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Počiatočná slovenská adaptácia nástroja Burnout Assessment Tool–Core Symptoms (BAT-C) pre študentov

Initial Slovak Adaptation of the Burnout Assessment Tool–Core Symptoms (BAT-C) for Students

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Abstrakt: Výskum vyhorenia zameraný na študentov sa v posledných rokoch rozrástol. Validované nástroje na zachytenie príznakov vyhorenia sú preto dôležité. Preto sa táto štúdia zameriava na poskytnutie počiatočných informácií o psychometrických vlastnostiach jadrových symptómov študentskej verzie nástroja Burnout Assessment Tool (BAT-C; Schaufeli, Desart & De Witte, 2020) v slovenskom prostredí. Náš výskumný súbor pozostával zo 150 študentov. Konfirmačná faktorová analýza (CFA) naznačila, že teoreticky preferovaný faktorový model druhého rádu (štyri faktory prvého rádu – vyčerpanie, mentálny odstup, kognitívne ťažkosti a emocionálne ťažkosti – a jeden faktor druhého rádu, vyhorenie) nevykazoval dobrú zhodu s dátami. Výsledky podporili konvergentnú (a súbežnú) validitu: BAT-vyhorenie bolo pozitívne asociované s depresívnymi symptómami, neuroticizmom, negatívnym afektom (a školským vyhorením), zatiaľ čo bolo negatívne asociované s optimizmom a pozitívnym afektom. Vnútorné konzistencie boli uspokojivé. Hlavnou limitáciou štúdie je výber výskumného súboru na základe dostupnosti.

Kľúčové slová: vyhorenie; študenti; symptómy vyhorenia; príznaky vyhorenia; burnout assessment tool

Abstract: Burnout research focusing on students has grown in recent years. Validated burnout complaint measures are, therefore, of importance. Thus, the present study is focused on providing initial information about the psychometric properties of the core symptoms of the Burnout Assessment Tool (BAT-C; Schaufeli, Desart & De Witte, 2020) for students in Slovakia. Our sample consisted of 150 students. Confirmatory factor analysis (CFA) indicated that the theoretically preferred second-order factor model (four first-order factors – exhaustion, mental distance, cognitive impairment, and emotional impairment – and one second-order factor, burnout) did not fit the data well. Results supported convergent (and concurrent) validity: BAT-burnout was positively associated with depressive symptoms, neuroticism, negative affect (and school burnout), while negatively associated with optimism and positive affect. Internal consistencies were satisfactory. The main limitation of the study is convenience sampling.

Keywords: burnout; students; burnout symptoms; burnout complaints; burnout assessment tool

1 Introduction

Although initially a phenomenon primarily studied in people who provide social and health care services (Maslach et al., 2001), burnout was eventually recognized and studied in relation to students as well (Hamann & Daugherty, 1985; McCarthy et al., 1990; Neumann et al., 1990). For instance, it was documented that students suffering from burnout might be at greater risk of serious mental health issues, such as suicidal ideation (Seo et al., 2021). However, to the best of our knowledge, despite ample empirical findings with practical implications (Madigan & Curran, 2021; Madigan et al., 2024), the conceptual advancement in burnout (Desart

& De Witte, 2019) and recent developments in burnout complaints assessment (e.g., the Burnout Assessment Tool as discussed later; Schaufeli, Desart & De Witte, 2020); there is currently no up-to-date burnout measurement tool for students available in the Slovak language. The present study aims to provide the first phase of validating the Burnout Assessment Tool, focusing on its core dimensions (BAT-C), and offer guidance for future research. In the following section, we will discuss burnout in general and specifically its relevance to students. Subsequently, the measurement of burnout complaints will be covered.

2 Burnout and its correlates (with emphasis on students)

Burnout, primarily understood as exhaustion due to long-term exposure to work-related stressors (Guseva Canu et al., 2021), has been studied for a long time. In the recent 11th Revision of the International Classification of Diseases (ICD-11), the World Health Organization (2018) acknowledged it as an occupational phenomenon[1]. However, burnout can be a major issue not only for employees but for students as well. Students may potentially suffer from burnout symptoms, given that, similarly to employees, they participate in compulsory activities that have a certain structure (e.g., class activities, homework, various projects) and aim at certain goals (e.g., acquiring good grades) (Sulea et al., 2015), that is, they work in a psychological sense.

This has important implications. For example, a meta-analysis indicates that – not just well-established phenomena such as depression – but also burnout is linked with suicide ideation among medical students (Seo et al., 2021). Studies also consistently link burnout with anxiety, depression, and somatic symptoms among high-school students (for a review, see Walburg, 2014; for burnout-depression comorbidity in college students, see Wang et al., 2024). In line with these findings is also research documenting a positive link between burnout complaints and negative affect in workers (Basińska et al., 2023; Kim et al., 2023) and students (Merhi et al., 2018); and a negative link between burnout and positive affect in workers (Kim et al., 2023) and students as well (Merhi et al., 2018). Besides mental health, studies also point to poorer academic achievement among students with higher levels of burnout and its dimensions (for a meta-analysis, see Madigan & Curran, 2021), which might partially explain their higher departure intentions (Emerson et al., 2023).

According to the most influential theory explaining burnout development, Job Demands-Resources theory (JD-R), two fundamental aspects of work – demands and resources – play a crucial role in burnout development (Bakker et al., 2023). Given the importance of JD-R in explaining burnout, initial attempts to adapt JD-R to the student context of burnout have been made and so far have proven to be meaningful (i.e., patterns of associations roughly follow those generally found in employee samples; Jagodics & Szabó, 2023; Jagodics et al., 2023; Lesener et al., 2020; for overviews of the Study Demands-Resources model, see Bakker & Mostert, 2024; Salmela-Aro et al., 2022). For example, social support from teachers and, to a lesser degree, also family and friends, might be an important resource shielding students from burnout symptoms. A meta-analysis by Kim et al. (2018) supports this, suggesting a negative link between the two variables.

However, in recent years, literature dedicated to JD-R has started to emphasize personal resources in burnout development as well. For example, resilience was found to relate negatively to student burnout (for a meta-analysis, see Gong et al., 2021; Velando-Soriano et al., 2023). Similarly, optimism was also found to relate negatively to burnout and its dimensions in students (Vizoso et al., 2019). However, compared to various job demands and resources (Bakker et al., 2023), the role of highly stable characteristics, such as personality traits, has been underappreciated (Bianchi, 2018; Bianchi et al., 2018). In particular, neuroticism shows a positive association with burnout in workers (Schaufeli, De Witte & Desart, 2020), and it may predict burnout better than (at least some) work-related factors (Bianchi et al., 2021).

Taking the adverse associations of burnout with mental health and academic performance into consideration, studying burnout to eventually uncover its etiology and provide guidelines for combating it seems of crucial importance. This point may be further stressed by an observation that around half of the student population may suffer from symptoms of burnout, as a recent meta-analysis suggests (56.3% suffer from exhaustion, 55.3% from cynicism, and 41.8% from low personal accomplishment; Abraham et al., 2024). It is worth noting that these estimates might be subject to a *prevalence inflation hypothesis* (Foulkes & Andrews, 2023); additionally, some authors have questioned the validity of any such estimates, given the lack of well-defined, valid clinical diagnosis of burnout (Bianchi & Schonfeld, 2024). However, recent developments have emphasized the need to differentiate between severe burnout as a clinical diagnosis and milder burnout complaints, which are still important to screen for. Relatedly, high-quality measurement of burnout complaints – essential for practitioners and a sound and nuanced academic discussion about burnout and its nomological network – has been highlighted as well (De Beer & Schaufeli, 2025; De Witte & Schaufeli, 2025). We will focus on the measurement of burnout in the following part.

3 Burnout Measurement

Despite a relatively long history of burnout research, the most prominent measure – Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981) – has several shortcomings, including questionable validity (Shoman et al., 2021; for a review of the validity of MBI-General Survey (Schaufeli et al., 1996), see De Beer, van der Vaart et al., 2024). Additionally, some authors have argued that MBI does not measure burnout per se, given that burnout is presented as a syndrome, and the MBI manual

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[1] It is worth noting that ICD-11 does not recognize burnout as a medical condition but as a phenomenon belonging to "Factors influencing health status or contact with health services".

recommends using only separate scores of each burnout dimension, not the overall burnout score (Bianchi et al., 2024). This is problematic because a formal diagnosis is often needed (particularly in Europe) to receive various social or medical services. Also, given the absence of an overall score, MBI can not be used for screening.

Schaufeli, Desart & De Witte (2020), (for some similar points, see also Desart & De Witte, 2019) summarize MBI's shortcomings in three main areas: conceptualization, psychometric properties, and pragmatics.

For example, considering conceptual issues, MBI does not consider impaired cognition as a part of the burnout, despite ample literature suggesting that individuals experiencing burnout symptoms tend to suffer from cognitive malfunctions (Gavelin et al., 2022; Koutsimani et al., 2021; Koutsimani & Montgomery, 2022; Lemonaki et al., 2021). This area is very important, especially considering students, from whom substantial cognitive effort is often required. Similarly, Schaufeli, Desart and De Witte (2020) are also skeptical of professional efficacy as a burnout dimension, as it might be better treated as an outcome of, rather than a core dimension of, burnout.

Relatedly, there are also various psychometric issues with MBI, such as extreme formulation of some items (which is potentially responsible for lower internal consistencies, especially for personal accomplishment and depersonalization; Wheeler et al., 2011). The positive wording of the professional efficacy scale has also been deemed problematic. For example, in a student sample, Bresó et al. (2007) found a better model fit when the efficacy scale was worded negatively (i.e., a higher score indicated higher inefficacy) than positively (MBI-Student Survey was used; Schaufeli et al., 2002). Also, pragmatically speaking, while various versions of MBI, including MBI for students, have been created, these questionnaires are not freely available and require fees, which hinders their use.

Given these limitations, Schaufeli, Desart and De Witte (2020) have proposed a new instrument for assessing burnout – the Burnout Assessment Tool (BAT) – as well as an updated conceptualization of burnout. We will focus on this in the next section.

3.1 Burnout Assessment Tool

According to the updated conceptualization of burnout, there are two main aspects characterizing it: inability and unwillingness to expend effort at work. *Inability* is a lack of energy, while *unwillingness* is a lack of motivation or increased resistance. These burnout characteristics are present in core burnout dimensions identified by Schaufeli, Desart and De Witte (2020). Specifically, based on theory and semi-structured interviews with practitioners (encountering burnout cases), the authors settled on four core burnout dimensions (BAT-C): (1) exhaustion, (2) mental distance, (3) emotional

impairment, and (4) cognitive impairment. *Exhaustion* represents severely diminished mental and physical energy. *Emotional impairment* represents a reduced ability to self-regulate emotions (sadness, anger), while *cognitive impairment* is a reduced ability to self-regulate cognition (memory, attention). These three symptoms represent the inability to exert an adequate work-related effort. On the other hand, *mental distance* is a psychological detachment or withdrawal from one's job and expresses unwillingness to exert an adequate work-related effort.

Although secondary dimensions can also be identified in terms of (1) non-specific psychological complaints, (2) psychosomatic complaints, and (3) depressed mood, in the present study, we are interested only in the core dimensions as these are, conceptually, of main importance.

Considering the factor structure of four core symptoms, the four-factor model was initially hypothesized (Schaufeli, Desart & De Witte, 2020). However, the second-order model was later preferred by the authors on conceptual grounds, viewing it as a set of specific symptoms (first-order factors) representing a single condition, namely, burnout syndrome (second-order factor). Later, alternative factor models with good fit were also identified. For example, De Beer, Schaufeli et al. (2024) found support for the bifactor model (using bifactor ESEM) across large representative samples from nine countries. In their overview, Schaufeli and De Witte (2023) conclude that, in terms of factor validity of the core symptoms, evidence suggests that BAT-C could be employed for overall burnout assessment, as well as assessment of four core burnout dimensions.

Regarding construct validity, the BAT converged with well-established burnout measures such as MBI and OLBI (for a review, see Schaufeli & De Witte, 2023), while Consiglio et al. (2021) also noted the incremental validity of the BAT, as the BAT explained variance in distress beyond the MBI. Discriminant validity of the BAT has been evidenced when taking into account variables such as work engagement, workaholism, and quality of life, among others (for a review, see Schaufeli & De Witte, 2023). Similarly, a large study carried out by De Beer, Hakanen et al. (2024) highlights the distinctiveness of burnout as assessed by BAT-C; specifically, bifactor modeling revealed a global factor of psychological distress but also similarly strong specific factors of burnout and depression.

Shoman et al. (2023) conducted a systematic review of studies assessing the psychometric properties of the BAT (and the Shirom-Melamed Burnout Measure), and concluded that BAT is the most sound alternative out of all the self-report measures included in their current and previous review, which included MBI, the Oldenburg Burnout Inventory, the Copenhagen Burnout Inventory, the Pines' Burnout Measure, and the

Psychologist Burnout Inventory (Shoman et al., 2021). This is an important argument when choosing this tool for adaptation to the Slovak language.

Relatedly, while Schaufeli, Desart and De Witte (2020) define burnout as a work-related state, they are explicit about "work" as a goal-oriented activity requiring effort, such that school-related activities also count as work. In fact, student versions of the BAT have been adapted to various languages (e.g., Flemish; Annelies et al., 2024; Italian; Romano et al., 2022; Romanian; Popescu et al., 2024); however, the Slovak language is missing.

4   The Present Study

The BAT is a new measure dedicated to overcoming previous shortcomings of more popular burnout complaint measures, such as the MBI. The present study aims to examine the psychometric properties of the student version of the BAT-C (S-BAT-C) in the Slovak language. BAT-C measures four dimensions of burnout complaints (i.e., exhaustion, mental distancing, cognitive and emotional impairment), which can be assessed separately, but also as the overall level of burnout complaints by considering their shared variance. Specifically, we were interested in examining (a) factor structure (construct validity), (b) convergent validity, (c) concurrent validity, (d) internal consistencies, and (e) test-retest reliability of the full version (23 items) of S-BAT-C[2].

Regarding construct validity, we examined the second-order factor structure, which we preferred on conceptual grounds. However, we also examined alternatives, specifically the bifactor model. Also, the four correlated factors model and the one-factor model (all items load on a single factor) were examined. We expected that the second-order factor model would provide an acceptable and superior model fit to the four correlated and one factor model. We did not expect the second-order factor model to provide a better fit than bifactor, as bifactor models tend to overfit the data (Bonifay et al., 2017; Sellbom & Tellegen, 2019). Also, as discussion concerning higher-order and bifactor model solutions is ongoing, our goal is not to provide arguments for model selection based on model fit, but rather to examine theoretically viable options.

Regarding convergent validity, we examined the association of the S-BAT-C with multiple variables across two areas. *First*, given that burnout can be regarded as an important type (or an indicator) of student well-being (Bakker & Mostert, 2024), it should be related to

other well-being variables. Specifically, given the unpleasant nature of burnout experience (e.g., due to lack of energy, cognitive and emotional issues) and previous research findings (Basińska et al., 2023; Kim et al., 2023; Merhi et al., 2018), burnout should be negatively related to the experience of (a) positive emotions and positively related to negative emotions. Given the vast literature documenting associations and similarities (in symptomatology and/or etiology) between burnout and depression (e.g., Bianchi et al., 2019; Wang et al., 2024), burnout, as measured by S-BAT-C, should be associated positively with (b) depressive symptoms. *Second*, research shows that some dispositional characteristics are important in predicting burnout as well. Specifically, some research suggests that neuroticism might be a better predictor of (or more strongly related to) burnout than some work-related characteristics (Bianchi, 2018; Bianchi et al., 2018; Bianchi et al., 2021); therefore, (a) neuroticism should be positively related to burnout as measured by S-BAT-C. On the other hand, positive attributes, such as (b) optimism, were also found to be related to burnout (Vizoso et al., 2019), as they may function as resources to counter burnout development; therefore, we expect burnout to relate negatively to study-related optimism as a component of psychological capital. For concurrent validity, we expected the S-BAT-C to be positively related to another measure of student burnout. Specifically, we used the School Burnout Inventory (SBI; Salmela-Aro, 2009) to examine this association.

5   Method

In accordance with the open-science movement, data, analytic code, and further information – including our Slovak translation of the S-BAT-C – can be found on OSF (https://osf.io/9y8ae/). Results, regarding factor validity, were analyzed using R (R Core Team, 2024; ver. 4.4.2) and the lavaan package (Rosseel, 2012; ver. 0.6-19). SemTools package (Jorgensen et al., 2025; ver. 0.5-7) was used to assess factor reliability of the BAT (and to assess AVE – average variance extracted); the rest of the results were obtained using jamovi (The jamovi project, 2022; ver. 2.3.28).

5.1   Participants

Our sample consisted of 150 students, 81.3% were females (18.7% males). The average age of the participants was 20.9 years ($SD = 1.72$). In terms of their current field of study, majority of participants (103) reported to study psychology, followed by philosophy – psychology (11), British and American studies (8), social work (8), history – psychology (6), slovak language and literature – psychology (6), biology – psychology (4), mathematics – psychology (2), geography – psychology (1), and Latin language and literature – psychology (1). Participants

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[2] Note that we have partly pre-registered the study (https://aspredicted.org/8kkq-y2wd.pdf), although the data collection was ongoing at the time of the registration, and we have not expressed intent of examining (d) and (e) in it.

consisted mostly of first-year bachelor's degree students (83), followed by second-year bachelor's degree students (39), third-year bachelor's degree students (13), first-year master's/engineer students (8), second-year master's/engineer students (6), and doctoral students (1).

5.1.1 Sample size considerations

To determine the required sample size for our study, we conducted a power analysis, taking into account both factor and convergent validity. Considering the former, based on the parameters of the second-order factor CFA model in a previous study examining the student version of the BAT-C (Romano et al., 2022), 140 cases were sufficient for a statistical power of 80% or more for the majority of parameters (Wang & Rhemtulla, 2021). Additionally, we based our power analysis on RMSEA, using the test of not-close fit (Jak et al., 2021): in the case of RMSEA H0 = .05, RMSEA H1 = .01, significance level of .05, N = 140, df = 226, statistical power exceeds 90%. Regarding the latter – convergent validity – we expected to find the smallest effect size of around $r = .30$, which, when considering a significance level of .05 and N = 140, provides a statistical power of 95% (Zhang, 2018). In the case of $r = .25$, statistical power is 85%. Given the considerations above, we aimed to collect at least 140 responses.

5.2 Procedure

The study was conducted using the online platform Google Forms. We used convenience sampling; participants were given the opportunity to enter a random draw to win a coupon. The study was approved by the local ethics committee as part of a bigger research project (FIL006215/2024). At the beginning of the questionnaire, participants were informed about the voluntary nature of the participation and the anonymity of the data they provide. They were also informed that the questionnaire was aimed at college students, that the research did not pose any risk, and that the data collected would be used for scientific purposes only. Next, they were informed that, by sending the questionnaire, they indicated agreement with the processing of the information they provided. In the next section, they were instructed to create an anonymous code and provide demographic information such as their gender, field of study, or work status. After that, they were presented with research scales, which we describe below[3].

5.3 Measures

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[3] They also filled out other scales that were not part of this study (see our preregistration: https://aspredicted.org/8kkq-y2wd.pdf). Some participants also filled out another questionnaire administered later (for test-retest reliability) that only probed them to use previous anonymous code and contained only BAT-C scale.

We used the *Burnout Assessment Tool* (Schaufeli, Desart & De Witte, 2020) to assess core burnout symptoms (BAT-C). Our translation was based on the English student version of the BAT (available on the authors' website; Schaufeli, De Witte & Desart, 2020), using the forward-backward translation procedure. The BAT-C has a total of 23 items, and consists of four subscales that represent the four core burnout dimensions: (*i*) exhaustion (8 items; e.g., "After a day working on my study, I find it hard to recover my energy."), (*ii*) mental distance (5 items; e.g., "I struggle to find any enthusiasm for my studies."), (*iii*) cognitive impairment (5 items; e.g., "When I am working on my studies, I have trouble staying focused."), (*iv*) emotional impairment (5 items; e.g., "I feel unable to control my emotions."). Respondents were instructed to mark how often particular statements apply to them on a scale ranging from 1 (*Never*) to 5 (*Always*).

To assess affective well-being, we used the *Emotional Habitual Subjective Well-being Scale* (SEHP; Džuka & Dalbert, 2002). The scale contains 10 items; four represent positive affective states (e.g., happiness; ω = .81), and six of them represent negative affective states (e.g., sadness; ω = .75). Participants were instructed to answer on a scale ranging from 1 (*almost never*) to 6 (*almost always*) how often they experience such states.

School Burnout Inventory (Salmela-Aro et al., 2009; Slovak translation Škodová & Lajčiaková, 2015) was used as an alternative measure of burnout in students. Inventory consists of nine items (e.g., "I feel overwhelmed by my schoolwork"; ω = .88). Participants were instructed to evaluate statements on a scale of 1 (*completely disagree*) to 6 (*completely agree*) in a way that best describes their situation over the last month.

To assess optimism, we used an optimism subscale from the *Revised Compound PsyCap Scale* (CPC-12R_SK; Slovak adaptation Kačmár et al., 2022; original version Dudášová et al., 2021; Lorenz et al., 2016). This subscale has three items (e.g., "I am looking forward to the life ahead of me"; ω = .87). Respondents indicate on a scale of 1 (*totally disagree*) to 6 (*totally agree*) how much they agree with the statements when they think about their current job. We slightly modified the instructions to focus on students instead of employees.

We assessed neuroticism with the neuroticism subscale from the short form of the *Big Five Inventory-2* (BFI-2 S; Slovak adaptation Kohút et al., 2020; original version Soto & John, 2017). This subscale contains six items (e.g., "I am someone who worries a lot"; ω = .82). Respondents indicate on a scale from 1 (*Disagree strongly*) to 5 (*Agree strongly*) to what extent they agree with the statements that may or may not apply to them.

Depressive symptoms were assessed with the depression subscale from the short version of the *Depression, Anxiety and Stress Scale* (DASS-21; Slovak adaptation Hajdúk & Boleková, 2015; original version Lovibond

& Lovibond, 1995). The subscale consists of seven items (e.g., "I couldn't seem to experience any positive feeling at all"; ω = .87). Respondents indicated on a scale of 0 (*Did not apply to me at all*) to 3 (*Applied to me very much or most of the time*) how much the statements applied to them over the past week.

6 Results

Here we report the main results concerning factor validity, reliability, convergent, and concurrent validity. For descriptive statistics of all the scales used in the study, see Table 1. We had no missing data for any of the scales.

6.1 Factor validity

Based on the dominant understanding of the BAT in the research literature, working with it as a reflective measurement model (i.e., burnout as a latent construct causes observable symptoms/indicators), Covariance-Based Confirmatory Factor Analysis has been used. Specifically, to examine the factor validity of S-BAT-C, we performed confirmatory factor analysis (CFA) in R Studio using the lavaan and the semTools package. Due to the Likert nature of the BAT scale with only 5 response categories, and use of individual items as indicators, we used the WLSMV estimator (Weighted Least Squares Mean and Variance Adjusted), as robust estimators for ordinal data are recommended in such cases (Klein, 2023). To assess model fit, we focused on global and local fit. Specifically, for the global fit, we employed the chi-square test ($\chi 2$) as an indicator of exact fit. In this case the null hypothesis (model fits the data) was rejected in case of $p < .05$. Considering approximate fit indices that further quantify the degree of misfit, we used the following benchmarks: Standardized Root Mean Squared Residual Fit Index (SRMR) ≤ 0.08 indicates a good fit; Root Mean Square Error of Approximation (RMSEA) ≤ 0.05 indicates a very good fit, ≤ 0.08 a good fit; considering incremental fit indices: Comparative Fit Index (CFI) ≥ 0.90 and ≤ 0.94 indicates a good fit, CFI ≥ 0.95 very good fit; Tucker–Lewis Index (TLI) ≥ 0.90 and ≤ 0.94 indicates a good fit, and TLI ≥ 0.95 indicates a very good fit (Gana & Broc, 2018).

6.1.1 Second-order factor model

The hypothesized second-order factor model did not provide a satisfactory fit, considering the exact fit ($\chi 2$ (226) = 389.954, $p < .001$). Considering approximate fit indices, CFI = .95, and TLI = .94, suggest a very good and good fit, respectively. Similarly, RMSEA = .07, 90% CI [.06, .08], suggests a good fit. However, SRMR = .09 was beyond the recommended range.[4] Furthermore, we

also examined local fit via standardized residuals and factor loadings. Examination of standardized residuals suggested a poor fit, as multiple residuals fell outside of the – 2.58 + 2.58 range (the largest value being 5.52; full residual matrix is available at the OSF link provided earlier), which we deemed acceptable. All standardized factor loadings, except two – the first item from exhaustion subscale (EX1; λ = .42), and emotional impairment factor (EI; λ = .46) – had factor loadings above .50 (see Fig. 1). Average Variance Extracted (AVE) was .46 for exhaustion factor; .58 for mental distance; .67 for cognitive impairment; and .53 for emotional impairment factor.

6.1.2 Alternative factor models and sensitivity analysis

Considering alternative models, the one-factor model (one general factor – burnout) showed the poorest fit in terms of all examined global fit indices ($\chi 2$ (230) = 971.567, $p < .001$; CFI = .75; TLI = .72; RMSEA = .15, 90% CI [.14, .16]; SRMR = .14). The four correlated factors model ($\chi 2$ (224) = 385.404, $p < .001$; CFI = .95; TLI = .94; RMSEA = .07, 90% CI [.06, .08]; SRMR = .08), and the bifactor model ($\chi 2$ (207) = 312.437, $p < .001$; CFI = .96; TLI = .96; RMSEA = .06, 90% CI [.05, .07]; SRMR = .07) fit the data well (i.e., good to very good fit). Considering all examined global fit indices, the bifactor model fits the data best. Although global fit favours the four-factor and the bifactor model above the preferred second-order factor model, local fit, specifically standardized residuals, do not suggest a good fit of the four-factor model, nor the bifactor model (multiple residuals outside the – 2,58 + 2,56 range, largest value for the four-factor model = 6.02; for the bifactor model = 4.31).

To see whether our results are robust, considering the preferred second-order model, we used the MLR estimator for sensitivity analysis, as various authors warn that conventional benchmarks were developed for the maximum likelihood estimator and their application for alternative estimators is not warranted (e.g., Shi & Maydeu-Olivares, 2020). Some approximate fit indices were comparable, resulting in the same interpretation considering the benchmarks we have set above, with the exception of CFI and TLI. CFI = .90 now suggests a good rather than a very good fit; TLI = .88 now suggests not a good fit, rather than a good fit (for comparison of all the fit indices used, see Table 2).

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[4] Although our model interpretation did not rest on robust version of the fit indices, we report them here for interested reader (second-order factor model: CFI = .85; TLI = .83; RMSEA = .10, 90% CI [.08, .11];

robust indices for the alternative factor models are available at the OSF link provided earlier).

Table 1 Descriptive statistics of the study variables

	BUR	EXH	M.DIS	COG.I	EMO.I	SCH.B	NEG.A	POS.A	OPT	NEU	DEP
M	2.85	3.34	2.18	2.79	2.77	3.53	3.02	3.99	4.58	3.20	0.95
Mdn	2.85	3.38	2.20	2.80	2.80	3.61	3.00	4.00	4.67	3.33	0.86
SD	0.60	0.72	0.81	0.90	0.86	1.14	0.86	0.96	1.16	0.90	0.73
Min	1.26	1.38	1.00	1.00	1.00	1.00	1.17	1.25	1.00	1.17	0.00
Max	4.43	5.00	4.40	5.00	5.00	5.67	5.50	6.00	6.00	4.83	3.00

Note: BUR = BAT-burnout; EXH = exhaustion; M.DIS = mental distance; COG.I = cognitive impairment; EMO.I = emotional impairment; SCH.B = school burnout; NEG.A = negative affect; POS.A = positive affect; OPT = optimism; NEU = neuroticism; DEP = depression
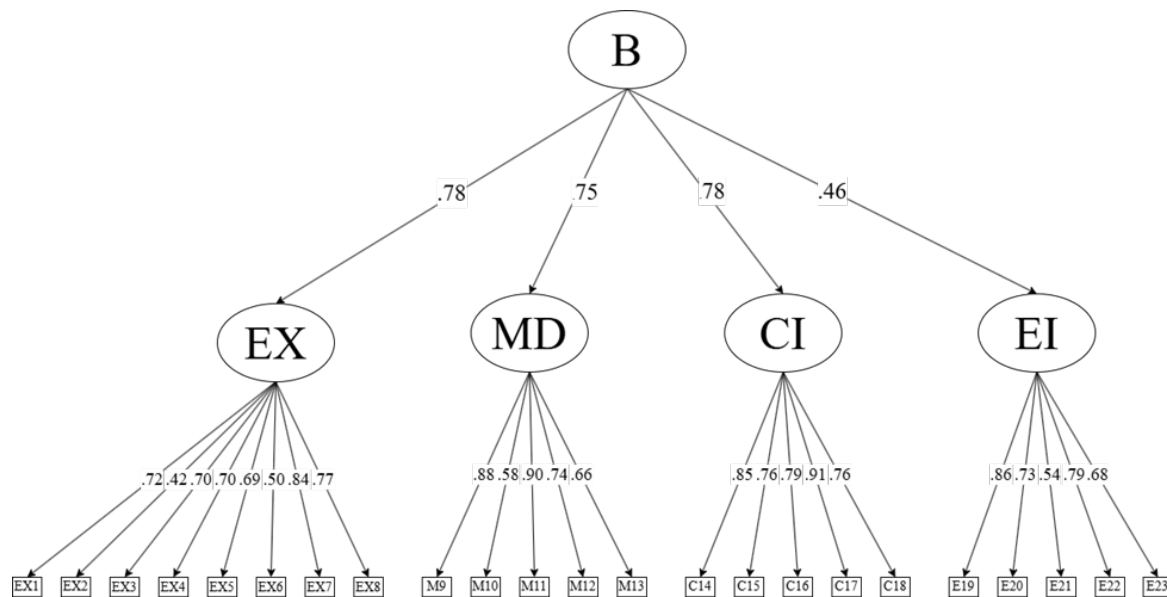
Figure 1 The second-order factor model of the BAT-C, and its factor loadings

Table 2 Comparison of fit indices using different estimation methods: WLSMV vs. MLR

	WLSMV	MLR	Discrepancy in interpretation
CFI	.95	.90	Yes
TLI	.94	.88	Yes
RMSEA	.07, 90% CI [.06, .08]	.06, 90% CI [.05, .08]	No
SRMR	.09	.09	No

6.2 Reliability analysis

We evaluated internal consistency based on McDonald's omega (ω) using the package semTools in R, but for the interested reader, we also provide values of Cronbach's alpha (α) for the subscales. Internal consistencies for all BAT-C subscales and scale as a whole were satisfactory: $\omega = .85$ ($\alpha = .82$) for emotional exhaustion; $\omega = .83$ ($\alpha = .81$) for mental distance; $\omega = .89$ ($\alpha = .87$) for cognitive impairment; $\omega = .82$ ($\alpha = .80$) for emotional impairment; and $\omega = 0.79$[5] for overall burnout.

Furthermore, in Jamovi, we conducted test-retest reliability, using data from the participants who completed questionnaire both times[6], with the time interval

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[5] Here we report omega L2 value calculated using reliability L2 function for estimating a reliability of a second-order factor.

[6] Note that for the test-retest reliability, the sample was smaller (N = 53), for the following reasons: (a) not all participants completed the questionnaire at both time points, or identification codes were missing in some instances; (b) the interval between T1 and T2 responses was either too short (i.e., less than two weeks, for example, in our study most T2 responses were recorded on 07.05.2024, which meant that only T1 responses dated 23.04.2024 or earlier could be used; although the actual latest included T1 response was from 22. 04. 2024) or too long (i.e., more than three weeks and closer to one month; in terms

of approximately two to three weeks between completions. Due to potential non-normal distribution, we based our test-retest reliability on Spearman's correlation (r_s; two-tailed), which had the following values: $r_s = .73$ ($p < .001$) for exhaustion; $r_s = .86$ ($p < .001$) for mental distance; $r_s = .72$ ($p < .001$) for cognitive impairment; $r_s = .59$ for emotional impairment; and $r_s = .77$ ($p < .001$) for burnout.

6.3 Convergent and concurrent validity

To examine convergent and concurrent validity, we again used r_s (one-tailed) due to potential non-normality of the data. We hypothesized burnout to be related to well-being. Specifically, we found that burnout, as measured by S-BAT-C, had a large[7] positive association with negative affect ($r_s = .37$, $p < .001$), and a very large negative association with positive affect ($r_s = -.40$, $p < .001$). That is, the level of burnout tends to increase with the increase in negative affect and decrease with the increase in positive affect. Further, as we hypothesized, we found a positive (very large) association of burnout and depressive symptoms ($r_s = .49$, $p < .001$). This suggests that an increase in burnout is associated with an increase in depressive symptoms.

Secondly, we hypothesized burnout to be associated with certain dispositional characteristics. Specifically, consistent with our hypothesis, we found a positive (very large) association of burnout and neuroticism ($r_s = .43$, $p < .001$). On the other hand, also consistent with our assumptions, the correlation between optimism and burnout was negative and of medium size ($r_s = -.26$, $p < .001$). Thus, burnout tends to increase with increasing neuroticism, while it decreases with increasing level of optimism.

Thirdly, we expected a positive association between BAT-burnout and burnout measured by a different instrument (concurrent validity). Specifically, we found a very large positive association between BAT-burnout and SBI-burnout ($r_s = .71$, $p < .001$) in line with our expectation.

7 Discussion

The main objective of the present research was to provide initial information on the psychometric properties of the Slovak student version of the BAT-C.

First, we wanted to examine the factor structure of the BAT-C using CFA. We hypothesized that the second-order factor model (four first-order factors – exhaustion, mental distance, cognitive impairment, and emotional impairment; and one second-order factor – burnout) would fit the data well. The Results were not fully consistent with this assumption, as some global and local fit indicators pointed to poor fit. For instance, Item 2, which represents the exhaustion factor, had a considerably smaller factor loading (.42) than other items representing the same factor. This may be potentially caused by the content of item 2, which is more focused on effort, while the other items representing the same factor are more concerned with exhaustion (a lack of energy). In principle, the feeling of *something requiring a lot of effort* and the feeling of *something being exhausting* could be disentangled. For example, some students may feel exhausted by their studies, but at the same time think – at least in principle – that (objectively) their studies do not require that much effort. Similarly, the emotional impairment factor had a smaller factor loading (.46) than the rest of the factors ($\geq .75$). One possible explanation is that, due to the lack of explicit reference to *students' studies* in the items of this subscale (all other items in all other subscales refer explicitly to studying), some participants may have forgotten that these items were meant to relate to their studies (i.e., they may have already forgot the initial instructions). Other studies, such as study of the authors of the BAT using Danish and Flemish sample of working population (Schaufeli, De Witte & Desart, 2020), and student versions of the BAT in other languages (e.g., Italian; Romano et al., 2022), have not encountered such issues of markedly smaller factor loading of emotional impairment factor; possibly because of explicit mention of work/school in all the items. Thus, reformulation of items of the emotional impairment subscale to include mention of the school/study context may be a sensible option for future research. However, it should also be noted that the threshold for acceptable factor loadings varies across the literature. Some authors consider values greater than .40 to be sufficient (see Cheung et al., 2024, for a brief review). According to this less stringent criterion, the factor loadings in our model can be considered acceptable. From alternative factor models, the bifactor model was the most superior and showed a good/very good global fit. This is in line with the literature as the bifactor model of the BAT tends to outperform the higher-order factor model (for a brief overview, see Schaufeli & De Witte, 2023). However, when examining local fit, the residuals were concerning. Additionally, model fit should not be the sole deciding factor for preferring certain models over others, as bifactor models may, in general, fit better, but at the same time lack theoretical rationale (Sellbom & Tellegen, 2019); which we believe applies in the case of the BAT model, but a full discussion is beyond the scope of the present study.

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of the actual largest time interval, participants who responded at T1 on 15.04.2024 and at T2 on 07.05.2024 were still included in the analysis).

[7] Note that we interpret effect sizes based on Funder and Ozer (2019) and similar to Gignac and Szodorai (2016).

Secondly, we focused on the convergent validity of the BAT-C. Results were in line with our hypotheses. The BAT-C was related to all selected variables in the hypothesized direction: positively to school burnout, depression, neuroticism, and negative affect, and negatively to positive affect and optimism. The correlation between BAT-burnout and SBI-burnout was very large, suggesting concurrent validity. Association of BAT-burnout and depressive symptoms was also very large (though of smaller magnitude compared to BAT and SBI), consistent with vast literature documenting their relationship (for a meta-analysis, see Koutsimani et al., 2019). Given that burnout is negative in nature, we also expected a positive association with negative affect (which is also suggested by previous research, e.g., Basińska et al., 2023) and an inverse association with positive affect (e.g., Kim et al., 2023), which we have found. Considering the growing emphasis on dispositional constructs that may pose as risk (or protective) factors for burnout development, we focused on neuroticism, as some research suggests it might predict burnout better than some work-related factors (Bianchi, 2018; Bianchi et al., 2021), and we found a very large positive association. On the other hand, optimism might work as a resource shielding students from burnout (Bakker & Mostert, 2024), and thus they may be inversely related, which is consistent with our results and other studies examining student burnout and optimism (Vizoso et al., 2019) or BAT-burnout and optimism in workers (Mazzetti et al., 2022). Future studies may also examine the correlation with study demands and resources, although we are not aware of validated scales for these variables in the Slovak language (which represents another opportunity for future research).

Thirdly, we were interested in the reliability of the BAT instrument. Whole scale, representing burnout, as well as all four individual subscales (representing exhaustion, mental distance, cognitive impairment, and emotional impairment), had satisfactory internal consistencies. We also examined test-retest reliability. Emotional impairment was the least reliable (r_s = .59), while mental distance was the most reliable (r_s = .86). Schaufeli, De Witte and Desart (2020) found higher (or comparable) reliability of emotional impairment after six months and even twelve months (stability coefficient r_t = .67 and .60, respectively). One possibility is that, as discussed above in regards to factor validity, items of the emotional impairment scale in our study did not refer explicitly to the study/school context, which may have an effect on stability over time. Perhaps, if items were explicitly constrained to experiences of emotional dysregulation in a school context, the reliability estimate would be higher. Also, more precise point estimates (and confidence intervals) could be obtained in larger samples. Thus, future research is needed before a more robust conclusion can be drawn.

The primary contribution of our study is the initial adaptation of an instrument, which, to our knowledge, is lacking in the Slovak environment – a validated burnout complaints measure for students. A valid and reliable measure of student burnout is important, as it may be of use not only to researchers but also to practitioners (e.g., school psychologists and clinicians), who may encounter students with various levels of burnout symptoms. Relatedly, norms and cut-off scores may be of interest in future research.

Our results point to good convergent validity and internal consistency of the Slovak version of the BAT-C for students. On the other hand, factor validity was not fully supported and may be a subject of future research, which, together with other limitations, we discuss below.

Given the limitations of our study, such as a relatively small sample size primarily consisting of psychology students, future research could focus on a more representative and larger sample of students to examine factor validity in such a context, while also examining whether results concerning convergent validity would replicate. Other variables – such as study/school engagement, study resources, and demands – may also be of interest to further examine the convergent validity of the student version of the BAT. Use of conventional benchmarks for global fit evaluation is another limit, as these were not developed for the estimator that was used in the present study. Furthermore, as the wording of the items of the emotional impairment subscale potentially represents another limit, future research may address this by reformulating items to include contextual cues, i.e., by emphasizing the school/study environment.

8 Conclusion

Given the lack of up-to-date, validated burnout measures for students in the Slovak language, the goal of the present study was to provide initial results regarding the adaptation of the Burnout Assessment Tool (core symptoms) for students to the Slovak language. Results are mixed; unlike the bifactor model (which showed good global but problematic local fit), the theoretically preferred second-order model of the BAT-C did not fit the data well. However, we found evidence of convergent validity and good internal consistency. Future research could, among other things, address shortcomings such as a smaller sample size and reliance on convenience sampling, and reassess factor structure to further establish whether BAT-C is a valid and appropriate instrument for researchers and practitioners alike.

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