

1 **The utility and limitations of the New Ecological Paradigm Scale for**
2 **children**

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13 **The utility and limitations of the New Ecological Paradigm Scale for**
14 **children**

15 The New Ecological Paradigm (NEP) scale adapted for use with children (NEP-
16 C) is one of the most frequently used measures of children's environmental
17 beliefs. Though widely utilized, the limitations of the NEP-C instrument are often
18 overlooked. Based on a systematic synthesis of existing literature examining the
19 NEP-C, we argue that the scale assesses specific types of beliefs within the larger
20 NEP, that some children have difficulty comprehending items of this scale, and
21 that the one-factor and three-factor models proposed in the original NEP-C did
22 not achieve an exact fit to empirical data. Additionally, the relevance of the NEP-
23 C total score as a predictor of children's pro-environmental behaviors is
24 questionable. Although the NEP-C is useful for measuring specific types of
25 environmental beliefs, many researchers using this scale may be interested in
26 broader constructs. We highlight potential benefits and drawbacks of using the
27 NEP-C and discuss new directions for environmental education research.

28 **Keywords:** Child, environmental attitudes, environmental beliefs, questionnaire,
29 validation

30 **Introduction**

31 Environmental problems threaten the present and future of life on planet Earth (Steffen
32 et al., 2015). Given that individual and collective human behavior is, in large part,
33 responsible for environmental issues, the promotion of sustainable lifestyles has become
34 a global priority (Wynes & Nicholas, 2017). Children are an important part of the
35 solution, both as agents of change in the present and key leaders and decision-makers in
36 the future (Bandura & Cherry, 2020). In fact, some children and adolescents like the
37 activist Greta Thunberg are already calling for collective action that enhances global
38 sustainability (Marris, 2019; Wallis & Loy, 2021).

39 Many environmental education programs aim to promote children's pro-
40 environmental behaviors and their correlates (Collado et al., 2020; Zint, 2012). Among
41 these correlates, special attention has often focused on the measurement of children's
42 beliefs regarding environmental issues, also called environmental beliefs (Cruz &
43 Manata, 2020; Harrison, 2020). One reason for this emphasis is the fact that many
44 influential behavioral theories, such as the value-belief-norm (VBN) theory (Stern et al.,
45 1999) and the Theory of Planned Behavior (TPB, De Groot & Steg, 2007), posit that
46 environmental beliefs can predict pro-environmental behaviors. Some researchers view
47 environmental beliefs as the cognitive component of environmental attitudes (Kopnina,
48 2011; Schultz et al., 2005). Thus, beliefs can be conceptualized as more specific than
49 attitudes and **may** constitute estimates **of** one's knowledge or expectations that a referent
50 is true or expected to be true (Harrison, 2020).

51 A specific set of environmental beliefs, those captured by the New Ecological
52 Paradigm (NEP, Dunlap et al., 2000; Dunlap & Van Liere, 1978), have received
53 extensive attention in the research community (Hawcroft & Milfont, 2010; Rosa et al.,
54 2021). Central ideas of the NEP are that (1) the balance of the Earth's system is fragile;

55 (2) there are limits to population and economic growth because natural resources are
56 finite; (3) human beings are not exempt from the constraints of nature; (4) the economic
57 and social status quo will provoke an ecological crisis; and, (5) humans do not have the
58 right to modify the natural environment to suit their needs (Dunlap et al., 2000). Dunlap
59 and van Liere (1978) designed the original New Environmental Paradigm scale for
60 adults to capture shifts in the dominant social paradigm of the 1970s, which elevated the
61 importance of environmental issues. This scale was later revised to tap the five central
62 ideas of the New Ecological Paradigm (Dunlap et al., 2000). In this revision, where the
63 term Environmental was replaced by Ecological, there were three main modifications to
64 the scale (Dunlap et al., 2000). First, the scale became more comprehensive, including
65 aspects related to human exemptionalism and the possibility of an ecological crisis.
66 Second, the scale became more balanced in terms of pro-NEP and anti-NEP items.
67 Third, outdated terminologies like “mankind” were avoided in the revised scale. Since
68 then, the revised NEP scale has been used around the world (Dunlap, 2008; Hawcroft &
69 Milfont, 2010).

70 The NEP has been described and utilized as a measure of many constructs,
71 including environmental attitudes (Hawcroft & Milfont, 2010), environmental values
72 (De Groot & Steg, 2008), environmental concerns (Xiao et al., 2019), and
73 environmental beliefs (Harrison, 2020). Dunlap (2008), [the co-creator of the scale](#),
74 suggested environmental beliefs might be the most appropriate term, but he indicated a
75 personal preference for the term ecological worldview because (according to him) the
76 NEP measures the degree to which respondents view the world ecologically. Later in
77 this essay, we will explain why we believe the term “NEP beliefs” may be the most
78 precise description of the construct the NEP scale aims to measure.

79 Due to widespread interest in using the NEP in assessment, researchers have
80 examined evidence relevant for the interpretation of NEP scores (Hawcroft & Milfont,
81 2010; Rosa et al., 2021). For example, Rosa et al. (2021) examined the internal structure
82 and consistency of the original and revised Brazilian version of the NEP scale, and
83 Amburgey and Thoman (2012) examined the internal structure of the English version of
84 the revised NEP scale. Rosa et al. (2021) found that prior exploratory factor analyses of
85 the revised NEP scale led to different solutions in terms of internal structure, ranging
86 from one to six factors. Their findings also showed the internal consistency of the scale
87 differed from study to study (Cronbach's α ranging from .56 to .76). Amburgey and
88 Thoman (2012) ran a confirmatory factor analysis on the English version of the revised
89 NEP scale and found that items' response variance was best explained by a higher-order
90 factor with five first-order factors, with item loadings ranging from .21 to .81. Studies
91 like these demonstrate the variability of the NEP measurement properties across diverse
92 applications, raising some concerns regarding the internal structure and internal
93 consistency of this scale.

94 As interest in measuring NEP beliefs expanded from adults to children, efforts
95 have been made to adapt the revised NEP scale for use with children. Manoli et al.
96 (2007) developed a revised NEP scale for children (NEP-C) aged 10-12 years, which
97 has been used in many contexts (Cruz & Manata, 2020). Specifically, this scale was
98 designed to gather information regarding three domains: rights of nature (e.g., Plants
99 and animals have as much right as people to live), eco-crisis (e.g., If things don't
100 change, we will have a big disaster in the environment soon), and human
101 exemptionalism (e.g., People are clever enough to keep from ruining the Earth). Manoli
102 et al. (2007) argued that the internal structure of the NEP-C could be seen as both
103 unidimensional (i.e., a one-factor scale) and multidimensional (i.e., a three-factor scale).

104 Although the NEP-C was developed with children from the United States of America
105 (USA), it has since been adapted for use with a wide array of children from different
106 countries such as Spain (Corraliza et al., 2013), the Netherlands (Kopnina, 2011, 2012),
107 Estonia (Siim, 2012), Turkey (Şahin et al., 2015), Senegal (Grůňová et al., 2019),
108 Jordan (Sa'di, 2019), and Slovenia (Torkar et al., 2020). The NEP-C has also been used
109 to evaluate the effectiveness of environmental education interventions designed to foster
110 pro-environmental beliefs and behaviors (e.g., Collado et al., 2020; Manoli et al., 2007).
111 The specific characteristics of the NEP-C₂ as well as the items of the three subscales
112 described by Manoli et al. (2007)₂ can be seen in Tables 1 and 2.

113 <Please insert Tables 1 & 2 about here>

114 Despite this popularity, just as the NEP scale for adults has faced critique
115 (Hawcroft & Milfont, 2010; Rosa et al., 2021), the utility of NEP-C has also been
116 scrutinized (Harrison, 2020; Kopnina, 2011). In this paper, we build on these concerns
117 to explore (a) what the NEP-C really measures, (b) children's ability to comprehend the
118 scale items, and (c) how well the proposed factors/subscales on the NEP-C fit empirical
119 data. We then discuss the broader benefits and drawbacks of using the NEP-C to
120 measure children's environmental beliefs and correlates. To accomplish this aim, we
121 conducted the first literature review and systematic synthesis of studies that assessed the
122 measurement properties of the NEP-C. Results presented in this essay favor a critical
123 view of findings based on the NEP-C, highlighting the need for improvements and
124 future considerations for environmental education research.

125 **Identifying and Interpreting Studies Assessing the NEP-C**

126 We conducted a literature review based on the COnsensus-based Standards for the
127 selection of health Measurement INstruments (COSMIN) guidelines (Mokkink et al.,
128 2018) and the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et

129 al., 2019). Our analysis of evidence relevant for the interpretation of the NEP-C scores
130 (i.e., validity evidence) used the argument-based approach to validation (AERA et al.,
131 2014; Cook et al., 2015; Hawkins et al., 2018; Kane, 2013; Lavery et al., 2020). The
132 argument-based approach involves stating an argument or assumption underlying the
133 interpretation of the NEP-C scores and assessing whether this argument is supported by
134 empirical evidence and logic.

135 Our review included published and unpublished studies in any language focused
136 on assessing any evidence relevant for the interpretation of the NEP-C scores. Our
137 primary search strategy was to retrieve every study citing Manoli et al. (2007) in Google
138 Scholar ($N = 264$) up to August 4th, 2020. One researcher assessed the studies for
139 eligibility and extracted relevant information from included studies. Another researcher
140 checked the information extracted. Discrepancies were discussed to achieve consensus
141 about the correct information to be used. Each unique sample of participants was
142 considered a study. For example, we considered Kopnina (2011, 2012) as one study
143 because these two papers presented results for the same sample of Dutch children.
144 Similarly, we considered Grúňova et al. (2019) as two studies because they reported
145 results from two different samples. See the Supplementary File for a detailed
146 description of the methods.

147 Eleven studies met our eligibility criteria (references available in Supplementary
148 Table 2). Only one study was not published in a peer-reviewed scientific journal (Siim,
149 2012). Collectively, the studies included 3798 participants with ages ranging from seven
150 to 18 years old (Table 3), although most studies included participants with an age close
151 to 10 to 12 years old (the age group for whom the scale was designed). Most studies
152 were gender-balanced. Data were collected in eight different countries and mainly in
153 schools. Most studies collected cross-sectional quantitative or qualitative data and

154 assessed the internal structure and internal consistency of the NEP-C. Six studies
155 provided information regarding the content of the NEP-C, and four studies assessed the
156 correlations between the NEP-C and measures of other outcomes such as energy-saving
157 behaviors and environmental concern (i.e., hypotheses testing for construct validity).
158 Few studies assessed test-retest reliability (Şahin et al., 2015), measurement invariance
159 (Harrison, 2020), and responsiveness (Manoli et al., 2007).

160 <Please insert Table 3 about here>

161 In line with the argument-based approach, we focused on the NEP-C scale's
162 comprehensiveness (i.e., how extensively the NEP-C content covers the NEP construct),
163 item comprehensibility (i.e., how well do children comprehend NEP-C items?), ~~the~~
164 internal structure (i.e., does the internal structure of the scale consistently align with the
165 structure proposed?), and the benefits and drawbacks of using this scale. Each of these
166 aspects (e.g., comprehensibility) corresponds to a specific argument (e.g., children
167 comprehend the NEP-C items) relevant for the interpretation of this scale's scores, and
168 evidence related to each of these arguments ~~are~~is described in detail below.

169 **What does the NEP-C assess?**

170 A key issue to consider when interpreting the scores of the NEP-C is whether the scale
171 fully covers the range of beliefs embedded in the NEP (AERA et al., 2014; Mokkink et
172 al., 2018). Unfortunately, none of the studies included in our review discussed how well
173 the NEP-C covers the NEP. Dunlap et al. (2000, p. 429) acknowledged that the NEP is
174 “somewhat amorphous,” making it difficult to determine whether the NEP-C covers all
175 aspects of this paradigm. Based on previous studies (Dunlap, 2008; Dunlap et al., 2000;
176 Dunlap & Van Liere, 1978; Manoli et al., 2007), we argue that the NEP conveys beliefs
177 about the balance of nature, the existence of ecological limits, ~~the~~ human role as a part
178 of nature, human exemptionalism, the possibility of an eco-crisis, the need to have a

179 steady-state economy, and the need of living in harmony with nature. Dunlap (2008)
180 also suggested that the NEP encompasses a sociopolitical domain, but he explained that
181 this domain was not the focus of the original ~~and-or~~ revised NEP. Because Dunlap
182 (2008) did not clearly articulate what this sociopolitical domain might encompass, it is
183 hard to determine if there is any item covering this domain on the NEP scales. Though
184 the NEP-C was developed to collect information about three dimensions of the NEP
185 (see Table 2), item content seems to relate to virtually all beliefs described above. The
186 exceptions are beliefs about a steady-state economy and, possibly, the sociopolitical
187 domain mentioned by Dunlap (2008). Thus, it appears that the NEP-C provides
188 information about most, but not all, of the themes encompassed by the NEP.

189 **Do children comprehend the NEP-C items?**

190 In their original article, Manoli et al. (2007) did not report whether all ~~their~~ youth
191 participants in their study comprehended the NEP-C items. Nonetheless, they indicated
192 that after interviewing 30 fifth-grade students, only a few scale items needed further
193 revision, which suggests that most items were comprehensible. Also, Manoli et al.
194 (2007) eliminated one item because it received a high frequency of the response option
195 “Do not understand.” Further evidence related to children's understanding of NEP-C
196 items comes from Harrison (2020), who reported that children had difficulty
197 understanding the expressions “laws of nature” (item 4) and that one of seven children
198 did not fully understand the expression “modern lifestyle” (item 6), suggesting
199 comprehension problems with two items of the original NEP-C scale (see Table 2 for
200 item content).

201 An additional factor to consider is that most ~~studies that adapted~~ researchers who
202 adapted the NEP-C for use with children speaking other languages than English did not
203 provide detailed information about the translation method and comprehensibility of the

204 NEP-C items (Cheung et al., 2020; Heggstad et al., 2019). For example, Şahin et al.
205 (2015), Torkar et al. (2020), and Sa'di (2019) did not comment on the
206 comprehensibility of their translated versions. Regarding the comprehensibility of the
207 Spanish version of the NEP-C, Corraliza et al. (2013, p. 3) simply stated that “a pilot
208 study was conducted in 20 children to confirm the items could be easily
209 comprehended”. Similarly, Siim (2012) reported that the wording of the Estonian
210 statements was clear to the 6th grade students and that there were no problems in filling
211 in the questionnaire. Two studies provided more information about the
212 comprehensibility of their translated versions. Kopnina (2011, 2012) indicated that the
213 terms ‘laws of nature’ (item 4) and ‘modern lifestyle’ (item 6) were not always clear to
214 children filling in the Dutch version of the NEP-C. Grůňová et al. (2019) reported that
215 modifications on items 5 and 10 of the French version of the NEP-C were necessary to
216 avoid misunderstanding. Thus, it seems that most items of the Dutch version are
217 comprehensible (except potentially items 4 and 6) and one might assume that all items
218 from the final French version are comprehensible.

219 **Is the proposed internal structure of the NEP-C supported by empirical**
220 **data?**

221 Exploratory or confirmatory factor analyses are commonly seen in studies presenting a
222 newly developed scale. It is uncommon, however, to see a critical discussion of the
223 assumptions of these techniques, which are based on the latent variable model, also
224 known as the common factor model (Fried, 2020; Rhemtulla et al., 2020; Schmittmann
225 et al., 2013). The latent variable model is often described as a model assuming the cause
226 of people’s observed responses to specific questionnaire items is a latent, or
227 unobservable, variable (Dalege et al., 2016; Fried, 2020; Rhemtulla et al., 2020). The
228 latent variable model considers unshared variance among observed responses as

229 measurement error, based on two assumptions: local independence and exchangeability
230 (Dalege et al., 2016; Fried, 2020; Rhemtulla et al., 2020; Schmittmann et al., 2013). The
231 assumption of local independence suggests observed responses should be unrelated
232 when conditioned on the latent construct (Fried, 2020). **The assumption of**
233 **exchangeability** implies that all items within a subscale should measure the same
234 construct, being perfectly correlated in the absence of measurement error (Rhemtulla et
235 al., 2020); it means that the target construct “is equivalent to whatever is in common
236 among all indicators” (Rhemtulla et al., 2020, p. 32). These two assumptions might not
237 be plausible for the NEP-C.

238 Regarding local independence, it is not clear that NEP beliefs are independent of
239 each other. In fact, as Dalege et al. (2016) suggest, beliefs toward the same attitude
240 object (e.g., the rights of nature) often align with each other. Concerning
241 exchangeability, whereas all items refer to beliefs related to the NEP, these beliefs are
242 distinct. In our view, one should not expect a perfect correlation among responses to
243 NEP-C items, even in the absence of measurement error. For example, a child who
244 agrees with the statement “people must still obey the laws of nature” does not
245 necessarily have to agree with “plants and animals have as much right as people to
246 live.” Therefore, the latent variable model may not be the best way to conceptualize the
247 relationship between the construct and the observed responses, and the treatment of
248 unshared variance as measurement error is unwarranted.

249 Despite this theoretical fragility, we assessed whether the three-factor model and
250 the one-factor model proposed by Manoli et al. (2007) fit empirical data in previous
251 studies using the NEP-C. We first discuss the results for the three-factor model, which
252 suggests ~~that~~ the NEP-C scores can be organized into three subscales (see Table 2).
253 Before discussing the findings from factor analyses of the NEP-C, we note that Harrison

254 (2020) concluded that the content of some NEP-C items does not seem to match the
255 label of the subscale in which they are included. For example, the item “Nature is strong
256 enough to handle the bad effects of our modern lifestyle” is included in the human
257 exemptionalism subscale of the NEP-C (Manoli et al., 2007). However, further
258 qualitative analyses of this item suggest that it is more closely related to ideas regarding
259 the balance of nature (Harrison, 2020). In fact, considering the adults’ version of the
260 NEP scale, the item that is most closely related to this one (“The balance of nature is
261 strong enough to cope with the impacts of modern industrial nations”) is included in the
262 balance of nature subscale (Dunlap et al., 2000).

263 Despite this limitation, both Manoli et al. (2007) and Harrison (2020) tested this
264 three-factor model with the NEP-C English version through confirmatory factor
265 analysis. Based on the results of these two studies, the three-factor solution seems
266 questionable (Table 4). Factor loadings ranged from .09 to .77, and fit indices indicated
267 some degree of misspecification on the model. The authors of both studies, however,
268 did not report the reasons for this misspecification. Confirmatory factor analyses on the
269 translated versions of the NEP-C were conducted in three additional studies (Grúňová et
270 al., 2019; Sa’di, 2019; Torkar et al., 2020). Overall, results showed some degree of
271 misspecification in their models, although this misspecification seems less serious in
272 Sa’di’s (2019) Arabic version. Again, the authors did not report reasons for
273 misspecification. Two studies kept their analyses at a more basic level by conducting
274 exploratory factor analysis (Şahin et al., 2015; Siim, 2012), which is not the
275 recommended method to assess ~~the a~~ proposed three-factor model (Mokkink et al.,
276 2018). Siim (2012) found a different dimensional structure in the [Arabie-Estonian](#)
277 version of the NEP-C than the one proposed by Manoli et al. (2007). In ~~their a~~ Turkish

278 version of the NEP-C, Şahin et al. (2015) found some support for the structure proposed
279 by Manoli et al. (2007), although the factor loadings were somewhat low (.45 to .73).

280 <Please insert Table 4 about here>

281 As indicated above, Manoli et al. (2007) also argued that children's responses to
282 NEP-C items could be accounted for by a single factor. This argument, also based on
283 the latent variable model, is theoretically not the best way to account for the shared
284 variance among the observed responses to the NEP-C items. Nevertheless, both Manoli
285 et al. (2007) and Harrison (2020) tested the one-factor model for the English language
286 NEP-C instrument using confirmatory factor analysis. Their results did not support ~~this~~
287 a single-factor model, suggesting misspecifications (see Table 4). The authors of both
288 studies did not report ~~the~~ reasons for this misspecification. Similarly, Torkar et al.
289 (2020) used the Slovenian version of the NEP-C and found some degree of
290 misspecification on the one-factor model (e.g., CFI = .692). For the Spanish version of
291 the NEP-C, Corraliza et al. (2013) tested the existence of a higher-order factor that
292 influenced s three second-order factors. Based on their ~~results (i.e.,~~ factor loadings and
293 the scale's internal consistency), the authors excluded items 1 and 2 from the NEP-C
294 and included item 11 (not present in the final English version). Corraliza et al.'s (2013)
295 results indicated some degree of misspecification of the model (e.g., RMSEA = .083) ~~of~~
296 the model, noting that a considerable amount of observed variance among responses
297 remained unexplained (e.g., $\lambda = .51$). Again, these authors did not report the reasons for
298 this misspecification.

299 **Benefits and drawbacks to consider when using the NEP-C**

300 The NEP-C has been, and will presumably remain, a popular tool for assessing
301 children's NEP beliefs around the world. We acknowledge the value of this instrument
302 and its utility as an evaluation tool for environmental education programs that aim to

303 influence beliefs and inspire pro-environmental behavior. For example, by applying the
304 NEP-C to children, environmental educators can characterize the extent to which
305 children agree with each NEP belief covered by the scale and also assess associations
306 among different belief statements and scales. The NEP-C can also be used to determine
307 what kind of environmental education interventions influence NEP beliefs and how
308 these beliefs relate to pro-environmental behaviour. However, our review of past studies
309 examining the use of the NEP-C across different cultural contexts raises some concerns
310 and reveals several factors that should be considered before interpreting the results of
311 this scale or employing the tool in future research.

312 Items in the NEP-C measure the broader NEP constructs of rights of nature, eco-
313 crisis, and human exemptionalism, but may fail to integrate other components of the
314 NEP. Thus, the NEP-C may miss some critical aspects of the emerging ecological
315 paradigm – particularly beliefs about the need for a steady-state economy (Dunlap &
316 Van Liere, 1978) and sociopolitical aspects (Dunlap, 2008). Another issue is the highly
317 variable interpretation of the NEP scales, which are often said to measure constructs
318 ranging from attitudes, values, and worldviews to concerns and beliefs (Dunlap, 2008;
319 Dunlap et al., 2000; Manoli et al., 2007). For instance, the studies included in our
320 literature review referred to the construct assessed by the NEP-C as environmental
321 orientations (Manoli et al., 2007; Sa'di, 2019), environmental attitudes (Grůňová et al.,
322 2019; Kopnina, 2011, 2012), environmental worldviews (Manoli et al., 2007; Siim,
323 2012; Torkar et al., 2020), ecological beliefs (Corraliza et al., 2013; Şahin et al., 2015),
324 and environmental beliefs (Harrison, 2020). Researchers should recognize that the NEP-
325 C does not measure all of these things comprehensively. What the NEP is (and what it is
326 not) needs to be described more precisely (Dunlap, 2008; Dunlap et al., 2000). ~~R,~~ and
327 researchers should carefully choose items and scales that effectively operationalize their

328 specific goals by asking: ~~are~~ if there **are** complementary or alternative measures to
329 cover constructs and outcomes of interest. For instance, if outcomes such as
330 connection to nature (Salazar et al., 2021), eco-affinity (Larson et al., 2011), or
331 environmental concern (Casaló & Escario, 2016) are of greatest interest, then the NEP-
332 C may not be the most effective instrument regardless of its popularity (see Cruz &
333 Manata, 2020). **Researchers should also note that not all NEP-C items may be indicators**
334 **of environmental concern or ecocentric beliefs (Grúňová et al., 2019; Harrison, 2020;**
335 **Kopnina, 2011). For example, Grúňová et al. (2019) explain that children may agree**
336 **with the item “There are too many (or almost too many) people on earth” without**
337 **linking population to impacts on the environment or human well-being. This highlights**
338 **the need for more research and reflection that explores the reasons underpinning youth**
339 **responses to NEP-C items.**

340 Regarding comprehensibility, results suggest that certain items on the English
341 version of the NEP-C may be difficult for children to understand (Harrison, 2020).
342 Similar comprehension problems were also identified in the Dutch version of the scale
343 (Kopnina, 2011, 2012). While no other study reported comprehension problems in the
344 final version of the scale, it should be noted that most studies provided limited
345 information regarding the assessment of the scale’s comprehensibility. More evidence is
346 needed regarding the comprehensibility of translated versions of the scale (e.g., Şahin et
347 al., 2015; Torkar et al., 2020). Future research using NEP-C should include pilot testing
348 to ensure the scale functions as intended with the target population.

349 The internal structure of the NEP-C also appears questionable. According to our
350 findings, neither the one-factor model nor the three-factor model proposed by Manoli et
351 al. (2007) had an exact fit with empirical data in any previous studies using the NEP-C
352 (Table 4). Fit indices for the one and three-factor solutions were often below or above

353 acceptable values, and a considerable proportion of the variance of observed responses
354 was not explained by these models and was inappropriately treated as measurement
355 error. Additionally, the use of a latent variable model to examine the internal structure
356 of the NEP-C proposed by Manoli et al. (2007) may not be appropriate, a limitation
357 commonly seen in scale-based research (Fried, 2020; Rhemtulla et al., 2020). Future
358 research could utilize approaches such as network theory to assess responses using
359 models that simultaneously account for common causes (i.e., latent variables) and
360 interactions between items (Borsboom, 2017). However, as Fried (2020) notes, these
361 types of statistical models are lamentably absent from most applied work in the field of
362 psychology. When researchers feel confident that ~~the~~ NEP-C items are
363 comprehensibleunderstood by a particular audience and that the scoring approach is
364 appropriate, it may also be necessary to gather evidence about other aspects of the scale
365 such as the stability of the scores across occasions (Kane, 2013).

366 When researchers believe they can appropriately interpret NEP-C scores, they
367 should consider the social benefits of using the scale. The value of understanding NEP
368 beliefs might be articulated ~~as follows~~based on the following assumptions. First,
369 researchers may assume that a better understanding of NEP beliefs will inform the
370 development of interventions to modify these beliefs, ~~especially those targeting youth~~.
371 Second, a change in NEP beliefs will ~~favor~~support engagement in pro-environmental
372 behaviors that stem from these beliefs, resulting in benefits to society (Dunlap et al.,
373 2000). ~~Whereas~~Although there is evidence that NEP beliefs can be influenced by
374 environmental education interventions (e.g., Collado et al., 2020; Manoli et al., 2007),
375 the influence of these beliefs on pro-environmental behaviors is ~~questionable~~debatable.
376 For example, Collado et al. (2020) found, ~~after a nature-based environmental education~~
377 ~~intervention~~, a 5% increase in NEP-C total score after a nature-based environmental

378 [education intervention](#), but no improvement on self-reported pro-environmental
379 behaviors. In line with this finding, Corraliza et al. (2013) found that the NEP-C total
380 scores explained only 2% of the variance of self-reported energy-saving behaviors.
381 Weak links between the NEP and pro-environmental behavior have also been revealed
382 in studies of adults, which often point to stronger behavioral antecedents such as culture
383 and ethnicity (Johnson et al., 2004), individual locus of control (Derdowski et al., 2020),
384 and values (Steg et al., 2011). Thus, we caution researchers to avoid the assumption that
385 strong NEP beliefs will be accompanied by high engagement in pro-environmental
386 behaviors. [In light of this, and](#) we encourage [researchers them](#) to clearly describe and
387 measure the benefits they plan to address by assessing children's NEP beliefs.

388 When using self-reported questionnaires to assess children's beliefs, additional
389 considerations must be weighed (AERA et al., 2014). These costs and tradeoffs include
390 the expenditure of resources such as the time and money required for data collection, as
391 well as the youth participants' time. Instruments that are long and complex may be
392 difficult to administer and challenging for children to complete, ultimately impacting
393 data quality (AERA et al., 2014). As seen with the NEP, finding the appropriate balance
394 between scale length/complexity and construct coverage is difficult (Hawcroft &
395 Milfont, 2010). While the NEP-C was designed with these considerations in mind
396 (Manoli et al., 2007), additional adaptations may be required to ensure that the scale
397 adequately and efficiently captures the perspectives of youth from diverse backgrounds.

398 **Conclusion**

399 Our findings regarding the utility of the NEP-C have many implications for
400 environmental education research. The synthesis reveals that researchers may need to
401 adapt the NEP-C before using this scale in future research (e.g., modifying items that
402 are not well understood). It also underscores the value of ensuring that measured

403 variables align with targeted outcomes and anticipated societal benefits. Our review
404 highlights the importance of conducting an ~~appropriate~~ thorough evaluation of model
405 assumptions ~~before the~~ prior to -interpretation of results; failure to do so might lead to
406 incorrect aggregation of scores and inaccurate conclusions. Finally, we emphasize the
407 need to critically assess ~~the~~ outcome measures used in ~~the~~ evaluation, even when these
408 measures – like the NEP-C – are widely employed. The NEP-C is a valuable tool in
409 environmental education research. Nonetheless, improving the practices of adapting and
410 interpreting the NEP-C will increase the accuracy of findings and enhance researchers’
411 ability to effectively assess the impacts of interventions designed to influence NEP
412 beliefs.

413 **Declaration of interest**

414 The authors declare they have no conflict of interest.

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584 Table 1. Description of the New Ecological Paradigm Scale for children (NEP-C), based
 585 on Manoli et al. (2007).

Construct measured	Beliefs related to the New Ecological Paradigm
Target population	10 to 12 years-old children
Mode of administration	Self-report
Subscale (number of items)	The rights of nature (3); Human exemptionalism (3); Eco-crisis (4)
Response options	1. Strongly disagree; 2. Disagree; 3. Not sure; 4. Agree; 5. Strongly agree
Range of scores/scoring	Total score: 10 to 50
Original language	English
Available translations¹	Arabic, Dutch, Estonian, French, Slovenian, Spanish, and Turkish

586 Note: ¹The information about available translations is based on the studies included in
 587 this literature review.

Table 2. Subscales and item content of the NEP-C.

Subscales or factors	Items
Rights of nature	<p>1. Plants and animals have as much right as people to live.</p> <p>4. People must still obey the laws of nature.</p> <p>7. People are supposed to rule over the rest of nature.</p>
Eco-crisis	<p>2. There are too many (or almost too many) people on earth.</p> <p>5. When people mess with nature it has bad results.</p> <p>8. People are treating nature badly.</p> <p>10. If things don't change, we will have a big disaster in the environment soon.</p>
Human exemptionalism	<p>3. People are clever enough to keep from ruining the earth.</p> <p>6. Nature is strong enough to handle the bad effects of our modern lifestyle.</p> <p>9. People will someday know enough about how nature works to be able to control it.</p>

Note: Adapted from Manoli et al. (2007).

Table 3. Characteristics of the studies and samples included in our review of research evaluating the NEP-C developed by Manoli et al. (2007).

First author and year	Population			Instrument administration			Study design	Validity evidence assessed
	N	Age Mean (SD, range)	Girls%	Setting	Country	Language		
Manoli 2007	515	fourth-, fifth-, and sixth-grade students	53	Unclear	USA	English	Cross-sectional observational study and non-randomized intervention*	Internal structure and responsiveness.
Siim 2012	396	Sixth-grade students	48.7	School classrooms	Estonia	Estonian	Cross-sectional observational study	Content validity (comprehensibility), internal structure, internal consistency, and hypotheses testing for construct validity.
Kopnina 2011, 2012	59	10 to 12 years-old	Mixed	Unclear	Netherlands	Dutch	Focus group, in-depth interviews, and observations	Content validity (comprehensibility).
Corraliza 2013	574	11.32 (1.39, 8 to 13 years old)	52.8	Cultural center	Spain	Spanish	Cross-sectional observational study	Content validity (comprehensibility), internal structure, internal consistency, hypotheses testing for construct validity.
Şahin 2015	263	10.18 (9 to 12 years old)	53.6	Unclear	Turkey	Turkish	Cross-sectional observational study	Internal structure, internal consistency, and test-retest reliability.
Şahin 2015	200	10.9 (10 to 12 years old)	NI	Unclear	Turkey	Turkish	Cross-sectional observational study	Hypotheses testing for construct validity.

Grůňová 2019	765	13 (1.3, 10 to 18 years old)	48.9	Urban and rural schools	Senegal	French	Cross-sectional observational study	Internal structure and internal consistency.
Grůňová 2019	17	12 to 14	Mixed- gender	Schools	Senegal	French	Interview	Content validity (comprehensibility).
Sa'di 2019	337	7 to 9 years old	34.8	UNRWA schools	Jordan	Arabic	Cross-sectional observational study	Internal structure and internal consistency.
Torkar 2020	310	9 to 13 years old	NI	School classrooms	Slovenia	Slovenian	Cross-sectional observational study	Internal structure, hypotheses testing for construct validity.
Harrison 2020	362**	Students in Grades 6 to 12	NI	Data collected electronically	USA	English	Mixed method cross- sectional observational study	Content validity (comprehensibility), internal structure, internal consistency, and measurement invariance.

Note: *In Manoli et al. (2007), a paired sample t-test analysis was performed with the 186 students who participated in the Sunship Earth program. **In Harrison (2020), only seven students participated in cognitive interviews. NI = no information; UNRWA = United Nations Relief and Works Agency for Palestine Refugees

Table 4. Evidence for the internal structure of the NEP-C as reported by studies included in the literature review.

Study	NEP-C language	Factor analysis	Structure tested	The <i>P</i> -value for the χ^2 test	χ^2/df	Range of factor loadings	Fit indices
(Manoli et al., 2007)	English	CFA	Three factors	NI	NI	.09 to .77	GFI = .96; AGFI = .93 CFI = .75; RMSEA = .066
(Harrison, 2020)	English	CFA	Three factors	NI	3.83	.44 to .75	CFI = .901, TLI = .905, RMSEA = .089
(Grůňová et al., 2019)	French	CFA	Three factors	NI	NI	.24 to .72	CFI = .805, RMSEA = .041 and SRMR = .047; IFI = .812
(Sa'di, 2019)	Arabic	CFA	Three factors	<.01	4.12	.74 to .89	CFI = .92; RMSEA = .039
(Torkar et al., 2020)	Slovenian	CFA	Three factors	NI	1.87	NI	CFI = .847, TLI = .700, RMSEA = .050
(Torkar et al., 2020)	Slovenian	CFA	One factor	NI	2.39	NI	CFI = .692, TLI = .517, RMSEA = .063
(Manoli et al., 2007)	English	CFA	One factor	NI	NI	NI	GFI = .94; AGFI = .90 CFI = .83; RMSEA = .085
(Harrison, 2020)	English	CFA	One factor	NI	7.00	NI	CFI = .781, TLI = .798, RMSEA = .129
(Corraliza et al., 2013)*	Spanish	CFA	One higher-order factor and three second-order factors	NI	2.93	.51 to .96	GFI = .95; AGFI = .91; CFI = .94; RMSEA = .083
(Siim, 2012)**	Estonian	EFA	NA	NA	NA	NA	NA
(Şahin et al., 2015)	Turkish	EFA	NA	NA	NA	.45 to .73	NA

Note: *Items 1 and 2 were deleted and item 11 (eliminated by Manoli et al. (2007)) was included. **Results from exploratory factor analysis suggested a different dimensionality than the one proposed by Manoli et al. (2007). CFA = confirmatory factor analysis; *df* = degrees of freedom; EFA = exploratory factor analysis; NA = not applicable; NI = no information.