
Title	Modifying the PERMA profiler to assess student well-being
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Modifying the PERMA Profiler to Assess Student Well-Being

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Modifying the PERMA profiler to assess student well-being

Abstract

Student well-being is inexorably bound to modern educational systems and schools have an inherent responsibility to examine student well-being. It is vital that schools have at their disposal a valid and reliable measurement tool to assess student well-being. A popular conceptual framework of well-being is the PERMA model (positive emotions, engagement, relationships, meaning, and a sense of accomplishment). The PERMA-Profiler is a scale that focuses exclusively on measuring these factors. However, results from previous validation studies have been mixed with issues arising from items on engagement and its model structure. Thus, the aims of the present study were to 1) modify the PERMA-Profiler to assess student well-being in secondary schools, and 2) evaluate the psychometric properties of the modified PERMA-Profiler. Study one included focus group discussions with 5 teachers and 20 students, followed by a preliminary trial to 387 secondary one (year 7 equivalent) students (194 boys, 193 girls). Several items were modified after analysing the results from study one. Study 2 aimed to validate the amended questionnaire by extending its administration to 3788 secondary one students (2202 boys, 1586 girls) over 17 schools. Results indicated that the questionnaire exhibited good psychometric properties, namely a) it had excellent reliability indices of coefficient omega, b) convergent validity was established with school satisfaction and test anxiety and c) it demonstrated excellent fit with a five-factor model. Furthermore,

there was measurement invariance between gender. The modified PERMA-Profiler shows promise as a valid and reliable measurement of student well-being in secondary schools.

Keywords: student well-being; PERMA; positive psychology; measurement; assessment

Accepted manuscript

Modifying the PERMA profiler to assess student well-being

Student well-being is inexorably bound to modern educational systems. To address increasing levels of student stress and anxiety, schools all over the world have extended their focus beyond acquisition of skills and knowledge to the domains of well-being (Govorova et al., 2020; Ng, 2020). Schools have an inherent responsibility to examine student well-being as the formal education period offers an extensive window for potential interventions before graduation into working society. Furthermore, student well-being has been found to enhance mental health and resilience (Roffey, 2015), and is positively associated with student engagement, motivation (Kotera & Ting, 2021) and academic achievement (Kaya & Erdem, 2021). It is thus imperative that schools have at their disposal a valid and reliable measurement tool that can not only assess and monitor student well-being, but also identify suitable well-being components for meaningful interventions.

A conceptual framework of well-being used in many schools is the PERMA model (Seligman, 2012). The model posits that the building blocks of well-being are positive emotions, engagement, positive relationships, meaning, and a sense of accomplishment. Positive emotions pertains to hedonistic well-being, and refers to feelings of joy, pleasure and hope. Engagement refers to a psychological state of flow, in which a person loses a sense of time whilst involved on tasks or interactions. Positive

relationships represent the social support and networks that are the foundations of societal life. A sense of meaning pertains to eudaemonic well-being, and refers to a sense of purpose or direction in life. A sense of accomplishment involves a sense of competency in reaching one's goals or achieving mastery in tasks. The framework offers educators a parsimonious list of well-being contributors that may lead to potential specific interventions (Seligman, 2018).

Although scales to measure each PERMA factor separately has been developed and used in many previous studies, there is an existing instrument that focuses exclusively on capturing the five PERMA factors, namely the PERMA-Profiler (Butler & Kern, 2016). The PERMA-Profiler has been used to capture the multi-dimensional nature of PERMA across many different countries, such as Australia (Iasiello et al., 2017), Greece (Pezirkianidis et al., 2021), Indonesia (Hidayat et al., 2018), Iran (Payoun et al., 2020), China (Yang & Mohd, 2021), Turkey (Ayse, 2018), Germany (Wammerl et al., 2019) and the United States (Umucu, 2021). The scale has also been adapted into the workplace context (Choi et al., 2019).

Furthermore, the PERMA-Profiler was designed for maximum brevity whilst still maintaining psychometric integrity (Butler & Kern, 2016), rendering it a highly suitable tool for schools to use. However, validation studies across different cultures surfaced several issues pertaining to the instrument, that includes the reliability of its factors as well as its factor structure. Thus, the aims of the present study were to 1) modify the PERMA-Profiler to assess

student well-being and 2) to investigate the psychometric properties of the modified PERMA-Profilier for use in secondary schools (Years 7 to 12 equivalent).

PERMA-Profilier

Butler and Kern (2016) developed the PERMA-Profilier after a rigorous process of item selection, refinement and validation. Items were selected from a large item bank and trimmed down by experts in positive psychology. These items were further trimmed down by including only wordings that were positively worded and assessed stable aspects of well-being rather than momentary feelings. Finally, the items were analysed and refined through three validation studies. The refined set comprised of 15 items, with three items measuring each PERMA factor. Subsequently, a further eight items measuring negative emotions (three items), self-perceived physical health (three items), overall happiness (one item) and loneliness (one item), were added to the final set of items. The finalized set was then subjected to a further eight validation studies to assess its psychometric properties. Confirmatory factor analysis demonstrated that the five-factor PERMA-Profilier had acceptable model fit, whilst further analysis showed that the scale had good levels of reliability, convergent and divergent validity.

Although participants in the comprehensive validation studies conducted by Butler and Kern (2016) were drawn world-wide, it was difficult to ascertain the validity of the PERMA-Profilier on specific countries

or groups as the analysis were conducted holistically. This may be vital as perceptions of well-being may function different across cultures due to embedded beliefs and expectations (Author, in press). As such, researchers in various countries have conducted independent validation studies on the PERMA-Profilier. Generally, these studies have shown that the various domains of PERMA exhibit convergent and divergent validity with other related constructs. However, other results arising from these studies have largely been mixed. Table 1 shows a list of validation studies conducted and the issues encountered in their results. From the table, it seemed that the PERMA-Profilier has two main areas that require clarification: 1) the items measuring engagement, and 2) its model structure.

Table 1

List of Validation Studies Conducted on PERMA-Profilier

No.	Author(s)	Country	Sample	Issues encountered
1	Ayşe (2018)	Turkey	250 university students	-
2	Bartholomaeus et al. (2020)	Australia	1942 adults	Low internal consistency for engagement.
3	Choi et al. (2019)*	Korea	316 adults	-
4	De Carvalho et al. (2021)	Brazil	1327 adults	-
5	Elfida et al. (2018)	Indonesia	439 adults (mean age = 30.82)	Low factor loadings for one item on engagement ("How often do you lose track of time when

				you're working on something you love?")
6	Faran and Malik (2021)	Egypt	600 students (mean age = 23.2)	Second-order model indicated acceptable model fit. Poor discriminant validity for the five factors.
7	Giangrasso et al. (2021)	Italy	2533 students (mean age = 26.4)	Low internal consistency for engagement. Low factor loadings for one item on engagement (same item as Elfida et al., (2018))
8	Grenawalt et al. (2021)	United States	127 adult survivors of CNS tumor (mean age = 23.8)	Exploratory factor analysis showed a one-factor model. Low factor loadings for one item on engagement (same item as Elfida et al., (2018)).
9	Hidayat et al. (2018)	Indonesia	274 students (18 - 22 years)	Second-order model indicated acceptable model fit.
10	Jimenez et al. (2021)*	United States China	284 adults from US (mean age = 35.8) 420 adults from China (mean age = 32.0)	Unacceptable model fit for the U.S. sample.
11	Khaw and Kern (2014)	Malaysia	342 adults (mean age = 26)	Exploratory factor analysis showed a three-factor model.

12	Payoun et al. (2020)	Iran	384 older adults (mean age = 68.4)	Exploratory factor analysis showed a three-factor model. Low factor loadings for one item on positive relationships.
13	Pezirkianidis et al. (2021)	Greece	2539 adults (mean age = 35.1)	Low internal consistency for engagement. Low convergent validity for engagement. Unacceptable model fit for second-order factor.
14	Reid and Smith (2018)	Australia	120 students (Years 9 to 11)	Exploratory factor analysis showed a four-factor model.
15	Ryan et al. (2019)	Australia	439 adults (mean age = 41.3)	Low internal consistency for engagement. Unable to conduct CFA on five-factor model due to mis-specified model.
16	Umucu et al. (2020)	United States	196 student veterans (mean age = 29.4)	Exploratory factor analysis showed a two-factor model. Low internal consistency for engagement.
17	Umucu (2021)	United States	156 veterans with mental illnesses (mean age = 37.9)	Unacceptable model fit for first and second-order factor model.
18	Wammerl et al. (2019)	Germany	854 adults (mean age = 28.9)	Low internal consistency for engagement.

				Bi-factor model showed a better fit than first-order model.
19	Watanabe et al. (2018)*	Japan	310 adults (mean age = 44.9)	Unacceptable model fit for the first-order factor model.
20	Yang and Mohd (2021)	China	309 students (18 to 22 years)	-

*The scale used was the Workplace PERMA-Profilier. Items were similar to the PERMA-Profilier with the general context replaced by a work context.

Engagement

In the initial version, Butler and Kern (2016) had already noted that items measuring the engagement was the weakest link in the PERMA-Profilier as it had the lowest reliability score. Several previous studies had also shown poor values for internal consistency for the engagement factor, with values ranging from .50 to .60 (Burke & Minton, 2019; Giangrasso et al., 2021; Goodman et al., 2018; Pezirkianidis et al., 2021). Furthermore, some confirmatory factor analysis studies also showed that a specific item, “How often do you lose track of time when you're working on something you love?”, had poor standardized loadings ranging from .12 to .39 (Elfida et al., 2020; Giangrasso et al., 2021; Grenawalt et al., 2021). The item was intended to assess the frequency of individuals being in a state of full involvement with engrossing activities that would ultimately spiral towards well-being (Schueller & Seligman, 2010). However, some researchers have pointed out that the phrasing is prone to mis-interpretation (Elfida et al., 2020; Giangrasso, 2021), whilst others have highlighted the multi-

dimensional nature of engagement that may have resulted in the poor loadings (Grenawalt et al., 2021).

Model structure

Several researchers have also encountered anomalies when validating the number of factors in the PERMA-Profiler, with the number of factors found to range from one to four (Grenawalt et al., 2021; Khaw & Kern, 2014; Payoun et al., 2020; Reid & Smith, 2018; Umucu et al., 2020). Furthermore, some studies were also unable to replicate the five-factor model appropriately, although no alternative was provided (Jimenez et al., 2021; Ryan et al., 2019; Umucu, 2021; Watanabe et al., 2018). As the scale was originally intended to coincide with the five factors of the PERMA framework, researchers concluded that this was largely due to differences in understanding between the general population and specific groups. For example, these validation studies were conducted on Malaysians (Khaw & Kern, 2014), Japanese (Watanabe et al., 2018), senior citizens (Payoun et al., 2020), student veterans (Umucu et al., 2020) and high school students (Reid & Smith, 2018). In particular, Reid and Smith (2018) did not retain the factor of a sense of meaning for students between Years 9 and 11.

A secondary concern lies in the type of model that is best suited for the PERMA-Profiler. Butler and Kern (2016) had observed that a single score may provide a global indication of well-being, but the information may not be as meaningful as domain scores. Nonetheless, some researchers have attempted to show that the PERMA domains load to a higher order

factor of well-being. Wammerl et al. (2019) compared four different models, namely the single factor model, five-factor model, higher order model and a bifactor model. The researchers eventually concluded that the five-factor model was the most suitable model in terms of theoretical compatibility and model fit statistics. Similarly, Pezirkianidis et al. (2021) and Hidayat et al. (2018) compared the five-factor model with a second order factor model. In both instances, the five-factor model produced a better fit to the data.

Research objectives

Taken together, the current literature conveys the need to examine the psychometric properties of the PERMA-Profilier in order to measure student well-being in secondary schools. Specifically, only the five-factor model will be examined as identifying well-being components for interventions is a central objective for schools. In addition, as comparisons may be made between boys and girls within the school, measurement invariance of the model between gender will also be analysed. Thus, two studies were conducted to address the following research objectives:

- 1) Modify the PERMA-Profilier to assess student well-being in secondary schools. It was expected that some items in the instrument would be amended to improve its psychometric properties.
- 2) Evaluate the psychometric properties of the modified PERMA-Profilier as a tool to assess student well-being. It was hypothesized that the items would a) fit a five factor structure model, b) demonstrate a high

level of reliability, and c) exhibit convergent validity with related variables.

- 3) Evaluate the measurement invariance between gender of the modified PERMA-Profiler. It was hypothesized that modified instrument would be valid for both males and females.

Study 1

Method

Sample and Procedure

The first study aims to answer the first research question by refining the items on the PERMA-profiler to be suitable for secondary school students in a school context. This was done through a) focus group discussions with teachers and students and b) an administration of the questionnaire with a group of students in two government schools in Singapore. The focus group discussions were conducted over five separate sessions. The first session was conducted with a group of 5 teachers (2 males, 3 females). The teachers had between 12 to 18 years in service and had prior experience teaching either Year 6 or Year 7 equivalent students. Subsequent sessions were conducted with 10 boys and 10 girls who were all secondary one students (Year 7 equivalent) in a government school. All the discussions were conducted and recorded online through a video conferencing platform. Following the discussions, the questionnaire was administered as a preliminary trial to 387 secondary one students (194

boys, 193 girls, $M_{\text{age}} = 12.8$ years, $SD_{\text{age}} = .50$). Results from Study 1 informed the research team on the modification of the items.

Clearance was sought and approved by the university's ethics board before the commencement of the study. Informed consent was also sought and obtained from parents and students prior to data collection.

Instruments

Student well-being. The initial questionnaire used was a slightly modified version of the PERMA-Profiler (Butler & Kern, 2016). There were a total of 23 items, with each item measured on an 11-point scale, whereby a higher score indicated a higher level of the factor. Previous studies had indicated that the subscales exhibited differing levels of internal consistency ($.50 \leq \alpha \leq .96$). Notably, several previous studies had shown poor alpha values for the engagement factor. The five constructs of PERMA (i.e. positive emotions, engagement, positive relationships, sense of meaning, sense of accomplishment) were measured with three items each. There were four other constructs, namely negative emotions, health, happiness and loneliness. Negative emotions and health were measured with three items each whilst happiness and loneliness were each measured with a single item. The questionnaire was modified so that items relate to the school context, rather than a general context as originally specified. For example, "In general, how often do you feel joyful?" was reworded to "In school, how often do you feel joyful?".

Data analysis

Data from the focus group discussions were recorded. Suggestions on paraphrasing the items were discussed during the discussions and subsequently agreed on by the research team. Based on the discussion, several items were amended. Subsequently, the amended scale was administered to students and correlations were computed between all the variables. Convergent validity was examined through the correlations of the PERMA subscales with the other subscales of negative emotions, health, happiness, and loneliness in the PERMA-Profilier. In addition, reliability was assessed with coefficient omega using the R package *semTools*. Coefficient omega was chosen as its estimates are unbiased with varying factor loadings whereas coefficient alpha assumes that factor loadings are equal across all items (Flora, 2020). Although there are no universally fixed criteria for coefficient omega, a good benchmark would be the standards of coefficient alpha with a minimum value of 0.5 and preferred values of 0.75 and above (Watkins, 2017). Variables that did not satisfy convergent validity or reliability standards were identified and items measuring the variables were re-examined.

Prior to examining the factor structure of the model, multivariate normality was assessed by Mardia's multivariate skewness and kurtosis coefficients. The R package *MVN* was used for this purpose. A confirmatory factor analysis was then conducted using the R package *Javaan* to examine the factor structure of a five-factor PERMA model. As the results indicated

that the data did not satisfy multivariate normality, a maximum likelihood estimation with robust standard errors was used. Model fit will be assessed by the Satorra-Bentler scaled χ^2 , where a non-significant χ^2 value would indicate a good fit. In addition, the robust fit measures of CFI, TLI and RMSEA were examined, where values of CFI, TLI greater than .95, and values of RMSEA less than .06 would indicate a good fit (Hu & Bentler, 1999). Standardized factor loadings within the model were also examined. A poor model fit or items with low/insignificant standardized factor loadings would signify a need to re-look at the items.

Results

Focus group discussions

From the focus group discussions, five items were amended as the teachers and students felt that the phrases used were vague and ambiguous. Table 2 shows the original five items and the reasons given for their amendment. The items were from the subscales of sense of meaning, sense of accomplishment and health. The five items were then reworded before administration to a preliminary group of students.

Table 2

Items Amended from Focus Group Discussions

No.	Factor	Original item that needed to be amended	Reason

1	Sense of meaning	To what extent is your school life purposeful and meaningful?	School activities may be purposeful but not meaningful to students.
2	Sense of meaning	To what extent do you generally feel you have a sense of direction in your school?	Some students mis-interpreted the phrase "sense of direction".
3	Sense of accomplishment	How often are you able to handle your school-related responsibilities?	Some students mis-interpreted the phrase "school-related responsibilities".
4	Health	In general, how would you say your health is?	There was confusion over whether the item meant physical health or mental health.
5	Health	Compared to others of your same age and gender, how is your health?	There was confusion over whether the item meant physical health or mental health.

Reliability

The PERMA subscales showed adequate to good levels of reliability ($\omega_{\text{positive emotions}} = .89$, $\omega_{\text{engagement}} = .68$, $\omega_{\text{positive relationships}} = .77$, $\omega_{\text{sense of meaning}} = .92$, $\omega_{\text{sense of accomplishment}} = .81$).

Convergent validity

Positive significant correlations were observed between the PERMA subscales and the subscales of health ($r = .28$ to $.40$, $p < .001$) and happiness ($r = .54$ to $.73$, $p < .001$). Negative significant correlations were

observed between the PERMA subscales and the subscale of loneliness ($r = -.16$ to $-.36$, $p < .001$). Negative significant correlations were observed between the subscales of positive emotions, positive relationships, sense of meaning, sense of accomplishment with the subscale of negative emotions ($r = -.13$ to $-.21$, $p < .05$). However, the correlation between the subscale of engagement and negative emotions were not significant ($r = -.04$, $p = .46$).

Confirmatory Factor Analysis

Mardia's multivariate skewness and kurtosis were found to be statistically significant ($p < .001$) for the PERMA subscales, thus indicating that the data did not satisfy the condition of multivariate normality. Thus, a maximum likelihood estimation with robust standard errors was used in the confirmatory factor analysis.

The model in the preliminary trial showed an excellent fit, $\chi^2_{\text{Satorra-Bentler}} = 106.5$, $p < .05$, $\text{CFI}_{\text{robust}} = .990$, $\text{TLI}_{\text{robust}} = .986$, $\text{RMSEA}_{\text{robust}} = .035$. Most of the standardized factor loadings were high ($\beta > .60$, $p < .001$). However, one item measuring the construct of engagement, namely "At school, how often do you lose track of time while doing something you enjoy?", had a relatively low standardized factor loading ($\beta = .33$, $p < .001$). After considering the various results arising from the preliminary trial, the school context and previous validity studies on the PERMA-profiler (e.g. Butler & Kern, 2016; Burke & Minton, 2019; Giangrasso, 2018; Pezierkianidis et al., 2021) that showed weaker results for engagement, the item was reworded to "To what extent do you enjoy your activities in

school?”. Table 3 shows the final items that were modified from the original version whilst Table 4 shows the final version of the questionnaire. As with the original scale, the modified PERMA-Profler had 15 questions measuring the PERMA constructs and additional items that measure negative emotions, health, happiness and loneliness.

Table 3

Modified Items from the Original PERMA-Profler

No.	Factor	Original item	Modif item
1.	Engagement	At school, how often do you lose track of time while doing something you enjoy?	To what extent do you enjoy your activities in school?
2.	Sense of meaning	To what extent is your school life purposeful and meaningful?	To what extent is your school life purposeful?
3.	Sense of meaning	To what extent do you generally feel you have a sense of direction in your school?	To what extent is your school life meaningful?
4.	Sense of accomplishment	How often are you able to handle your school-related responsibilities?	How often are you able to handle your responsibilities at school?
5.	Health	In general, how would you say your health is?	In general, how would you say your physical health is?
6.	Health	Compared to others of your same age and gender, how is your health?	Compared to others of your same age and sex, how is your physical health?

Table 4

Items in the Modified PERMA-Profiler

No	Label	Item	Response Anchors
.	1		
1.	PE1	At school, how often do you feel joyful?	0 = never, 10 = always
2.	PE2	At school, how often do you feel positive?	0 = never, 10 = always
3.	PE3	At school, to what extent do you feel satisfied?	0 = never, 10 = always
4.	EN1	To what extent do you enjoy your activities in school?	0 = not at all, 10 = completely
5.	EN2	To what extent do you feel excited and interested in your activities in school?	0 = not at all, 10 = completely
6.	EN3	At school, how often do you become absorbed in what you are doing?	0 = never, 10 = always
7.	RS1	At school, to what extent do you receive help and support from others when you need it?	0 = not at all, 10 = completely
8.	RS2	At school, to what extent do you feel appreciated?	0 = not at all, 10 = completely
9.	RS3	At school, how satisfied are you with your personal relationships?	0 = not at all, 10 = completely
10.	ME1	To what extent is your school life purposeful?	0 = not at all, 10 = completely
11.	ME2	In general, to what extent do you feel that what you do in school is valuable and worthwhile?	0 = not at all, 10 = completely
12.	ME3	To what extent is your school life meaningful?	0 = not at all, 10 = completely
13.	AC1	How much of the time do you feel you are making progress towards accomplishing your goals in school?	0 = not at all, 10 = completely

- | | | | |
|-----|-----|---|---------------------------------|
| 14. | AC2 | How often do you achieve the important goals in school you have set for yourself? | 0 = never, 10 = always |
| 15. | AC3 | How often are you able to handle your responsibilities at school? | 0 = never, 10 = always |
| 16. | NE1 | At school, how often do you feel anxious? | 0 = never, 10 = always |
| 17. | NE2 | At school, how often do you feel angry? | 0 = never, 10 = always |
| 18. | NE3 | At school, how often do you feel sad? | 0 = never, 10 = always |
| 19. | HE1 | In general, how would you say your physical health is? | 0 = terrible, 10 = excellent |
| 20. | HE2 | How satisfied are you with your current physical health? | 0 = not at all, 10 = completely |
| 21. | HE3 | Compared to others of your same age and sex, how is your physical health? | 0 = terrible, 10 = excellent |
| 22. | HAP | Taking all things together, how happy would you say you are at school? | 0 = not at all, 10 = completely |
| 23. | LON | How lonely do you feel at school? | 0 = not at all, 10 = completely |
-

Note: PE = positive emotions, EN = engagement, RS = positive relationships, ME = sense of meaning, AC = sense of accomplishment, NE = negative emotions, HE = health, HAP = happiness, LON = loneliness

Study 2

Method

Sample and Procedure

Study 2 aims to address the second and third research objectives. It aims to validate the modified questionnaire by expanding its administration

to 3788 secondary one students (2202 boys, 1586 girls, $M_{\text{age}} = 12.25$, $SD_{\text{age}} = .46$) over 17 schools in Singapore. In addition to the PERMA-profiler, a questionnaire assessing students' satisfaction with school and test anxiety were also administered at the same time to elicit further evidence of convergent validity. In both studies, the questionnaires were administered online through Qualtrics and students accessed the questionnaire through a learning management system.

Clearance was sought and approved by the university's ethics board before the commencement of the study. Informed consent was also sought and obtained from parents and students prior to data collection.

Instruments

Student well-being. The modified version of the PERMA-Profiler (Table 3) was used to assess student well-being.

Satisfaction with school. Students' school satisfaction was measured using the Satisfaction with School scale (Nie & Lau, 2009). There were four items, with each item measured on a 5-point scale (1 = strongly disagree, 5 = strongly agree). A sample item was "I am glad to be in this school". School satisfaction has been shown to be positively associated with well-being (Casas et al., 2013). The scale had been shown to exhibit validity and internal consistency ($\alpha = .86$) in a previous study (Nie & Lau, 2009). Data from this scale will be used to assess for convergent validity of the PERMA domain scales.

Cognitive test anxiety. Test anxiety was measured using the Cognitive Test Anxiety Scale (Cassady & Finch, 2014). There were 17 items, with each item measured on a 5-point scale (1 = strongly disagree, 5 = strongly agree). A sample item was “I lose sleep over worrying about examinations”. Test anxiety has been shown to be negatively associated with well-being (Steinmayr et al., 2016). The scale had been shown to exhibit validity and internal consistency ($\alpha = .93$) in a previous study (Cassady & Finch, 2014). Data from this scale will be used to assess for convergent validity of the PERMA domain scales.

Data Analysis

Similar to Study 1, correlations between subscales were used to assess the convergent validity of the subscales. Additional evidence of convergent validity were examined through the correlations of the PERMA subscales with the subscales of satisfaction with school, and cognitive test anxiety. Reliability was assessed with coefficient omega. Multivariate normality was assessed by Mardia’s multivariate skewness and kurtosis coefficients. As the results indicated that the data did not satisfy multivariate normality, a confirmatory factor analysis using a maximum likelihood estimation with robust standard errors was conducted to examine the structure of a five-factor PERMA model. The Satorra-Bentler scaled χ^2 as well as the robust modest fit measures of CFI, TLI and RMSEA were also examined.

Finally, the model was investigated for measurement invariance between gender. The model would be tested for configural, metric, scalar and residual invariance. Configural invariance tests the equivalence of the factor structure, metric invariance tests the equivalence of factor loadings, scalar invariance tests the equivalence of item intercepts, and residual invariance tests the equivalence of items' residuals. The absolute change (Δ) in the fit indices of CFI and RMSEA will be examined, where Δ CFI less than .01 coupled with Δ RMSEA less than .015 would indicate measurement invariance (Chen, 2007).

Results

Table 5 shows the descriptive statistics of the 23 items. The full range of response categories was utilized (min scores = 0, max scores = 10). Mardia's multivariate skewness and kurtosis were found to be statistically significant ($p < .001$) for the PERMA subscales, thus indicating that the data did not satisfy the condition of multivariate normality. Thus, similar to Study 1, a maximum likelihood estimation with robust standard errors was used in the confirmatory factor analysis.

Table 5

Descriptive Statistics of Items

Label	Mean	SD	Min	Max	Skewness	Kurtosis
PE1	6.78	1.97	0	10	-0.63	0.45
PE2	6.54	2.10	0	10	-0.52	0.09
PE3	6.51	2.08	0	10	-0.59	0.41

EN1	7.07	1.95	0	10	-0.71	0.68
EN2	6.90	2.03	0	10	-0.69	0.57
EN3	6.52	1.98	0	10	-0.61	0.55
RS1	6.60	2.33	0	10	-0.57	-0.06
RS2	6.48	2.37	0	10	-0.68	0.22
RS3	7.16	2.33	0	10	-0.86	0.49
ME1	7.07	2.13	0	10	-0.79	0.72
ME2	7.02	2.15	0	10	-0.76	0.61
ME3	7.17	2.13	0	10	-0.84	0.72
AC1	6.57	2.12	0	10	-0.73	0.60
AC2	6.29	2.16	0	10	-0.68	0.51
AC3	7.08	1.97	0	10	-0.83	0.89
NE1	5.09	2.67	0	10	-0.05	-0.81
NE2	3.56	2.53	0	10	0.50	-0.45
NE3	3.62	2.67	0	10	0.47	-0.59
HE1	6.64	2.27	0	10	-0.64	0.24
HE2	6.28	2.75	0	10	-0.55	-0.41
HE3	6.26	2.45	0	10	-0.57	-0.06
HAP1	7.03	2.17	0	10	-0.79	0.56
LON1	3.23	2.82	0	10	0.56	-0.71

Reliability

Table 6 shows the values of coefficient omega for the various subscales. All the subscales demonstrated good levels of reliability ($\omega = .79$ to $.93$). In particular, the reliability values for engagement have increased substantially.

	6.75	1.9	0.6	0.6	1.0								
RS		7	8	1	0								
	7.09	1.9	0.7	0.7	0.6	1.0							
ME		8	3	2	5	0							
	6.65	1.8	0.6	0.6	0.6	0.7	1.0						
AC		0	5	8	0	1	0						
	4.09	2.1	-	-	-	-	-						
		8	0.4	0.2	0.3	0.3	0.3	1.0					
NE			1	8	5	1	0	0					
	6.39	2.2											
		3	0.4	0.3	0.4	0.3	0.4	0.2	1.0				
HE			1	9	0	8	2	2	0				
	7.03	2.1											
		7	0.7	0.6	0.6	0.7	0.5	0.3	0.4	1.0			
HAP			4	8	4	0	9	7	3	0			
	3.23	2.8	-	-	-	-	-	-	-	-			
LO		2	0.3	0.2	0.4	0.2	0.2	0.4	0.2	0.3			
N			4	3	1	8	5	9	1	5	1.00		
	3.92	.78											
SW			0.4	0.4	0.4	0.5	0.4	0.2	0.2	0.4	-		
S			8	7	1	1	0	7	0	9	0.27	1.00	
	3.28	.88	-	-	-	-	-	-	-	-			
			0.2	0.1	0.2	0.1	0.2	0.4	0.2	0.2		-	1.0
CTA			5	7	0	7	3	6	0	0	0.28	0.17	0

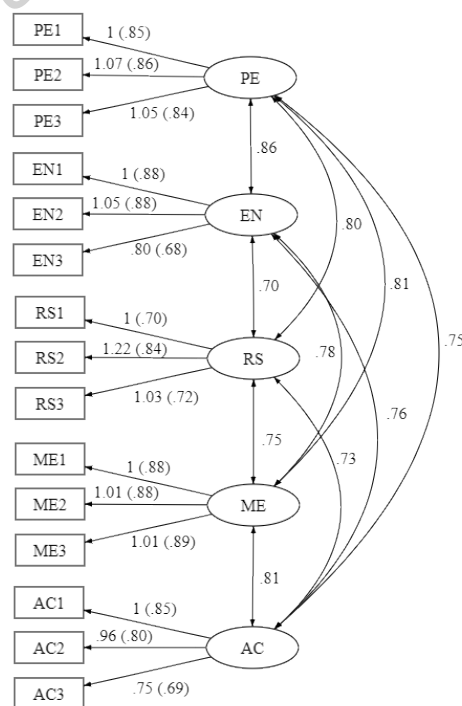
Note: 1) PE = positive emotions, EN = engagement, RS = positive relationships, ME = sense of meaning, AC = sense of accomplishment, NE = negative emotions, HE = health, HAP = happiness, LON = loneliness, SWS = Satisfaction with school, CTA = Cognitive test anxiety. 2) All correlations are significant at $p < .001$.

Confirmatory Factor Analysis

Figure 1 shows the model structure for the modified PERMA-Profiler with standardized loadings and latent correlations. The model showed an excellent fit, $\chi^2_{\text{Satorra-Bentler}} = 523.78$, $p < .001$, $\text{CFI}_{\text{robust}} = .980$, $\text{TLI}_{\text{robust}} = .974$, $\text{RMSEA}_{\text{robust}} = .052$. Latent correlations between the factors were substantial ($r = .73$ to $.81$). All standardized factor loadings were high ($\beta > .60$, $p < .001$). In particular, the standardized loadings for all items on engagement were high.

Figure 1

Model Structure for Modified PERMA-Profiler



Note: Standardized loadings are given in parentheses.

Measurement Invariance

Table 8 shows the χ^2 difference tests and the fit indices for the measurement invariance models. As χ^2 difference tests are sensitive to sample size (Chen, 2007), more emphasis is placed on the differences in fit indices. The absolute change in CFI and RMSEA was $\leq .01$ and $\leq .015$ for all the model comparisons, thus indicating that the PERMA scales exhibited measurement invariance between gender.

Table 8

Results for Measurement Invariance

Model	χ^2	CFI	RMSEA	Model comp	$\Delta\chi^2$	Δ CFI	Δ RMSEA	Decision
M1: Configural	1142.2 7	.979	.053	-	-	-	-	-
M2: Metric	1147.1 7	.979	.051	M1	3.73	.000	.002	Yes
M3: Scalar	1220.0 2	.978	.052	M2	78.83* *	.001	.001	Yes
M4: Residual	1397.2 7	.974	.053	M3	82.17* *	.004	.001	Yes

Note: ** $p < .001$

Discussion

To reiterate, the aims of the study were to modify the PERMA-Profiler to assess student well-being in secondary schools and to ascertain the psychometric properties of the modified scale. This was achieved through two studies. Study 1 comprised of focus group discussions with students and teachers, followed by a preliminary trial of the items. Several items in

the original PERMA-Profiler were adjusted in response to the discussions and trial. Study 2 extended the administration of the scale to a larger group of students. The final scale demonstrated good levels of validity and reliability, suggesting that it was appropriate to use in schools.

Several items in the original PERMA-Profiler were deemed to be vague or ambiguous by both students and teachers. Some of these misinterpretations may be attributed to cultural differences, whereby different aspects of education are emphasized in schools. For example, the item “To what extent is your school life purposeful and meaningful?” was observed to be double-barreled as purpose and meaning were considered as separate issues. Students may find examinations to be purposeful (e.g. good results in examinations are something to aim for because of societal pressure) but meaningless (e.g. examination scores are pointless because they are not good representations of learning). Some phrases were also understood in a literal sense. “A sense of direction” may mean that students know their way around the school environment and “school-related responsibilities” may refer to specific leadership roles that only a few selected students would have. Additionally, it was observed that current trends in education make a difference in the item wordings. For example, the trend towards mental wellness in schools caused some confusion over the word “health” as referring to mental health or physical health.

The preliminary trial of the modified PERMA-Profiler surfaced issues with an item on engagement, that was similarly found in previous validation

studies (e.g. Elfida et al., 2018; Pezirkianidis et al., 2021). The questionable item “At school, how often do you lose track of time while doing something you enjoy?” may not be suitable in a school context. Most, if not all, schools follow a structured timetable that is consistently enforced by teachers. It would be difficult for students to lose track of time even if they enjoy participating in school activities. Following recommendations for an alternative phrasing (Grenawalt et al., 2021), the item was amended to “To what extent do you enjoy your activities in school?” to capture the affective dimension of engagement. The amended item improved the factor loadings, reliability, and convergent validity of the engagement subscale.

Findings from the extended administration indicated that the modified PERMA-Profiler supported the multi-dimensional five factor model of PERMA. The latent correlations between the factors were substantial, suggesting high interdependency and the possibility of a higher order factor. This would be in line with the argument that PERMA converges into a single well-being factor (Goodman et al., 2018). However, computing a second-order factor score is likely to lose information such as the effectiveness of interventions and the predictive strength of each factor towards well-being (Seligman, 2018). An analysis of measurement invariance also showed that the model demonstrated full invariance across gender, meaning that the model structure, factor loadings, item intercepts and residuals were equal for boys and girls. This is especially important as comparisons in student well-being would inevitably be made between

gender. For example, comparisons could be made between schools with an all-girls or all-boys population. Moreover, well-being interventions are likely to differ and it would be necessary to obtain a correct evaluation for each gender.

Although each subscale of the modified PERMA-Profilier comprised of only three items, the reliability indices were excellent, satisfying Butler and Kern's (2016) original criteria of keeping the number of items to a minimum whilst retaining validity and reliability. Each subscale also exhibited significant convergent validity with related constructs such as school satisfaction and test anxiety. Overall, the results indicated that the modified PERMA-Profilier shows promise as a valid and reliable measurement of student well-being.

Limitations

There were four notable limitations to the current study, all pertaining to data collection. First, no causal statements can be made on the relation between PERMA and other related constructs due to the cross-sectional nature of data collection. At the same time, no information on test-retest reliability can be obtained as well. Second, data was collected purely through self-report measures, which is inherently subjected to response biasness. Third, the scale is not generalizable to primary school students (Years 1 to 6 equivalent) as the sample constituted solely secondary school students. Fourth, the scale may not be generalizable to other cultures as the sample was wholly from a specific country. Future research could focus on

1) using a longitudinal research to assess changes in well-being, 2) using objective school indicators to elicit further evidence of well-being and 3) extending the sample to include primary school students and other cultures.

Conclusion

Student well-being is gaining in importance for schools. Researchers and educators have begun to recognize the impact of school processes on students' mental health and happiness levels. Practically, the modified PERMA-Profilier provides educators and policy makers with a useful multi-dimensional instrument to understand and monitor the level of students' well-being. Theoretically, the study has contributed to literature by modifying an existing instrument that can be used to assess student well-being. We hope that the present findings have taken a large step in the direction of assessing, evaluating and identifying well-being needs.

Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Compliance with ethics

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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