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Title page

“I never thought it would be that bad” – Increasing teachers’ awareness of psychological well-being through recovery-stress monitoring and individualised feedback

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35 **Abstract**

36 **BACKGROUND:** The demanding working conditions of teachers make them
37 susceptible to stress. Monitoring temporal changes in recovery and stress may provide a
38 valuable approach for maintaining wellbeing.

39 **OBJECTIVE:** This exploratory study followed a two-stage approach aimed at: a)
40 collecting data about the potential effects of holidays on stress in teachers, and b) utilising
41 these findings to provide tangible feedback to teachers.

42 **METHODS:** Thirty-seven **German** teachers completed online questionnaires over six
43 months
44 (eight measurements) which included two holiday periods (Easter break, Summer break).
45 Sociodemographic data regarding recovery and stress were gathered using the Recovery-
46 Stress Questionnaire Work. Interested teachers received individual feedback sessions.

46 **RESULTS:** The results, inter alia, indicated significant time effects for the dimensions
51 *Overall Stress* ($F(7,119) = 5.31, p < .001$) and *Overall Recovery* ($F(3.7,67.7) = 4.33, p =$
52 $.004$). Significant positive changes were identified over the Summer, but not the Easter
53 break. In the feedback sessions, group-based findings were connected with the individual
54 recovery-stress values. Notable scores were highlighted in a matrix

55 **CONCLUSIONS:** This study demonstrates an approach to monitoring and providing
56 group and personalised feedback to raise teachers' awareness and sensitivity of
57 psychological health status in relation to their working environment.

58

59 Introduction

60 Teachers have an essential role in the personal and academic development and future of
61 the children and adolescents for whom they are responsible, since they provide content
62 knowledge in a variety of subjects and also influence the formation of values and attitudes
63 of adolescents [1, 2]. Time and resources are needed for the preparation of classes,
64 administrative duties, marking assessment and exams, and organisational appointments
65 [3, 4]. Novice teachers in particular can struggle with these challenges [5, 6]. More recently,
66 Australian research has also demonstrated the extensive role that teachers play in
67 promoting the health and wellbeing of children and young people, which can extend to
68 the management of complex family welfare issues and crises [7, 8].

69 As a result, teachers are confronted with substantial psychological demands which
70 can collectively cause *teacher stress*. Kyriacou [9] describes this job specific condition
71 of teacher stress as the perception of negative emotions as a consequence of work-related
72 demands considered as a personal threat. This may stem from reduced self-efficacy as a
73 consequence of having to deal with the demands per se, being unable to cope with the
74 demands appropriately, and a lack of (personal or occupational) resources to manage life
75 stressors [10, 11]. The working hours in schools are often insufficient to fulfil all tasks,
76 which results in teachers working extended hours at home. This significantly diminishes
77 the possibility for teachers to detach (i.e., unwind physically and mentally from work)
78 and recover at home [12, 13].

79

80 Due to these manifold influences, the population of teachers is susceptible to reduced
81 well-being and increased stress [14]. Studies examining the relationship between teacher
82 health, well-being and stress are numerous and corroborate that an accumulation and
83 chronic presence of stressors may ultimately result in severe psychological issues [15,
84 16]. These issues may include burnout, anxiety disorders, or somatoform disorders which
85 precipitate teacher turnover and attrition [17-20]. High rates of teacher attrition and low
86 rates of retention have significant implications both economically and educationally.
87 Watlington, Shockley [21] as well as Synar and Maiden [22] report costs in the United
88 States extending to several billion dollars for items such as sick leave pay, recruitment
89 costs, pre-employment administrative costs, and professional development costs for new
90 personnel. From an educational standpoint, intangible factors play an important role when
91 it comes to providing uninterrupted education for students and creating an enjoyable
92 learning environment with teachers knowing the internal processes of the school [23, 24].

93 To counteract this negative spiral of teacher stress, reduced well-being, and
94 increased attrition, attempts to promote teacher well-being by targeting work-related
95 stress represents a meaningful approach. Naghieh, Montgomery [25] summarised studies
96 which conducted interventions to improve well-being in teachers via changes at an
97 organisational level. Three organisational facets were recognised, namely changes in the
98 work tasks, changing organisational features (e.g., teacher support), and multicomponent
99 programmes (e.g., combining performance bonus pay and mentoring). Only four studies
100 meeting the selection criteria were identified, encompassing a total of 2199 teachers and
101 providing merely low-level quality of evidence. Naghieh, Montgomery [25] concluded
102 that more methodologically sound and convincing studies are warranted regarding the
103 effectiveness of organisational programmes for teacher well-being. The authors
104 recommended that future research should include both organisational (i.e., structural

105 changes to change the environment to individual needs) and individual-level (i.e.,
106 individual changes in attitudes, behaviours, coping) interventions.

107 Structural changes targeting the inherent processes of a school or the schooling
108 system itself appear to be difficult to achieve, particularly within a global schooling
109 landscape characterised by high surveillance, performativity and incessant testing of
110 student performance [26]. Approaches at an individual level predominantly involve stress
111 management interventions [27, 28], but there is a lack of synthesised research in terms of
112 systematic reviews and documented conclusive effects. This may be due to the variety of
113 potential sources of stress which limits the possibility to successfully reduce stress.

114 Another approach to deal with constant and a range of stressors involves efficient
115 recovery through individually and deliberately chosen recovery-related activities (e.g.,
116 exercise, relaxation techniques, social interactions). Kallus (2016) characterises
117 recovery as “an inter- and intra-individual multilevel (e.g., psychological, physiological,
118 social) process in time for the re-establishment of personal resources and their full
119 functional capacity” (p. 42). The idea of the interplay between recovery and stress is that
120 stress is not problematic if sufficient recovery activities and strategies are implemented
121 to balance the stress. Kellmann, Bertollo [30] state that with accumulating stress, more
122 recovery is essential to constrain further increase in stress, establish an equilibrium
123 between stress and recovery, and thereby maintain individual well-being and optimal
124 performance. This may result in an imbalance of recovery and stress characterised by
125 ‘underrecovery’ which may cause physical and psychological issues [19, 31]. Approaches
126 to preserve the well-being of individuals, while considering the relationship between
127 recovery and stress, aim to monitor the changes in these psychosocial constructs over
128 time in order to detect negative alterations, provide suitable feedback, and derive potential
129 interventions [32]. Previous studies have successfully conducted recovery-stress

130 monitoring in a variety of contexts, for example injuries in athletes and individuals with
131 back pain [31, 33].

132 One issue for monitoring of teachers is the existence of scheduled holiday periods
133 as potential phases of augmented recovery and reduced stress. However, only Kühnel and
134 Sonnentag [34] investigated the effects of holidays in 131 teachers while assessing health-
135 related variables at one measurement point before and three measurement points after a
136 holiday period. The results suggested that although teachers' work engagement
137 significantly improved and burnout significantly decreased after the holiday period, a
138 fade-out effect (i.e., return of beneficial post-vacation effects to pre-vacation levels)
139 established within one-month post assessment. Leisure time relaxation after the holidays
140 served as a buffer and prolonged the beneficial holiday effects. These sparse findings
141 provide valuable insights into the effectiveness and longevity of holiday effects but
142 should be extended by examining the potential impact of multiple holiday periods with a
143 different duration over a longer period of time. This could be complemented by
144 subsequent individualised feedback on the recovery-stress monitoring in order to provide
145 information regarding stress sources and recovery activities [35, 36]. Additionally, this
146 combined procedure could represent a meaningful and practically relevant approach in
147 improving and sustaining teacher well-being [25].

148 Therefore, this pilot study had two related objectives combining data collection
149 and its transfer into a practical application. First, developments of the recovery-stress
150 balance in teachers was monitored over six months, including two holiday periods (Easter
151 break, Summer break). Second, the monitoring data was used to provide the participants
152 with group-based as well as individual feedback based on their recovery-stress scores.
153 This approach could provide a basis for a brief intervention to raise teacher awareness of
154 the recovery-stress process.

155 **Materials and Methods**

156 *Participants*

157 A group of 37 teachers ($M_{Age} = 43.2$ years, $SD_{Age} = 11.1$; 21 females) participated in the
158 study. After completing the data collection, 18 teachers provided complete data for all
159 measurement points. An a priori calculation of the sample size was not conducted since
160 the main goal of the study was exploratory to assess individual feedback sessions. All
161 participants were recruited from one integrative school in the vicinity of the university
162 which served as a pilot school to test the combined approach of recovery-stress
163 monitoring and subsequent individualised feedback for the participants. A more detailed
164 summary of the characteristics of the sample is provided in Table 1.

165

166 ***** INSERT TABLE 1 HERE *****

167 *Procedure*

168 *Survey*

169 The partnership for this study was organised between the university research unit and an
170 alumnus of the university who was working in a leadership position as a teacher at the
171 participating school. The first author was invited to present the framework of the study at
172 a school staff meeting of the entire teaching staff with approximately 120 teachers.
173 Participants were provided with information about the nature of the online survey and
174 regarding organisational procedures (e.g., delivery of questionnaire link) using a short
175 PowerPoint presentation. As an incentive, individualised feedback, to be provided after
176 the finalisation of the survey, was offered for each participant who completed at least five
177 measurement points. The online survey was created with the software *SoSci Survey* which

178 was chosen due to its user-friendliness and free availability for scientific purposes [37].
179 Each participant's email address was associated with a computer-generated participant
180 code to provide anonymity. The code was used to deliver the individual questionnaire
181 link for each participant and to organise the individual feedback sessions after the study.
182 Each participant received a questionnaire link via email at each measurement point at 1
183 pm and up to two reminder emails, one at the same day at 4 pm and the second on the
184 next day at 10 am. To optimise opportunity for response from this specific sample of
185 teachers, the times of the day the questionnaire emails were sent were based on the school
186 schedules.

187 The questionnaire survey was conducted eight times between March and
188 September 2018. Specific emphasis (i.e., pre- and post-vacation measurements) was put
189 on the evaluation of holiday effects (2-weeks Easter break vs. 6-weeks Summer break) as
190 periods of prolonged recovery. The completion of each survey took about 10-15 minutes.
191 Figure 1 illustrates the assessment timing protocol.

1921 ***** INSERT FIGURE 1 HERE *****

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194 *Individual feedback sessions*

195 After the data collection was completed in September, individual face to face feedback
196 sessions with a duration of 30-40 minutes were arranged in October to coordinate with
197 the schedules of the participating teachers. These feedback sessions were provided by the
198 first and last author. Based on their unique participant code, a time slot was reserved for
199 a feedback meeting using the respective individual evaluation sheet. The feedback
200 sessions consisted of group-based and individual information evaluating the recovery-
201 stress development of the whole sample and the respective teacher. The individual
202 feedback on the personal recovery and stress values was provided on a differentiated scale
203 level for all measurement points. A decrease in recovery or an increase in stress
204 respectively represented an unfavourable process. These deviations from the group mean
205 were coloured either yellow ($< 1 - 2$ SD for recovery, $> 1 - 2$ SD for stress) or red (< 2
206 SD for recovery, > 2 SD for stress) in an overview matrix [38] to provide a starting point
207 for discussion and individual clarifications. A more detailed description of the feedback
208 procedure is given in the results section. This study was awarded ethical approval and
209 was conducted in accordance with the ethical principles of the **Faculty of Sport Science of
the Ruhr University Bochum** and the Declaration of
210 Helsinki.

211 *Measures*

212 The data were collected using self-administered questionnaires. The first measurement
213 (T_0) differed from the remaining seven measurement points in that it included assessment
214 of basic sociodemographic characteristics in combination with recovery-stress data.
215 Participants provided sociodemographic information regarding their age, gender, marital
216 status, employment status, working experience, and the school subjects they were
217 teaching the remaining assessments assessed working hours at school and at home.

218 The recovery-stress measurement was conducted using the Recovery-Stress
219 Questionnaire (RESTQ; Kallus and Kellmann 2016) which is a validated psychometric
220 questionnaire to monitor the development of the psychosocial factors of recovery and
221 stress. In the context of this study, a detailed assessment of the recovery and stress
222 experiences was conducted focusing on the working environment of the sample.
223 Therefore, the RESTQ-Work with 92 items was implemented at all measurement points
224 [40]. The instrument provides a means of systematic assessment of individual recovery
225 and stress experiences within the previous seven days and requires approximately 10-15
226 minutes for completion. These experiences and states can be synthesised into the
227 recovery-stress balance. For stress, the RESTQ evaluates the degree to which individuals
228 experience physically and/or mentally demanding events (e.g., “I had difficulties in
229 concentrating”) and perceptions of well-being and recovery (e.g., “I was in a good
230 mood”). Each item is rated on a seven-point Likert-like rating scale ranging from 0 (*never*)
231 - 6 (*always*). The 92 items of the RESTQ-Work are reduced to 26 scales which in turn are
232 categorised into six sub-dimensions namely *Overall Stress* (Scales: *General Stress*,
233 *Emotional Stress*, *Social Stress*, *Conflicts/Pressure*, *Fatigue*, *Lack of Energy*, *Physical*
234 *Complaints*) and *Overall Recovery* (Scales: *Success*, *Social Recovery*, *Physical Recovery*,
235 *General Well-being*, *Sleep Quality*) as well as four work specific dimensions, namely
236 *Burnout* (Scales: *Emotional Exhaustion*, *Loss of Control*, *Loss of Meaning*, *Conflicts with*
237 *Colleagues*, *Spillover*), *Leisure/Breaks* (Scales: *Undisturbed Leisure Time*, *Leisure*,
238 *Efficient Breaks*, *Undisturbed Breaks*), *Psychosocial Recovery* (Scales: *Social Support*
239 *Friends*, *Social Support Colleagues*), and *Work-related Recovery* (Scales: *Participation*,
240 *Personal Growth*, *Action Latitude*). Both the scales and dimensions of the RESTQ-Work
241 show good internal reliability in both German and English populations [39]. The RESTQ-
242 Work has been validated with other similar psychometric instruments and used as a

243 monitoring instrument with a variety of populations including athletes or administrative
244 employees [33, 41].

245 *Data analyses*

246 The datasets saved in the online survey system *SoSci Survey* were directly transferable
247 into a SPSS data sheet. After reorganising the data sheet to prepare it for the data analysis,
248 the data were thoroughly checked by two student assistants experienced in data control
249 and management to identify any errors having occurred during the reorganisation of the
250 data. The data analysis at the group level regarding the changes over time were conducted
251 in SPSS Version 24.0 (SPSS, Inc., Chicago, IL) using repeated measures analysis of
252 variance (ANOVA) after the statistical assumptions were checked. The Greenhouse-
253 Geisser adjustment was applied to account for violations of sphericity. A Bonferroni
254 correction for multiple testing was applied to control for the inflation of the alpha error.
255 The individual-level results including the figures and matrices for the feedback sessions
256 were derived using Microsoft Excel 2010. A general overview of results for all
257 participants and each measurement point with all the means of the recovery and stress
258 scales as well as the working hours at home and at school was listed in the first Excel
259 tabs. Using these data, the group-based figures for the development of recovery and stress
260 were created. Additionally, an individual matrix for each participant including the
261 individual values for all parameters was integrated into the Excel sheet. Using the
262 conditional formatting command in excel, formulas for each cell were generated and the
263 cells were coloured yellow or red automatically (see **Procedure**) depending on the
264 reference value (Figure 3).

265 Results

266 *General results on holiday effects*

267 Six repeated repeated measures ANOVAs were conducted for the RESTQ dimensions to
268 identify potential differences over time. Bonferroni corrected post-hoc tests were applied
269 to detect specific differences between the measurement points. For *Overall Stress*, a
270 significant time effect was found, $F(7,119) = 5.31, p < .001, \eta^2 = .24$. For the Easter
271 break data, the post-hoc comparisons did not indicate significant differences for the pre-
272 and post-measurements ($T_2 - T_1$). The post-hoc tests revealed that T_6 (after the Summer
273 break) was characterised significantly lower stress values than all of the other
274 measurement points, thereby indicating a significant decrease in *Overall Stress* over the
275 Summer break. The largest difference in stress scores was $-.93 (T_6 - T_5), p < .001$ and was
276 identified between the measurement points before and after the Summer break.

277 Significant variations across the measurement points were also obtained for *Overall*
278 *Recovery*, $F(3.7,67.7) = 4.33, p = .004, \eta^2 = .20$. Again, no significant discrepancies
279 appeared for the pre- and post- assessments of the Easter break. Post-hoc examinations
280 showed that the *Overall Recovery* values were significantly higher for T_6 than for $T_0, T_1,$
281 T_4, T_5, T_7 , with the largest difference of $+.69$ identified between $T_6 - T_7, p = .013$. For the
282 work-related dimensions of the RESTQ, both *Burnout* $F(4.4,74.9) = 5.54, p < .001, \eta^2$
283 $= .25$ and *Leisure/Breaks* $F(3.6,61.2) = 5.57, p = .001, \eta^2 = .25$ had significant
284 differences over the course of the survey. For *Burnout*, no statistically significant effects
285 for the Easter break were detected. However, the *Burnout* scores after the Summer break
286 were significantly lower than those of almost all other assessment points (with the
287 exception of T_2 which was after the Easter break). The greatest discrepancy of $-.95$ was
288 between $T_6 - T_5, p < .001$ which suggested a significant effect of the Summer break. A
289 statistically significant Easter break increase of $+.55$ was found for the dimension

290 *Leisure/Breaks*, $T_2 - T_1$, $p = .019$. Similar to the *Burnout* dimension, the *Leisure/Breaks*
291 scores were significantly higher after the Summer break than almost all other
292 measurements (exception: T_2 after the Easter break). The significant holiday effect of the
293 Summer break was reflected by the largest difference of +1.0 regarding $T_6 - T_5$, $p = .001$.
294 The dimensions of *Psychosocial Recovery* and *Work-related Recovery* did not display
295 significant differences over time.

296 *Feedback sessions*

297 The feedback sessions followed a defined structure to ensure that all participants were
298 informed identically. The first component consisted of a description of the group-based
299 results which were derived from those individuals who completed the questionnaires at
300 all eight measurement points ($n = 18$). To describe these processes, the researchers used
301 five different group-based figures. These were shown to the participants to provide them
302 with an overview of the sample across the time. The first figure displayed the course of
303 all six sub-dimensions of the RESTQ (Figure 2). Following this, two illustrations were
304 provided showing the general and work specific dimensions separately. Subsequently, the
305 general dimensions *Overall Stress* and *Overall Recovery* were displayed in greater detail
306 on a scale level. An example for *Overall Recovery* is presented in Figure 3. The
307 researchers emphasised the holiday effects, elaborated on the greater effect of the
308 Summer Break, and concluded that these holiday effects appeared to vanish relatively
3093 quickly after the teachers returned to their working routine.

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311 *** INSERT FIGURE 2 AND 3 HERE ***

312 For the second component, a matrix visualising the individual scores over time
313 was shown to the individual teachers. The individual data on recovery and stress was
314 presented in greater detail on a scale level to highlight inter- and intrapersonal
315 characteristics. Figure 4 depicts all the individual scores for all recovery and stress scales
3163 including their overarching dimensions for all completed measurement points.

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3183 ***** INSERT FIGURE 4 HERE *****

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320 The approach for analysing the individual matrices was equivalent for all teachers.
321 The matrix was screened for noticeable patterns and potential systematic effects both
322 vertically (i.e., boldness for one or more measurement points) and horizontally (i.e.,
323 abnormalities for one or more scales). The identified patterns were addressed by the
324 researcher and the teachers were asked whether the data reflected their subjective
325 evaluation of their recovery-stress balance. The third feedback component consisted of a
326 discussion of the potential personal relevance of the data. Depending of the frequency
327 and severity of exceptional patterns, this part of the feedback process varied in duration.
328 Finally, the fourth feedback component varied based on the existing recovery-stress
329 balance and individual preferences of each teacher. For the more unfavourable recovery-
330 stress cases, recommendations on how to improve recovery in the daily routine were
331 provided. Individuals with an already favourable recovery-stress balance were
332 commended and advised on how to maintain the healthy balance.

333 For the example case illustrated in Figure 4, starting points for discussion were
334 found in regards to the last measurement point (September 27) where a couple of red
335 scales were identified. More specifically, a high stress load seems to be present for the
336 teacher especially on a physical level (e.g., *Fatigue*, *Lack of Energy*) together with

337 reduced effectiveness to experience and benefit from breaks after work (e.g., *Spillover*,
338 *Leisure, Efficient Breaks*). During the interaction with the teacher, potential work- and
339 non work-related reasons for these observations were discussed and suggestions for
340 changes were considered (e.g., promoting detachment after work, designing specific
341 plans for recovery activities). Similarly, a horizontal analysis could be conducted which
342 in this case confirmed the vertical data. Deficits on the scales *Fatigue, Lack of Energy*,
343 *Emotional Exhaustion*, and *Spillover* manifested at almost all measurement points. Such
344 tendencies warrant cognitive and behavioral changes and were addressed in these
345 individual feedback sessions.

346 **Discussion**

347 The present study had two related aims. First, to extend the evidence regarding holiday
348 effects on well-being in teachers by monitoring the recovery-stress balance over six
349 months including two holiday periods. Second, to introduce and describe an approach to
350 combine well-being monitoring in teachers with related group-based and individual
351 feedback. This strategy of obtaining and reporting back data serves as a starting point to
352 further refine the approach in terms of the data acquisition process, participant
353 recruitment, adherence, and the feedback process.

354 *Holiday effects*

355 The outcomes at the group level reflect previous findings indicating that holiday periods
356 contribute to a reduction in stress and increase in recovery [42, 43]. The results of the
357 current study extend previous research by providing new information regarding the length
358 of the overall monitoring period and the observation of two holiday periods of different
359 durations (i.e., 2-weeks Easter break vs. 6-weeks Summer break). Significant
360 improvements in stress and recovery were identified for the Easter break for

361 *Leisure/Breaks*, and after the Summer break for *Overall Stress*, *Overall Recovery*,
362 *Burnout*, and *Leisure/Breaks*. This could be explained by both the duration and timing of
363 the breaks. In the feedback sessions, many teachers reported that the two weeks of the
364 Easter break were not actually used for resource restoration and unwinding, but rather
365 marking exam papers and preparing for conferences scheduled immediately after the
366 break. This reflects previous research indicating that a spillover of work and leisure time
367 may impair recovery processes and maintain stress levels [44]. Dealing with work at
368 home increases the presence of work-related problems and interferes with detachment
369 and functional stress management. In comparison, the Summer break signified the end of
370 the school term and could therefore be effectively utilised for recovery activities.
371 Additionally, some teachers indicated that they normally require a few days to ‘power
372 down my system’ to reduce their allostatic load which had accumulated during teaching.
373 In our sample, this process occurred over the six weeks’ time span, but two weeks was
374 too short to realise a profound restoration. Other than the duration of the holiday period,
375 fade-out effects in recovery and stress manifested after both the Easter break and Summer
376 break in the study participants. Such processes have also been reported in a meta-analysis
377 by de Bloom, Kompier [45] for various health variables in other demographic groups,
378 although the potential underlying mechanisms of these processes could not be identified.
379 With the feedback sessions in this study, we aimed to explore potential individual-level
380 mechanisms contributing to the development of the participants’ individual recovery-
381 stress balance.

382 *Feedback sessions*

383 In addition to understanding the recovery-stress process over the six months period
384 including holiday effects, these data were the basis for feedback sessions with the
385 teachers. The structured feedback procedure demonstrated a combined approach of

386 providing group-based and individual results., the visual presentation of the outcomes
387 provided a method of illustration which was then unpacked by explanations from the
388 authors.

389 For the most part, teachers were surprised by the comparatively low levels of
390 recovery across all measurement points, indicating a lack of proactive recovery. This
391 suggests that a focus on stress reduction is present despite that the circumstances often
392 make it impossible to decrease stress-related situations. Rather, a proactive promotion of
393 recovery should be realised in order to buffer stressful periods [46]. These reflections
394 were discussed with the teachers in the feedback sessions, with the aim of sensitising
395 them to the importance of active recovery through self-initiated behaviour. These
396 discussions were combined with the feedback using the individual matrix of each teacher
397 (Figure 4). Specific areas of need, signs of unfavourable developments, as well as reasons
398 for the findings were addressed and ideas for improvement were discussed. Depending
399 on individual preferences, potential recovery strategies (e.g., playing an instrument, 15-
400 minute run, reading a book) were generated collaboratively, and teachers were
401 encouraged to create space for these activities.

402 A caveat of this study is that no outcome data on the potential impact of the
403 feedback sessions regarding the direct interactions using protocols and qualitative
404 analyses are available. However, the material in terms of the data preparation and analysis
405 is shown in Figures 1-4 and can provide an impression of the nature of the feedback
406 sessions and the potential benefits to participants This exploratory study can serve as a
407 starting point for subsequent research aiming to incorporate facets of the proposed
408 feedback process and synthesise the feedback output to identify topics for interventions.
409 Consistent with the claims of Naghieh, Montgomery [25], the feedback procedure
410 demonstrated in this study has the potential of identifying potential organisational and

411 individual changes. Organisational changes can be common overarching problem areas
412 identified during the feedback sessions and that involve modifications to the working
413 conditions in schools. Individual changes can focus on is individual strategies for stress
414 management and recovery improvement. The individual feedback information could also
415 be used to identify topics of common interest for the development of related workshops
416 for teacher groups.

417 *Limitations and future directions*

418 Some limitations need to be taken into account with regards to the study. The number of
419 individuals completing all eight measurement points ($n = 18$) was small and does not
420 allow us to draw any general conclusions. However, this study aimed to demonstrate and
421 exploratively examine the approach of monitoring and providing teacher feedback. For
422 future studies, multiple schools should be contacted and the feedback approach could be
423 used as an incentive for participation. Ideally, the prospect of receiving data-based
424 individual feedback for participation could increase the likelihood of full data sets.
425 Another issue relevant to all volunteer -based studies is the composition of the sample. It
426 can be assumed that selection biases including volunteer bias and a self-report bias may
427 have influenced the data [47, 48]. These biases are difficult to exclude completely given
428 the reliance on self-report data and should be considered when interpreting the data. These
429 biases may be minimised through transparent information about the underpinnings of the
430 study together with pre-study information emphasising that the individualised feedback
431 is only helpful if genuine and authentic information is provided. The monitoring process
432 could be refined by adding questionnaires which gather additional data relevant to the
433 well-being of the participants (e.g., coping strategies) and reducing the number of items
434 for the assessment of recovery and stress. The extended version of the RESTQ-Work with

435 92 items could be implemented at a limited number of pivotal measurement points (e.g.,
436 first and last assessment) and a shortened version could be used at other assessment points
437 to reduce participant burden. The balance between the number of measurement points
438 and participant adherence needs to be considered and a qualitative evaluation of the
439 impact of the feedback sessions (e.g., on self-awareness and resolution to change) could
440 also be considered in future research.

441 ***Conclusion***

442 The present study proposed a framework and approach to study recovery-stress processes
443 over time and link data collection with feedback for the participants. Teachers appear to
444 experience extended stress periods with low levels of recovery. Using individual
445 feedback, the specific associations between recovery and stress were explored which in
446 turn enabled personalised recommendations on how to initiate individual-level changes
447 to promote well-being. The individual feedback sessions could also provide a means to
448 identify common issues that could then be addressed in either individual or organisational
449 level approaches to reduce teacher stress. As teachers play a vital role for the future of
450 children, more resources should be invested into processes to promote psychologically
451 healthy and regenerated teachers able to provide high quality education for children and
4524 adolescents.

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454 Acknowledgements

455 No funding agency supported this project. No conflict of interest is declared.

456 Ethical approval

457 All procedures performed in studies involving human participants were in accordance
458 with the ethical standards of the institutional ethics committee of the Faculty of Sport
459 Science of the [Ruhr University Bochum obtained) and with the 1964
460 Helsinki declaration and its later amendments or comparable ethical standards.

461 Informed consent

462 Informed consent was obtained from all individual participants included in the study.

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582

Tables

Table 1
Participant demographics.

Variables	Total (<i>N</i> = 37)
Age; <i>M</i> (<i>SD</i>)	43.4 (10.9)
Gender	
Male; <i>n</i> (%)	13 (35.1)
Female; <i>n</i> (%)	21 (56.8)
Missing; <i>n</i> (%)	3 (8.1)
Marital status	
Single; <i>n</i> (%)	6 (16.2)
Married/in a relationship; <i>n</i> (%)	25 (67.6)
Divorced/separated; <i>n</i> (%)	2 (5.4)
Widowed; <i>n</i> (%)	1 (2.7)
Missing; <i>n</i> (%)	3 (8.1)
Work status	
Full time; <i>n</i> (%)	22 (59.4)
Part time; <i>n</i> (%)	9 (24.3)
Missing; <i>n</i> (%)	6 (16.3)
Professional experience in years; <i>M</i> (<i>SD</i>)	12.3 (7.3)
Subjects taught	
Languages; <i>n</i> (%)	14 (37.8)
Science; <i>n</i> (%)	9 (24.3)
HSIE ^a ; <i>n</i> (%)	16 (43.2)
Other ^b ; <i>n</i> (%)	7 (18.9)

Note. *M* = Mean; *SD* = Standard Deviation; *n* = Number of participants; ^aHSIE = Human society and its environment. Includes history, geography, economics, society and culture, etc.; ^bOther = Subjects entailing domains such as philosophy, psychology, physical education.

584 **Figure captions**

585

586 Figure 1. Chronological sequence and participant distribution over the course of the study.

587

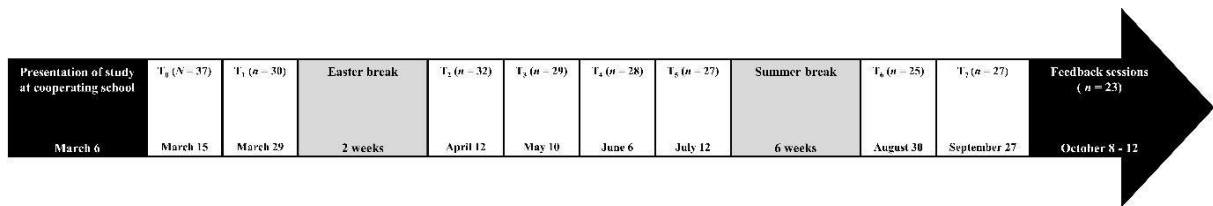
588 Figure 2. Development of all dimensions of the RESTQ-Work-92 across all measurement points ($N = 18$).
589 The recovery dimensions are displayed in blue shades, while red shades were chosen for the stress
590 dimensions.

591

592 Figure 3. Development the five general recovery dimensions of the RESTQ-Work-92 across all
593 measurement points ($N = 18$).

594

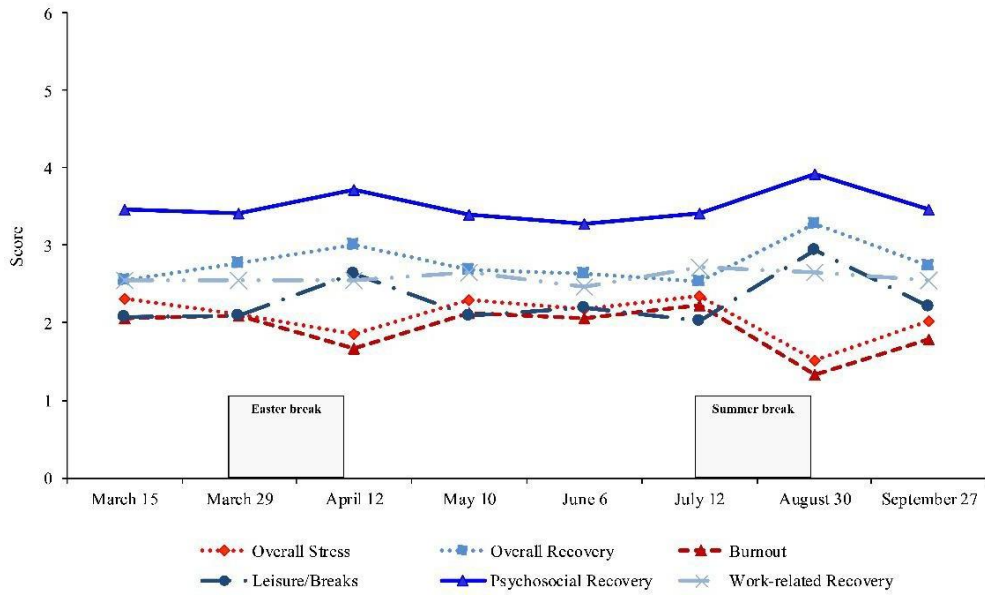
595 Figure 4. Example matrix for the individual teacher feedback illustrating a teacher's recovery-stress
596 balance over the course of the study. The recovery dimensions are highlighted in blue, the stress
597 dimensions are highlighted in red, and the working hours are highlighted in green. The individual values
598 displayed in the matrix were compared with the average scores of the entire sample of teachers for each
599 measurement point. Individual values with a difference between 1-2 standard deviations from the mean of
600 the reference sample are marked in yellow. Individual values with a difference of > 2 standard deviations
601 from the mean of the reference sample are highlighted in red. Notably, only the critical deviations are
602 marked in colour, i.e., noticeable low scores for the recovery dimensions ('too little') and noticeable high
603 scores for stress dimensions and weekly working hours ('too much'). The range for all dimensions was 0
604 (*never*) -6 (*always*). Working hours were specified in hours per week. The 'H' in the header indicates the
605 post-holiday measurement points.
606



607

608 Figure 1. Chronological sequence and participant distribution over the course of the study.

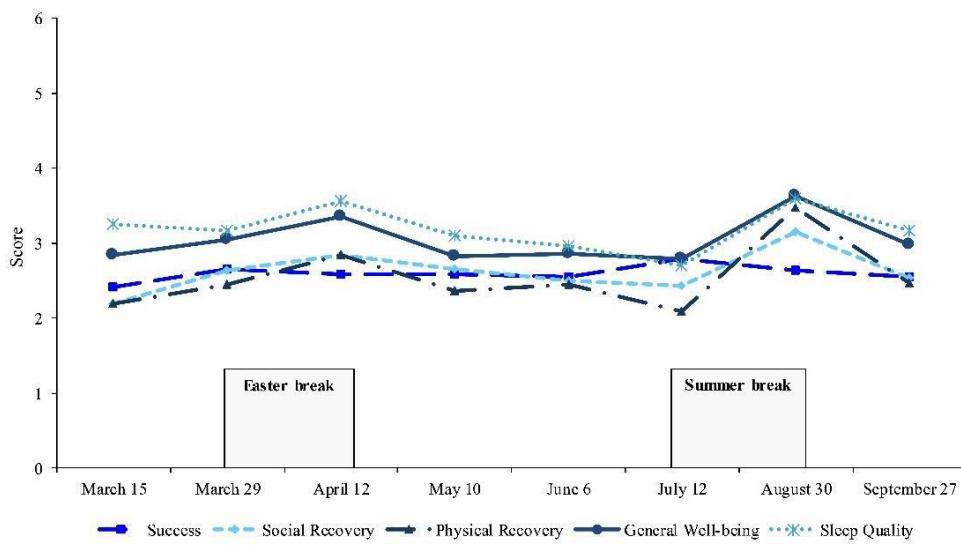
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 613 dimensions.

614



615

616 Figure 3. Development the five general recovery dimensions of the RESTQ-Work-92 across all
 617 measurement points ($N = 18$).

618

Topic	Participant code: CS672345	March 15	March 29	April 12 (H)	May 10	June 06	July 12	August 30 (H)	September 27
Overall Stress	General Stress	3.25	1.25	0.50	2.25	1.00	1.00	0.25	3.25
	Emotional Stress	3.00	2.00	0.75	1.00	1.50	1.00	0.75	2.00
	Social Stress	4.25	2.00	0.75	1.75	3.00	1.25	1.50	2.50
	Conflicts/Pressure	3.75	2.00	2.25	3.00	1.75	2.00	2.00	4.25
	Fatigue	4.25	3.75	1.25	5.00	3.25	1.75	3.75	5.00
	Lack of Energy	3.00	3.75	1.00	4.25	4.25	2.75	2.75	4.00
Overall Recovery	Physical Complaints	3.75	4.00	4.00	5.00	4.00	3.25	1.75	4.50
	Success	2.50	3.50	4.00	2.75	2.75	4.00	3.25	4.00
	Social Recovery	1.50	2.75	3.25	3.00	3.50	3.75	3.75	1.25
	Physical Recovery	1.50	1.25	2.75	1.75	2.25	2.50	3.25	1.50
	General Well-being	3.00	3.00	4.75	3.00	3.25	4.25	4.50	3.50
	Sleep Quality	2.00	2.00	2.00	3.00	3.00	2.00	4.00	2.25
Burnout	Emotional Exhaustion	3.67	5.00	3.67	5.00	1.00	3.00	2.33	5.00
	Loss of Control	2.00	1.67	0.67	1.67	1.00	1.00	1.67	1.00
	Loss of Meaning	1.33	0.33	0.00	0.33	1.33	0.33	0.33	1.00
	Conflicts with Colleagues	3.00	0.50	0.00	0.50	3.25	1.00	0.25	1.25
Leisure/Breaks	Spillover	4.67	3.33	5.00	5.00	4.00	4.00	3.33	5.67
	Undisturbed Leisure Time	1.40	1.80	3.40	5.00	4.00	3.70	2.60	1.60
	Leisure	1.50	1.00	1.00	1.00	1.00	1.00	2.00	0.00
	Efficient Breaks	1.67	2.00	1.00	1.00	2.33	2.67	3.00	0.67
Psychosocial Recovery	Undisturbed Breaks	1.00	0.50	1.00	1.00	1.00	1.00	2.00	0.00
	Social Support Friends	4.50	4.50	3.00	4.00	4.00	2.50	4.00	2.50
Work-related Recovery	Social Support Colleagues	3.25	3.50	4.50	3.00	3.25	3.25	3.00	3.25
	Participation	2.25	3.50	4.50	2.00	2.50	2.75	2.25	4.00
	Personal Growth	3.25	3.50	5.00	5.00	2.75	4.75	3.75	5.25
Working hours	Action Latitude	3.50	3.00	2.50	2.00	2.00	2.50	1.50	3.00
	At School	16.00	24.00	6.00	31.00	20.00	35.00	18.00	40.00
	At Home	28.00	18.00	3.00	70.00	15.00	5.00	8.00	8.00

619

620 Figure 4. Example matrix for the individual teacher feedback illustrating a teacher's recovery-stress
621 balance over the course of the study. The recovery dimensions are highlighted in blue, the stress
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623 displayed in the matrix were compared with the average scores of the entire sample of teachers for each
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