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PAPER

Quality of Life of Engineering Educators in Vocational Education and Training: Implications for Vocational and Engineering Pedagogy

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ABSTRACT

The study examines the perceived quality of life (QOL) of educators with an engineering background working at different levels of schools using the standardized WHOQOL-BREF questionnaire (containing domains: physical health, psychological health, social relationships, environment, overall QOL, and general health). The study included 76 vocational education and training (VET) educators in Slovakia. Perceived QOL by VET teachers shed light on differences based on gender, age, and level of the school. The results show that teachers generally rate their psychological well-being and social relationships positively, while physical health and overall health received lower ratings, especially among older respondents. No statistically significant differences were found based on gender or school level. Age emerged as the only significant factor, particularly in the environmental domain. A statistically significant difference emerged, with the youngest generation perceiving the QOL more positively than the oldest generation. Beyond descriptive insights, the study highlights the relevance of teacher wellbeing as a critical factor influencing teaching effectiveness, innovation readiness, and the capacity to integrate technological and pedagogical advancements in engineering education. The results suggest that insufficient attention to teachers' quality of life may limit their ability to adopt modern teaching approaches and respond to the increasing demands of digital and technology-enhanced learning environments. The study contributes to the field of engineering pedagogy by linking educator wellbeing with educational quality and proposes age-sensitive and system-level interventions aimed at supporting sustainable teaching performance in VET and engineering education contexts.

KEYWORDS

engineering pedagogy, quality of life (QOL), engineering educators, vocational education and training (VET), World Health Organization Quality of Life (WHOQOL)-BREF questionnaire, well-being

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1 INTRODUCTION

Educators play a crucial role in shaping future generations. Their well-being and perceived quality of life (QOL) directly impacts their retention and effectiveness in the classroom, student outcomes, and the overall health of the education system. There's an ongoing effort to understand teacher well-being all over the world [1], [2], [3], including Slovakia. A survey conducted under the project Teacher wellbeing Index Slovakia [4] proved that more than 95% of teachers experience some degree of stress in their work, 40% experience moderate stress, and 20% experience high stress. The demanding school year and its impact on teachers' mental health affects primarily their personal lives, family lives, and teachers' work performance. Almost half of teachers consider leaving the profession [4]. Similarly, results from TALIS 2024 [5] show, that 14% of teachers in Slovakia experience stress "a lot" in their work; 8% say their job negatively impacts their mental health (lower than the OECD average: 10%), and 6% report that it negatively impacts their physical health. Between 2018 and 2024 there is an increasing trend in teachers experiencing stress "a lot" in their work [5]. As stated above and in accordance with investigations globally [6], [3] there has been a significant decline in teacher wellbeing and an increase in burnout and stress due to new challenges that teachers face without adequate resources, training, and support. Especially, engineering educators operate at the intersection of technical expertise and pedagogical practice, where rapid technological advancements continuously reshape teaching requirements. Despite this, limited attention has been paid to how educators' wellbeing influences their ability to adapt to these changes and effectively implement innovative teaching approaches. This can have negative consequences for their health, self-efficacy, and teaching practices. These factors increase the likelihood of leaving the profession [1]. The current context of the teaching profession is connected to high attrition, shortages and low attractiveness as proved by data across various countries [7]. Across the OECD countries, on average, 51% of teachers who left resigned. Alarmingly, in five of the seven countries with data on seniority (Austria, Estonia, Israel, Poland and the Slovak Republic), at least 30% of those resigning had been teaching for less than five years [5]. This situation may be attributed to two factors: first, the perception of a low value of the profession; and second, increasingly challenging working conditions (e.g., curriculum changes, technological integration, diverse student needs, and societal expectations). Moreover, the recruitment and retention of educators specializing in vocational education and training (VET) represents a mounting challenge in numerous countries worldwide while a workforce problem is based on the aging of VET teachers, the high level of casualisation, industry currency, and the need to increase the capacity of trainers, as the VET sector responds to critical workforce development needs [9]. Investigating teachers' well-being and their perceived QOL is an important direction to better recognise current challenges of the teaching profession.

The QOL of an individual can be defined as the degree to which that individual is healthy, comfortable, and able to participate in or enjoy life events. The term is inherently ambiguous, as it can refer to the experience an individual has of his or her own life as well as the living conditions in which individuals find themselves. The concept of perceived QOL is defined as the subjective assessment individuals make regarding their life circumstances and the satisfaction they derive from them. This perception is indicative of the subjective evaluation of life experience. The term "perceived quality of life" has been employed to denote individuals' subjective assessment of their well-being and welfare, or the evaluation of their life experiences. Consequently, the concept of QOL is inherently subjective. The conceptualization of

QOL is a multifaceted phenomenon that can be understood through a variety of lenses. For instance, an individual's definition of QOL may be influenced by their material wealth or their subjective satisfaction with life. Alternatively, another individual's definition may be informed by their capabilities (e.g., having the ability to live a good life in terms of emotional and physical well-being) or the opportunities they have to lead a fulfilling life [10], [11]. This multidimensionality enables a thorough and nuanced investigation.

2 VOCATIONAL EDUCATION AND TRAINING TEACHERS PERCEIVED QUALITY OF LIFE

Quality of life, as mentioned above, is a synthetic concept implying economic and social indicators and indicators of subjective psychological well-being. The concept of "quality of life" is a multidimensional construct that encompasses various aspects, including physical health, mental well-being, job satisfaction, work-life balance, stress levels, social support, and financial stability. It represents a summary of the essential aspects of the life of society, social groups and individuals, including economic, socio-political, ecological-environmental, medical-health, psychological, legislative and other aspects. The thinking about QOL is mostly connected to human health. At present, the medical aspect of this problem is increasingly seen from its psychological vantage point. While the teaching profession is not generally considered physically demanding, nevertheless in the middle of their professional career, most teachers experience physical fatigue, for example back-ache and foot-ache after finishing classes or cardiovascular diseases [6], [12], [13]. A special problem can also be intensive vocal cord strain [14]. The relationship between health and QOL is defined by the World Health Organization [15] as "*the perception of one's position in life in the context of cultural and value systems, in relation to one's goals, expectations, standards, and concerns. This concept is complexly influenced by a person's physical health and mental state, their level of independence and their relationships with significant features of their environment*." Health is one of the determining indicators, determinants of QOL, while respecting the participation and influence of other determinants. The World Health Organization Quality of Life (WHOQOL) is an assessment developed by the WHOQOL Group as QOL assessment that would be applicable cross-culturally [16]. QOL is the result of a combination of conditions (health, psychosocial, economic, and environmental) that enable (ensure) health and satisfaction with life in the complex of factors and dimensions of human life. The concept of QOL expresses a positive evaluative pole as a prerequisite for the active development of one's own human potential.

Existing research is usually focusing on teachers' QOL involving assessment of occupational and individual well-being through standardized scales [17], [18], [19] and custom questionnaires based on frameworks [20] or the OECD's comprehensive well-being framework [21]. These measures examine various dimensions, including physical and mental health, work-life balance, job satisfaction, professional development, and social connections, all of which impact overall job satisfaction and retention in the teaching profession. Questions of a psychological nature pertaining to the QOL are often addressed in a cursory manner. This is understood as a quantification of satisfaction with one's life. In this context, satisfaction is recognized as a pivotal catalyst for engagement. Several studies have been devoted to research QOL of teachers who work in Higher Education Institutions [2], [22], various studies explore the factors that impact the wellbeing and QOL of kindergarten, primary, and

secondary schoolteachers [23], [24], [25], but rarely is research on QOL and well-being devoted to a specific group of educators in engineering or VET. Examining the wellbeing and QOL of this specific group of educators can reveal drivers and barriers influencing the persistent teacher shortages and the findings can contribute making VET teaching a more attractive profession.

3 MATERIALS AND METHODS

The research focused on the exploration of the selected areas of QOL perceived by Slovak VET teachers, and examination of differences between various groups of respondents (age, gender, type of school). This investigation led to a discussion revealing the factors that may influence the overall QOL of VET teachers. The most often used methods for assessing this phenomenon are multi-item scales where distinct factors have been specified. In practice, there are several variations of the WHOQOL questionnaire, regarding QOL measurement; it offers goals and conditions from which an individual assorts personally important items.

This study aimed to analyse and evaluate the QOL of current teachers with an engineering background utilizing the standardized WHOQOL-BREF questionnaire led by the question: What is the teachers' perceived quality of life?

Standardized World Health Organization Quality of Life-BREF version (WHOQOL-BREF) [26] questionnaire (Slovak version) for assessing QOL consisting of 26 items was employed. Two general questions focus on the overall assessment of QOL and overall health, and the remaining 24 items are divided into four domains: 1. Physical health (e.g., energy, fatigue, pain, sleep); 2. Mental health (e.g., mood, satisfaction, self-esteem); 3. Social relationships (e.g., support, relationships, sexuality); 4. Environment (e.g., safety, finances, working conditions, leisure time).

During the preparation of the final draft of this study, DeepL Translate [DeepL.com] was used to generate translations from Slovak into English. After using this tool, the authors reviewed and edited the content. Through the questionnaire, the survey focused on exploring: 1. How do teachers subjectively assess their QOL? 2. What are the differences in QOL perceived by VET teachers in terms of school level, gender, age? 3. Which areas of life do VET teachers rate as most and least satisfying?

3.1 Study setting

The study was conducted among lower and upper secondary and tertiary education teachers with an engineering background in Slovakia. The research data was collected from available intended selection samples. Teachers who provided information for the research were from southern and central regions of Slovakia. All participants were active educators at various levels of education – especially at lower secondary (Primary schools), upper secondary (Secondary vocational schools), and tertiary higher education (University) institutions. The teaching profession in Slovakia is regulated, and qualification requirements are set by legislation on education. Vocational subjects in schools are rarely taught by teachers trained in VET teacher training programmes. These programmes preparing teachers for VET schools were originally predominantly offered for teachers specialising in economy subjects or mechanical engineering subjects. These programmes in Slovakia gradually diminished and vocational theoretical subjects are as a rule taught by graduates from non-teaching programmes at universities. These graduates are obliged to

complete a supplementary pedagogical study providing them with teaching competences [8]. They bring to their profession both vocational and pedagogical expertise, they are dual professionals [9].

3.2 Participants and procedure

As the intention was to recruit teachers in vocational education or teachers with a vocational or engineering education background (obtained master's degree in engineering and practicing as an educator), a snowball sampling method was used. Teachers were invited to participate through Google forms questionnaire links via their e-mail addresses. In total, 76 respondents participated, aged 25 to 70 years, currently teaching at primary schools, secondary vocational schools and universities. Quantitative research design was employed through standardized scales to measure different aspects of QOL, analysing and comparing the QOL between teachers in terms of the school level, gender, and age. Results were processed by means of descriptive statistics, using the arithmetic mean (M), median (Md), and standard deviation (STD) to analyse the responses. The internal consistency (reliability) of the questionnaire was assessed using Cronbach's alpha, with an overall value of alpha = 0.912, indicating excellent reliability of the instrument. We used methods of statistics to test the relationships between variables. The practical and statistical significance of the results was assessed based on the significance level p (p-value), where results with a value lower than 0.05 were statistically significant. Respondents were asked to rate their satisfaction with their QOL on a scale from 1 to 5. The higher the value, the more positively the QOL is rated. Data collection was conducted using an online form of the questionnaire. Internal consistency coefficients (Cronbach's α) for WHOQOL-BREF domains are displayed in Table 1. Internal consistency reached an acceptable level which ranges between 0.6 and 0.9. Since Cronbach's α is negatively sensitive to a low number of items, the three-item domain of social relationships shows a lower value.

Table 1. Internal consistency coefficients (α) for WHOQOL-BREF

Domain	Number of Items	α
Domain 1 – Physical health	7	0.782
Domain 2 – Mental health	6	0.814
Domain 3 – Social relationships	3	0.655
Domain 4 – Environment	8	0.847
WHOQOL-BREF	26	0.912

The data was collected from April to June 2025. Respondents were informed about the purpose of the research, and the anonymity of their responses was guaranteed. Participation in the survey was voluntary. The study was conducted in accordance with the local legislation and institutional requirements. The participants provided their informed consent to participate in this study. The study was conducted in accordance with the ethical standards of the Declaration of Helsinki for research involving humans.

4 RESULTS

4.1 Characteristics of respondents

In total, 76 (100%) respondents attended the study. Number of females 52 and male respondents 24. Table 2 shows the distribution of respondents (level of the school, age, and gender).

Table 2. Distribution of participants

	N	%
Level of School		
Primary Schools	30	39.5
Secondary Vocational Schools	22	28.9
University	24	31.6
Gender		
Female	52	68.4
Male	24	31.6
Age		
25–40 years	27	35.5
41–55 years	37	48.7
56–65 years	8	10.5
66 years and older	4	5.3
Total	76	100%

4.2 Quality of life perceived by teachers

The descriptive assessment of the quality-of-life domains, as well as the overall QOL and general health status of the respondents is presented in Table 3. The QOL was rated by the respondents slightly above average in all aspects.

Table 3. Quality of life perceived by teachers—domain differences

	N	*M*	*Md*	*STD*	*Min.*	*Max.*
Q1 – Overall Quality of life	76	3.43	3	0.78	2	5
Q2 – General health	76	3.38	4	0.97	1	5
Domain 1 – Physical health	76	3.11	3	1.20	1	5
Domain 2 – Mental health	76	3.54	4	0.98	1	5
Domain 3 – Social relationships	76	3.71	4	0.99	1	5
Domain 4 – Environment	76	3.45	4	0.97	1	5

The results indicate that respondents generally hold a positive attitude toward their subjective assessment of QOL, though with varying degrees of internal consistency across individual domains. In most of the domains surveyed (Q2, Domain 2, Domain 3, Domain 4), the median settled at 4.00, indicating that most

respondents lean toward a positive assessment. The overall arithmetic mean of all data ranges from 3.11 to 3.71. The most positively perceived domain is *social relationships* (including satisfaction with personal relationships, sexual life, and social support from friends) (mean 3.71), where the highest level of agreement with the presented statements was recorded. Domain 1 – *physical health* (assessment of pain, medical treatment, energy for daily life, mobility, sleep quality, daily living abilities, and work capabilities) exhibits the lowest median (3.00) and, at the same time, the highest standard deviation (SD = 1.20). This data suggests that respondents' opinions in this domain are the most polarized and inconsistent.

Mental health (enjoyment of life, sense of purpose, concentration abilities, acceptance of body image, self-satisfaction, and frequency of negative feelings) with a score of 3.54 was the second highest result and indicates the overall mental well-being of respondents. This is followed by the *environment* domain (perceptions of safety in daily life, the healthiness of the physical environment, financial sufficiency to meet needs, access to daily information, opportunities for leisure activities, satisfaction with the living conditions, and the availability of healthcare and transportation) followed by the lowest rating in *physical health*.

Overall Quality of life (3.43) and the *General Health* (3.38) indicate a satisfaction assessed slightly above the average with lower arithmetic mean in *General Health*.

All three groups of teachers according to the school level achieved the highest scores in social relations (range: 3.68–3.74), confirming high satisfaction with interpersonal relations in all types of educational institutions (the highest rating among secondary school teachers). The lowest score was achieved in the physical health domain among all participants. In this domain secondary school teachers scored the lowest (2.94), while university teachers scored highest (3.22). Primary school teachers scored in between (3.17). The age of teachers influences their physical health and general health assessment with the youngest and oldest groups showing more significant deviations. On the contrary, mental well-being and social relationships are consistently rated positively without major differences. Male respondents achieved slightly higher average scores than females in all areas. The largest difference is observed in satisfaction with health (men 3.50; women 3.33).

The authors also examined the subjective QOL across its specific indicators among respondents. When analysing the 26 individual items, the results show that the highest-rated items were: Q13 *How available to you is the information that you need in your day-to-day life?* (average 4.11), Q15 *How well are you able to get around?* (4.05), Q6 *To what extent do you feel your life to be meaningful?* (4.05) indicating the highest level of satisfaction or the best situation in this area.

Lowest-rated items: Q3 *To what extent do you feel that physical pain prevents you from doing what you need to do?* and Q4 *How much do you need any medical treatment to function in your daily life? (both 1.96).* These low scores below 2.0 indicate actually a very positive result. It means that respondents experience only a low level of physical pain and have little need for medical assistance in their daily lives. The combination of low levels of physical pain (Q3) and high levels of mobility (Q15) suggests that respondents are physically fit and able to fully utilize the accessible environment provided by their school or institution.

Question Q26 *How often do you have negative feelings, such as a blue mood, despair, anxiety, or depression?* It also achieved a relatively low average (2.43), placing it among the topics in the survey concerning the mental health and mental wellbeing of respondents. Although negative emotions among respondents remain at a low level, they occur slightly more frequently than physical limitations. This may

suggest that psychological stress (stress, anxiety) is more prevalent among teachers than physical health problems.

4.3 Quality of life by school level

Respondents from the higher education sector reported slightly higher average scores in Q1 – overall QOL, domain 1, domain 2 and domain 4, while primary school teachers dominated in assessment of Q2. The overall QOL and satisfaction with health were rated worst in both indicators by secondary school teachers (refer to Table 4).

Despite of the results that show slightly higher average score in several domains rated by university teachers, these differences are not statistically significant. Nonparametric Kruskal-Wallis test was applied to analyse differences based on school level (primary, secondary, and higher education). The results suggest that the level of educational institution where respondents work does not have a statistically significant effect on their perceived QOL ($p > 0.05$ in all cases) (refer to Table 4).

Table 4. School level differences based on Kruskal-Wallis test

	Primary School (M)	Secondary School (M)	University (M)	p
Q1 – Overall quality of life	3.40	3.27	3.63	0.239
Q2 – General health	3.53	3.14	3.42	0.430
Domain 1 – Physical health	3.17	2.94	3.22	0.162
Domain 2 – Mental health	3.54	3.48	3.60	0.605
Domain 3 – Social relationships	3.68	3.74	3.72	0.973
Domain 4 – Environment	3.43	3.31	3.63	0.208

4.4 Quality of life by age

The highest overall rating for QOL (3.70) and satisfaction with health (3.78) was among the youngest group aged 25–40. The middle age group (41–55 years) shows slightly lower scores in physical health (3.14). Teachers aged 56–65 reported a decline in physical health (2.98) and satisfaction with their health (2.88), what is reflecting common health limitations at this age stage. The oldest respondents (aged 66 and over) rated their physical health the lowest (2.86). Mental health and social relationships maintain relatively high scores in all age groups (around 3.29–3.58 and 3.5–4), suggesting that these domains are relatively independent of age. The age of teachers primarily influences their physical health and satisfaction with their health, with the youngest and oldest groups showing more significant deviations. On the contrary, mental well-being and social relationships are consistently rated positively without major differences (refer to Table 5).

To analyse differences in terms of age, the nonparametric Kruskal-Wallis test was used, which is designed to compare multiple (in our case, four) independent groups. The results suggest that the level of QOL assessment is relatively consistent across generations, with one statistically significant exception. A statistically significant

difference was identified in Domain 4 – environment (p = 0.048), where the youngest teachers (25–40 years) exhibited the most positive perception (3.69), while the oldest group (over 66 years) was the most critical of this domain (3.13). In Q2-general health, we recorded a result at the marginal statistical significance (p = 0.060), where again the younger age groups' more positive assessment predominates. In the other domains and in Q1-overall QOL, the differences between age groups were not significant enough to be considered statistically supported (p > 0.05). However, the overall trend remains a slight decline in agreement with increasing age of respondents in most of the indicators examined (refer Table 5). The youngest group of teachers consistently has the highest or nearly highest averages.

Table 5. Age differences based on Kruskal-Wallis test

	25–40 (M)	41–55 (M)	56–65 (M)	66+ (M)	p
Q1 – Overall quality of life	3.70	3.32	3.13	3.25	0.160
Q2 – General health	3.78	3.22	2.88	3.25	**0.060**
Domain 1 – Physical health	3.17	3.14	2.98	2.86	0.226
Domain 2 – Mental health	3.56	3.55	3.58	3.29	0.591
Domain 3 – Social relationships	3.95	3.60	3.50	3.50	0.190
Domain 4 – Environment	3.69	3,30	3.53	3.13	**0.048***

Note: M = mean; p = significance level; * p < 0.05.

4.5 Quality of life by gender

We tested the effect of gender on perceptions of QOL using the nonparametric Mann-Whitney U test (refer to Table 6). The results show that in none of the categories examined (questions Q1 and Q2, nor in the four main domains) was a statistically significant difference observed between men and women (p > 0). Although men showed slightly higher average scores in all areas (e.g., in Domain 2, the average for men was 3.63 compared to 3.50 for women), these differences do not reach the level of statistical significance. It can therefore be concluded that the gender of respondents is not a determining factor influencing the perceived QOL. The views of both groups are consistent with slight tendency toward higher rating among male respondents in all areas of QOL. The highest difference is in *satisfaction with health* (men 3.50, women 3.33) and *overall QOL* (men 3.54 and women 3.38). *Social relationships* are rated almost equally (men 3.74 and women 3.70).

Table 6. Gender differences based on Mann-Whitney U test

	Males (M)	Females (M)	p
Q1 – Overall quality of life	3.54	3.38	0.383
Q2 – General health	3.50	3.33	0.429
Domain 1 – Physical health	3.21	3.07	0.140
Domain 2 – Mental health	3.63	3.50	0.161
Domain 3 – Social relationships	3.74	3.70	0.839
Domain 4 – Environment	3.56	3.41	0.398

5 DISCUSSION

This study examined perceived QOL differences between teachers at different levels of education with engineering and vocational background in Slovakia. Slovak teachers rated their QOL rather positive. The findings show that perceived QOL of teachers is fundamentally based on human resources development and targeted support strategies for teaching staff in educational institutions, with significant implications for health promotion approaches. Secondly, our findings underscore the significance of group variations within the components of the QOL. The study revealed that, among factors such as age, gender, social aspects, and health status, age has the greatest impact on teachers' perceived quality of life.

5.1 Social support

The results point to the highest satisfaction of teachers in social relationships (containing satisfaction with personal relationships, sexual life, and social support from friends) which correspond with the findings of several studies. Good interpersonal relationships in the work environment, support from colleagues and family are one of the main protective factors against burnout syndrome in teachers and contribute to their wellbeing [27], [28]. Fostering positive relationships are key factors that contribute to teacher subjective QOL. Despite small differences, social relationships are rated very similarly across genders. This is confirming the findings of Švecová [29], who identifies social support as one of the most important protective factors in the teaching profession, regardless of gender. Our study confirmed high scores in social relationships across all educators what indicates the importance of social support and quality interpersonal relationships. Correspondingly, other research prove that it is important to understand the function of social activities in their role as interventions that foster social belonging and well-being [30].

5.2 Physical health support needs

Teachers' physical health (including energy for daily life, mobility, sleep quality, daily living abilities, and work capabilities) is perceived as the most problematic, but on the contrary assessment of pain and need of medical treatment were assessed the lowest. This data may be related to high workloads, stress, or insufficient opportunities for regeneration. This is proved also by other research, which show that a lack of training in the latest advances and low confidence can have negative impacts on teachers' well-being-related factors such as workload and stress [28]. Although teaching is not generally perceived as a very physically demanding profession, it appears to have a significant impact on subjective health perception. Our results suggest that while interpersonal relationships function as an important support factor, areas related to health and the environment require greater attention and systemic improvement. In connection to perceived physical health several studies revealed the connection of the level of physical activity and exercise to Health-Related QOL in teachers [23], [25], [31]. Other studies indicate that teachers in general are vulnerable to specific health issues connected to their profession [6], [13]. Whilst the teachers' health is likely to be multifaceted, with numerous factors interacting, research has identified stress, personality and organisational conditions as possible predictors of worse physical health [6]. The available data also suggest that the health of teaching

staff is deteriorating, and teachers most often suffer from headaches, mood swings, forgetfulness, anxiety attacks, and muscle tension, exhaustion (Teacher wellbeing Index Slovakia, 2021). The highest and lowest rated areas in our investigation can help to understand the complex nature of the satisfaction and further retention in teaching profession. As found by Tyler [9] the major influences on retention of new educators in VET were partly extrinsic, including employment conditions, lifestyle balance and support for professional development, and partly intrinsic, including a supportive culture and job satisfaction through enjoyment of teaching and giving back to industry.

5.3 Gender differences and different support needs

Results suggest that male teachers tend to have a slightly positive view of various areas of QOL compared to their female colleagues, but the differences are not statistically significant. Stelmach and Stoltz [22] proved higher assessment of various areas of QOL by men in comparison to women. This finding may be related to different expectations, social roles, or approaches to healthcare by men and women. Some authors [32], [33] draw attention to the phenomenon of the double burden (of combining work and family responsibilities) of female teachers, which can lead to reduced satisfaction with health and QOL. Kalousek [34] points out that men more often hold leadership positions and have greater access to decision-making powers, which may be reflected in their higher subjective assessment of QOL. In certain instances, life milestones such as motherhood have been demonstrated to exert an influence on academic trajectories. This is evidenced by the way caregiving responsibilities have been shown to impede the academic progression of women, particularly in professions that demand a significant investment of time [35]. Similarly, other studies prove gender differences in psychological and physical health factors in educators and suggest to considering gender-specific needs in stress management and wellness initiatives [36] with more attention to be given to married female teachers aged 40–55 years [37]. In addition, according to TALIS survey female and younger teachers are more likely to experience stress “a lot” in their work, on average across OECD education systems [5]. These findings suggest that education systems can consider providing different types of support to help teachers with different needs.

Wellbeing is shaped beside individual traits or workplace conditions, also by the broader cultural narratives and gendered expectations that inform how teachers engage with their roles and evaluate their experiences [38]. The gratitude interventions, therapy-based interventions, physical activity interventions, and most mindfulness and meditation interventions, professional development and mixed activities interventions positively contribute to teacher well-being [3].

Further, the results prove, that both genders rate their social relationships very positively (men 3.73 and women 3.70). This consistent result suggests that social support and interpersonal relationships are generally a strong aspect of teachers’ QOL, with no gender differences.

5.4 School level differences

There are no statistically significant differences in QOL in terms of school level, even though University lecturers tend to perceive their physical health most positively (3.22) among the three groups. Conversely, secondary VET school teachers

rate their health lowest (2.94), which may be related to higher workloads or administrative burdens, and constant pressure on the responsibility for students' results at graduation exams, university entrance exams, or even the graduate's placement in the labour market. They may face more frequent monitoring by parents and school management, by external evaluation institutions, as well as time pressure connected to higher demands for vocational training and preparation for future students' careers. According to our results, primary school teachers' assessment of their physical health is in between in comparison to university and secondary teachers. The results can be supported by the research on the well-being of pedagogical staff in primary and secondary schools in Slovakia [39], that revealed that teachers felt that their work had a negative impact on their mental or physical health. Further results show within the teaching population, secondary school teachers are more likely at risk of mental health problems, they more often experience stress and work overload [32], [40]. On the other side, university teachers have better working conditions, a higher degree of autonomy, and greater control over their working hours [34]. Teachers' well-being and overall job satisfaction, including satisfaction with both the profession and their current work environment, varies more within rather than between education systems. This finding indicates that individual and school-level factors exert a substantial influence on teachers' experiences [5].

In all investigated school levels, social relationships are rated highly and very evenly (3.68–3.74), indicating good community and social support. However, the differences between schools in this domain are minimal, it can indicate relative stability in social well-being among teachers across educational levels.

The results show that university teachers experience a slightly better QOL in most of the areas than their colleagues in lower stages of education. The biggest difference between school levels is observed in the domains of environment and health satisfaction. These findings can indicate differences in working conditions or lifestyles associated with various levels of education and a particular institution.

5.5 Ageing–main factor affecting QOL

As teachers age, their perception of their physical health gradually deteriorates. The highest rating of QOL is given by the youngest teachers in the 25–40 age group (3.17), and the lowest rating is given by the oldest teachers in the 66+ age group (2.86). This decline may be related to the demanding nature of the teaching profession, which often involves long periods of standing, noise, and insufficient opportunity for regular exercise and physical activity. With age, these factors can accumulate and contribute to a deterioration in perceived physical health. Other research also shows a negative impact of teaching profession on teachers' mental or physical health regardless of their length of service, except for those with less than one year of service [39]. The results support the conclusions of several authors stating that age affects the physical health and subjective satisfaction with health [37] and suffering biopsychosocial pathologies, and physical health are the main causes of consequences in the quality of teaching life [22].

As proved, social relationships can stay relatively highly rated across the age groups. This suggests that younger teachers perceive their social interactions and support at work very positively. With increasing age, there is a gradual, though not drastic, decline in the rating of social relationships. Teachers in the 41–55 age group achieve an average of 3.60, which is still a relatively high value, but lower than that of the youngest group. In the 56–65 and 66+ age groups, the average rating of

social relationships has stabilized at 3.5. Although older teachers still perceive their social relationships positively, their rating is slightly lower than that of their younger colleagues.

The gradual decline in the rating of social relationships with age may be influenced by various factors. These may include changes in job positions, less interaction with younger colleagues, different priorities, etc. Social relationships remain important for older teachers, but they may no longer be as strong as they are for younger colleagues. Individual-level factors (e.g., gender and age) should not be considered as only determinants of teacher well-being, and tailored support can benefit teachers at various career stages with different levels of experience. School stakeholders should look beyond these individual factors to use staff voice to identify areas that could be considered for impact [28].

Result pointing to the ageing as the main factor affecting the perceived QOL by teachers indicates the need for consistent age management implementation in schools. It is crucial that age management strategies concern not only work, but also life outside work, aimed at personal development and maintaining a good mental and physical condition [41]. Furthermore, other research shows that organisations that implement comprehensive age management strategies have been shown to experience improved workforce retention among older employees. Participants have expressed a desire for extended careers, provided that the organisation provides adequate support. To facilitate the implementation of age management strategies, it is imperative that organisations prioritise the enhancement of technology training approaches, the refinement of flexible work policies, and the establishment of structured knowledge transfer programmes. This necessitates the formulation of comprehensive strategies that address both immediate workplace requirements and long-term workforce sustainability [42].

5.6 Implications for engineering pedagogy and VET

The findings of this study extend beyond general teacher wellbeing and have direct implications for engineering pedagogy and VET. Educators with an engineering background operate in a rapidly evolving environment characterized by technological innovation, digitalization, and increasing demands for interdisciplinary competencies.

The results suggest that QOL, particularly in domains related to physical health and environmental conditions, may influence teachers' capacity to effectively implement modern pedagogical approaches, including technology-enhanced learning, project-based learning, and the integration of digital tools and artificial intelligence. Lower perceived physical health and environmental satisfaction may reduce teachers' adaptability, innovation potential, and engagement with new teaching methodologies.

Moreover, the absence of significant differences across school levels indicates that systemic factors, rather than institutional context alone, shape teacher wellbeing. This highlights the importance of system-wide strategies to support educators in engineering and VET contexts.

Age-related differences in perceived QOL further emphasize the need for differentiated support. Younger educators appear more adaptable to changing conditions, while older educators may require targeted interventions to support their engagement with evolving technological and pedagogical demands.

From an engineering pedagogy perspective, the sustainability of high-quality teaching is closely linked to the wellbeing of educators. Institutions should therefore integrate wellbeing-oriented policies with professional development initiatives, particularly those focused on digital competencies and innovation in teaching. Supporting educators holistically can enhance not only their QOL but also the effectiveness and future-readiness of engineering education systems.

6 CONCLUSIONS

Based on all the tests conducted (gender, age, school level), we can draw the following key conclusions:

- Gender: Plays no role; men and women respond almost identically, with slightly positive assessment of QOL by male teachers.
- School level: Plays no role; differences between primary, secondary, and higher education are not significant.
- Age: This is the only significant factor. Specifically, in domain-environment, a statistically significant difference emerged, with the youngest generation perceiving the QOL more positively than the oldest generation (66+).

The findings underscore the need for age sensitive approaches to promoting the health and QOL of teachers, considering their specific life stages and biological and social characteristics. Enriching support measures such as flexible working arrangements and mentoring could help to reduce the gap. Wellbeing programs focused on physical activity support or regular preventive checkups could be particularly beneficial. Recognizing also the importance of other factors as salary satisfaction, job security and workload management, and work – life balance is crucial for enhancing teacher well-being and retention. Teachers could benefit from targeted healthcare and programs aimed at improving the working environment (modernization of classrooms, reduction of bureaucracy, etc.). Age management is an inevitable part of the institutional support. Teachers of all ages should have the access to various activities to enhance their physical fitness, to stay active and healthy for as long as possible. Social support should remain balanced across all age groups, as these dimensions demonstrate the greatest influence and source of stability in teachers' profession. Based on the findings, the study proposes a framework for age-sensitive institutional support. Key recommendations include:

- Environmental optimization that is enhancing the physical and digital workspaces for older educators to mitigate the significant decline in 'Environment' domain satisfaction.
- Intergenerational Mentorship: Implementing programs where younger educators (who reported higher QOL) can share digital-pedagogical efficiencies, while older educators provide long-term career resilience strategies.
- Biological-Stage Health Initiatives: Developing targeted health-promotion programs that address the lower physical health ratings.

These recommendations underscore the necessity of a life-cycle approach to educational institutions management, ensuring that engineering pedagogy remains sustainable by protecting its most experienced human capital.

Further examination of teachers' perceived QOL can help building framework for the systematic supports for state employees and to take specific measures. Furthermore, the results of more detailed investigation can lead to change the school management systems by eliminating formalism and unclear school direction, building mutual trust and cohesion among teachers and supporting teacher engagement. This can help support the teachers by recognizing their work, setting up a transparent system of criteria and evaluation that considers their work and activities related to their professional life.

Potential for Practical Implications: Research findings can inform policy changes, school-level interventions, and professional development programs aimed at improving educators' well-being and retention. This can lead to a more sustainable and effective education system.

Contribution to Existing Literature: While there is relatively rich existing research on teacher wellbeing, burnout and job satisfaction, a focused study on the broader "quality of life" can offer a more holistic understanding of educators' experiences and contribute valuable insights to the fields of educational psychology, sociology of education, and occupational health. Furthermore, specific groups of educators with engineering background and vocational education teachers are being rarely investigated as a particular vulnerable group. This study contributes to the field of engineering pedagogy by providing empirical evidence on the relationship between educator wellbeing and teaching conditions in vocational and engineering education contexts. Unlike general studies on teacher wellbeing, this study focuses specifically on educators with an engineering background, a group that remains underrepresented in the literature. By linking QOL with the capacity to respond to technological and pedagogical challenges, the study offers a more holistic understanding of factors influencing teaching effectiveness in engineering education. The findings support the need for integrating wellbeing strategies into institutional and policy-level approaches aimed at sustaining innovation and quality in VET systems.

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