Work 67 (2020) 671–688
DOI:10.3233/WOR-203317
IOS Press

Work analysis tool for higher education: Development and validation of the German student measure *WA-S Screening*

Cornelia Strecker[a,*], Thomas Höge[a], Mirjam Brenner[a], Alexandra Huber[b], Melanie Hausler[b] and Stefan Höfer[b]
[a]*Institute of Psychology, University of Innsbruck, Innsbruck, Austria*
[b]*Department of Medical Psychology, Medical University of Innsbruck, Innsbruck, Austria*

Received 25 February 2019
Accepted 29 October 2019

Abstract.
BACKGROUND: Work demands, resources and stressors affecting health, well-being and motivation also exist in the work of university students. There is a shortage of measures for analyzing work characteristics in this setting.
OBJECTIVE: This article addresses that shortage of measures and describes the development and the validation of the short *Work Analysis Measure for Students* (*WA-S Screening*).
METHODS: In study 1 ($N = 422$ students in Austria) the final version of the measure was developed based on analyzing the factor structure and psychometric properties of items and scales. Study 2 ($N = 333$ German-speaking students in Germany, Austria and Switzerland) was conducted for a cross validation and analyzing the criterion validity.
RESULTS: An eight-scale structure of the *WA-S Screening* was supported in study 1 and 2. The scales have shown to be significantly associated with burnout and work engagement in study 2.
CONCLUSIONS: The examinations indicate that the *WA-S Screening* is a short, reliable and valid instrument to identify critical, health-promoting work characteristics in the context of studying at university.

Keywords: Work characteristics, studying, university, burnout, work engagement

1. Introduction

Due to the transnational change to bachelor and master degrees in Europe (*Bologna process*) accompanied by a substantial change of demands, university students faced some new conditions for their study work in the last decade [1]. Examples relate to time constraints, higher frequency of exams, less scope for action or less training of "thinking-out-of-the-box skills" and less quality of teaching [1–3]. Meanwhile, the numbers of students in Europe (EU) were constantly increasing through the last decades, i.e. from about 17 million to over 20 million students between 2002 and 2012 [4], remaining at a high level between 19 and 20 million in total [5] and still slightly increasing in some countries like Germany [6]. In addition, students have become one of the groups being studied and associated with the burnout syndrome [7, 8]. International research of student burnout mostly focuses on medical students so far – in particular to find early causes of recurrent physician burnout [9, 10], which affects a society's health care system by risking a lower quality of patient care [11]. Studies examining (medical) students revealed a burnout

*Address for correspondence: Cornelia Strecker, MSc PhD, Institute of Psychology, University of Innsbruck, Innrain 52f, 6020 Innsbruck, Austria. Tel.: +43 512 507 56016; E-mail: cornelia.strecker@uibk.ac.at.

prevalence – mostly regarding the burnout dimension *exhaustion* – about 50 up to over 70 percent with having at least once burnout symptoms during medical school [12–16]. Robins, Roberts, and Sarris [17] showed, regarding exhaustion and cynicism in a longitudinal study with different health professions, that student burnout directly predicted future burnout in the workplace. Nearly all of these studies recommended to increase the awareness of the phenomenon "burnout" in university students and to implement interventions in the (medical) curriculum, such as educational and individual interventions to increase general student well-being [12]. However, they rarely suggested looking further at condition-related demands, stressors and resources that could cause or prevent student burnout as well as other mental health outcomes. We know that students – like employees – are able to experience burnout as well as work engagement. Consequently, an examination of work characteristics promoting or preventing those outcomes appears to be important for the identification of preventive measures within the study conditions. Work and Organizational Psychology provides well-established models and instruments for this purpose in the "normal" gainful work context. Apart from the individual perspective (e.g., capacity to deal with job demands), corresponding studies include an integrated organizational perspective, where working conditions as well as person-organization fit come to the fore [18, 19]. Work-role fit for example is not only associated with burnout and work engagement [20] but also with meaning in work [21]. In addition, many scales have been developed for describing and analyzing work characteristics in different occupational fields [e.g., *Six Areas of Worklife Scale (AWS)* [18], *Job Diagnostic Survey (JDS)* [22], *Stress Oriented Task Analysis (ISTA)* [23], *Screening for Work and Task Analysis (Screening TAA)* [24]. Most of them are capable to predict a certain risk of burnout and/or are related to other work-related aspects of mental health, motivation and well-being (e.g., work engagement) and thus can deliver important information for work design. In the last years, a few studies applied work-related models in the university student context, however without deeply arguing the adequacy for this special work context from a theoretical perspective [25, 26]. Therefore, there is a shortage of theory-driven condition-related instruments to examine the study context properly. So far, only one German student measure *(BARI-S)* [27] has been described, which analyzes three demands (time pressure, overtaxing demands, conflict between study and private life) and three resources (support by fellow students, support by lecturers, potential for qualification), applying the *Job Demands-Resources (JD-R)* model to university students [28]. The authors of *BARI-S* [27] compared some aspects of student and employment working conditions and concluded that the *JD-R* model could be applied successfully in a student sample. However, there are further developments of the *JD-R* model [29] and the question of the comparability of "employment" versus "study work" regarding basic work characteristics has not been comprehensively discussed on a theoretically grounded level.

Thus, our aim was to go further to existing theories and concepts of work characteristics and their positive or negative effects on the individual, developing a condition-related instrument for measuring work characteristics of students that distinguishes not only between demands and resources (like the *JD-R*) but between learning demands, stressors and resources [29]. In the following, we first elaborate the basic assumption: The comparability of employment versus study work regarding basic work characteristics. Then, we illuminate student-relevant theories and research findings about working conditions predicting burnout and other health and well-being variables. Subsequently, we describe the development and the validation of a measure for analyzing work characteristics of students in German speaking countries.

1.1. Do students at university "work"?

Is the work in employment structurally comparable to the activities a student is involved in for her/his studies at university? The *Online Oxford Dictionary* [30] defines work as (1) an "activity involving mental or physical effort done in order to achieve a purpose or result", (2) "a task or tasks to be undertaken" and (3) "a thing or things done or made; the result of an action". Work therefore consists of many targeted actions "one has to do in order to earn a living or to achieve a particular aim". In the last citation, "work" refers to typical labor in employment as well as in a broader formulation ("achieving an aim") "work" possibly includes e.g. domestic work, working as parents, voluntary work or study work. Both cases refer to the same work construct, therefore the answer can be yes – students *work* at university for the aims of obtaining professional skills and a university degree. However, at this stage it is still unclear if there are critical differences or not in terms of measureable work characteristics. The fundamental perspective of

the *Action Regulation Theory* [31, 32] may provide a framework for answering this question. According to the *Action Regulation Theory*, goal-oriented actions regulated by the individual are the core of work, regardless whether these actions are paid or unpaid [33]. In employment, the goals of actions are usually redefined from formal or informal job descriptions for the specific position within the enterprise or organization and formulated tasks by supervisors. The situation in university studies is practically the same: Students have to show goal-oriented actions (e.g., preparing and presenting a paper, learning for an exam, conducting an experiment or fulfilling tasks in the laboratory). The goals of such actions are also redefined from institutionally specified higher-level goals described in curricula or formulated by professors and lecturers. Both, the employees and the students, have to regulate their actions mentally to achieve their redefined goals. Thus, the psychological structure of activities in employment and studying at a university appears widely similar. The only difference is that the final "object" or "product" of goal-oriented actions in employment is usually located outside the working person, whereas the student finally works on her- or himself by developing her or his own knowledge and competences. However, also the student has to accomplish external "products", like exams, essays or presentations, to achieve defined sub goals. Finally, the highly competent student – developed by an institution of higher education – serves the society as a whole [34]. Looking at the illustrated basic psychological similarities between activities in employment and studying, we propose that there are parallels of relevant work characteristics affecting the psychological regulation and the probability of positive (e.g., work engagement) or negative (e.g., burnout) consequences for the individual.

1.2. Theories and concepts of work characteristics affecting mental health and well-being

Addressing the mentioned concepts of work characteristics beyond the *JD-R*, this section aims to provide more insights for the evidence of the proposed comparability of employment and study work.

According to the above-mentioned *Action Regulation Theory*, work and task characteristics can be categorized and evaluated based on their role for the regulation of goal-oriented actions. Frese and Zapf [31] distinguished between (1) regulation requirements (e.g., task complexity), (2) helpful resources for this regulation (e.g., decision latitude) and (3) conditions causing regulation problems (e.g., quantitative work overload, external interruptions). Against this theoretical background, elicited regulation problems are the "defining feature" for classifying a work characteristic as "stressor" impairing health and well-being and causing stress reactions like burnout. Considering the conditions of work – no matter if labor or study work – these basic processes should comprehensively be valid in every kind of goal-oriented mental or physical activity [31]. Equivalent effects apply to other classifications of work characteristics. For example, the well-established *JD-R* model [28] distinguishes between (1) demands and (2) resources. In the *JD-R* model, demands – "associated with certain physiological and/or psychological costs" [28 p. 312] – are conceptualized as potential stressors. If not buffered, they lead to strain and subsequently to health impairment and burnout, among others. Resources refer to "*physical, psychological, social, or organizational aspects of the job that are either/or: Functional in achieving work goals; Reduce job demands and the associated physiological and psychological costs; Stimulate personal growth, learning, and development*" [28 p. 312]. According to the *JD-R* model, resources can increase motivation (e.g., work engagement) and subsequently may lead to better health, as they are able to buffer the costs of health impairing demands [28]. Nevertheless, the (direct) effects in each case between resources affecting work engagement (positive connotation) and demands affecting burnout (negative connotation) seem to be the strongest [35]. Since empirical results have shown that job demands do not always impair performance and job satisfaction [36], LePine, Podsakoff and LePine [37] distinguished between *challenge* and *hindrance* stressors. In their definition, challenge stressors are able to elicit learning and personal growth, whereas hindrance stressors threaten regulation capacities and health. Whether a stressor functions as challenge or hindrance depends on subjective appraisal processes [38]. In this case, the term *stressor* is equivalent to the term *demand* because of their "cost-character" as they are conceptualized in the *JD-R* model [39]. In a recent paper, Glaser et al. [29] theoretically integrated the classification of work characteristics based on the *Action Regulation Theory*, *JD-R* model, and the challenge-hindrance-demands distinction into one *Model of Learning Demands, Work-related Resources, and Stressors*. This is the specific model we refer to in our study. Learning demands (e.g., cognitive demands) in this case

correspond to challenge stressors/demands, show overlap with regulation requirements and have a positive, motivational and developing character. Resources (e.g., autonomy) play a similar but rather supportive role in this model in order to enhance motivation, well-being, engagement and performance. The stressors (e.g., work overload) on the other hand clearly correspond to hindrance stressors and regulation problems. They can directly lead to irritation, mental/physical health problems and absenteeism, possibly being buffered by the impact of resources. This model should consequently be a standard reference, as it integrates many relevant aspects from the research field of work characteristics and extends the well-established *JD-R*.

Regardless of which taxonomy of work characteristics is referred to, none proposes basic elements or mechanisms restricted to work in employment relationships (e.g., receiving a salary) and therefore in principle they have to be valid in students' work. As it is evident that employment and study work are both "work" with the same underlying action regulation requirements (see 1.1), established concepts of *work analysis* from the field of employment should also be applicable in the study context and contribute to a better understanding and prediction of students' work-related health and well-being.

1.3. Present research in the European university context

There are several studies analyzing potential negative (mental) health effects of study conditions confirming the conclusions above [2]. In this regard, work characteristics like (perceived) workload, low social support, information problems or a conflict between study and private life were often associated with burnout [40, 41]. The studies refer in their terms and theories to the *Demand-Control Model* (*DCM*) [42] or the *JD-R* model [27, 17]. Wörfel et al. [2] showed an existing relation of increasing demands at university and physical complaints. Concerning burnout, Gusy, Lohmann, and Drewes [40] found the highest burnout rates in German students, compared to student groups from the Netherlands and Spain. Organizational factors were examined and authors recommended more autonomy as well as better support by supervisors in order to create healthier study conditions [43]. Bachmann, Berta, Eggli, and Hornung [44] showed that structured and transparent study conditions lead to lower strain at universities. Also, in connection with organizational conditions, the longitudinal results of Dahlin and Runeson [45] showed that it is workload that predicts high burnout of medical students. Olwage and Mostert [7] identified inconsistent information as predictor for cynicism and Robins, Robert, and Sarris [17] a combination of high job demands (i.e. stressors: workload, lack of organizational structure etc.) and low job resources (feedback, skill variety, autonomy). Gusy et al. [27] identified social support by colleagues and teachers as well as the anticipated potential for qualification as significantly related to students' work engagement. Work-family conflict and job demands were the most important predictors of psychological distress and risk of a psychiatric disorder in PhD students in Flanders [46]. Potentially positive learning demands according to the demand definition of the Action-Regulation Theory have not been analyzed in the study context so far.

2. Adaptation of the *Screening TAA* and pre-test

2.1. The TAA measure

To develop a screening measure of relevant work characteristics in the study setting, we decided to adapt a well-established work analysis screening measure from the field of employment: The *Screening for Work and Task Analysis* (*Screening TAA*) [47] is a validated measure, which distinguishes between learning demands, resources and stressors in different kinds of work settings (universal screening). It arose from the self-report version of the *Activity and Work Analysis in Hospitals* (*TAA-KH-S*) [24], being originally based on the *Action Regulation Theory* and the concept of the *completeness of actions* [31, 48, 49]. The newer and universal *Screening TAA* scales also fit to the state-of-the-art *Model of Learning Demands, Work-related Resources, and Stressors* by Glaser and colleagues [29], both theoretically and practically [50]. The *Screening TAA* consists of 21 subscales (80 items) representing five domains: *Learning demands* (e.g., cognitive demands), *task-related and social resources* (e.g., supervisor feedback), *organizational and social stressors* (e.g., job insecurity), *task-related stressors* (e.g., work overload) and *physical stressors* (e.g., physical workload). The instrument or selected subscales has/have been applied to many studies in different work settings proving good psychometric properties as well as good prediction capabilities [29, 47, 51–54]: Stressors and low work-related resources

predicted e.g. health impairment and emotional exhaustion, whereas learning demands and work-related resources predicted e.g. work engagement, intrinsic motivation and (creative) performance.

2.2. Adaptation procedure and pre-test

To develop a sound and economic measure focusing on the central aspects of work characteristics in the context of studying at university, the following steps were taken.

(1) First, we began to adapt and shorten the *Screening TAA* [47] in detail for study contexts, with permission of and in cooperation with one of the original authors of the measure. We reduced the pool of the comprehensive instrument of 80 items/21 subscales to 40 items/10 subscales further on representing learning demands, resources and stressors as intended by the *Model of Learning Demands, Work-related Resources, and Stressors* [29]. Obviously inappropriate scales for the study context were removed after consensual group discussions between the authors of this article and in consultation with the researchers involved in the development of the original *Screening TAA and TAA-KH-S*. For example: *Unfavorable Work Environment* (e.g., noise, lighting, climatic conditions) and *Physical Workload* (e.g., long distances, hefting) due to not (strictly) being mental aspects; *Quality Impairments* (e.g. accumulation of errors due to unfavorable conditions), *Work Interruptions* (e.g., by calls, missing work equipment), *Task Predictability* (e.g., knowing the chronological sequences of the tasks), *Skill Applicability* (e.g., applicability of practical skills learnt) and five other subscales due to focusing too much on a fixed office/employment setting and permanent job-inherent tasks. For adaptation process including all previous subscales, see also Table A.1. In every item of the remaining subscales, specific employment-related wording (e.g., concerning the location "at work") was reformulated (e.g., into "in my studies").
(2) To ensure content validity of the shortened and adapted measure (version 1), we conducted a cognitive debriefing, which is a cognitive questionnaire pre-testing method, where target group representatives evaluate a new (adapted/translated) measure [55]. Therefore, we first generally discussed the main topics (subscales) of the *Screening TAA* with three students via semi-structured interviews regarding their incidence and spontaneous associations in the students' context. Secondly, the students were asked to verbally evaluate the items of the adapted measure regarding comprehensibility and appropriateness for the university context in general.
(3) Based on the qualitative pre-test, we added a few content-related supplements by adaptation of wording in existing items and adding five new items, which were named to be necessary in study context (e.g., sufficient self-regulation capability in the subscale *Skill Adequacy*). This slightly adapted version (version 2) was then tested in a quantitative online pre-test survey ($N = 125$).
(4) The quantitative pre-test survey led to a removal of another five items including one subscale (*Task Transparency*) due to poor reliability (e.g., *Omega total* far below recommended cut-off $\omega t > .70$ and item factor loadings $< .50$).
(5) The final version for study 1 (version 3) consisted of 40 items and nine subscales.

3. Study 1

The purpose of study 1 was to examine the factorial construct validity and the psychometric properties of the *Work Analysis Measure for Students* (*WA-S Screening*), analyzed in the pre-tests.

Hypothesis 1: We hypothesize a nine-factor-structure representing the nine subscales identified in the adaptation process and the pre-tests.

3.1. Methods

3.1.1. Participants and procedure

Cross-sectional data were collected in a university town in Austria addressing university students from a wide range of disciplines at one university. The link to the survey was sent out by mail to all enrolled students at this university, which did not explicitly deregister from a mailing list of academic surveys ($N > 10{,}000$). An additional incentive was a raffle, in total 50,- €worth of money for five prizewinners. $N = 422$ students of 71 different studies fully completed the questionnaire. 67 % of the students were female. The age ranged from 18 to 50 years ($M = 23.5$;

SD = 4.6), with 94 % ranging between 18 and 30 years.

3.1.2. Measures

We tested the adapted *WA-S Screening* (version 3) to assess the study work characteristics as described before in section 2. Nine subscales with 40 items were applied on a 5-point Likert-scale (1 = *no, not at all* to 5 = *yes, exactly*). Missing-values were allowed. The nine subscales were: (1) *Skill Adequacy* (e.g., "My self-regulation skills correspond with the demands of my study"), (2) *Skill Acquisition* (e.g., "My studies offer opportunity to expand my theoretical knowledge"), (3) *Cognitive Demands* (e.g., "My studies require to continually weigh various topics and to set priorities before I can get things done"), (4) *Lecturer Feedback* (e.g., "My lecturers provide clear feedback on my study performance"), (5) *Autonomy* (e.g., "I am free to determine how I do my work"), (6) *Participation* (e.g., "In these studies, one can participate in decisions on process and organization of courses"), (7) *Organizational Stressors* (e.g., "In these studies, one is frequently confronted with ambiguous information or rumors"), (8) *Work Overload* (e.g., "I often have too much work to do at once") and (9) *Information Problems* (e.g., "Information needed for my studies is frequently not available").

3.1.3. Statistical analysis

The psychometric scale properties were analyzed using SPSS 21.0.0.2. For assessing reliability/internal consistency of scales, we calculated Omega total as state-of-the-art measure instead of Cronbach's alpha [56]. To confirm the nine-factor structure (construct validity regarding the dimensions) of the *WA-S Screening* we first conducted a confirmatory factor analysis (CFA) using the maximum likelihood algorithm (Amos 21.0.0). The theoretical foundation of the adapted measure, the given sample size (>300) [57], and the level of measurement indicated that our sample properties met the requirements for performing a CFA. Further requirements (lack of collinearity, multivariate normal distribution) [57] were tested. All models included the manifest variables as item scores (and not as sum scores or item parcels) and correlations among the latent variables (subscales).

The following conventional fit indices were calculated to assess the model fit according to the cut-offs [58, 59]: For comparative fit index (CFI), values above .90 are satisfactory, around .95 they are good. A root mean square error of approximation (RMSEA) of .06 or below and a standardized root mean square residual (SRMR) of .08 and below indicate good fit.

3.2. Results

3.2.1. Psychometric properties

Analyses showed that critical collinearity was not given as the item-inter-correlations never exceeded $r > .80$, which allows performing a CFA. The *Mardia test* for multivariate normal distribution revealed adequate kurtosis for all items (<7) and still high multivariate kurtosis (182.87; $z = 32.42$). Therefore, we first corrected the *p*-Value for the χ^2-test with *Bollen-Stine-Bootstrapping* ($N = 1000$). Internal consistencies (*Omega total*, ωt) of eight of the nine subscales ranged from $\omega t = .70$ to $\omega t = .89$, which displays sufficient reliability. The subscale *Skill Acquisition* showed a questionable internal consistency of $\omega t = 63$. Furthermore, we recorded a small number of 23 missing values out of 16,880 answers to be indicated (40 items × 422 participants).

3.2.2. Construct validity

The first CFA (Model 1, nine factors, 40 items; *WA-S Screening* version 3; see Table 1) revealed an insufficient model fit [$\chi^2(704) = 1918.45$, $p < .001$; $\chi^2/df = 2.73$, RMSEA = .064 (CI90: .061–.067), SRMR = .081, CFI = .838]. We eliminated one item each of the subscales *Cognitive Demands*, *Skill Adequacy* and *Participation* due to poor factor loadings (cut-off <.50; CFA). To identify potential double and multiple loadings, we additionally performed an exploratory factor analysis (EFA; Kaiser's eigenvalue criterion > 1). This led to the elimination of four items in the subscale *Autonomy* due to double or multiple loadings (EFA). Furthermore, both the factor loadings and the internal consistency ($\omega t = 63$) of the subscale *Skill Acquisition* were poor. Also, the content validity and value of this scale appeared more and more questionable as the characterization of studying at university itself is defined by skill acquisition on a global level and no acquired skill beyond the study tasks seems to be typical of this specific work anymore. Thus, statistical and content arguments justified removing the subscale *Skill Acquisition* as a whole. Afterwards a second model of eight subscales and 28 items remained (Model 2, eight factors– 28 items: *WA-S Screening* version 4, see Table 2). The CFA for Model 2 confirmed a good model fit [$\chi^2(322) = 664.9$, $p < .001$; $\chi^2/df = 2.06$, RMSEA = .050 (CI90: .045 –.056), SRMR = .050, CFI = .935]. Concerning the internal consistencies, only the sub-

scale *Skill Adequacy* ($\omega t = .67$) did not meet the minimum standards perfectly. Due to the fact that this subscale assessing the adequacy of theoretical, social and practical skills is more formative than reflexive [60], a comparatively lower internal consistency can be justified. Moreover, we assessed an alternative four-factor model (Model 3), which integrates second order factors of resources and stressors including three subscales each, keeping the two subscales *Skill Adequacy* and *Cognitive Demands* as separate factors (see Table 1). According to the theory, this was the most reasonable way to group the eight subscales left. Three of the subscales each are clearly defined as resources and stressors, respectively [24]. *Cognitive Demands* are defined as so-called learning demands [29], but strictly speaking, *Skill Adequacy* is not a demand within the work activities but an important conditional qualification aspect [24]. Therefore, we kept the two scales separately.

The model fit was still satisfactory but showed less model fit than for Model 2 [$\chi^2(338) = 756.98$, $p < .001$; $\chi^2/df = 2.24$, RMSEA = .054 (CI90: .049 –.059), SRMR = .069, CFI = .921] (see Table 1).

Table 2 displays the intercorrelations of the eight final subscales in Model 2 and 3 (both version 4). 24 of the 28 correlations are significant at least at the significance level of 5% (2-tailed) and lead into the expected direction. For example, the three resources were significantly intercorrelated ranging from $r = .16$ to.41, the stressors from $r = .48$ to.64, and all stressors were negatively intercorrelated with all resources.

In sum, results of study 1 revealed good psychometric properties for the *WA-S Screening* (version 4). However, the model fit of the original nine-factor model (Model 1) and some factor loadings did not meet the necessary criteria. Therefore, our initial *Hypothesis 1* had to be rejected. After excluding in total twelve items due to poor and multiple factor loadings, the model fit improved clearly (Model 2) without losing essential content. 28 items and eight reliable subscales remained.

4. Study 2

For a cross-validation of the results of study 1 and analyzing the relations of the subscales of the *WA-S Screening* with the three dimensions of burnout (emotional exhaustion, cynicism, inefficacy) and work engagement (criterion validity), we conducted a second, transnational study including various universities in Germany, Austria and Switzerland. Recapitulating mentioned theories and studies in

Table 1
Fit indices for models 1, 2 and 3 | study 1

Study 1 ($N = 422$)				Fit indices					
	Version	Factors	Items	χ^2	df	χ^2/df	CFI	RMSEA [CI]	SRMR
Model 1	V3	9	40	1918.5	704	2.73	.838	.064 [.061 –.067]	.081
Model 2	V4	8	28	664.9	322	2.06	.935	.050 [.045 –.056]	.050
Model 3*	V4	4	28	756.98	338	2.24	.921	.054 [.049 –.059]	.069

Note. χ^2 = chi-square discrepancy; *df* = degrees of freedom; χ^2/df = relative chi-square; CFI = comparative fit index; SRMR = standardized root mean square residual; RMSEA = root mean square error of approximation; CI = 90% confidence interval for population RMSEA; * = (alternative model: 2nd order).

Table 2
Intercorrelations of the *WA-S Screening* subscales (version 4) | study 1

Scale		Variables indicated by numbers						
		1	2	3	4	5	6	7
1	Skill Adequacy	1						
2	Cognitive Demands	–.03						
3	Lecturer Feedback	.22**	.12*					
4	Autonomy	.19**	–.07	.16**				
5	Participation	.16**	–.04	.41**	.18**			
6	Organizational Stressors	–.17**	.12*	–.24**	–.24**	–.11*		
7	Work Overload	–.24**	.33**	–.23**	–.22**	–.20**	.49**	
8	Information Problems	–.24**	.11*	–.23**	–.11*	–.07	.64**	.48**

Note. *$p < .05$ (2-tailed), **$p < .01$ (2-tailed); $N = 422$.

employment and study setting, resources at work are positively related to work engagement and negatively to the three burnout dimensions emotional exhaustion, cynicism and inefficacy [28, 29, 31, 40, 43]. Skill adequacy – in terms of enabling the applicability of personal skills and therefore the fit between a person's skills and the work tasks – is a basic work characteristic of an organization affecting action regulation requirements. In accordance with the theory, it is also positively related to work engagement and negatively to the three burnout dimensions [20, 31]. Cognitive demands are a prototype of challenge demands [37] and are therefore expected to be positively related to work engagement and negatively to the three burnout dimensions [29]. Stressors at work are negatively related to work engagement and positively related to the three burnout dimensions [2, 7, 28, 31, 45].

According to stated findings and theories, we set the following hypotheses in study 2:

Hypothesis 1: We hypothesize an eight-factor-structure of the *WA-S Screening* representing the eight subscales identified in study 1.
Hypothesis 2: Resources measured by the *WA-S Screening* (*Autonomy, Lecturer Feedback and Participation*) are positively related to work engagement and negatively related to burnout (emotional exhaustion, cynicism and inefficacy).
Hypothesis 3: Skill Adequacy measured by the *WA-S Screening* is positively related to work engagement and negatively related to burnout (emotional exhaustion, cynicism and inefficacy).
Hypothesis 4: Cognitive Demands measured by the *WA-S Screening* – as learning demands – are positively related to work engagement and negatively related to burnout (emotional exhaustion, cynicism and inefficacy).
Hypothesis 5: Stressors measured by the *WA-S Screening* (*Organizational Stressors, Work Overload and Information Problems*) are negatively related to work engagement, and positively related to burnout (emotional exhaustion, cynicism and inefficacy).

4.1. Methods

4.1.1. Participants and procedure

The cross-sectional data for study 2 were collected from 19 different universities in Germany ($N = 11$), Switzerland ($N = 2$) and Austria ($N = 6$) via online survey ($N = 333$ students). The link to the survey had been sent out by mail to available distributors at the universities and had been posted in social networks. A special incentive was the offer for individual feedback, for example on their current burnout risk status. Students of all stages, from the first to the seventh year of study, were represented from a broad range of academic disciplines. The two largest groups were psychology students ($N = 118$) and medical university students ($N = 172$). 71 % were female and the age ranged from 18 to 52 years ($M = 24.3$; $SD = 6.4$). Like in study 1, the majority of students (89%) ranged between 18 and 30 years. The psychology students were the "oldest" group (32%>30 years) and the medical students appeared the "youngest" group (0%>30 years).

4.1.2. Measures

In order to assess the student work characteristics, we applied the final 28-items *WA-S Screening* version as described before (version 4). Responses had to be given on a 5-point Likert-scale (1 = *no, not at all*; 5 = *yes, exactly*). This time, no missing-values were allowed (due to the extremely small number of missing-values in study 1). For analyzing criterion validity, we assessed burnout and work engagement with two widely established valid and reliable measures. *Burnout* with its three dimensions *Emotional Exhaustion* (*EE*), *Cynicism* (*CY*) and reversed *Efficacy* (*Inefficacy; IE*) was measured by the 15-item German Version of the *Maslach Burnout Inventory-Student Scale* (*MBI-SS-GV*) by Gumz, Erices, Brähler, and Zenger [61] originally by Schaufeli et al. [8]. Item-examples for the subscales are "I feel emotionally drained from my studies" (*EE*), "I doubt the significance of my studies" (*CY*) and "I feel stimulated when I achieve my study goals" (*IE - reverse*). Responses had to be given on a 7-point frequency scale (0 = *never*; 6 = *daily*). The three scales showed acceptable and good reliability in our study (EE: $\omega t = .87$, CY: $\omega t = .88$ and IE: $\omega t = .76$). *Work engagement* was measured with the German 9-item student-version of the *Utrecht Work Engagement Scale* (*UWES*) [62], including the three dimensions *vigor*, *dedication* and *absorption*. Following the recommendations for the short 9-item version, one total score was used as indicator of work engagement without distinguishing the three dimensions [63]. An item example is "When I'm doing my work as a student, I feel bursting with energy". Responses had to be given on a 7-point frequency scale (0 = *never*; 6 = *always/every day*). The scale showed a good reliability in our study ($\omega t = .93$).

4.1.3. Statistical analyses

To confirm the eight-factor structure (construct/cross validity) of the *WA-S Screening*, we conducted a confirmatory factor analysis (CFA) using maximum likelihood estimation in Amos 21.0.0. All models included the manifest variables as item scores (and not as sum scores or item parcels) and correlations among the latent variables (subscales). Item parameters for both studies were analyzed via SPSS 21.0. Configural invariance regarding the version 4 measurement models in both studies was tested by comparing the different measurement models in Amos 21.0.0. Metric invariance was tested by stepwise placing equality constraints on factor loadings [64]. This process further assesses the psychometric validity of the instrument.

To assess criterion validity, we inspected the bivariate correlations and performed multiple linear regression analyses using SPSS 21.0, with the three *Burnout* dimensions and *Work Engagement* as dependent variables.

4.2. Results

4.2.1. Cross-validation (construct validity)

The CFA of the model with the best psychometric properties in study 1 (Model 2; eight factors, 28 items; version 4; see Table 1) revealed satisfactory standardized factor loadings from .57 to .92 and a very good model fit [$\chi^2(322) = 600.2$, $p < .000$; $\chi^2/df = 1.86$, RMSEA = .048 (CI90: .042 –.053), SRMR = .049, CFI = .939]. The second-order factor model (Model 3) was slightly poorer but also sufficient [$\chi^2(338)=710.22$, $p < .000$; $\chi^2/df = 2.13$, RMSEA = .054 (CI90: .048–.059), SRMR = .066, CFI = .919]. Internal consistencies for seven scales were acceptable to good ($\omega t = .75$ to $\omega t = .88$). Like in study 1 the subscale *Skill Adequacy* showed a lower internal consistency ($\omega t = .66$). Due to its formative scale-properties (see study 1), again the comparative lower reliability can be justified. Cross-validation for Model 2 and 3 was therefore confirmed. Means, standard deviations, internal consistencies and correlations are depicted in Table 5. Analyses of scale-scores between the largest groups of study (medicine, psychology and others) showed that medical students reported comparatively high scores on *Cognitive Demands* ($M = 4.11$; $SD = .72$) and low scores on *Participation* ($M = 1.77$; $SD = .90$). Whereas psychology-students scored high on *Skill Adequacy* ($M = 4.19$; $SD = .61$) and lowest on the three stressors ($M = 2.23 – 2.66$; $SD = .81 –.92$).

4.2.2. Analyses of invariance

The analyses of configural invariance including both studies (measurement model version 4) again confirmed a very good model fit [$\chi^2(644)=1216.4$, $p < .000$; $\chi^2/df = 1.89$, RMSEA = .034 (CI90: .031–.037), SRMR = .050, CFI = .938].

The analyses of metric invariance revealed an essentially tau-equivalent measure (version 4) in comparing study 1 and 2 (see Table 3). Stepwise invariance tests of the essentially tau-equivalent model compared to the congeneric model revealed non-significant for the subscales *Skill Adequacy, Cognitive Demands, Autonomy, Participation, Organizational Stressors, Work Overload* and *Information Problems* as well as for the whole instrument. The subscale *Lecturer Feedback* resulted partial essentially tau-equivalent as two of three items revealed invariant. As (at least partial) metric invariance has to be established for a test to be meaningful [64] – which

Table 3
Invariance analyses | study 1 vs. study 2 | female vs. male | 3 subject groups

	Study 1 vs. study 2			Female vs. male			Different subjects[a]		
Essentially tau-equivalent model	*df*	*CMIN*	*p*	*df*	*CMIN*	*p*	*df*	*CMIN*	*p*
Skill Adequacy	3	2.488	.48	3	2.894	.41	6	6.420	.38
Cognitive Demands	2	2.473	.29	2	.473	.79	4	2.111	.71
Lecturer Feedback	2	7.857	.02*	2	2.075	.35	4	23.832	.00**
Autonomy	3	3.332	.34	3	0.748	.86	6	8.808	.18
Participation	1	2.004	.16	1	0.168	.68	2	0.196	.91
Organizational Stressors	4	1.395	.84	4	1.567	.81	8	2.254	.97
Work Overload	3	3.344	.34	3	4.246	.24	6	3.82	.70
Information Problems	2	.643	.72	2	0.333	.85	4	1.522	.82
WA-S Screening (version 4)	20	23.645	.26	20	12.62	.89	40	44.932	.27

Note. * $p < .05$; ** $p < .001$; [a] psychology - vs. medicine - vs. other students.

Table 4
Item parameters | study 1 & 2 | version 4

Item	*M*	*SD*	Kurtosis	Skewness	r_{it}
Skill Adequacy					
1	3.65	1.07	–.33	–.54	.43
2	4.20	0.85	.95	–1.04	.48
3	4.07	0.92	.38	–.89	.46
4	3.74	1.02	–.14	–.61	.45
Cognitive Demands					
5	3.78	0.98	–.32	–.56	.57
6	3.69	1.07	–.78	–.38	.72
7	3.59	1.04	–.58	–.39	.69
Lecturer Feedback					
8	2.76	1.08	–.55	.22	.71
9	2.26	1.00	–.16	.53	.77
10	2.29	1.06	–.39	.52	.72
Autonomy					
11	3.61	1.06	–.25	–.55	.69
12	3.77	1.02	.13	–.72	.72
13	3.54	1.10	–.36	–.50	.63
14	2.92	1.12	–.69	.13	.62
Participation					
15	2.16	0.98	–.39	.52	.74
16	2.01	0.93	–.10	.67	.74
Organizational Stressors					
17	3.05	1.24	–1.00	–.06	.58
18	2.59	1.17	–.63	.45	.58
19	2.76	1.13	–.61	.39	.60
20	2.92	1.28	–1.07	.14	.57
21	2.83	1.15	–.80	.23	.66
Work Overload					
22	2.56	1.12	–.52	.46	.64
23	3.43	1.15	–.68	–.37	.74
24	3.30	1.17	–.82	–.18	.72
25	2.99	1.18	–.83	.17	.73
Information Problems					
26	2.62	1.12	–.58	.41	.77
27	2.54	1.15	–.64	.43	.81
28	2.66	1.12	–.60	.34	.77

Note. $N = 755$; Min-max for all items: 1–5; $r_{it;}$ corrected item-total correlation.

was confirmed – another important indicator for psychometric validity of the instrument is given.

Due to the satisfying invariance results, the item parameters (Table 4) of the *WA-S Screening* in study 1 and 2 were analyzed at once ($N = 755$).

Accordingly, also additional invariance analyses regarding gender and the three largest groups of studies (see above) were computed in one total set of available data (study 1 and 2). These analyses confirmed an essentially tau-equivalent measure with partial essentially tau-equivalent *Lecturer Feedback* in comparing the three groups and full metric invariance comparing females and males (Table 3).

4.2.3. Criterion validity

The correlation matrix revealed expected relations between the eight subscales and the criteria (Table 5). Nearly all of the 32 correlations were significant ($p < .05$) and appeared in the expected directions. The strongest relations were found between *Skill Adequacy* and two criteria of *Burnout* (*EE*: $r = –.41$; *IE:* $r = –.59$) as well as *Work Engagement* ($r = .34$) and between the stressors and the *Burnout* dimensions (e.g., *Organizational Stressors* and *EE/CY*: $r = .31$, *Work Overload* and *EE*: $r = .59$, *Work Overload* and *IE*: $r = .35$, *Information Problems* and *EE*: $r = .34$).

For a multivariate perspective, four structural equation model (SEM) analyses were performed with the eight subscales of the *WA-S Screening* as predictors and *Work Engagement* as well as the three *Burnout* dimensions as criteria (Table 6). Model fits were acceptable including the outcome *Work Engagement* [$\chi^2(593) = 1392.8$, $p < .000$; $\chi^2/df = 2.35$, RMSEA = .064 (CI90: .059–.068), CFI = .876]. The fit indices including the *Burnout* dimensions revealed good results [χ^2 (428–491) = 847.2–955.0, $p < .000$; $\chi^2/df = 1.94$–1.98, RMSEA = .053–.056 (CI90: .048 –.061), CFI = .895 –.916].

The results of the SEM analyses showed that *Skill Adequacy* was the work characteristic, that was significantly associated with all four outcomes in the expected ways (β= |.25|–|84.|). Further high path coefficients (in expected directions) were found for *Cognitive Demands* on *Work Engagement* (+), *CY* (-) and *IE* (-), for *Work Overload* on *EE* (+) and *Organizational Stressors* on *CY* (+). For both *Burnout* and *Work Engagement*, it is critical that the stressor *Information Problems* (in each case) showed no significant effect on the outcomes when tested in the models (see Table 6).

4.3. Summary

Study 2 confirmed the factor structure and good psychometric scale properties of the *WA-S Screening*. Invariance analyses between study 1 and 2, different groups of studies and gender confirmed (partial) metric invariance. Like in study 1 the eight-factor model (Model 2) as well as the four-factor model including two second order factors for resources and stressors (Model 3) showed good model fits.

Although both models were confirmed it is recommended to score the *WA-S Screening* on the level of the eight subscales as their distinction reveals more relevant information and the eight-factor model showed a slightly better model fit. *Hypothesis 1* is therefore confirmed.

Criterion validity was tested for the work-related outcomes *Burnout* and *Work Engagement*. From a bivariate perspective, the correlations with the

Table 5
Omega total, means, standard deviations and correlations | study 2 | version 4

		Omega total [CI]	M (SD)	Min-max	Skewness	1	2	3	4	5	6	7	8	9	10	11
Subscales																
1	Skill Adequacy	.66 [.60;.72]	3.99 (.66)	1 – 5	–.49											
2	Cognitive Demands	.82 [.79;.85]	3.79 (.87)	1 – 5	–.46	–.11*										
3	Lecturer Feedback	.86 [.83;.89]	2.29 (.88)	1 – 5	.37	.07	.03									
4	Autonomy	.84 [.81; 87]	3.48 (.89)	1 – 5	–.41	.10	.09	.06								
5	Participation	.75[a]	1.96 (.89)	1 – 5	.81	.05	–.11*	.39**	.15**							
6	Organizational Stressors	.78 [.74;.82]	2.78 (.82)	1 – 5	.29	–.13*	.18**	–.16**	–.14**	–.04						
7	Work Overload	.87 [.84;.89]	3.14 (.99)	1 – 5	.03	–.37**	.39**	–.21**	–.17**	–.19**	.42**					
8	Information Problems	.88 [.86;.90]	2.52 (.99)	1 – 5	.48	–.22**	.07	–.11*	–.18**	–.09	.57**	.43**				
Criteria																
9	Exhaustion	.87 [.85;.90]	2.60 (1.16)	0 – 6	.37	–.41**	.23**	–.20**	–.24**	–.12*	.31**	.59**	.34**			
10	Cynicism	.88 [.85;.90]	1.64 (1.47)	0 – 6	.87	–.22**	–.20**	–.14*	–.26**	.08	.31**	.12*	.23**	.38**		
11	Inefficacy	.76 [.71;.80]	4.08 (.84)	0 – 6	.14	–.59**	–.07	–.21**	–.16**	–.15**	.16**	.35**	.24**	.44**	.38**	
12	Work Engagement	.93 [.92;.94]	3.94 (1.15)	0 – 6	–.52	.34**	.28**	.21**	.24**	.05	–.21**	–.14*	–.24**	–.37**	–.70**	.56**

Note. [a] Spearmann correlation for 2-item-scale (Eisinga, Grotenhuis, & Pelzer, 2013); * $p < .05$; ** $p < .001$; $N = 333$.

Table 6
Standardized path coefficients from the *WA-S Screening* subscales on *Work Engagement* and *Burnout* dimensions tested in four structural equation models | study 2 ($N = 333$)

Variable	Work engagement β	Emotional exhaustion β	Cynicism β	Inefficacy β
Skill Adequacy	.42***	–.25***	–.31***	–.84***
Cognitive Demands	.39***	.08	–.26***	–.21***
Lecturer Feedback	.16*	–.11	–.13	–.08
Autonomy	.10	–.16**	–.17**	–.05
Participation	–.01	.06	.16*	–.09
Organizational Stressors	–.24*	.09	.44***	.05
Work Overload	.04	.47***	–.07	.10
Information Problems	.03	–.04	–.11	–.03

Note. $^{*}p < .05$; $^{**}p < .01$ $^{***}p < .001$.

resources (*Hypothesis 2*) revealed small but without exception significant coefficients of *Lecturer Feedback* and *Autonomy* with all measured criteria. In SEM analyses, these relations were confirmed for *Work Engagement*, although not always for all *Burnout* dimensions (see Table 6). *Participation* was only and inconsistently related to *Burnout*. While correlations showed very small, but significant relations with *EE* ($r = –.12$, $p < .05$) and *IE* ($r = –.15$, $p < .001$) in expected ways, SEM analyses revealed a small, but unexpected positive impact on *CY* ($\beta = 16$, $p < .05$). *Hypothesis 2* therefore is partly confirmed for *Lecturer Feedback* and *Autonomy* and is not confirmed for *Participation*. The subscale *Skill Adequacy* (*Hypothesis 3*) was significantly correlated with all dimensions of *Burnout* and *Work Engagement*. These results were verified in the SEM analyses. *Hypothesis 3* is therefore confirmed. The subscale *Cognitive Demands* (*Hypothesis 4*) revealed an expected significant relation with *Work Engagement* ($r = .28$, $p < .001$) and low *CY* ($r = –.20$, $p < .001$), but also an unexpected positive correlation with *EE* ($r = .23$; $p < .001$). The fact that *Cognitive Demands* are also positively related to the stressor *Work Overload* ($r = .39$; $p < .001$) could be a reasonable explanation. Indeed, the relation between *Cognitive Demands* and *EE* disappeared in the SEM when *Work Overload* was statistically controlled. In the SEM analyses, *Cognitive Demands* displayed the expected relations to *Work Engagement*, *IE* and *CY*. *Hypothesis 4* therefore is partly confirmed. Finally, each of the stressors *Organizational Stressors, Work Overload* and *Information Problems* (*Hypothesis 5*) was significantly related to all of the measured criterion scales ($p < .05$) as well as to each other ($r = .42–.57$, $p < .001$). The subscale *Information Problems* did not show significant paths in SEM analyses. A probable reason is the middle to high intra-correlation of the stressor-scales, which could have subsequently led to an indistinct overlap of variance explanation. Nevertheless, each of the eight subscales could at least once prove expected relationships to the examined criteria (in correlations and/or SEM analyses). *Hypothesis 5* thus is partly confirmed for *Organizational Stressors* as well as *Work Overload* and is not accepted for the subscale *Information Problems*.

5. Discussion

This article aimed to outline the development of a theory-driven, short measure of student work characteristics and the investigation of the psychometric properties as well as the predictive criterion validity. Study 1 revealed a) a measure model of eight subscales with good reliability (internal consistency) and b) a notable alternative model with four subscales. Study 2 confirmed the factor structure, metric invariance and additionally displayed the relations of the subscales with the criteria burnout and work engagement. In sum, the two studies found substantial evidence for the reliability and validity of the developed *WA-S Screening*. They fill the shortage of theoretically grounded measurements in the study-work context of university students based on the latest developments in the *Model of Learning Demands, Work-related Resources, and Stressors* [29]. In the following, we discuss the detailed findings also within the context of university students and suggest research and practical implications.

5.1. Measure development and psychometric properties

The *Screening TAA* indicated an excellent base for a measure-adaptation into other particular work

settings (study work). The focus of the TAA authors, taking the quality of working-structure and -processes into account [24], is also a crucial aspect in terms of learning and studying at university. Nevertheless, it took many steps (adaptation in cooperation with one of the original authors, qualitative and quantitative pre-tests) to identify the central aspects of work characteristics for students to create a short screening instrument with stable and satisfactory psychometric (item) properties. Only the subscale *Skill Adequacy* still shows moderate internal consistencies (ωt) between .6 and .7, which is however justified by its formative character (section 3.2.). Additionally, the subscale *Participation* persisted with only two items in the final version (the former third item in version 1 was removed due to a too small factor loading), which does not fulfil the formal criterions of a test scale. However, the scale covers a conceptually important aspect of work characteristics and therefore we decided to keep it in the instrument. Altogether, the instrument shows stable and satisfactory psychometric properties. As of now, it should be considered in future surveys in the context of university students as it is based on the latest theoretical models regarding the distinction of work characteristics.

5.2. The WA-S Screening and mental health-related outcomes

Concerning the indicated prediction of criteria by each of the eight *WA-S Screening* subscales the results showed that especially the resource *Lecturer Feedback* is positively associated with *Work Engagement* and *Autonomy* negatively at least with two of the burnout dimensions. *Participation* is associated with *Cynicism* concerning study work and shows no positive impact on *Work Engagement.* A possible explanation for the unexpected impact of *Participation* on *Cynicism* in SEM analyses could be the general perception of low *Participation* ($M = 1.96$; $SD = .89$) in the sample. Only a few participants were probably aware of such possibilities of e.g. co-designing curricula and taking part in organizational decisions, due to being involved in such activities themselves. Consequently, the involvement and often voluntary additional work could be a separate factor leading to cynicism and not directly be related to the work characteristic of participation itself. Another explanation could be that the perceived participation opportunities offered by some universities appear as "pseudo opportunities" not including real impact and thus understandably leading to higher cynicism. However, this connection should be kept in mind for further analyses. For practical implications of low *Participation,* see 5.4.

Taking all analyses together, *Skill Adequacy* appeared to be a very important prerequisite in the context of university students being associated with motivation as well as work-related well-being (work engagement) and indicators of mental health (low burnout). As mentioned above it concerns the effort taken by organizations (e.g. universities) to take care of the fit between their demands and the students' skills, for example on the one hand in being mindful with the recruitment of students, inherent requirements or application processes to courses and concurrently on the other hand supporting skill-promoting tutorials for students.

Regarding the indicated prediction of the typical burnout dimension *Emotional Exhaustion*, the characteristics *Work Overload*, low *Autonomy* and low *Skill Adequacy* appeared to be key variables. For the association with *Work Engagement*, the resource *Lecturer Feedback*, and especially *Skill Adequacy* as well as the challenging *Cognitive Demands* came to the fore. As described before, the latter was also correlated to *Emotional Exhaustion*. This is not surprising as also in terms of action regulation demands "it is the amount that makes the poison". *Learning Demands* hereby clearly appear as work characteristics to be seen in a differentiated view. Whereas resources and stressors are more explicit supporting or impairing factors. These results fit to the *Model of Learning Demands, Work-related Resources, and Stressors* [29] we proposed in this study.

In sum, the instrument should be considered in future surveys when it comes to identify health- and personality-relating conditions in the context of university students.

5.3. Limitations

Several limitations should be kept in mind concerning the results of the two studies. First, the design of our studies was cross-sectional, which in particular restricts the validity of the results from regression analyses in study 2. Future studies should apply longitudinal study designs in order to examine criterion validity and ensure the causal predictability of work engagement and burnout by the *WA-S Screening* scales over time. Second, the samples were limited to occasionally acquired samples in German speaking

countries, mostly representing medical and psychology students, including an imbalance between the number of females and males. As the results are potentially not universal, they should be verified in different student samples (e.g., technical fields of study) in the future. Nevertheless, the metric invariance between the two studies and therefore between the countries and explicitly also between the fields of study as well as between females and males was already confirmed. Compared to the other existing student measure we involved some "special" kinds of studies like medical students. Possible research should further aim to verify the predictability of the *WA-S Screening* towards relevant criteria, including more and different criteria of well-being and health (e.g. life satisfaction and/or physical complaints). Additionally, more objective (performance) outcomes like study dropouts and grades could be taken into account to complete the picture of work characteristics and their potential consequences.

As we decided to develop the *WA-S Screening* measure for students' working conditions based on the comprehensive *Screening TAA* [47], we did not consider other possible work characteristics beyond the *Screening TAA* that are associated with work-related well-being and health, for example social support from colleagues or supervisors [29, 40]. We had to eliminate the *Screening TAA* subscales *Social Climate* and *Social Stressors* due to a high employment focus and the aim to create a short measure (Table A.1). In retrospect, it would still have made sense to include new items regarding social support by colleagues, friends, and/or lecturers. Other burnout-relevant working conditions in study contexts may be the organizational structure of studies, their curricula or number of exams. It is of course possible to extend the *WA-S Screening* with established and easy-to-adapt instruments measuring curricular conditions or social support [65].

5.4. Practical implications and recommendations

Apart from the essential extension possibilities, the application of the *WA-S Screening* in practice also "allows" the researcher to reduce the assessment via selected subscales and even dimensions (resources and stressors). As the models of our analyses showed, it should nevertheless be the first choice to assess work characteristics at university on subscale level.

Potential practical implication examples for universities and other organizations in the sector of higher education can be drawn from the content of the subscales and are proposed in the following. We hereby point out that we did *not* examine those implications in our studies. Resulting subscale mean values above/below the response scale mean (= 3) can be considered as criteria for high/low levels.

(Low) *Skill Adequacy*: Focusing even more on the fit between the students' skills and their range of courses in the process of application, inscription and the first years of study in being mindful with the recruiting and also providing supporting tutorials.

(Too low or high) *Cognitive Demands*: In order to ensure e.g. an appropriate level of cognitive demands, enough autonomy and to avoid work overload for students, persons responsible should take a look at existing curricula verifying if those conditions realistically are provided.

(Low) *Lecturer Feedback*: Additionally, each lecturer could be trained or at least be informed concerning the importance of lecturer feedback in class and its positive effect on students' work engagement. Many lecturers are obviously not implementing this behavior yet, due to several reasons. It could also be helpful to implement in the curriculum explicitly the type of feedback that has to be given (e.g., verbally, in writing and/or according to certain rules to be perceived as constructive). In addition, the introduction of periodical peer feedback could be considered.

(Low) *Autonomy*: In order to avoid burnout symptoms, the curricula should not determine too many preconditions regarding order and attendance of modules and seminars. High *Autonomy* should go hand in hand with secured transparent information, goals and instructions (see also high *Organizational Stressors* and *Information Problems*).

(Low) *Participation*: Serious structures of (democratic) participation opportunities need to be provided and communicated both in courses and in the university in general.

(High) *Organizational Stressors*: University departments, curricula and study management should be clear and transparent. All members need to communicate and collaborate in a constructive way to enhance also the organizational work climate.

(High) *Work Overload*: Training lecturers to change perspectives into the students' view and to collaborate more with colleagues, to avoid concurrent exams etc. (see also improvement of curricular management). In equivalent addition, offers for training students' communication and planning skills should be institutionalized.

(High) *Information Problems*: Clear and transparent information needs to be accessible for students by coordinators and lecturers. Competent contact persons (staff) and tutors are recommended.

In general and in accordance with the model of Glaser et al. [29]: Resources should always complement high challenge demands. Moderate to high stressors combined with high demands should be avoided or at least be complemented by more or higher levels of resources.

As the *WA-S Screening* is a *condition*-related instrument, we suggested potential *condition*-related practical implications. Nevertheless, it is also recommended to address the responsibility of the students in the interplay of study conditions at university and individual health-related outcomes in practice. This responsibility can also be addressed mindfully and be encouraged to a certain degree.

6. Conclusion

In these studies, we found indicators for the validity and reliability of the *Work Analysis Measure for Students* (*WA-S Screening*). The instrument was developed to measure students' working conditions in an economic and simultaneously theoretically grounded way, addressing the shortage of theory-based measures in this context. The *WA-S Screening* is associated with relevant university-related aspects of well-being and mental health. It is ready to be applied, further examined and validated in different student contexts such as other forms of tertiary educational institutions, academic subjects or German-speaking regions. The instrument can form the base to appropriate actions that might subsequently help young adults at university to stay engaged and to prevent them from being affected by the burnout syndrome, before even having entered the job markets.

Acknowledgments

This research is funded by the Austrian Science Fund (FWF), project number P27228-611 G22. We express our gratitude to all participants of the two studies for their participation and to Jürgen Glaser, Christian Seubert, Severin Hornung, Lisa Hopfgartner and Alexander Herrmann for the professional interchange.

Conflict of interest

None to report.

References

[1] Pietzonka M. Gestaltung von Studiengängen im Zeichen von Bologna: Die Umsetzung der Studienreform und die Wirksamkeit der Akkreditierung. Springer VS; 2014.

[2] Wörfel F, Gusy B, Lohman K, Kleiber D. Validierung der deutschen Kurzversion des Maslach-Burnout-Inventars für Studierende (MBI-SS KV). Zeitschrift Für Gesundheitspsychologie. 2015;23(4):191-6.

[3] Oelze B. Für eine kritische Soziologie des Bologna-Prozesses. Soziologie. 2010;39(2):179-85.

[4] Statista [homepage on the internet]. Anzahl von Studierenden in Deutschland und der Europäischen Union (EU-28) von 2003 bis 2012; 2017 [updated 2017; cited 2019 Dec 02]. Available from https://de.statista.com/statistik/daten/studie/160339/umfrage/anzahl-der-studenten-in-deutschland-und-der-eu/

[5] Statistische Veröffentlichung der Kultusministerkonferenz [homepage on the internet]. Vorausberechnung der Studienanfängerzahlen 2014–2025. Erläuterung der Datenbasis und des Berechnungsverfahrens; 2014 [updated 2014 July; cited 2019 Dec 02]. Available from https://www.kmk.org/fileadmin/pdf/Statistik/Dokumentationen/Dok_Vorausberechnung_2014.pdf

[6] Eurostat [homepage on the internet]. Students enrolled in tertiary education by education level, programme orientation, sex, type of institution and intensity of participation; 2019 [updated and cited 2019 Dec 02]. Available from https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=educ_uoe_enrt01&lang=en

[7] Olwage D, Mostert K. Predictors of student burnout and engagement among university students. Journal of Psychology in Africa. 2014;24(4):342-50.

[8] Schaufeli WB, Martinez IM, Pinto AM, Salanova M, Bakker AB. Burnout and Engagement in University Students: A Cross-National Study. Journal of Cross-Cultural Psychology. 2002;33(5):464-81.

[9] Dyrbye LN, West CP, Satele D, Boone S, Tan L, Sloan J, Shanafelt TD. Burnout among U.S. medical students, residents, and early career physicians relative to the general U.S. population. Academic Medicine. 2014;89(3):443-51.

[10] Dyrbye L, Shanafelt T. A narrative review on burnout experienced by medical students and residents. Medical Education. 2016;50(1):132-49.

[11] Wallace JE, Lemaire JB, Ghali WA. Physician wellness: a missing quality indicator. The Lancet. 2009;374(9702):1714-21.

[12] IsHak R, Lederer S, Perry R, Ogunyemi D, Bernstein C, Waguih N. Burnout in medical students: a systematic review. The Clinical Teacher. 2013;10:242-5.

[13] Galán F, Sanmartín A, Polo J, Giner L. Burnout risk in medical students in Spain using the Maslach Burnout Inventory-Student Survey. International Archives of Occupational and Environmental Health. 2011;84(4):453-9.

[14] Jennings ML. Medical student burnout: Interdisciplinary exploration and analysis. Journal of Medical Humanities. 2009;30(4):253-69.

[15] Mazurkiewicz R, Korenstein D, Fallar R, Ripp J. The prevalence and correlations of medical student burnout in the pre-clinical years: a cross-sectional study. Psychology, Health & Medicine. 2012;17(2):188-95.
[16] Urbaski M, Kukanova A, Wincierz A, Krysta K, Krupka-Matuszczyk I. The burnout syndrome occurrence among the students of the medical university of silesia in katowice, poland. In: Abstracts of the 21th European Congress of Psychiatry. European Psychiatry. 2013;28(Supl 1):1.
[17] Robins TG, Roberts RM, Sarris A. The role of student burnout in predicting future burnout: Exploring the transition from university to the workplace. Higher Education Research & Development. 2018;37(1):115-30.
[18] Leiter MP, Maslach C. Areas of Worklife: A Structured Approach To Organizational Predictors of Job Burnout. Research in Occupational Stress and Well Being. 2003;3(3):91-134.
[19] Maslach C, Schaufeli WB, Leiter MP. Job Burnout. Annual Review of Psychology. 2001;52(1):397-422.
[20] Brom SS, Buruck G, Horváth I, Richter P, Leiter MP. Areas of worklife as predictors of occupational health – A validation study in two German samples. Burnout Research. 2015;2(2-3):60-70.
[21] Schnell T, Höge T, Pollet E. Predicting meaning in work: Theory, data, implications. The Journal of Positive Psychology. 2013;8(6):543-54.
[22] Hackman JR, Oldham GR. Development of the Job Diagnostic Survey. Journal of Applied Psychology. 1975;60(2):159-70.
[23] Semmer NK, Zapf D, Dunckel H. Assessing stress at work: A framework and an instrument. In: Svane O, Johansen C, editors. Work and health - scientific basis of progress in the working environment. Luxembourg: Office for Official Publications of the European Communities; 1995. pp. 105-113.
[24] Büssing A, Glaser J. Das Tätigkeits- und Arbeitsanalyseverfahren für das Krankenhaus – Selbstbeobachtungsversion (TAA-KH-S). Hogrefe; 2002.
[25] Bakker AB, Sanz Vergel AI, Kuntze J. Student engagement and performance: A weekly diary study on the role of openness. Motivation and Emotion. 2015;39(1):49-62.
[26] Mokgele KR, Rothmann S. A structural model of student well-being. South African Journal of Psychology. 2014;44(4):514-27.
[27] Gusy B, Wörfel F, Lohmann K. Erschöpfung und Engagement im Studium. Zeitschrift Für Gesundheitspsychologie. 2016;24:41-53.
[28] Bakker A, Demerouti E. The job demands-resources model: State of the art. Journal of Managerial Psychology. 2007;22(3):309-28.
[29] Glaser J, Seubert C, Hornung S, Herbig B. The impact of learning demands, work-related resources, and job stressors on creative performance and health. Journal of Personnel Psychology. 2015;14(1):37-48.
[30] Oxford Dictionaries [homepage on the internet]. Work; 2019 [cited 2019 Dec 02]. Available from https://en.oxforddictionaries.com/definition/work
[31] Frese M, Zapf D. Action as the Core of Work Psychology: A German Approach. In Triandis HC, Dunnette MD, Hough LM, editors. Handbook of Industrial and Organizational Psychology (2nd ed.). Palo Alto, CA: Consulting Psychologists Press; 1994. pp. 271-340.
[32] Hacker W, Sachse P. Allgemeine Arbeitspsychologie: Psychische Regulation von Tätigkeiten. 3rd ed. Göttingen: Hogrefe; 2014.
[33] Hacker W. Action Regulation Theory: A practical tool for the design of modern work processes? European Journal of Work and Organizational Psychology. 2003;12(2):105-30.
[34] Caballero CC, Breso É, Gutiérrez OG. Burnout en estudiantes universitarios. Psicología Desde El Caribe. 2015;32(3):424-41.
[35] Schaufeli WB, Bakker AB. Job demands, job resources, and their relationship with burnout and engagement: A multi-sample study. Journal of Organizational Behavior. 2004;25(3):293-315.
[36] Cavanaugh MA, Boswell WR, Roehling MV, Boudreau JW. An empirical examination of self-reported work stress among U.S. managers. The Journal of Applied Psychology. 2000;85(1):65-74.
[37] LePine JA, Podsakoff NP, LePine MA. A meta-analytic test of the challenge Stressor-hindrance stressor framework: An explanation for inconsistent relationships among Stressors and performance. Academy of Management Journal. 2005;48(5):764-75.
[38] Lazarus RS. Theory-Based Stress Measurement. Psychological Inquiry. 1990;1(1):3-13.
[39] Van den Broeck A, De Cuyper N, De Witte H, Vansteenkiste M. Not all job demands are equal: Differentiating job hindrances and job challenges in the job demands-resources model. European Journal of Work and Organizational Psychology. 2010;19(6):735-59.
[40] Gusy B, Lohmann K, Drewes J. Burnout bei Studierenden, die einen Bachelor-Abschluss anstreben. Prävention Und Gesundheitsförderung. 2010;5(3):271-5.
[41] Jacobs SR, Dodd D. Student burnout as a function of personality, social support, and workload. Journal of College Student Development. 2003;44(3):291-303.
[42] Karasek RA. Job Demands, Job Decision Latitude, and Mental Strain: Implications for Job Redesign. Administrative Science Quarterly. 1979;24(2):285-308.
[43] Wörfel F, Gusy B, Lohmann K. Schützt Selbstmitgefühl Studierende vor Burnout? Prävention Und Gesundheitsförderung. 2014;10(1):49-54.
[44] Bachmann N, Berta D, Eggli P, Hornung R. Macht studieren krank? Die Bedeutung von Belastung und Ressourcen für die Gesundheit der Studierenden. Bern: Huber; 1999.
[45] Dahlin ME, Runeson B. Burnout and psychiatric morbidity among medical students entering clinical training: a three year prospective questionnaire and interview-based study. BMC Medical Education. 2007;7(1):6.
[46] Levecque K, Anseel F, De Beuckelaer A, Van der Heyden J, Gisle L. Work organization and mental health problems in PhD students. Research Policy. 2017;46(4):868-79.
[47] Glaser J, Hornung S, Höge T, Strecker C. Das Tätigkeits- und Arbeitsanalyseverfahren (TAA) – Screening psychischer Belastungen in der Arbeit. Innsbruck: innsbruck university press; forthcoming.
[48] Hacker W. Arbeitspsychologie. Bern: Huber; 1986.
[49] Hackman JR, Oldham GR. Motivation through the design of work: test of a theory. Organizational Behavior and Human Performance. 1976;16(2):250-79.
[50] Strecker C, Huber A, Höge T, Hausler M, Höfer S. Identifying thriving workplaces in hospitals: Work characteristics and the applicability of character strengths at work. Applied Research in Quality of Life. 2019; online first.
[51] Degen C, Weigl M, Glaser J, Li J, Angerer P. The impact of training and working conditions on junior doctors' intention to leave clinical practice. BMC Medical Education. 2014;14(119).

[52] Hornung S, Weigl M, Glaser J, Angerer P. Is it so bad or am I so tired? Cross-lagged relationships between job stressors and emotional exhaustion of hospital physicians. Journal of Personnel Psychology. 2013;12(3):124-31.
[53] Weigl M, Hornung S, Parker SK, Petru R, Glaser J, Angerer P. Work engagement accumulation of task, social, personal resources: A three-wave structural equation model. Journal of Vocational Behavior. 2010;77(1):140-53.
[54] Hornung S, Glaser J, Rousseau D. Mitarbeiterorientierte Flexibilisierung von Arbeit durch individuelle Aushandlungen: Ein Forschungsprogramm der Angewandten Psychologie. Pabst Science Publishers; 2019.
[55] Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, Erikson P. Principles of good practice for the translation and cultural adaptation process for patient-reported outcomes (PRO) measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. Value in health. 2005;8(2):94-104.
[56] McNeish D. Thanks Coefficient Alpha, We'll Take It From Here. Psychological Methods. 2018;23(3):412-33.
[57] Tabachnick BG, Fidell LS. Using Multivariate Statistics. 5th ed. Pearson Education; 2007.
[58] Hu L, Bentler PM. Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling. 1999;6:1-55.
[59] Kline RB. Principles and Practice of Structural Equation Modeling. Statewide Agricultural Land Use Baseline 2015. 3rd ed. New York: Guilford Press; 2011.
[60] Diamantopoulos A, Siguaw JA. Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration. British Journal of Management. 2006;17(4):263-82.
[61] Gumz A, Erices R, Brahler E, Zenger M. Factorial structure and psychometric criteria of the German translation of the Maslach Burnout Inventory-Student Version by Schaufeli et al. (MBI-SS). Psychotherapie, Psychosomatik, Medizinische Psychologie. 2013;63(2):77-84.
[62] Schaufeli WB, Bakker AB. Utrecht work engagement scale. Occupational Health Psychology Unit Utrecht University; 2003.
[63] Schaufeli WB, Bakker AB, Salanova M. The Measurement of Short Questionnaire A Cross-National Study. Educational and Psychological Measurement. 2006;66(4):701-16.
[64] Vandenberg RJ, Lance CE. A Review and Synthesis of the Measurement Invariance Literature: Suggestions, Practices, and Recommendations for Organizational Research. Organizational Research Methods. 2000;3(1):4–70.
[65] Frese M. Gütekriterien der Operationalisierung von sozialer Unterstützung am Arbeitsplatz. Zeitschrift Für Arbeitswissenschaft. 1989;43:112-21.

Appendix

Table A.1
Adaptation process from the original *Screening TAA* to the first *WA-S Screening* version (1) and the final version (4)

Original *Screening TAA*		Adaptation	*WA-S Screening* version for pre-tests (version 1)		Adaptation	*WA-S Screening* final (version 4)	
	Items			Items			Items
Cognitive Demands	4	*B*	*Cognitive Demands*	4	*D*	*Cognitive Demands*	3
Learning Requirements	3	*A*					
Skill Acquisition	3	–>	*Skill Acquisition*	3	*A, B', D*		
Skill Adequacy	4	–>	*Skill Adequacy*	4	*B', D*	*Skill Adequacy*	4
Skill Applicability	3	*A*					
Task Transparency	3	*B*	*Task Transparency*	3	*C, D*		
Task Predictability	3	*A*					
Supervisor Feedback	3	*B*	*Lecturer Feedback*	3	–>	*Lecturer Feedback*	3
Autonomy/Job Control	9	–>	*Autonomy*	9	*D*	*Autonomy*	4
Participation	4	*A', B*	*Participation*	3	*D*	*Participation*	2
Social Climate	5	*A, C*					
Organizational Stressors	4	*B, B'*	*Organizational Stressors*	4	*B'*	*Organizational Stressors*	5
Social Stressors	4	*A, C*					
Work Overload	3	*B, B'*	*Work Overload*	4		*Work Overload*	4
Goal Conflicts	4	*A*					
Information Problems	4	*A'*	*Information Problems*	3	*B*	*Information Problems*	3
Work Interruptions	4	*A*					
Quality Impairments	3	*A*					
Additional Effort	3	*A, C*					
Unfavorable Work Environment	3	*A, C*					
Physical Workload	4	*A*					
21 subscales	80		10 subscales	40		8 subscales	28

Notes: A: Exclusion of subscale | A': Exclusion of item | Due to no/too little study fit (low content validity, high employment focus) | B: Important subscale, but larger textual adaptation on item level | B': Supplement of new item(s) | C: No central aspect on work and task characteristic level (aiming for a short measure) | D: Exclusion of item(s) due to psychometric properties.

A.2 Final instrument

The final instrument with all items is available on request in German. Please contact the authors.