

PAPER

Evaluation of Psychosocial Risks Among High School Teachers in Morocco

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ABSTRACT

Professional hazards, particularly psychosocial risks that are likely to affect teachers' physical and mental health, are a particular concern in the education sector. It is in this context that this research work evaluates the psychosocial risks encountered by secondary school mathematics teachers in Safi city (Morocco). Indeed, it is a cross-sectional descriptive study based on a questionnaire that compiled socio-demographic and professional data as well as the psychometric variables of the French version of the Karasek questionnaire. The latter has three components, namely psychological demand (PD), decision latitude (DL), and social support (SS). The sample consisted of 218 teachers, ranging from 22 to 61 years old, and the participation rate was 72.66%. The sex ratio was 1.5: 61% men and 39% women. The prevalence of stress risk variables was 98%, 79%, and 4% for high PD, low DL, and low SS, respectively. While Isostrain prevalence was detected in only 2% of instances, job strain was present in 77% of them. Men are more exposed to psychosocial risks due to the lack of social support, "job-strain," and isostrain than women. Indeed, they experience stress at work, thus demonstrating that psychosocial risks are a significant occupational exposure for teachers. These results promote the development of preventive means to improve working conditions and protect these teachers' well-being.

KEYWORDS

psychosocial risks, secondary school teachers, Morocco

1 INTRODUCTION

Psychosocial risks, which emanate from inadequate job design, work organization, or management, and unfavorable socio-professional environment [1], are currently one of the biggest challenges to be overcome in the sector of health and safety in the workplace. They can have negative psychological, physical, and social consequences, such as work stress, overworking, or depression [2].

Teachers, who consider themselves among the employees most affected by these dangers due to the demands of their profession, acknowledge that these stresses have a substantial influence on their own health. Examples include feeling pressured or

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overworked, lacking passion or enthusiasm for the profession, and engaging in poor social interactions, which can include aggressive action toward teachers and be made worse by the absence of hierarchical support [3]. Next comes [4, 5], the emotional demands of the job, which are followed by the level of social interactions with coworkers.

Stress is frequently misunderstood or stigmatized, just like many other mental health problems. In fact, psychosocial risks (PSR) and stress can even be viewed as any other health and safety risk if they are considered as organizational issues rather than individual deficiencies at the workplace [6].

Despite the absence of ready-made approaches to address psychosocial concerns, the attention to and prevention of these concerns have become crucial to improve the quality of life at work. This entails taking steps to identify occupational risks and work strain, i.e., actions to disseminate knowledge and training and to set up an organization with the appropriate resources. Such an organization must also take care to adapt these measures to account for contextual changes and lean toward alleviating the recognized current difficulties [7, 8] in order to provide optimal conditions for the workers' physical and mental well-being.

A technique customized to the individual's opinion of his/her work is used to evaluate the PSR based on the specific circumstances. The method advocated by the Karasek model [9] enables the establishment of a link between work experience and working-health concerns. Three categories of psychosocial elements are distinguished, including work demands (or "psychological demand"), flexibility (or "decision latitude"), and social support [10, 11, 12].

The present research work lies within this context to examine the prevalence of work-related psychosocial constraints in a population of math teachers in the Moroccan city of Safi using the Karasek model. The evaluation of PSRs is based on a faithful collection, via a tool adapted to the individual's perception of his or her work.

2 MATERIAL AND METHOD

2.1 Type and population of study

The present descriptive cross-sectional study was conducted between January and March 2020 during the COVID-19 pandemic. The data gathering involved 218 teachers from various public high schools and institutions [13].

The respondents' characteristics—namely their age, level of education, and years of experience—were fairly varied. We insisted on distributing our questionnaire among urban and rural areas of Safi (Marrakech-Safi, Region, Morocco) in order to target various types of instructors, with a focus on those who are permanent teachers.

2.2 Measurement instruments

We created a two-part questionnaire to assess the psychosocial hazards for teachers. Concerning the first part, it pertained to the identification of teachers' socio-demographic and professional characteristics. The second part of the questionnaire was the French version of the Karasek stress questionnaire, translated and validated in Canada.

The three dimensions of the workplace's psychosocial environment—psychological demand (9 items), decision latitude (9 items), and social support (11 items)—were examined and evaluated. As regards the psychological demand, it corresponds to the psychological load associated with tasks' accomplishment and

their quantity and complexity, as well as with the unexpected, such as time constraints, interruptions, and contradictory demands. With respect to decision-making latitude, it covers two notions that are decision-making autonomy and competence autonomy [14]. With respect to the social support at work, it is determined by the help and recognition of colleagues and superiors [15, 16, 17].

For each participant, the items were coded from 1 to 4 according to the 4-point Likert scale, which makes it possible to calculate a score for each of the three dimensions that are derived from the literature presented in Table 1.

High psychological demand (PD) corresponds to a score above the median, low decision latitude (DL) is defined by a score below the median, and low social support (SS) corresponds to a score below the median. We used the French values of the medians: (DL = 70, PD = 21, SS = 24).

We therefore distinguish “tense work” or “job strain”, which is the combination of low decision latitude (score below 70) and high psychological demand (score greater than 21), depending on whether the scores of both variables are low or high. Individuals who get this combination find themselves in the group at high risk and with negative repercussions on physical and psychological health [18].

When added to “job strain” and low social support (score less than 24), job strain with isolation leads to the “isostrain”. Indeed, individuals who obtain this combination find themselves in the risk group with the greatest negative repercussions on physical and psychological health.

Table 1. The three dimensions of the Karasek model

Psychological Demand	Social Support	Decision Latitude
Work fast Work very hard Hectic job No excessive work Enough time No conflicting demands Intensive concentration Tasks interrupted Wait for others	<u>A. Supervisor:</u> supervisor is concerned supervisor pays attention Hostility (supervisor) helpful supervisor supervisor good organizer <u>B. Coworkers:</u> co-workers helpful co-workers encouraging Hostility (coworker) friendly co-workers co-workers interested co-workers competent	<u>A. Skill discretion:</u> learn new things repetitive work requires creativity high skill level variety develop own abilities <u>B. Decision authority:</u> A lot of say allows own decisions Little decision freedom

2.3 Method of calculating the scores

According to the model of Karasek, the variables are measured using 29 items. Decision latitude (DL), psychological demand (PD) and social support (SS) were calculated on the basis of the following formulas:

- decision latitude (9 items):

$$4.[q4 + (5 - q6) + q8] + 2.[q1 + (5 - q2) + q3 + q5 + q7 + q9]$$

- psychological demand (9 items):

$$q10 + q11 + q12 + (5 - q13) + q14 + q15 + q16 + q17 + q18$$

- social support (11 items):

$$q19 + q20 + q12 + (5 - q21) + q22 + q23 + q24 + q25 + q26(5 - q27) + q28 + q29$$

Based on the results of the scores, the variables Job and Isostrain were determined according to the following conditions:

- Job strain: score (DL < 70) and score (PD > 21)
- Isostrain: score (DL < 70), score (PD > 21) and score (SS < 24)

2.4 Data processing and analysis

While data collection and processing were carried out concomitantly, data analysis was conducted using the SPSS software (version 25). Also, the categorical variables were compared using the chi-square test, and a threshold significance of .05 was found. The descriptive results were presented in the form of bivariate cross-analysis in effective percentage in the form of tables.

3 RESULTS

3.1 Population characteristics

Our sample was made up of 218 teachers aged 22 to 61, out of whom 39% were women (n=36) and 61% were men (n=132). The sample was 37% single, 61% married, and 2% divorced, and their working time varied between 3 and 15 years (seniority). As for degrees, 8% of respondents had a baccalaureate (n=17), 7% had a DEUG diploma (n=15), 58% had a bachelor's degree (n=127), 22% had a master's degree (n=47), and 2% had a doctorate (n=5).

Among the teachers representing our sample (Table 2), there was a predominance of permanent teachers, who represent 70%, compared with senior teachers of the academy, who represent 29%. The majority of teachers worked in urban areas (n=145).

Table 2. Socio-demographic characteristics and professional data of study population (N=218)

	Frequency	Percentage
Gender		
Female	86	39%
Male	132	61%
Age (years)		
Below 25	14	6%
25–35	111	51%
35–45	42	19%
45–55	36	17%
More than 55	15	7%

(Continued)

Table 2. Socio-demographic characteristics and professional data of study population (N=218) (Continued)

	Frequency	Percentage
Teaching area		
Rural	73	33%
Urban	145	67%
Familial situation		
Single	80	37%
Divorced	5	2%
Married	133	61%
Number of children		
0	109	50%
1	40	18%
2	40	18%
More than 2	29	13%
Level of studies		
Aggregation	1	0%
Baccalaureate	17	8%
DESA	2	1%
DEUG	15	7%
ENS diploma	1	0%
Bachelor's degree	127	58%
Master's degree	49	22%
PhD	5	2%
Professional status		
Contractual teacher	64	29%
Trainee teacher at CPGE	1	0%
Recruited teacher	153	70%
Cycle of studies		
Middle school	96	44%
High school	122	56%
Years of experience		
More than 25	32	15%
16–25	21	10%
6–15	72	33%
3–5	65	30%
Below 2	28	13%

Notes: DEUG, Diploma of General University Studies 0.2 years; DESA, Diploma of Advanced Graduate Studies; ENS, Diploma from the Teacher Training Center; CPGE, Preparatory Classes for Grandes Ecoles.

3.2 Data analysis

The analysis shows that out of 218 people, 173 have a low DL score, 213 have a high PD score, and only 9 have a low social support score (Table 3). After calculating the scores, we identified 98% of people with a PD score above the average of 21, 79% of respondents have a DL score below 70, and only 4% of participants have a SS score below 24.

Table 3. Proportion of teachers exposed to the main stress factors at work

	N	%
Low DL	173	79%
High PD	213	98%
Low SS	9	4%
Job strain	168	77%
Isostrain	5	2%

Notes: High psychological demand (PD > 21), low decision latitude (DL < 70), low social support (SS < 24), job strain (PD > 21 & DL < 70), and isostrain (PD > 21, DL < 70, & SS < 24).

According to the obtained results, the share of job strain is 77%, which means that 168 people had a DL score below 70 and a DP above 21. However, the share of isostrain represents 2%; only 5 people of our sample had a DL score below 70, a DP above 21, and an SS above 24 (Figure 1).

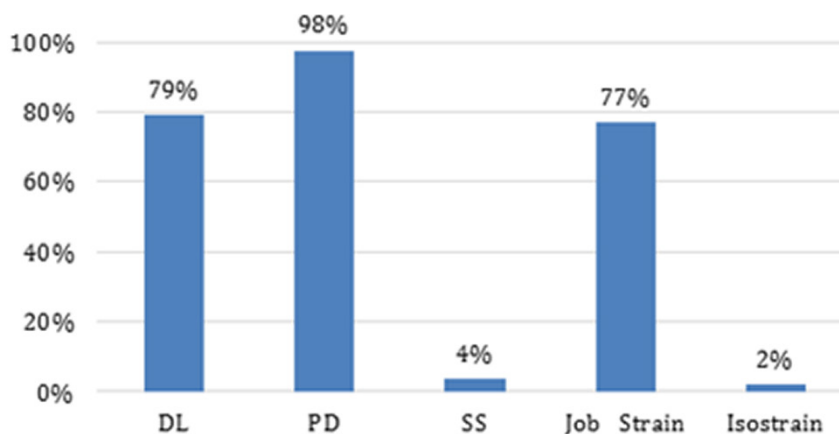


Fig. 1. Prevalence of pathological dimensions according to the Karasek model

3.3 Dimensions of the Karasek JCQ questionnaire

Table 4 presents the results of the cross-tabulations of the 4 indicators (DL, DP, SS, job strain, and isostrain) as a function of the socio-demographic and professional characteristics of each teacher.

In order to determine the existence of a significant difference between the scores for each modality of variable, we carried out the test of difference by the method (chi-square). The results are as follow:

It is clear that men are more likely than women to experience job strain and isostrain. In fact, 80% of men had low DL scores, high PD scores, and low SS scores, compared with only 20% of women.

Table 4. Distribution of studied population according to gender, age, and psycho-organizational dimensions (N=218)

	DL Low	PD High	SS Low	Job Strain	Isostrain
Gender					
Female	38%	39%	44%	38%	20%
Male	62%	61%	56%	63%	80%
<i>p</i> -value	.266	.980	.754	.280	.368
Age (Years)					
Below 25	8%	6%	0%	0%	7%
25–35	51%	52%	67%	67%	53%
35–45	18%	20%	33%	33%	19%
45–55	17%	16%	0%	0%	16%
More than 55	6%	6%	0%	0%	5%
<i>p</i> -value	0.498	0.005*	0.377	0.193	0.195

Note: **p* < .05.

To test whether or not this variation in scores is influenced by gender, we applied the chi-square test, which gave us nonsignificant results with an error threshold greatly exceeding the threshold of 0.05 for the four scores (DL, PD, SS, job strain, and isostrain).

It should be noted that, for age level, the job strain scores are reported more frequently for teachers aged 25 to 35 years and isostrain scores are reported more frequently for teachers aged 35 to 45 years. Age has a substantial effect on the PD score, according to the chi-square test, which indicates that the PD score varies depending on the teacher’s age (*p*=.005).

Table 5 describes how job and isostrain scores were found to be higher for single and married people. We also detected a significant impact of the family situation on the DL and the job strain score with error levels of (*p*=.037) and (*p*=.04), respectively.

Table 5. Distribution of studied population according to number of children, familial situation and psycho-organizational dimensions (N=218)

	DL Low	PD High	SS Low	Job Strain	Isostrain
Number of children					
0	52%	50%	56%	52%	60%
1	18%	19%	22%	19%	20%
2	17%	18%	11%	17%	0%
More than 2	12%	13%	11%	11%	20%
<i>p</i> -value	0.570	0.285	0.933	0.298	0.748

(Continued)

Table 5. Distribution of studied population according to number of children, familial situation and psycho-organizational dimensions (N=218) (Continued)

	DL Low	PD High	SS Low	Job Strain	Isostrain
Familial situation					
Single	39%	37%	33%	40%	60%
Divorced	1%	2%	11%	1%	0%
Married	60%	61%	56%	59%	40%
<i>p</i> -value	0.037*	0.667	0.196	0.040*	0.537

Note: * $p < .05$.

The working hours variable level likewise recorded the same observation. In fact, the study revealed a strong relationship between the number of working hours and DL ($p=.021$), SS social support ($p=.038$), and job strain score ($p=0.042$), as presented in Table 6.

Table 6. Distribution of studied population according to teaching cycle, working hours, and psycho-organizational dimensions (N=218)

	DL Low	PD High	SS Low	Job Strain	Isostrain
Teaching cycle					
Middle school	42%	44%	44%	42%	20%
High school	58%	56%	56%	58%	80%
<i>p</i> -value	0.283	0.854	0.980	0.333	0.273
Working hours					
Below 8	0%	0%	0%	0%	0%
8–15	4%	4%	11%	4%	20%
16–24	93%	91%	67%	93%	80%
More than 24	3%	5%	22%	3%	0%
<i>p</i> -value	0.021*	0.921	0.038*	0.042*	0.256

Note: * $p < .05$.

Table 7 displays that except for the level of PD, which provides a statistically significant value below the error level of .05, neither the degree of education nor the number of years of experience has any discernible effect. This implies that a teacher's PD score can vary depending on their degree of study.

Table 7. Distribution of studied population according to years of experience, level of studies, and psycho-organizational dimensions (N=218)

	DL Low	PD High	SS Low	Job Strain	Isostrain
Years of experience					
Below 3	13%	13%	11%	13%	20%
3–5	31%	31%	22%	32%	0%
6–15	33%	34%	67%	34%	80%
16–25	10%	10%	0%	10%	0%
More than 25	13%	13%	0%	11%	0%
<i>p</i> -value	0.836	0.001*	0.223	0.147	0.172
Level of studies					
Aggregation	1%	0%	0%	1%	0%
Baccalaureate	7%	7%	0%	6%	0%
DESA	1%	1%	0%	1%	0%
DEUG	7%	7%	0%	7%	0%
ENS diploma	2%	0%	0%	1%	0%
PhD	2%	2%	0%	2%	0%
Bachelor's degree	61%	59%	78%	62%	80%
Master's degree	20%	23%	22%	21%	20%
<i>p</i> -value	0.667	0.000*	0.965	0.223	0.994

Notes: DEUG, Diploma of General University Studies 0.2 years; DESA, Diploma of Advanced Graduate Studies; ENS, Diploma from the Teacher Training Center. **p* < .05.

Table 8 shows that for number of children, professional status, teaching cycle, and teaching area there were no significant difference between the scores recorded in each category.

Table 8. Distribution of studied population according to professional status, teaching area and psycho-organizational dimensions (N=218)

	DL Low	PD High	SS Low	Job Strain	Isostrain
Professional status					
Contractual teacher	31%	30%	22%	32%	20%
Trainee teacher at CPGE	1%	0%	0%	1%	0%
Recruited teacher	68%	69%	78%	67%	80%
<i>p</i> -value	0.425	0.337	0.868	0.210	0.884
Teaching area					
Rural	31%	34%	33%	32%	20%
Urban	69%	66%	67%	68%	80%
<i>p</i> -value	0.163	0.518	0.992	0.266	0.518

Notes: CPGE, Preparatory Classes for Grandes Ecoles. **p* < .05.

4 DISCUSSION

According to the present study, men are more likely than women to experience severe psychosocial pressures, with a 63% risk of 'job strain' for men compared with 38% for women. The data show that men have an isostrain prevalence of 80% compared with women, although these differences do not achieve statistical significance. This could be explained by the fact that a greater percentage of male teachers say they feel a high workload, a low decision latitude, and low social support. These findings are consistent with those obtained in a study carried out in Quebec, Canada, in 2019 by Sandrine Hegg-Deloye et al. [19]. According to the latter study, men are more likely than women to experience job strain (21.7% vs. 16.7%), while paramedics are more likely to experience "isostrain" (16.9% vs. 12.7% for nonparamedic workers).

In our study, low decision latitude was observed in 62% of men and 38% of women, which accords well with the findings of some studies [20]. Furthermore, low decision latitude was significantly correlated with family situation and number of working hours. The psychological demand was high in 98% of teachers, with a higher percentage in men than women. This conclusion is congruent with that of a Swiss survey of 5001 workers [21], which showed that 54% of males had high psychological demand.

The SUMER survey found a strong psychological demand among staff working in hospital structures [22]. As for our study, the variations observed for psychological demand were significant according to age, level of study, and length of service.

Low social support was found in 4% of teachers, with men being more concerned with this situation than women. Teachers who work between 16 and 24 hours per week appear to have much lower SS. Similar to our findings, social support was found to be better for women than for males in earlier studies [23].

Physical activity at work can be described using the job strain approach to professional stress, which is based on the Karasek model, integrating psychological demand and decision latitude. In our study, work strain had a prevalence of 77%, and in the 2003 SUMER study [24], it was 23.3% for all workers and 21.8% for those in the technical-commercial sector. According to two German research studies by Bauer and Groneberg, strained labor affected 55.5% of hospital doctors and 22.4% of the general population [25, 26]. According to a study conducted in Belgium [27], 14% of 251 professional firefighters experienced stress at work. The differences between nations, businesses, and industries can be used to explain these variations.

According to the current study, job stress appears to be more substantial in men and for people between the ages of 25 and 35. It is also highly connected with family conditions and work hours. These results contradict those obtained by other investigators, such as Choi et al. [28], reporting a higher prevalence in women (19.4%) than in men (11.2%), and that of Belstress [29], revealing a higher prevalence of strained labor in women (20%) compared with men (18%).

According to the SUMER study, 5.3% of male instructors and 23% of teachers in the private sector in the field of education experience job strain [30]. Another survey of 170 Moroccan teachers found that 18.2% of primary teachers are stressed, with 21.5% of women stressed compared with 16.2% of men [31], which does not accord with the results found in our study.

The World Labor Organization rates teaching as one of the most stressful occupations in the field of education [32, 33]. This can be explained by the complexity

of the work environment emanating from the overloaded programs, heavy time constraints, and a high workload.

5 CONCLUSION

The findings of this study show that certain teachers have a general profile of psychosocial constraints, which highlights a high rate of stress. This leads to burnout syndrome, which has detrimental effects on both the health of teachers and the caliber of their pedagogical work. Therefore, in order to improve working conditions, it is crucial to implement prophylactic strategies, such as training for teachers in techniques for managing stress, negative emotions, and interaction issues. It is also of primary importance to set up health plans for these teachers to ensure a pleasant working environment in which cordial interactions, social support, and mutual respect for the smooth running of the Moroccan educational system predominate.

6 REFERENCES

- [1] D. Beck and U. Lenhardt, "Consideration of Psychosocial Factors in Workplace Risk Assessments: Findings from a Company Survey in Germany," *Int Arch Occup Environ Health*, vol. 92, no. 3, pp. 435–451, Apr. 2019. <https://doi.org/10.1007/s00420-019-01416-5>
- [2] S. J. Bunker et al., "'Stress' and Coronary Heart Disease: Psychosocial Risk Factors," *Medical Journal of Australia*, vol. 178, no. 6, pp. 272–276, 2003. <https://doi.org/10.5694/j.1326-5377.2003.tb05193.x>
- [3] H. F. van der Molen, K. Nieuwenhuijsen, M. H. W. Frings-Dresen, and G. de Groene, "Work-Related Psychosocial Risk Factors for Stress-Related Mental Disorders: An Updated Systematic Review and Meta-Analysis," *BMJ Open*, vol. 10, no. 7, p. e034849, Jul. 2020. <https://doi.org/10.1136/bmjopen-2019-034849>
- [4] M. A. Lafraxo, M. Ouadoud, Y. El Madhi, M. Rehali, and A. Soulaymani, "Burnout Syndrome Prevention Measures among Nursing Staff: Implementing a Mobile Application based on MIT's App Inventor Tool using the Scratch Programming Code," *Int. J. Onl. Eng.*, vol. 17, no. 04, p. 81, Apr. 2021. <https://doi.org/10.3991/ijoe.v17i04.20393>
- [5] M. A. Lafraxo, M. Ouadoud, Y. El Madhi, and A. Soulaymani, "Burnout Syndrome Among Nursing Staff: Performing Data Analysis using the SPSS Statistic," *Int. J. Onl. Eng.*, vol. 17, no. 04, p. 145, Apr. 2021. <https://doi.org/10.3991/ijoe.v17i04.20979>
- [6] D. B. Baker, "The Study of Stress at Work," *Annual Review of Public Health*, vol. 6, no. 1, pp. 367–381, 1985. <https://doi.org/10.1146/annurev.pu.06.050185.002055>
- [7] B. Chimmalee and A. Anupan, "Enhancement of Mathematical Conceptual Understanding in a Cloud Learning Environment for Undergraduate Students," *Int. J. Eng. Ped.*, vol. 12, no. 6, pp. 50–69, Dec. 2022. <https://doi.org/10.3991/ijep.v12i6.33775>
- [8] D. Gormaz-Lobos, C. Galarce-Miranda, S. Kersten, and H. Hortsch, "Perceptions of Teaching Staff About the Online Learning in Engineering During SARS CoV Pandemic," *Int. J. Eng. Ped.*, vol. 12, no. 3, pp. 25–37, May 2022. <https://doi.org/10.3991/ijep.v12i3.27043>
- [9] R. A. Karasek Jr, "Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign," *Administrative Science Quarterly*, pp. 285–308, 1979. <https://doi.org/10.2307/2392498>
- [10] I. Holik and I. D. Sanda, "Character Strengths and Virtues of Mentor Teachers," *Int. J. Eng. Ped.*, vol. 10, no. 5, p. 7, Oct. 2020. <https://doi.org/10.3991/ijep.v10i5.13709>

- [11] R. A. Karasek, T. Theorell, J. E. Schwartz, P. L. Schnall, C. F. Pieper, and J. L. Michela, "Job Characteristics in Relation to the Prevalence of Myocardial Infarction in the US Health Examination Survey (HES) and the Health and Nutrition Examination Survey (HANES)," *Am J Public Health*, vol. 78, no. 8, pp. 910–918, Aug. 1988. <https://doi.org/10.2105/AJPH.78.8.910>
- [12] R. Karasek, C. Brisson, N. Kawakami, I. Houtman, P. Bongers, and B. Amick, "The Job Content Questionnaire (JCQ): An Instrument for Internationally Comparative Assessments of Psychosocial Job Characteristics," *Journal of Occupational Health Psychology*, vol. 3, pp. 322–55, Nov. 1998. <https://doi.org/10.1037/1076-8998.3.4.322>
- [13] I. Douelfiqar, Y. E. Madhi, and H. E. Faylali, "Psychometric Properties of the Maslach Burnout Inventory Adaptation and Validation among Moroccan Mathematics Teachers," *International Journal of Online & Biomedical Engineering*, vol. 18, no. 3, 2022. <https://doi.org/10.3991/ijoe.v18i03.28029>
- [14] I. Niedhammer, J. F. Chastang, L. Gendrey, S. David, and S. Degioanni, "Psychometric Properties of the French Version of Karasek's 'Job Content Questionnaire' and its Scales Measuring Psychological Pressures, Decisional Latitude and Social Support: The Results of the SUMER," *Sante Publique*, vol. 18, no. 3, pp. 413–427, Sep. 2006. <https://doi.org/10.3917/spub.063.0413>
- [15] K. O. Bernardes Santos, F. Martins Carvalho, and T. M. de Araújo, "Factor Structure and Validity Indicators of the Job Content Questionnaire: Discussing Stress in the Work Contexts," *PSYCH*, vol. 07, no. 12, pp. 1424–1437, 2016. <https://doi.org/10.4236/psych.2016.712142>
- [16] D. Żołnierczyk-Zreda and S. Bedyńska, "Psychometric Properties of the Polish Version of Karasek's Job Content Questionnaire," *International Journal of Occupational Safety and Ergonomics*, vol. 20, no. 4, pp. 583–593, Jan. 2014. <https://doi.org/10.1080/10803548.2014.11077075>
- [17] J. E. Sale and M. S. Kerr, "The Psychometric Properties of Karasek's Demand and Control Scales within a Single Sector: Data from a Large Teaching Hospital," *IAOEH*, vol. 75, no. 3, pp. 145–152, Mar. 2002. <https://doi.org/10.1007/s004200100289>
- [18] S. Zeike, L. Ansmann, L. Lindert, C. Samel, C. Kowalski, and H. Pfaff, "Identifying Cut-Off Scores for Job Demands and Job Control in Nursing Professionals: A Cross-Sectional Survey in Germany," *BMJ Open*, vol. 8, no. 12, p. e021366, Dec. 2018. <https://doi.org/10.1136/bmjopen-2017-021366>
- [19] S. Hegg-Deloye et al., "Portrait global de l'exposition aux contraintes psychosociales au travail des paramédics québécois," *pistes*, no. 16-3, Jan. 2014. <https://doi.org/10.4000/pistes.3859>
- [20] S. Schütte, J.-F. Chastang, A. Parent-Thirion, G. Vermeylen, and I. Niedhammer, "Facteurs psychosociaux au travail et santé mentale en Europe: y a-t-il des différences selon la catégorie professionnelle?," *Archives des Maladies Professionnelles et de l'Environnement*, vol. 73, pp. 720–721, Nov. 2012. <https://doi.org/10.1016/j.admp.2012.09.040>
- [21] S. Schütte, J.-F. Chastang, A. Parent-Thirion, G. Vermeylen, and I. Niedhammer, "Psychosocial Working Conditions and Exhaustion in a Working Population Sample of Swedish Middle-Aged Men and Women" (in French), *Archives des Maladies Professionnelles et de l'Environnement*, vol. 73, no. 5, pp. 720–721, 2012. <https://doi.org/10.1016/j.admp.2012.09.040>
- [22] A. Gintrac, "Le stress au travail, un état des lieux," *Management Avenir*, no. 1, pp. 89–106, 2011. <https://doi.org/10.3917/mav.041.0089>
- [23] B. Arnaudo, et al. "SUMER. Les risques professionnels en 2010: de fortes différences d'exposition selon les secteurs," *INRS*, vol. 133, pp. 59–67, 2013.

- [24] N. Guignon, L. Niedhammer, and N. Sandret, “Les facteurs psychosociaux au travail: une évaluation par le questionnaire de Karasek dans l’enquête Sumer 2003,” *Documents pour le médecin du travail*, no. 115, pp. 389–398, 2008.
- [25] J. Bauer and D. Groneberg, “Distress among Physicians in Hospitals – An Investigation in Baden-Württemberg, Germany,” *Deutsche medizinische Wochenschrift (1946)*, vol. 138, pp. 2401–6, Nov. 2013, <https://doi.org/10.1055/s-0033-1359859>
- [26] O. von dem Knesebeck, J. Klein, K. Grosse Frie, K. Blum, and J. Siegrist, “Psychosocial Stress among Hospital Doctors in Surgical Fields: Results of a Nationwide Survey in Germany,” *Dtsch Arztebl Int*, vol. 107, no. 14, pp. 248–253, Apr. 2010. <https://doi.org/10.3238/arztebl.2010.0248>
- [27] S. Sipos and F. Kittel, “Quantification du stress d’une population de sapeurs-pompiers,” *Archives des Maladies Professionnelles et de l’Environnement*, vol. 69, no. 1, pp. 31–38, 2008. <https://doi.org/10.1016/j.admp.2008.02.010>
- [28] B. Choi et al., “Synergistic Interaction Effect between Job Control and Social Support at Work on General Psychological Distress,” *Int Arch Occup Environ Health*, vol. 84, no. 1, pp. 77–89, Jan. 2011. <https://doi.org/10.1007/s00420-010-0554-y>
- [29] G. De Backer, M. Kornitzer, G. Karnas, P. Coetsier, W. De Corte, and C. Hellemans, “Belstress, étude belge sur le stress au travail: Scores normatifs, étude des déterminants et recherche prospective sur la relation avec l’absentéisme et avec l’incidence des maladies cardiovasculaires,” 1999.
- [30] N. Guignon, L. Niedhammer, and N. Sandret, “Les facteurs psychosociaux au travail: Une évaluation par le questionnaire de Karasek dans l’enquête SUMER 2003,” *Doc. Pour méd. trav*, no. 115, pp. 389–398, 2008.
- [31] A. Amri et al., “Psychosocial Risks of Moroccan Teachers: Study by the Karasek Questionnaire,” *Indian Journal of Public Health Research & Development*, vol. 11, no. 3, 2020.
- [32] M. Busby, “Teachers Experience More Stress than Other Workers, Study Shows,” *The Guardian*, 2019.
- [33] W. M. A. F. Wan Hamzah, I. Ismail, M. K. Yusof, S. I. Mohd Saany, and A. Yacob, “Using Learning Analytics to Explore Responses from Student Conversations with Chatbot for Education,” *Int. J. Eng. Ped.*, vol. 11, no. 6, pp. 70–84, Dec. 2021. <https://doi.org/10.3991/ijep.v11i6.23475>

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