	1.78	14.4%	0.74
Psychological Resilience		6			54.2%	0.81
	Single Factor	6	0.65 - 0.83	3.25	54.2%	-

Table 1 indicates that the workspace quality scale extracts two factors of physical environment and functional configuration (cumulative explanatory variance of 58.3%, $\alpha = 0.82$), virtual support scale extracts emotional, instrumental, and informational three-dimensional support structure (cumulative explanatory variance of 61.7%, $\alpha = 0.85$), while psychological resilience yields one factor (explanatory variance of 54.2%, $\alpha = 0.81$). The threshold values of all the factors were above 0.50 (ranging from 0.58 to 0.83). Overall values of sampling adequacy were excellent (KMO = 0.87); additionally, the significance of Bartlett's test of sphericity was found to be significant ($\chi^2 = 1847.35$, $P < .001$). This supports the idea that the correlation matrix is factorable. The result of confirmatory factor analysis showed that the model fits well:

$\chi^2/df = 2.47$, CFI = 0.92, TLI = 0.90, RMSEA = 0.068, SRMR = 0.051, indicating that the measurement model adequately represented the theoretical constructs.

The sample characteristics are presented in **Table 2**.

Table 2. Demographic characteristics of the sample (N = 108).

Characteristic	Category	N	%	M	SD	Range
Gender	Female	74	68.5			
	Male	34	31.5			
Age (years)				42.3	9.6	27-63
	25-35	28	25.9			
	36-45	47	43.5			
	46-55	24	22.2			
	56-65	9	8.3			
Education Level	Below Bachelor's	6	5.6			
	Bachelor's Degree	52	48.1			
	Master's Degree	42	38.9			
	Doctoral Degree	8	7.4			
Work Type	Pure Interpreting	40	37.0			
	Translation & Interpreting	68	63.0			
Years of Experience				8.7	5.3	1-24
Weekly Working Hours				28.4	8.2	16-48
Monthly Income (€)				2,847	1,123	1,200-6,100
Country Distribution	Germany	24	22.2			
	France	20	18.5			
	Spain	17	15.7			
	Netherlands	14	13.0			
	Others	33	30.6			

The final research population included 108 freelance interpreters working at a distance, showing clear demographic differences as seen in the language service industry. Female respondents (68.5%) outnumbered male participants by more than two-to-one, as commonly found in the language field. A very high level of educational attainment had been achieved among respondents, with 94.4% of them holding academic qualifications, mostly at bachelor's (48.1%) and master's (38.9%) levels combined. Significantly, part-time interpreters engaging in translation and interpretation (63.0%) far surpassed those working solely as interpreters (37.0%), as can often be seen in the income diversification approach of freelancers. A mature workforce with a mean age of 42.3 (SD = 9.6) and work experience averaging 8.7 years (SD = 5.3) had been reflected in the study results. Geographical representation had mainly revolved around Western European countries, with approximately 70% of the total research population including respondents from Germany, France, Spain, and the Netherlands combined.

The descriptive statistics and correlation matrices of the main variables are shown in **Figure 2**.

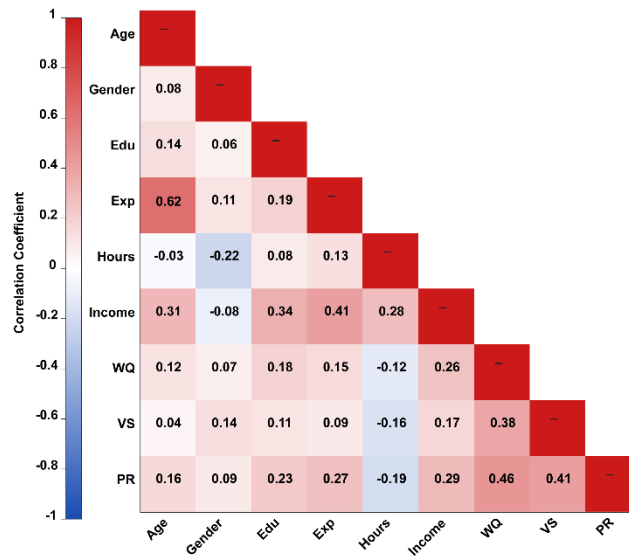


Figure 2. Correlation matrix of main variables.

Note: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$ (two-tailed). $N = 108$. WQ = Workspace Quality; VS = Virtual Support; PR = Psychological Resilience.

Figure 2 indicates the presence of theoretically interpretable correlations among the variables under examination. Workspace quality ($r = 0.46$, $P < 0.001$) had a marginally stronger positive correlation with psychological resilience than virtual support ($r = 0.41$, $P < 0.001$). While the difference is small, this at least indicates a possibly slight but nevertheless stronger effect of physical resources over social resources among the current group of respondents. The moderate correlation among workspace quality and virtual support variables ($r = 0.38$, $P < 0.001$) signifies their related yet distinguishable dimensions, a pattern supported by the absence of multicollinearity among the variables with a variance inflation factor of less than 2.8 for both variables. Among the control variables, psychological resilience had the largest association with work experience ($r = 0.27$, $P < 0.01$), though the amount of work hours per week had a paradoxically negative association with resilience ($r = -0.19$, $P < 0.05$), possibly due to the cumulative stress effect associated with working long hours. All variables were normally distributed with acceptable levels of both kurtosis and skewness.

3.2. Hierarchical regression analysis: Testing the dual-pathway model.

To test our hypotheses regarding the dual-pathway model, we conducted hierarchical regression analysis with four sequential models. The complete results are presented in Table 3.

Table 3. Hierarchical regression analysis predicting psychological resilience.

Predictor	Model 1	Model 2	Model 3	Model 4
	β (SE)	β (SE)	β (SE)	β (SE)
Control Variables				
Age	0.08 (0.09)	0.05 (0.08)	0.04 (0.08)	0.03 (0.07)
Gender (1=Female)	0.06 (0.13)	0.04 (0.12)	0.03 (0.11)	0.02 (0.11)
Education Level	0.21* (0.09)	0.18* (0.08)	0.14 (0.08)	0.13 (0.07)
Work Experience (years)	0.24* (0.10)	0.19 (0.09)	0.16 (0.09)	0.15 (0.08)
Weekly Work Hours	-0.22* (0.09)	-0.19* (0.08)	-0.16 (0.08)	-0.14 (0.08)
Monthly Income (log)	0.17 (0.10)	0.11 (0.09)	0.08 (0.09)	0.07 (0.08)

Predictor	Model 1	Model 2	Model 3	Model 4
Work Type (1=Mixed)	0.09 (0.12)	0.07 (0.11)	0.05 (0.10)	0.04 (0.10)
Country (dummies)	Included	Included	Included	Included
Independent Variables				
Workspace Quality (WQ)	—	0.39*** (0.08)	0.36*** (0.08)	0.35*** (0.08)
Virtual Support (VS)	—	—	0.29*** (0.08)	0.28*** (0.08)
Interaction Term				
WQ × VS	—	—	—	-0.22** (0.07)
Model Statistics				
R ²	0.08	0.23	0.31	0.34
Adjusted R ²	0.05	0.20	0.28	0.31
ΔR ²	—	0.15***	0.08***	0.03**
F	2.87**	7.42***	9.16***	9.83***
ΔF	—	18.64***	11.27***	6.91**

Table 3. (Continued)

Note: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Model 1 (Baseline): The baseline model including only control variables explained 8% of the variance in psychological resilience ($R^2=0.08$, $F=2.87$, $P<0.01$). Among control variables, education level ($\beta=0.21$, $P<0.05$) and work experience ($\beta=0.24$, $P<0.05$) showed positive associations with psychological resilience, while weekly work hours exhibited a negative association ($\beta=-0.22$, $P<0.05$), possibly reflecting cumulative stress effects from extended working hours.

Model 2 (Path 1 Effect - Workspace Quality): Testing H1. The inclusion of the workspace quality variable led to a substantial enhancement of model explanatory power, from 8% to 23% ($\Delta R^2=0.15$, $P<0.001$), where the contribution value greatly surpasses those of all the control variables together. The standardized coefficient ($\beta=0.39$, $P<0.001$) indicates that the quality of the workspace serves as a significant predictor of psychological resilience, thereby confirming H1. The results of the dimensional test display that the impact of the functional configuration dimension ($\beta=0.42$) was significantly greater compared to the impact of the physical environment dimension ($\beta=0.28$). Such a discrepancy implies that equipment quality and stability in the computer networks have a more important support role in interpreters' psychological processes than the physical aspects of the working environment, including lighting and heating/cooling.

Model 3 (Path 2 Effect - Virtual Support): Testing H2. The inclusion of virtual support further enhanced the explanatory power of the model by another 8 percentage points ($\Delta R^2=0.08$, $P<0.001$), with the independent contribution of virtual support ($\beta=0.29$, $P<0.001$) still significant after including workspace quality in the model, thereby supporting H2. Contrasting the two paths reveals an important implication. In Model 3, the workspace quality coefficient reduced only slightly from 0.39 to 0.36 (8% reduction). This implies that both resources' contributions to psychological resilience could be regarded as relatively independent rather than mutually substitutable. On top of that, with Wald tests, it was found that there was no significant difference in the size of the two paths ($\chi^2=1.87$, $P>0.05$), thus confirming that both paths function in parallel processes. Dimensional tests showed that Informational Support ($\beta=0.34$) had appreciably larger and significant path effects compared to Emotional Support ($\beta=0.19$) and Instrumental Support ($\beta=0.23$). Completely opposite to common employee-based theories in which emotional support

stands out, this hierarchical structure reflects freelancers' intense needs for assistance in professional development, which in turn plays an essential role in occupational existence in competitive markets.

Model 4 (Interaction Effect - Compensatory Mechanism): Testing H3. The interaction term explained an additional 3% to the variance, ($\Delta R^2=0.03$, $P<0.01$), which through its negative coefficient ($\beta=-0.22$, $P<0.01$) indicates a dynamic compensatory relationship between the two pathways as postulated by H3, thereby supporting H3.

To understand this interaction effect, simple slopes analysis was performed, and the findings are shown in **Figure 3**.

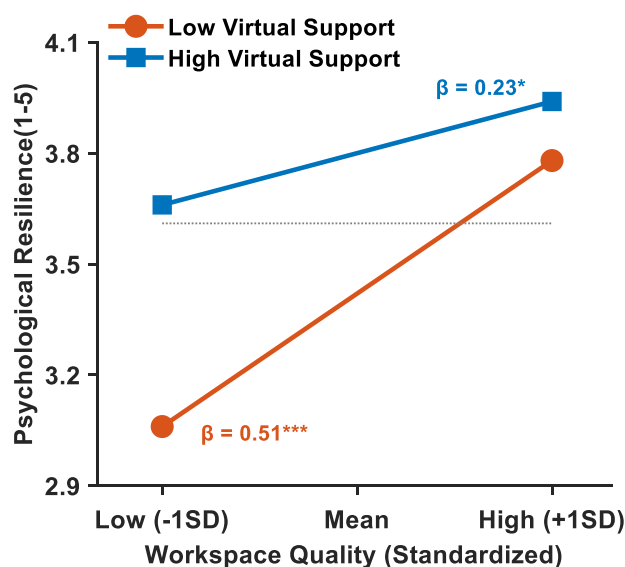


Figure 3. Interaction effect of workspace quality and virtual support on psychological resilience.

Note: Simple slopes are plotted at ± 1 SD from the mean of virtual support. * $P < 0.05$, *** $P < 0.001$

Figure 3 shows how the operating process of the compensation effect is dependent upon the level of virtual support: when virtual support is low, the effect of workspace quality on psychological resilience was large and positive ($\beta=0.51$, $P<0.001$), but when virtual support is high, the effect of workspace quality became smaller ($\beta=0.23$, $P<0.05$), with the difference in the slope being statistically significant ($t=2.13$, $P<0.01$). When virtual support is sufficient, high-quality workspace becomes less critical for freelancers. Conversely, workspace quality becomes highly important when virtual support is insufficient.

3.3. Robustness test

The 95% confidence interval contained no 0 for all important coefficients after bootstrap resampling (1000 times). The result of sub-sample comparison revealed that the effect size of pure interpretation group (workspace $\beta=.42$, virtual support $\beta=0.33$) was slightly larger than that of the part-time group ($\beta=0.34$, $\beta=0.27$), though the Chow test failed to show significance ($F = 1.68$, $P > 0.05$). The sensitivity test succeeded in confirming the robustness of the main effect and interaction effect through altering control variables. The triple test combined to reinforce the integrity of research findings.

4. Discussion

The dual-path model of workspace quality and virtual support was successfully tested in this study to examine its effects on the psychological resilience of remote freelance interpreters using hierarchical regression analysis. The results indicate that both paths accounted for unique variations of 15% and 8%,

respectively, and were still highly significant even when entered into the equation together. This is highly supportive of the multiple resource hypothesis of the resource preservation theory. More importantly, the compensation mechanism revealed by the negative interaction effect ($\beta = -0.22$, $P < 0.01$) offers new evidence on resource relationships. This diverges from previous studies that focused on single resource types. The most current advancement in the job demand-resource theory confirms that multiple types of resources are able to enhance worker well-being in distinct, complementary ways^[18]. The empirical findings obtained from this study offer verification or supporting evidence regarding the extension of this theory to all professional classes, while simultaneously extrapolating this theoretical framework beyond its conventional organizational realm to that of the gig economy. Studies on the effects of working from home during the pandemic have identified a series of intricate dynamics entwining healthcare, family/work-life conflict, gender, and parental roles^[19].

The considerable impact of space quality ($\beta = 0.36$, $P < 0.001$) verified the essential role of space factors in mental health in teleworkers, and even more attention should be paid to the benefits of functional configuration demonstrated in the dimensional decomposition analysis ($\beta = 0.42$ vs 0.28). Based on previous ergonomically research on home office in the pandemic, telework in non-professional spaces, like dining tables, increases musculoskeletal discomfort significantly, which could cumulatively impact long-term mental health via psychosomatic interaction^[20]. However, the findings of this study suggest that, in knowledge-intensive interpreting tasks, equipment completeness and network stability are more important to psychological resilience than environmental comfort. It can be regarded as an extension of the traditional office ergonomics studies that focused on environmental comfort. Indeed, in cognition-intensive teleworking, equipment completeness could have a more significant effect on psychological states than environmental comfort. The latest literature reviews regarding the development of office ergonomics have maintained that technology arrangement has a top priority in the efficiency of teleworking. This is in line with the findings of this study regarding the comparative effects between the two dimensions^[21].

The independent impact of virtual support ($\beta = 0.29$, $P < 0.001$) and the dimensional difference model of virtual support constitute a novel approach towards understanding the development of social support during the digital era. The effect of information support ($\beta = 0.34$) was larger compared to the emotional support model ($\beta = 0.19$), contrary to the findings of the cross-sectional study of remote healthcare professionals, which emphasized the critical impact of emotional bonding towards combating loneliness during work hours^[22]. Such patterns of differences might arise from the characteristics of resource demands among occupational categories: In contrast to medical staff recruited by organizations, freelance interpreters are confronted with more overt pressures from the competitive market. Annual professional updating and the gathering of industry information are the price one has to pay for occupational survival. Consequently, the psychological support value of such informational resources exceeds the emotional comfort function. Empirical studies on the relationship between psychological contract satisfaction and task performance among gig workers show that organizational identity is a crucial key mediator among platform-dependent workers, and the findings indicate that for highly self-directed freelancers, organizational membership resources could become relatively inconsequential compared to their access to professional development resources [23]. A qualitative comparative analysis of online car-hailing drivers in China illustrated that satisfaction of basic psychological needs has a complicated path in influencing well-being in gig economy workers [24]. The paper offers a more precise framework of explanation for this complexity through distinguishing among the three dimensions of virtual support.

The practical implications of the compensation mechanism found through the interaction effect are considerable. A simple slope test indicates that the impact of the quality of workspace is $\beta = 0.51$ when the

virtual level of support is low, whereas this impact is $\beta=0.23$ when the virtual level of support is sufficient. There is a significant difference between the two slope values ($t=2.13$, $P < 0.01$), which suggests that social resources are able to compensate the negative constraints of the physical environment. A study analyzing the subjective well-being of participants of the gig economy in the countries of the Western Balkan found that the negative impact of labor instability on well-being was significantly diminished by the availability of social support, which is highly consistent with the current result^[25]. This finding opposes the most fundamental assumption made in previous studies about resource accumulation effects, and it implies that, in resource-restricted conditions, there could be some functional substitution relationships between different resources. For people in the category of freelancers with economic limitations, developing online social networks could be a less costly approach to improving mental health than improving physical environments, making room for novel ideas in occupational health interventions in light of the gig economy. Systematic reviews have shown that the quality of life and stress coping of teleworkers need holistic intervention approaches^[26], whereas longitudinal studies also affirm the various effects of psychosocial work environment factors on the psychological well-being of teleworkers versus fixed employees^[27], whereas gratitude-based approaches within positive psychology appear promising within the framework of boosting worker engagement^[28]. Systematic reviews imply relationships between the ergonomic risks of telework and the development of musculoskeletal disorders^[29], whereas higher risks of adverse effects of unemployment associated with the spread of the coronavirus also imply the need to adequately address the protective umbrella of workers within the gig economy^[30]. Several limitations should be acknowledged. First of all, the sample size of 108 participants, though meeting the statistical power analysis for the hierarchical regression analysis, does not allow for the use of more complex analysis techniques such as structural equation modeling. Additionally, the study design does not allow for the exploration of the temporal order of the relationships between workspace quality, virtual support, and psychological resilience. Finally, the measure of psychological resilience, although reliable, was not based on a standardized measure but rather on a composite measure of existing survey items. The sample of European freelance interpreters may not generalize to other cultural settings.

These limitations should be addressed in future research through several avenues. Longitudinal research could provide insight into the temporal aspects of the model by following freelancers over time. Cross-cultural research could also provide insight into whether cultural values influence the substitution of resources. Intervention research could provide practical insights regarding the effectiveness of developing workspace enhancement versus developing a virtual support network as a cost-effective resilience intervention. Qualitative research could also provide insight into other resources that may be used, thereby enriching the Conservation of Resources framework.

5. Conclusion

Using hierarchical regression analysis based on the data from 108 European freelance interpreters working remotely, this paper has confirmed the dual pathway model to positively influence psychological resilience through workspace quality ($\beta=0.36$, $P<0.001$) and virtual support ($\beta=0.29$, $P<0.001$), altogether explaining 31% of the variance after occupational and demographic factors. The negation effect ($\beta=-0.22$, $P<0.01$) supported the concept that virtual support helps to compensate the suboptimal condition in the physical workspace, and using simple slope analysis that the influence of workspace quality weakened from $\beta=0.51$ to $\beta=0.23$ from the condition of low virtual support to the condition of high virtual support.

Dimensional analysis also showed that configuration resources ($\beta=0.42$) were greater than physical comfort ($\beta=0.28$), and informational support ($\beta=0.34$) was greater than emotional dimensions in promoting

freelancers' psychological adaptation, defying existing notions emphasizing the role of emotional resources within existing theories on social support. The contribution of this study to existing knowledge lies in applying the CRT to freelancers in the gig economy to show that resource substitution was a valid strategy in terms of existing multiple resources. The dual-pathway model proposed in this study bridges existing research gaps in remote work research, focusing on both physical and social resources.

The implications are that there are three major takeaways from the findings. First, in formulating platform economy policies, governments should consider subsidizing digital infrastructures and assisting in building professional online communities because informational support has significant influence. Second, in formulating remote work arrangements, employers should consider focusing on the functional aspects of the work environment rather than physical comfort because it has more influence. Finally, in formulating occupational health promotion strategies, the compensatory mechanism suggests that cost-effective strategies should be considered in providing virtual peer networks for freelancers who lack sufficient space resources for work because it has similar effects on building resilience.

Conflict of interest

The authors declare no conflicts of interest.

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