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Healthy Minds Index: A brief measure of the core dimensions of well-being

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18 **Abstract**

19 We developed a self-report measure of psychological well-being for teens and adults, the
20 Healthy Minds Index, based on a novel theory that four trainable pillars underlie well-being:
21 awareness, connection, insight, and purpose. Ninety-seven items were developed and revised by
22 experts and guided by qualitative testing with teens (n= 32; average age= 16.0 years). After
23 assessing the internal validity and factor structure in teens (n= 1607; average age= 16.7 years)
24 and adults (n= 420; average age= 45.6 years), we reduced the survey to 17 items. We then
25 validated the factor structure, internal and convergent and divergent validity, and retest reliability
26 of the 17-item Healthy Minds Index in two new teen samples (study 1: n= 1492, average age=
27 15.7 years; study 2: n= 295, average age= 16.1 years), and one adult sample (n= 285; average
28 age= 45.3 years). The Healthy Minds Index demonstrated adequate validity and provided a
29 comprehensive measure of a novel theory of psychological well-being that includes two domains
30 not found in other conceptualizations of this construct—awareness and insight. This measure
31 will be invaluable for primary research on well-being and as a translational tool to assess the
32 impact and efficacy of widely used behavioral training programs on these core dimensions of
33 wellbeing.

34 **Introduction**

35 On both the individual and societal level, human flourishing is a highly desirable goal.
36 Flourish is defined as “to grow or develop successfully” in the Cambridge English Dictionary,
37 and as synonymous with “thrive” and “prosper” in the Meriam Webster Dictionary. The latter
38 dictionary defines well-being similarly, as “the state of being happy, healthy, or prosperous”.
39 Various lines of research attest to the possibility of deliberately cultivating psychological well-
40 being. However, a unifying framework that clarifies the dimensions of well-being that can be
41 cultivated through training had not been introduced until recently. Integrating evidence from
42 well-being research, cognitive, affective and contemplative neuroscience, and clinical
43 psychology, Dahl, Wilson-Mendenhall and Davidson (2020) put forth such a framework. This
44 framework comprises four core dimensions, which have been robustly linked to well-being:
45 awareness, connection, insight, and purpose.

46 We sought to validate a novel measure of flourishing based on Dahl et al.’s (1)
47 framework for well-being, in teens (i.e., ages 14-18) and adults (i.e., >18 years old), that aligns
48 with areas of skills development that are central to flourishing and often the focus of wellness
49 training: awareness, connection, insight, and purpose. The present work builds from prior
50 conceptions of well-being, including Ryff and Keyes’ Psychological Well-Being index, which
51 includes the domains of purpose in life and positive relations with others (2). The self-report
52 measure of well-being developed in the present study characterizes the additional domains of
53 awareness and insight, which do not appear in prior conceptions or measures of well-being, and
54 which are necessary to adequately capture the full range of processes that contribute to well-
55 being in a single measure.

56 This new well-being framework arrives in the context of a crisis in well-being among
57 teens (3) and adults (4). Particularly in teens, very little focus has emerged specifically on the
58 measurement of well-being. A consistent measure of well-being across development may allow
59 deeper insight into the emergence of the core dimensions of well-being and the way these
60 dimensions of well-being are associated with positive outcomes across the lifetime, starting in
61 early adolescence. Therefore, the main goal of the present work was to develop a
62 psychometrically valid, reliable, and easily implementable self-report measure to capture how
63 teens and adults vary on these four core dimensions of well-being. We will refer to these
64 dimensions collectively as the Healthy Minds Framework.

65 **The four dimensions of the Healthy Minds Framework**

66 **Awareness**

67 In the Healthy Minds framework, awareness refers to heightened attentiveness to the
68 external cues in the environment, as well as to internal cues such as bodily sensations, thoughts,
69 and feelings. People at the high end of this dimension are typically aware of what they are doing,
70 who they are with, and their own internal states. People on the low end, on the other hand, are
71 easily distracted and frequently find themselves acting on “autopilot”.

72 An important component of awareness is meta-awareness. Meta-awareness refers to an
73 awareness of the processes of conscious experience as they occur in real time. For instance,
74 when we recognize an emotion inside us (e.g., anger) before it leads to a reaction, or when we
75 suddenly realize that we had been lost in thought, these are examples of meta-awareness (5,6).
76 The qualities of attentiveness and awareness have been closely linked to healthy psychological
77 functioning.

78 **Connection**

79 Connection refers to a benevolent orientation toward other people that promotes healthy
80 relationships and positive social interactions. It encompasses positive social perceptions (e.g.,
81 gratitude, trust, appreciation) as well as a desire and a sense of responsibility for the well-being
82 of others—even those who are outside of one’s immediate social circles. People on the high end
83 of this dimension generally have warm social interactions, think well of and wish well for others,
84 and are willing to balance others’ best interests with their own in their decision-making. People
85 on the low end, on the other hand, are more cynical toward others, have more selfish motivations
86 and less positive social interactions. Various aspects of the connection dimension have been
87 robustly linked to greater well-being .

88 **Insight**

89 Insight, in the Healthy Minds framework, refers to an ongoing awareness of how one’s
90 internal psychological processes (e.g., emotions, thoughts, beliefs, memories) influence one’s
91 subjective experience of both the internal and external world. People on the high end of this
92 dimension can recognize the impact of their own thoughts and emotions on how they feel and
93 how they act. Those on the low end, on the other hand, lack the intuitive access into their
94 psychological processes and cannot use that information to their advantage. Greater levels of
95 insight have been associated with greater levels of well-being (11), whereas low levels of insight
96 are considered to be a hallmark of psychological disorders (12).

97 **Purpose**

98 Purpose refers to a sense of clarity regarding what is important in one’s life and how one
99 wants to live. People on the high end of the purpose dimension have clear values and personally
100 meaningful aims that guide their day-to-day living. People on the low end of this dimension, on
101 the other hand, perceive little significance in their pursuits and are uncertain about what makes

102 their life worth living. They lack goals and aspirations that structure their life and provide it with
103 an overarching narrative. Research has linked a sense of purpose and meaning in life consistently
104 to well-being (13,14).

105 **Overview of studies**

106 Table 1 provides an overview of the methodological approach to validating the Healthy
107 Minds Index (HMx). The HMx scale items were generated and revised based on a combination
108 of expert input, user experience (UX) interviews and a series of 4 studies with teens. Then the
109 validity and reliability of the HMx was assessed across 4 additional studies, in both teen and
110 adult samples. Across these studies, we examined factor structure, internal consistency,
111 convergent and divergent validity, and test-retest reliability of the HMx. To succinctly present
112 the results, we have organized the results by psychometric analysis, and thus present and discuss
113 the studies relevant to a specific psychometric validation goal together (e.g., item generation,
114 convergent and divergent validity).

115 **Table 1. Summary of Healthy Minds Index validation studies in order of occurrence.**

Study name	N	Objectives
Qualitative Interviews	32	Gather teens' input on clarity of items and scale language
Scale Development (Teen Study D)	1607, total	Factor analysis & scale revision, separately for the 4 dimensions of the Healthy Minds Framework (with about n=400, each)
Adult Study 1	420	Full validation of revised HMx (online; Qualtrics)
Teen Study 1	1492; 934 at retest	Full validation and test-retest with 3-month interval (in-person)
Teen Study 2	285; 81 at retest	Convergent & divergent validity, internal consistency, and test-retest with 2-week interval (online; Qualtrics)
Adult Study 2	281; 96 at retest	Internal consistency and test-retest with 2-week interval (online; Prolific)

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117 **Methods**

118 **Participants**

119 In all studies, participants were either adults (>18 years old) or teens 13-18 years old.
120 Participants for the qualitative, scale development interviews were recruited from the Madison,
121 WI community using flyers, Craigslist ads, and school district mailing lists; through Facebook
122 posts; and through the mailing list of the Center for Healthy Minds (via e-mail). Participants for
123 the validation studies were recruited through an online survey platform (Qualtrics or Prolific), or
124 through the Character Lab Research Network (CLRN), to complete an online survey on tools to
125 measure well-being. Participants for the retest studies were recruited from those who completed
126 the first survey in the corresponding validation study, and for the online samples, the retest
127 studies were capped at 100 participants, based on a combination of logistical constraints and a
128 power analysis. Demographic information for participants in each study is shown in Table 2. All
129 adult participants provided written consent and minors provided written assent in a digital
130 consent form, and this study was approved by the Advarra Institutional Review Board (IRB),
131 protocol number Pro00033991. The IRB waived the requirement for parental consent of minors,
132 as the study was deemed no more than minimal risk to participants. Participants in the UX
133 testing were compensated with gift cards, and participants in online samples were compensated
134 according to the practices of the corresponding recruitment organization (Qualtrics or Prolific
135 participant panels). Recruitment and data collection began in September 2019 for the UX
136 research and ended with adult study 2 in April 2022.

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147 **Table 2. Summary of study demographics.**

Study name	Genders					Mean age, years (SD ^f)	Age Min, Max	Race & Ethnicity								
								White	Black	East Asian	South Asian	Native American/ Aboriginal	Latino	Native Hawaiian/ Pacific Islander	Other	NA
	F ^a	M ^b	N ^c	O ^d	NA ^e											
UX	17	3	0	0	12	16.0 (1.2)	14, 18	10	0	3	0	0	1	0	0	18
Teen D	760	817	26	4	0	16.7 (1.1)	14, 17	967	252	48	42	14	259	9	16	0
Teen 1	635	648	17	10	182	15.7 (1.2)	13, 18	441	204	53	475	11	11	63	52	182
Teen 2	159	113	10	3	0	16.0 (1.4)	14, 18	118	48	15	13	7	57	2	25	0
Adult 1	250	167	2	1	0	45.6 (17.6)	18, 85	201	70	19	9	9	84	8	20	0
Adult 2	142	137	2	0	0	45.3 (16.5)	18, 92	188	41	19	4	3	10	1	5	0

148 ^aF = female; ^bM = male; ^cN = nonbinary; ^dO = other/ prefer not to answer; ^eNA = no answer/ no data; ^fSD = standard
 149 deviation
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151 **Inclusion and exclusion criteria**

152 Inclusion criteria were the ability to speak and read English and residing in the United
 153 States of America. Participants in the adult studies had to be 18 years of age or older, and
 154 participants in the teen studies had to be between the ages of 13 and 18 years old. For studies
 155 conducted through the Character Lab Research Network, sample sizes were determined based on
 156 convenience sampling used by the network. In all other studies, studies were powered to detect
 157 small to medium effect sizes, with 80% power to detect an effect at $p < 0.05$.

158 All data were checked for straight-line responses, which were not present in any of the
 159 datasets. Data collected from online panels were further inspected and excluded for response
 160 times averaging under 315 ms per word, to remove “speeder” participants who may have sped
 161 through the surveys without reading the questions. This threshold has been used previously as a
 162 proxy for the minimum duration required to read and cognitively process a survey question (15),

163 and resulted in exclusion of data from 10 participants from teen study 2. Data from adult study 2
164 (online) were further excluded for failure of the attention check (n = 4 excluded).

165 **Item generation & scale development**

166 Content experts generated and iteratively reviewed items for each of the Healthy Minds
167 Framework dimensions. The original scale had 97 items, and the initial expert review reduced it
168 to 80 total items. The following guidelines were used for decisions on removing versus retaining
169 items during each round of expert review: 1) maintaining a mix of “easy”, “mid”, and “hard”
170 questions per domain (i.e., most participants expected to score high on “easy” items and low on
171 “hard” items); 2) avoiding reverse-coded items; 3) meet Protection of Pupil Rights Amendment
172 (PPRA) standards (<https://www2.ed.gov/policy/gen/guid/fpco/ppra/parents.html>); and 4)
173 avoiding socially desirable or evaluative language.

174 We then conducted a series of qualitative, user experience (UX) interviews with 32 teens
175 to assess and revise the scales for each domain. Participants in the UX studies completed a
176 virtual video interview in which they read each item aloud, for each of the scales of the HMX and
177 said aloud what came to mind. Interviewers then followed up with questions to understand
178 whether the questions in the scales were clear, and that participants understood the items as
179 intended. For example, interviewers asked, “What are you thinking as you look at this?” and
180 “Can you take me through the steps of how you came to that answer?” The qualitative insights
181 from the UX interviews were used to adapt the language of individual items, and to guide expert
182 review in subsequent revisions.

183 In Teen Study “D”, we then conducted a set of factor analyses to assess the scale
184 construction for each of the four dimensions of well-being, and to further revise the scale to
185 remove poorly performing items, while retaining the minimal number of items sufficient for

186 validity. This study consisted of 4 sub-studies (i–iv), in separate samples, to assess scales for
187 each of the 4 domains: Awareness (i), Connection (ii), Insight (iii), and Purpose (iv). All studies
188 had the same design and demographic criteria. Following factor analysis, we further reduced the
189 80-item HMx to 70 items, in consultation with expert reviewers.

190 The 70-item HMx was then used in Adult Study 1 for initial validation, and final
191 reduction to the short, 17-item form used in all subsequent studies. Revision of the scale to the
192 final version included the following steps:

- 193 • Removal of items that did not load on one of the Healthy Minds Framework
194 constructs
- 195 • Retention of items with cross-loadings below 0.30 (on orthogonal factors)
- 196 • Removal of items that cross-load on more than 2 factors (above 0.30)
- 197 • Removal of items that were the sole item to load on a factor (e.g., single-item
198 factors)

199 The HMx was reduced to 58 items following the above steps, and then further reduced to the
200 final 17-item HMx by rank ordering items based on their average correlation with well-being
201 surveys, and then iteratively calculating alpha for each scale for the top-ranked k number of
202 items, starting at k=2 and incrementing by 1 until alpha reached a rounded value of 0.70 or
203 higher. Results are reported for Adult Study 1 (and subsequent studies) with the 17 items
204 retained in the final version.

205 **Validation strategy**

206 We assessed internal consistency, convergent and divergent validity, and test-retest
207 reliability in teens and adults in a series of 3 follow-up studies, using R statistics (16). We used
208 the alpha function of the psych package (17) to assess internal consistency overall, and by

209 domain. Confirmatory and exploratory factor analysis used the *fa* function of the psych package
210 (18–21). Convergent validity was established for each of the four Healthy Minds framework
211 dimensions separately, and for the entire HMx, by computing correlations for each domain with
212 measures of similar, or overlapping, constructs in Teen Study 1 and Adult Study 1 (Table 3)
213 using the *apa.cor.table* function (version 2.0.8).
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Table 3. Measures for testing convergent and divergent validity of the Healthy Minds (HM) Index scales.

	Scale	Citation	Alpha*	
			Teen 1	Adult 1
Well-being Domain	World Health Organization Well-being Index (WHO-5)	Topp et al., 2015 (22)	0.88	0.91
	Diener Satisfaction with Life Scale (Life Sat.)	Gadermann et al., 2010 (23)	0.87	0.91
	Personal Well-being Index (PWI): Global life satisfaction	Tomyn et al., 2013 (24)	-	-
	Comprehensive Inventory of Thriving: Loneliness	Su et al., 2014 (25)	0.82	0.84
	Kessler Psychological Distress Scale (K10)	Kessler et al., 2002 (26)	0.89	0.95
Awareness	Comprehensive Inventory of Mindfulness Experiences – Adolescents (CHIME-A): Acting with awareness, Awareness of internal experiences	Johnson et al., 2017 (27)	0.73	0.85
	Emotional Styles Questionnaire (ESQ): Attention scale	Kesebir et al., 2019 (7)	0.71	0.59
	Mindful Attention Awareness Scale (MAAS) [less item 12]	Brown & Ryan, 2003 (28)	0.85	0.94
Connection	General Trust Scale	Yamagishi & Yamagishi, 1994 (29)	0.75	0.87
	Engagement, Perseverance, Optimism, Connectedness, and Happiness scale (EPOCH): Connectedness (teens)	Kern et al., 2016 (30)	0.83	-
	Positive emotion, Engagement, Relationships, Meaning and Achievement (PERMA): Relationships (adults)	Butler & Kern, 2016 (31)	-	0.86
	Dispositional Positive Emotions Scale (DPES): Compassion	Shiota et al., 2006 (32)	0.86	0.91
	Psychological Well-Being (PWB): Positive Relations	Ryff & Keyes, 1995 (2)	0.68	0.72
Insight	CHIME-A: Relativity of thoughts, Decentering and nonreactivity	Johnson et al., 2017 (27)	0.77	0.79
	Difficulties in Emotion Regulation Scale (DERS-16): Non-Acceptance of Emotion and Regulation Strategies	Gratz & Roemer, 2004 (33)	0.85	0.89
	Emotion Regulation Questionnaire (ERQ): Reappraisal (adults)	Gross & John, 2003 (34)	-	0.90
	ERQ – Children and Adolescents (CA): Reappraisal (teens)	Gullone & Taffe, 2012 (35)	0.88	-
Purpose	Francis: 1-item purpose measure	Francis, 2013 (36)	-	-
	Meaning in Life Questionnaire (Meaning)	Steger et al., 2006 (37)	0.87	0.84
	Costin: Purpose	Costin & Vignoles, 2020 (38)	0.84	0.75

218 *Alphas averaged if more than 1 subscale

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220 **Transparency and Openness**

221 We report how we determined our sample size, all data exclusions, all manipulations, and
222 all measures in the study. All data and code are available on the Open Science Framework at this
223 url: <https://osf.io/aw7bz/> (doi: 10.17605/OSF.IO/AW7BZ). This study was not preregistered.

224 **Results and Discussion**

225 **Scale Development**

226 We used an iterative process for assessing and revising the initial scale and individual
227 items, which included inspecting the distribution of scores (e.g., for normalcy), inter-item
228 correlations, and internal consistency. Below we describe how each scale was revised from the
229 original to the final version, and the internal consistency of the final version for the scale
230 development study samples. Cronbach’s alpha indicated very high internal consistency for each
231 scale (Table 4), where each item (for all scales) was rated on a 1 to 5 Likert scale.

232 **Table 4. Internal consistency from scale development studies.**

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Scale:	Awareness	Connection	Insight	Purpose
Cronbach’s Alpha	0.91	0.91	0.91	0.92
Confidence Interval	0.89, 0.92	0.90, 0.92	0.90, 0.93	0.91, 0.93

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235 **Awareness**

236 A large proportion of teens (15-20%, and 31% for one item) scored a 5 (“all the time”)
237 for 6 of the 20 scale items. These items may have been subject to confirmation bias and therefore
238 too easy to endorse. To address these issues, we changed response anchors and edited these items
239 to make them harder. The mean awareness score was 3.40 with a standard deviation (SD) of

240 0.64, and mean and median inter-item correlation was 0.36, reflecting a somewhat narrow trait as
241 intended for the dimensional approach (39).

242 **Connection**

243 Participants scored near the midpoint on this 6-item subscale, with a mean of 3.7, SD of
244 0.60, and a minimum of 1.5. There were 5 of the 24 scale items for which no one selected option
245 1, or where response 5 endorsement exceeded response 4 endorsement. We determined that
246 retaining these items would add little reliability or predictive power. Thus, we removed the
247 corresponding items. To further support their removal, we evaluated all items based on
248 nomological correlations. In summary, three items correlated less strongly with convergent and
249 criterion measures than the remaining items. Two other items performed equivalently on only
250 one measure (Engagement, Perseverance, Optimism, Connectedness, and Happiness [EPOCH]:
251 connectedness) (30). We interpreted these results as indicating that removing all 5 of these items
252 would not threaten the scale's predictive utility. All other analyses were conducted excluding
253 these items.

254 **Insight**

255 On the 22-item sub-scale, participants on average scored around the midpoint, with a
256 mean of 3.2 and SD of 0.65. There were no items for which no one selected option 1 (out of 5),
257 or where response 5 endorsement exceeded response 4 endorsement. We determined that no
258 items needed to be removed.

259 **Purpose**

260 On the 14-item sub-scale, participants on average scored around the midpoint, with a
261 mean of 3.5 and SD of 0.76. There were no items for which no one selected option 1, or where

262 response 5 endorsement exceeded response 4 endorsement. We determined that no items needed
 263 to be removed.

264 **Internal Consistency**

265 The revised 17-item HMIx (Appendix), based on the scale development studies
 266 (described above), was used in all subsequent analyses. The HMIx showed evidence for good
 267 internal consistency, as well as moderate to good internal consistency for each of the subscales
 268 (Table 5). Visual inspection of scale histograms indicated a normal distribution of scores across
 269 the samples.

270 **Table 5. Internal consistency and descriptive statistics: Healthy Minds Index**

Scale	Study	Mean	Teens				Adults				
			SD	Skew	Kurtosis	Alpha	Mean	SD	Skew	Kurtosis	Alpha
Well-being (Total score)	Study 1	3.42	0.57	-0.26	0.75	0.84	3.61	0.67	-0.45	0.76	0.92
	Study 2	3.35	0.61	-0.26	0.22	0.87	3.51	0.47	-0.26	0.22	0.83
Awareness	Study 1	3.31	0.74	-0.19	-0.04	0.60	3.64	0.72	-0.34	0.36	0.78
	Study 2	3.32	0.70	-0.19	-0.02	0.60	3.69	0.59	-0.19	-0.02	0.72
Connection	Study 1	3.57	0.67	-0.51	0.57	0.74	3.58	0.80	-0.58	0.33	0.84
	Study 2	3.42	0.76	-0.84	1.25	0.79	3.54	0.60	-0.84	1.25	0.75
Insight	Study 1	3.20	0.81	-0.14	-0.08	0.60	3.53	0.78	-0.28	0.17	0.76
	Study 2	3.26	0.85	-0.09	-0.32	0.64	3.12	0.71	-0.09	-0.32	0.65
Purpose	Study 1	3.59	0.88	-0.51	0.09	0.84	3.71	0.80	-0.54	0.14	0.83
	Study 2	3.39	0.89	-0.66	0.45	0.83	3.69	0.81	-0.66	0.45	0.86

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272 **Factor Structure**

273 Overall, the 4-factor structure of the HMIx was supported by the data, with the strongest
 274 evidence across exploratory and confirmatory analyses in teens and adults supporting a fit

275 between 3 and 5 factors. All items loaded onto their corresponding dimension of the ACIP
 276 framework in the exploratory 4-factor analysis (Table 6, 7). The only exceptions were in the case
 277 of Awareness items 1 and 2; in the adult sample, item 1 failed to load adequately on any
 278 dimension and item 2 loaded weakly with Connection. In the teen sample, these items cross-
 279 loaded with the Insight factor (loadings = 0.35 and 0.40, on Insight, respectively; and loadings =
 280 0.38 and 0.32 on Awareness, respectively).

281 **Table 6. Factor loadings to a 4-factor solution in exploratory analysis in teens.**

	Factor Number & Loading*				Within- dimension correlation
	F1	F2	F3	F4	
Awareness 1: When I want to focus, it's easy for me.	-	-	-	0.68	0.49
Awareness 2: In general, I'm able to focus when I'm reading.	-	-	-	0.59	0.44
Awareness 3: I can notice my thoughts as soon as I have them.	-	-	0.35	0.38	0.49
Awareness 4: When some of my thoughts lead to other thoughts, I realize it while it is happening.	-	-	0.40	0.32	0.43
Connection 1: I like all of the people that I see from day to day.	-	0.43	-	-	0.44
Connection 2: I actively take time to appreciate things about the people I see from day to day.	-	0.41	-	-	0.53
Connection 3: I believe that most people are doing the best they can.	-	0.54	-	-	0.48
Connection 4: I want all people to be happy, including people I don't like.	-	0.62	-	-	0.44
Connection 5: I care about the problems of people all over the world.	-	0.63	-	-	0.50
Connection 6: When I make decisions involving other people, I consider their best interests.	-	0.50	-	-	0.47
Insight 1: When I am interacting with someone, I reflect on how my feelings are causing me to treat them a certain way.	-	-	0.51	-	0.40
Insight 2: When I have a thought, I reflect on whether that thought is making me feel better or worse.	-	-	0.69	-	0.52
Insight 3: I can change how I feel about a situation by changing my thoughts about that situation.	-	-	0.35	-	0.35
Purpose 1: I have general life goals that make my daily activities worth doing.	0.81	-	-	-	0.72

Purpose 2: I know what's really important in my life.	0.68	-	-	-	0.65
Purpose 3: I have a life purpose that guides my day-to-day choices.	0.77	-	-	-	0.69
Purpose 4: I know what kind of life I want to lead.	0.76	-	-	-	0.66

282 *Loadings > 0.30 displayed in table.

283 **Table 7. Factor loadings of a 4-factor solution in exploratory analysis in adults.**

	Factor Number + Loading*				Within-dimension correlation
	F1	F2	F3	F4	
Awareness 1: When I want to focus, it's easy for me.	-	-	-	-	0.56
Awareness 2: In general, I'm able to focus when I'm reading.	-	0.32	-	-	0.53
Awareness 3: I can notice my thoughts as soon as I have them.	-	-	-	0.58	0.50
Awareness 4: When some of my thoughts lead to other thoughts, I realize it while it is happening.	-	-	-	0.62	0.43
Connection 1: I like all of the people that I see from day to day.	0.62	-	-	-	0.46
Connection 2: I actively take time to appreciate things about the people I see from day to day.	0.73	-	-	-	0.56
Connection 3: I believe that most people are doing the best they can.	0.72	-	-	-	0.48
Connection 4: I want all people to be happy, including people I don't like.	0.65	-	-	-	0.55
Connection 5: I care about the problems of people all over the world.	0.65	-	-	-	0.46
Connection 6: When I make decisions involving other people, I consider their best interests.	0.74	-	-	-	0.47
Insight 1: When I am interacting with someone, I reflect on how my feelings are causing me to treat them a certain way.	-	-	0.46	-	0.52
Insight 2: When I have a thought, I reflect on whether that thought is making me feel better or worse.	-	-	0.71	-	0.62
Insight 3: I can change how I feel about a situation by changing my thoughts about that situation.	-	-	0.33	-	0.27
Purpose 1: I have general life goals that make my daily activities worth doing.	-	0.74	-	-	0.74
Purpose 2: I know what's really important in my life.	-	0.62	-	-	0.66
Purpose 3: I have a life purpose that guides my day-to-day choices.	-	0.69	-	-	0.73
Purpose 4: I know what kind of life I want to lead.	-	0.62	-	-	0.74

284 *Loadings > 0.30 displayed in table. F = factor

285 Importantly, the constructs of Awareness and Insight are highly related in the ACIP
286 Framework, and their overlap in the current validation may reflect reduced external validity of
287 these measures as distinct, separable constructs in the general population. Since the ACIP
288 Framework was developed as a model of the components of well-being in terms of training-
289 based plasticity, particularly in the context of meditation and contemplative training, a critical
290 next step is to examine their validity among meditators, and in the context of meditation training
291 (i.e., among meditation-naïve individuals before and after meditation training). These factors are
292 thus expected to be non-orthogonal, and we encourage researchers modelling Awareness and
293 Insight, concurrently, to allow these factors to correlate.

294 Confirmatory factor analysis of the very simple structure (vss) and Velicer's minimum
295 average partial (MAP) supported a 2- or 3-factor solution with a maximum of 0.70 (and 0.74 in
296 adults), and a minimum criterion of 0.09 (0.10 in adults for 2 factors), respectively. Confirmatory
297 parallel factor analysis provided evidence for 5 factors with 3 components (with 2 components in
298 adults). Exploratory factor analysis of a 3-factor structure in teens indicated that Insight items 2
299 and 3 combined with the Awareness factor, and Insight item 1 combined with the Connection
300 factor. The exploratory analysis of the 3-factor model resulted in a Tucker Lewis Index (TLI) of
301 0.88, root mean square error of approximation (RMSEA) index of 0.06, and Bayesian
302 information criterion (BIC) of -24.13, indicating an acceptable fit. Exploratory analysis of the 4-
303 factor structure indicated a good fit (Table 6), a qualitative improvement on the 3-factor model in
304 exploratory analysis (TLI = 0.92, RMSEA = 0.05, BIC = -174.63). See Table 8 for a summary of
305 model fit indices for the exploratory factor analysis.

306 In adults, exploratory analysis of a 3-factor structure resulted in distinct factors for
307 Connection, Insight, and Purpose, where the Awareness items 1 and 3 loaded with Purpose, item

308 2 loaded with Connection, and item 4 loaded with Insight (TLI = 0.91, RMSEA = 0.06, BIC = -
 309 269.93). Exploratory analysis of the 4-factor solution in adults yielded similar results (Table 7),
 310 except Awareness items 3 and 4 loaded together on a single, distinct factor from the other
 311 domains (TLI = 0.93, RMSEA = 0.06, BIC = -252.02). Since both the 3- and 4-factor fits were
 312 acceptable in adults (rather than “good”), we also examined the 5-factor solution in an
 313 exploratory factor analysis, which produced a good fit (TLI = 0.95, RMSEA = 0.05, BIC = -
 314 241.79), whereby each factor corresponded to a distinct domain, and Awareness was split into 2
 315 factors (items 1 and 2 loaded together, as did items 3 and 4). We additionally report the 5-factor
 316 model in teens in Table 8 for completeness.

317 **Table 8. Results of exploratory factor analysis: Model fits**

Sample	Factors	Tucker Lewis Index	RMSEA	Bayesian Information Criterion
Teens	3	0.88	0.06	-24.13
	4	0.92	0.05	-174.63
	5	0.95	0.04	-232.34
Adults	3	0.91	0.06	-269.93
	4	0.93	0.06	-252.02
	5	0.95	0.05	-241.79

318

319 **Convergent and Divergent Validity**

320 The overall HMIx scale, as well as each of the subscales, demonstrated good convergent
 321 and divergent validity, in that each of the measures were related to measures of overall well-
 322 being (Table 9), and to similar constructs in the expected direction(s) (Table 10). The scale(s)
 323 also demonstrated good divergent validity, with relationships generally below a threshold of $r =$
 324 0.60. The one exception with regards to divergent validity was the Purpose scale, which was
 325 consistently correlated relatively strongly with measures of similar constructs ($r = 0.52$ to $r =$
 326 0.66).

327

328 **Table 9. Correlations between well-being measures and the Healthy Minds Index**

Measure ⁺	Study Version (Measure mean, SD ^a)	Wellbeing (total)	Awareness	Connect ^b	Insight	Purpose
EPOCH ^c (teens) / PERMA ^d (adults)	Teen 1 (3.9, 0.9)	0.42**	0.27**	0.38**	0.21**	0.38**
	Teen 2 (3.6, 1.0)	0.48**	0.33**	0.47**	0.30**	0.37**
	Adult 1 (6.9, 2.5)	0.47**	0.37**	0.48**	0.34**	0.44**
Life Satisfaction	Teen 1 (14.7, 7.5)	0.31**	0.22**	0.25**	0.16**	0.28**
	Teen 2 (16.1, 5.0)	0.40**	0.34**	0.32**	0.19**	0.39**
	Adult 1 (22.5, 7.7)	0.41**	0.29**	0.37**	0.32**	0.43**
WHO-5 ^e Well-being Index	Teen 1 (10.9, 7.0)	0.39**	0.31**	0.29**	0.22**	0.33**
	Teen 2 (11.7, 5.7)	0.53**	0.40**	0.43**	0.30**	0.49**
	Adult 1 (14.0, 6.3)	0.49**	0.41**	0.41**	0.41**	0.46**
Distress ^f	Teen 1 (25.0, 7.3)	-0.18**	-0.29**	-0.02	0.01	-0.24**
	Teen 2 (28.0, 9.7)	-0.09	-0.12*	-0.01	0.04	-0.19**
	Adult 1 (24.5, 10.8)	-0.01	0.01	0.01	0.05	-0.08
Loneliness	Teen 1 (2.5, 1.0)	-0.29**	-0.25**	-0.17**	-0.08**	-0.31**
	Teen 2 (2.9, 1.2)	-0.28**	-0.25**	-0.16**	-0.11	-0.32**
	Adult 1 (2.7, 1.2)	-0.16**	-0.11*	-0.14**	-0.07	-0.24**

329 ⁺See Table 3 for full names, citations, and alphas of comparison measures;
 330 ^aSD = standard deviation; ^bConnect = Connection; ^cEPOCH = EPOCH Connectedness; ^dPERMA = PERMA
 331 Relationships; ^eWHO = World Health Organization; ^fDistress = K10 Psychological Distress
 332 ***p*<0.01; **p*<0.05
 333
 334

335 **Table 10. Correlations between the Healthy Minds Index scales and domain-specific**
 336 **measures.**

Domain	Measure	Teen Study 1			Adult Study 1		
		Mean	SD ^a	Pearson's <i>r</i>	Mean	SD ^a	Pearson's <i>r</i>
Awareness	CHIME Act ^b	4.46	1.13	0.27**	5.04	1.34	-0.07
	CHIME Awa. ^c	4.38	1.02	0.40**	4.33	1.17	0.69**
	CHIME Dec. ^d	3.72	1.09	0.44**	4.04	1.17	0.58**
	MAAS ^e	3.25	0.81	-0.26**	3.17	1.13	0.00
	ESQ ^f Attention	3.93	1.20	0.57**	4.61	1.15	0.41**
Connection	Trust	3.15	0.62	0.43**	3.53	0.82	0.61**
	PWB: Pos. ^g	23.96	8.85	0.32**	26.19	6.22	0.51**
	Compassion	5.49	1.06	0.59**	5.31	1.31	0.67**
Insight	CHIME Rel. ^h	4.38	0.97	0.29**	4.0	1.1	0.37**
	CHIME Dec. ⁱ	3.72	1.09	0.38**	4.0	1.2	0.60**
	DERS Reg. ^j	2.51	1.16	-0.01	2.6	1.2	0.01
	DERS Non-Acc. ^k	2.69	1.22	0.08**	2.6	1.3	0.04
	Reappraisal	4.60	1.21	0.40**	5.1	1.3	0.60**
Purpose	Costin	4.97	1.38	0.66**	4.87	1.35	0.52**
	Francis	3.80	1.00	0.58**	3.89	1.00	0.58**
	Meaning	4.92	1.44	0.65**	6.47	1.67	0.61**

337 ^aSee Table 3 for full names, citations, and alphas of comparison measures; ^aSD= standard deviation; ^bAct = Acting
 338 with awareness; ^cAwa. = Awareness of internal experiences; ^dDec. = Decentering and nonreactivity; ^eMAAS =
 339 Mindful Attention Awareness Scale; ^fESQ = Emotional Styles Questionnaire; ^gPos. = Positive relations with others;
 340 ^hRel. = relativity of thoughts; ⁱDec. = Decentering; ^jReg. = Emotion regulation; ^kNon-Acc. = Non-acceptance
 341 ***p*<0.01; **p*<0.05
 342

343 **Test-Retest Reliability**

344 The HMIx scale and subscales showed moderate to good test-retest reliability, except for
 345 Insight (Table 11). The test-retest reliability for the insight sub-scale, which ranged from an

346 intra-class correlation (ICC) = 0.43 to 0.52, was consistently lower than the other domains (ICC
347 range = 0.59 to 0.85, average ICC = 0.72, at a 2-week lag).

348 **Table 11. Test-retest reliability: Intra-class correlations (ICC).**

Construct	Teen Study 1: 3-month lag	Teen Study 2: 2-week lag	Adult Study 2: 2-week lag
Well-Being (total)	0.65	0.75	0.81
Awareness	0.61	0.65	0.65
Connection	0.63	0.65	0.65
Insight	0.43	0.47	0.50
Purpose	0.64	0.76	0.85

349

350 **Constraints on Generality**

351 The HMIx was tested only with American participants, and primarily in online samples
352 for the retest reliability studies. It will be important to provide evidence for the scale's reliability
353 and validity in diverse populations and cultures, among meditators, and from pre- to post-
354 training in meditation.

355 **Conclusions**

356 The Healthy Minds Framework was proposed by Dahl, Wilson-Mendenhall and
357 Davidson (2020) to clarify the dimensions of well-being that can be cultivated through deliberate
358 training. In the present work, we developed a brief self-report scale that captures where people
359 stand with regard to these dimensions. The initial evidence for the psychometric adequacy of the
360 scale is encouraging and suggests that the Healthy Minds Index can be successfully employed to
361 measure dimensions of well-being in both adult and teen samples. The validity of the scale as an
362 assessment of characteristics that can change over time is important and will require additional

363 research. In particular, evaluating responsiveness to interventions targeting the domains of well-
364 being putatively assessed by the HMx and the predictive validity of strengthening those domains
365 on future well-being and on the distal outcomes that are mediated by improvements in well-being
366 is an important avenue of future research.

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466

467

468

469 Appendix

470 Healthy Minds Index

471 All items are rated on a 1 to 5 Likert scale. Scores are calculated by summing the responses to each item
472 for a given scale.

473

474 Awareness

475 Rating options 1=None of the time; 2=A little of the time; 3=Some of the time; 4=A lot of the
476 time; 5=All of the time

- 477 1. When I want to focus, it's easy for me.
- 478 2. In general, I'm able to focus when I'm reading.
- 479 3. I can notice my thoughts as soon as I have them.
- 480 4. When some of my thoughts lead to other thoughts, I realize it while it is happening.

481

482 Connection

483 Rating options (items 1–3): 1=None of the time; 2=A little of the time; 3=Some of the time; 4=A
484 lot of the time; 5=All of the time

- 485 1. I like all of the people that I see from day to day.
- 486 2. I actively take time to appreciate things about the people I see from day to day.
- 487 3. I believe that most people are doing the best they can.

488

489 Rating options (items 4–6): 1=Not at all; 2=A little bit; 3=Somewhat; 4=A lot; 5=To the highest
490 degree

- 491 4. I want all people to be happy, including people I don't like.
- 492 5. I care about the problems of people all over the world.
- 493 6. When I make decisions involving other people, I consider their best interests.

494

495 Insight

496 Rating options: 1=None of the time; 2=A little of the time; 3=Some of the time; 4=Most of the
497 time; 5=Every time

- 498 1. When I am interacting with someone, I reflect on how my feelings are causing me to treat them a
499 certain way.
- 500 2. When I have a thought, I reflect on whether that thought is making me feel better or worse.
- 501 3. I can change how I feel about a situation by changing my thoughts about that situation.

502

503 Purpose

504 Rating options: 1=Not at all; 2=A little bit; 3=Somewhat; 4=A lot; 5=To the highest degree

- 505 1. I have general life goals that make my daily activities worth doing.
- 506 2. I know what's really important in my life.
- 507 3. I have a life purpose that guides my day-to-day choices.
- 508 4. I know what kind of life I want to lead.

509