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# How Young “Early Birds” Prefer Preservation, Appreciation and Utilization of Nature

Patricia Raab <sup>1,\*</sup>, Christoph Randler <sup>2</sup>  and Franz X. Bogner <sup>1</sup> 

<sup>1</sup> Didactics of Biology, Z-MNU (Centre of Math & Science Education), University of Bayreuth, NW-1, Campus, D-95447 Bayreuth, Germany; franz.bogner@uni-bayreuth.de

<sup>2</sup> Department of Biology, Eberhard Karls University of Tuebingen, Auf der Morgenstelle 24, D-72076 Tuebingen, Germany; christoph.randler@uni-tuebingen.de

\* Correspondence: patricia.raab@uni-bayreuth.de

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**Abstract:** Since the 1990s, the Two Major Environmental Value model (2-MEV) has been applied to measure adolescent environmental attitudes by covering two higher order factors: (i) Preservation of Nature (PRE) which measures protection preferences and (ii) Utilization of Nature (UTL) which quantifies preferences towards exploitation of nature. In addition to the 2-MEV scale, we monitored the Appreciation of Nature (APR) which, in contrast to the UTL, monitors the enjoyable utilization of nature. Finally, we employed the Morningness–Eveningness Scale for Children (MESC) which monitors the diurnal preferences and associates with personality and behavioral traits. In this study, we analyzed data from 429 Irish students (14.65 years;  $\pm 1.89$  SD) with the aim of reconfirming the factor structure of the 2-MEV+APR and monitoring the relationship between the MESC and the environmental values (PRE, UTL, APR). Our findings identified a significant association between PRE and APR with MESC. In addition, we observed a gender difference. Our results suggest that morningness preference students are more likely to be protective of and appreciative towards nature. Recommendations for outreach programs as well as conclusions for environmental education initiatives in general are discussed.

**Keywords:** 2-MEV model; preservation; appreciation; utilization; environmental attitudes; circadian preference; morningness–eveningness

## 1. Introduction

Until the 1990s, reliable instruments for the measurement of green attitudinal variables were disputed. A meta-analysis by Leeming et al. [1] reviewed all existing psychometric approaches dealing with environmental attitudes and values, and reached the conclusion that they lacked sufficient rigorousness. Many instruments trying to cover children’s environmental values have been criticized, inter alia, due to their weak psychometric properties or the lack of a clear theoretical framework [2]. For a long time, the only accepted instrument was the New Environmental Paradigm (NEP) Scale which was originally designed for adults and later revised for children [3,4]. Three decades later, Dunlap et al. [5] theoretically revised and enlarged the instrument, renaming it the New Ecological Paradigm Scale (still abbreviated NEP) but with 15 items. As the construct that underlies the NEP Scale regards environmental perception as unidimensional, environmental attitudes and behavior can only be insufficiently studied [5,6]. There still is an ongoing debate in the literature about the number of dimensions of the NEP scale [5].

In the 1990s, the development of the Two Major Environmental Value model (2-MEV) scale provided a first instrument for adolescents [7]. In contrast to the NEP approach [3,5], the 2-MEV scale uses a two-dimensional construct. Subsequent studies refined the 2-MEV and reduced the

initial 69 items to a set of 20 [8–11]. Ten of these items load on the Preservation factor, whereas the other ten items load on the Utilization factor. With a total of 20 items, the two higher order factors Preservation (PRE) and Utilization (UTL) can be sufficiently examined on the basis of primary factors. Originally, the higher order factor of Preservation consisted of three primary factors, namely Intent of Support, Care with Resources, and Enjoyment of Nature; while the higher order factor of Utilization included, for instance, Altering Nature and Human Dominance [12]. The Preservation of Nature measures the intention of adolescents to preserve the environment and is “a biocentric dimension that reflects conservation and protection of the environment” [13] (p. 787). In contrast, the Utilization of Nature measures the tendency of adolescents towards utilizing/exploiting the environment and is “an anthropocentric dimension that reflects the utilization of natural resources” [13] (p. 787). According to Rokeach [14], the term “attitudes” stands for item-set based first-order factors and the term “values” for higher-order factors. We will therefore use the term “environmental values” hereafter.

After the implementation of the 2-MEV in the 1990s, multiple cross-validation studies were conducted to validate the instrument. Bogner et al. [15] described the relationship between environmental values and personality variables (more accurately risk-taking) and observed that preservers are prone to cautious behavior, while utilizers are prone to risky behavior. The study supported the two orthogonal dimensions Preservation and Utilization [15]. Additionally, Wiseman and Bogner [13] also backed the orthogonal structure of Preservation and Utilization in their study on the relationship between personality variables “Psychoticism”, “Extraversion” and “Neuroticism”, environmental values and social desirability [13,16]. In this study, preservers favored otherwise-orientated gratification and utilizers favored self-orientated gratification. The study of Wiseman et al. [17] measured the relationship between Authoritarianism and the two environmental values. They described that preservers correlate negatively with Authoritarianism, while utilizers correlate positively with Authoritarianism. The application of the 2-MEV in different European countries (e.g., Ireland, Denmark, France and Switzerland) also supported the orthogonal, two-dimensional structure of Preservation and Utilization [8,11,18,19]. A 2-MEV study with pre- and in-service teachers extended the applicability of the model to a higher age group [20]. These cross-validation studies dealt with different personality variables, diverging age groups, multiple languages and diverse cultural backgrounds. Together these variables added to the validity and reliability of the 2-MEV scale and supported its construct stability.

Over recent years, the 2-MEV model was scrutinized using different structural and methodological adaptations. Munoz et al. [21] modified the items for adults, while Schneller et al. [22] adapted the item-set to populations in subtropical ecosystems. However, slight changes such as the reduction or exchange of items did not influence the structure of the 2-MEV model. The 2-MEV proved to be a robust, reliable and valid scale. This was even true in instances where the positive wording of some items was rephrased negatively [23]: Negatively formulated Utilization items loaded on Preservation and negatively formulated Preservation items loaded on Utilization. A refusal of Preservation, therefore, entails Utilization and a refusal of Utilization entails Preservation [23].

Utilization of Nature is a complex, equivocal value as it summarizes different behaviors towards nature. On one end of the utilization spectrum is the exploitative usage of nature, while an appreciative usage of nature is the counter on the other end of the spectrum. It has been shown that people with an exploitative attitude towards nature selfishly exploit resources, while people with an appreciative attitude towards nature reply on it for recreational purposes with minimal exploitation [23]. The latter dimension, namely Appreciation of Nature, extended the 2-MEV model [24]. Bogner [24] was able to report a positive association between Preservation and Appreciation indicating that people who appreciate nature have a preservative attitude [25].

Morningness–Eveningness or circadian preference describes the individuals’ preference for and behavior at given times of a day and their time-dependent intellectual and physical peak performance [26]. Classically, a morning person gets up early in the morning and goes to bed early in the evening, while evening persons stay in bed for longer in the morning and turn in later. Usually,

morning persons reach their peak performance during morning hours, while evening people reach it during the afternoon or even during the night [26]. As some evidence suggests that there is a heritable component to this trait which was linked to candidate genes, it is considered an individual difference trait with a close link to personality. Differences are observed across the lifespan, whereby children are morning oriented, while adolescents become rapidly evening oriented. Towards the end of adolescence, this trait oscillates towards morningness again, but this change is more slowly [27,28]. Some studies indicate gender differences whereby women tend to be more morning oriented compared to men, however, these results only had small effect sizes [29].

The construct of morningness–eveningness has been linked to different personality and behavioral traits. For example, conscientiousness, a dimension of the Big Five personality inventory [30], was strongly associated with morning people [31]. Other aspects, such as school achievement, were also related to morningness with higher morning orientation being related with better school achievements [32]. Similarly, further personality traits were linked with morningness, e.g., proactivity [33]. Also thinking and behaving styles have been connected to morningness. Morning-types tend to rely on personal experience, creating knowledge from specific incidents [34]. Furthermore, rational thinking styles and dutifulness were related with morningness [34]. Concerning the psychological construct of time perspective (see details in Zimbardo and Boyd [35]), it is noteworthy that higher morningness scores were positively associated with future time perspectives [36]. On the other end of the morningness–eveningness continuum, eveningness was associated with the personality aspect of sensation seeking, i.e., looking for high arousal activities, such as bungee jumping [37]. Similar to this finding, risk-taking was related to a higher eveningness [34,38]. Moreover, unconventional and dissenting behavior was associated with eveningness [34]. The correlations between morningness–eveningness and the different personality and behavioral traits may lead to the assumption that morningness–eveningness may also be associated with environmental values. As seen from this individual difference perspective with a focus on personality, one would expect a positive relationship between pro-environmental values and morningness. Assuming that morning oriented people tend to possess higher proactivity, conscientiousness and a sense of duty, we hypothesize that they may also have a higher pro-environmental attitude. Furthermore, pronounced future oriented people with rational thinking styles may also be interested in the conservation of an intact environment and therefore inhabit pro-environmental attitudes. In support of this hypothesis is a study by Vollmer and Randler [39] reporting that morningness is related to social values and eveningness to individual values. This suggests that morning people might generally feel more responsibility for society and the environment. A time-budget approach showed that evening people spend more time with electronic media and less time with physical activity compared to morning people, consequently decreasing the time they spend outdoors experiencing nature [40]. It is worth noting, however, that these studies are based on correlational analyses which do not allow to draw solid conclusions on causal relationships between the investigated personality traits.

To our knowledge, this is the first-ever study to investigate the relationship between morningness–eveningness and environmental values. Thus, the objectives of our study were three-fold. Our first aim was to apply the Morningness–Eveningness Scale for Children (MESC) in an Irish adolescent sample. Our second aim was the reconfirmation of the factor structure of the Two-Major Environmental Values (2-MEV: consisting of Preservation of Nature (PRE) and Utilization of Nature (UTL)) and the Appreciation of Nature (APR). Finally, we aimed to unveil the relationship between MESC and 2-MEV+APR.

## 2. Materials and Methods

We recruited a convenience sample of 429 students from primary and secondary Irish schools, whereby the majority of the sample stemmed from the secondary schools. The average age was 14.65 years ( $\pm 1.89$  SD), 32.9% were female. During regular school lessons, all students completed a paper-and-pencil questionnaire comprising the 2-MEV scale, the APR scale and the

Morningness–Eveningness Scale for Children (MESC). The 2-MEV consisted of 14 items monitoring the orthogonal dimensions Preservation and Utilization of Nature [12,23,24]. The APR assessed the Appreciation of Nature with six items [24,41,42]. The response pattern followed a 5-point Likert scale ranging from totally disagree (1) to totally agree (5). The MESC, originating in Carskadon et al. [43], was adapted from the Composite Scale of Morningness [44] to children and adolescents and was recommended by Tonetti et al. [45] as a scale for assessing morningness–eveningness in children and adolescents. The MESC is a unidimensional scale [43,45], has been widely used since 1992 and is available in Brazilian, Italian, Croatian, Turkish, Spanish, American and Australian English [45–49]. It was applied in large samples ( $N = 345$ – $1393$ ) and in a broad age range (12–20 years), with an internal consistency ranging from 0.68–0.77 and a test-retest reliability between 0.53–0.59 (see Tonetti et al. [45] for details). The MESC has not yet been employed in Ireland, but the original English version was applied in the USA and Australia [45]. The scale consisted of 10 items in a Likert type response format. Three questions were scaled from 1–5 and seven from 1–4. For exemplary items of the MESC scale see Table 1. The items add up to a total score of 43, where a high score reflects a strong morning preference, and a low score a minimal morning preference. The morningness–eveningness scales can be used as a continuum (see Natale and Cocogna [50]), but there are also cutoff-values provided for the MESC. Given the higher statistical power of continuous scales and the loss of qualitative information when using cut-off scores, we opted for using the raw scores in the correlational analysis.

**Table 1.** Exemplary items of the Morningness–Eveningness Scale for Children (MESC) scale.

MESC_1	MESC_8
Imagine: School is canceled! You can get up whenever you want to. When would you get out of bed? Between ...	When does your body start to tell you it's time for bed (even if you ignore it)? Between ...
5:00 and 6:30 a.m.	8:00 and 9:00 p.m.
6:30 and 7:45 a.m.	9:00 and 10:15 p.m.
7:45 and 9:45 a.m.	10:15 p.m. and 12:30 a.m.
9:45 and 11:00 a.m.	12:30 and 1:45 a.m.
11:00 a.m. and noon	1:45 and 3:00 a.m.
MESC_2	MESC_5
Is it easy for you to get up in the morning?	When do you have the most energy to do your favorite things?
No way!	Morning! I'm tired in the evening
Sort of	Morning more than evening
Pretty easy	Evening more than morning
It's a cinch	Evening! I'm tired in the morning

All statistical analyses were conducted in IBM SPSS Statistics version 24 (IBM, Armonk, NY, USA). First, a principal component analysis (PCA) with oblique rotation for the 2-MEV+APR was applied to assure the correspondence with the results of Bogner [24]. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were used to investigate the appropriateness of the sample for factor analysis [51]. For the detection of variables which should be excluded, very small ( $r < 0.3$ ) and very high ( $r > 0.9$ ) correlations were examined in the correlation matrix. The anti-image matrix was checked for diagonal elements with values  $< 0.5$ . As the data was not accurate for the usage of the Kaiser-Guttman criterion, we therefore opted for the scree plot to determine the retaining factors [52,53]. To investigate the relationship between the environmental values and the morningness–eveningness preference, in the case of PRE, UTL and APR mean scores were calculated, while we used sum scores for the MESC. Due to the normal distribution of MESC using Shapiro-Wilk ( $p = 0.100$ ), the analyses concerning the relationships between PRE, UTL, APR and MESC were calculated based on parametric tests. The correlations between the mean values of PRE, UTL and APR and the sum scores of MESC were calculated using the Pearson correlation.

### 3. Results

#### 3.1. MESC in an Irish Sample

The MESC score average was 25.50 ( $\pm 5.458$  SD) and the values were normally distributed. The internal consistency of the present sample was high with a Cronbach's alpha of 0.78. There were no differences between boys ( $M = 25.53$ ,  $SD = 5.40$ ) and girls ( $M = 25.43$ ,  $SD = 5.59$ ) in MESC scores ( $t(422) = 0.243$ ,  $p = 0.808$ ). A negative association was observed for age and MESC scores ( $r = -0.103$ ,  $p = 0.034$ ), indicating that younger age is better linked to morningness; a finding reliably described in the literature.

#### 3.2. Factor Structure of 2-MEV+APR

Using an exploratory factor analysis with oblique rotation, we were able to extract a three-factor structure from the 2-MEV+APR, showing consistency with Bogner [24]. The Kaiser-Meyer-Olkin (KMO) test (0.813) (acceptable limit 0.5, [52]) and Bartlett's test of sphericity ( $p < 0.001$ ) confirmed the appropriateness of the sample for factor analysis. According to Ferretich [54], the scores in the correlation matrix should range between 0.3 and 0.9. When examining the correlation matrix in detail, four items did not meet this desirable threshold. UTL\_8, UTL\_12, UTL\_13 and PRE\_17 had correlations below 0.3. However, as previous studies supported the value of these items for the 2-MEV and correlations were very close to the critical value of 0.3, they were not excluded from further analysis. In the anti-image matrix all diagonal elements were equal or above 0.620 and the off-diagonal elements were mainly small ( $< 0.445$ ). Based on the analysis of the scree plot, which is supporting the assumption of a three-factor structure, the factors Appreciation, Utilization and Preservation were extracted from the 2-MEV+APR (see Table 2). The three-factor solution explained 43.24% of the total variance. All factor loadings producing scores exceeding 0.35 are shown (see Table 2). According to Kline [55], a Cronbach's alpha of 0.76 was appropriate.

**Table 2.** Factor loadings were extracted via principal component analysis (direct oblimin rotation, delta = 0), loadings below 0.35 were suppressed. Wording of the seven Appreciation of Nature (APR), seven Utilization of Nature (UTL) and six Preservation of Nature (PRE) items is shown.

Component			
APR	UTL	PRE	
0.817		APR_1	I consciously watch or listen to birds
0.737		APR_3	I deliberately take time to watch stars at night
0.734		APR_2	I take time to watch the clouds pass by
0.729		APR_4	I take time to consciously smell flowers
0.663		APR_5	I enjoy gardening
0.607		APR_7	Listening to the sounds of nature makes me relax
0.567		APR_6	I personally take care of plants
	0.686	UTL_14	We need to clear forests in order to grow crops
	0.626	UTL_9	Nature is always able to restore itself
	0.609	UTL_10	Our planet has unlimited resources
	0.603	UTL_11	We do not need to set aside areas to protect endangered species
	0.543	UTL_8	We must build more roads so people can travel to the countryside
	0.496	UTL_12	People worry too much about pollution
	0.388	UTL_13	The quiet nature outdoors makes me anxious
	0.745	PRE_15	Humans don't have the right to change nature as they see fit
	0.653	PRE_20	Not only plants and animals of economic importance need to be protected
	0.649	PRE_16	Human beings are not more important than other creatures
	0.600	PRE_19	Humankind will die out if we don't live in tune with nature
	0.484	PRE_17	I save water by taking a shower instead of a bath (in order to spare water)
	0.473	PRE_18	Dirty industrial smoke from chimneys makes me angry

#### 3.3. Relationship between MESC and 2-MEV+APR

The environmental value score yielded a mean for PRE of 3.50 ( $SD = 0.73$ ; min = 1; max = 5), for UTL of 2.46 ( $SD = 0.68$ ; min = 1; max = 5) and for APR of 2.70 ( $SD = 0.89$ ; min = 1; max = 5). Concerning the mean scores of PRE and APR, a significant difference was found between girls and



boys (PRE:  $t(424) = -3.057, p = 0.002$ ; APR:  $t(423) = -4.812, p < 0.001$ ). The girls' mean scores for PRE ( $M = 3.66, SD = 0.75$ ) and APR ( $M = 2.99, SD = 0.90$ ) were higher than the boys' mean scores for PRE ( $M = 3.43, SD = 0.70$ ) and APR ( $M = 2.56, SD = 0.85$ ). For UTL, no difference between girls' ( $M = 2.51, SD = 0.66$ ) and boys' ( $M = 2.43, SD = 0.69$ ) mean scores was observed ( $t(423) = -1.068, p = 0.286$ ).

The PRE, UTL and APR mean scores were tested regarding their correlations with each other and the MESC sum scores (Table 3). No relationship could be found between APR and UTL ( $r = 0.079, p = 0.104$ ) and the factors PRE and UTL ( $r = -0.078, p = 0.110$ ). As expected, a positive correlation between the factors APR and PRE was detected ( $r = 0.446, p < 0.001$ ). Regarding the relationship between the environmental values and MESC, APR and MESC ( $r = 0.195, p < 0.001$ ) as well as PRE and MESC ( $r = 0.143, p = 0.003$ ) correlated positively, whereas UTL did not ( $r = -0.005, p = 0.926$ ) (Table 3). In this context, a gender difference was evident. Among boys, positive correlations emerged for APR and PRE ( $r = 0.445, p < 0.001$ ), APR and MESC ( $r = 0.247, p < 0.001$ ) and PRE and MESC ( $r = 0.196, p = 0.001$ ) (Table 4). For girls, only a positive correlation between the environmental values APR and PRE ( $r = 0.395, p < 0.001$ ) was observed (Table 5).

**Table 3.** Pearson Correlations between mean scores of APR, PRE and UTL and sum scores of MESC (2-tailed) [total sample].

	Test Statistics	APR	PRE	UTL	MESC
APR	Pearson Correlation Sig. (2-tailed)	1.000	0.446 *** 0.000	0.079 n.s.	0.195 *** 0.000
PRE	Pearson Correlation Sig. (2-tailed)		1.000	-0.078 n.s.	0.143 ** 0.003
UTL	Pearson Correlation Sig. (2-tailed)			1.000	-0.005 n.s.

\*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

**Table 4.** Pearson Correlations between mean scores of APR, PRE and UTL and sum scores of MESC (2-tailed) [males only].

	Test Statistics	APR	PRE	UTL	MESC
APR	Pearson Correlation Sig. (2-tailed)	1.000	0.445 *** 0.000	0.048 n.s.	0.247 *** 0.000
PRE	Pearson Correlation Sig. (2-tailed)		1.000	-0.073 n.s.	0.196 ** 0.001
UTL	Pearson Correlation Sig. (2-tailed)			1.000	-0.063 n.s.

\*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

**Table 5.** Pearson Correlations between mean scores of APR, PRE and UTL and sum scores of MESC (2-tailed) [females only].

	Test Statistics	APR	PRE	UTL	MESC
APR	Pearson Correlation Sig. (2-tailed)	1.000	0.395 *** 0.000	0.113 n.s.	0.117 n.s.
PRE	Pearson Correlation Sig. (2-tailed)		1.000	-0.116 n.s.	0.051 n.s.
UTL	Pearson Correlation Sig. (2-tailed)			1.000	0.119 n.s.

\*\*\*  $p < 0.001$ .

## 4. Discussion

This study aimed to examine morningness–eveningness in an Irish sample and to confirm the structure of the 2-MEV+APR. Subsequently, it explored the relationship between the environmental values PRE, UTL and APR and morningness–eveningness in adolescents.

### 4.1. MESC in an Irish Sample

This first application of the MESC in Ireland produced a Cronbach's alpha of 0.78 showing an acceptable internal consistency. It is within the range of other studies from different languages and countries (0.68–0.77; [45]). Therefore, the original MESC as provided by Carskadon et al. [43] is applicable in our chosen country. However, further studies should assess the convergent validity of this scale with actigraphy, or dim light melatonin secretion as objective biological markers as well as with other empirical scales of circadian preference for children and adolescents that are currently in use (see Tonetti et al. [45]). A significant, negative correlation between age and MESC scores was observed, indicating that younger students tend to be more morning oriented, while older students tend to be more evening oriented. This is in line with Randler et al. [27], who described age-related variability concerning morningness–eveningness from young children to early adulthood (age range: 0–30 years) in a German sample. In Germany, school starts around 8 a.m., while Irish schools start one hour later. Apparently, the start of the school day does not impact students' preferred time to rise in the morning. In this study, we observed no gender differences contrary to literature which describes that girls score higher on morningness than boys [29]. The effect sizes of these differences reported in the literature, however, are rather small [29] and developmental effects in our sample may have masked any existing gender differences. Our sample was on average 14.65 years old which may have contributed to pubertal development overlaying these gender differences.

### 4.2. Factor Structure of 2-MEV+APR

A precursor of the 2-MEV scale, first published by Bogner and Wilhelm [7] in the 1990s, has been applied to Irish samples confirming the suitability of the item selection for that country [8]. However, at that time the factor structure was not yet finally elaborated because further bi-national studies and cross-validation studies were still ongoing (e.g., [11,18,19]). Therefore, a reconfirmation was advisable, especially as APR was not part of the original set of items. The two-dimensional structure of the 2-MEV was already independently supported by many different researchers from different fields of expertise [2, 6,56–58]: (i) Milfont and Duckitt [56] took a psychometric point of view and confirmed the secondary higher-order structure of Preservation and Utilization. (ii) Johnson and Manoli [2,6] approached from an educational point of view when they were searching for an appropriate instrument for evaluating US-wide earth education programs. (iii) Boeve-de Pauw and van Petegem [57] came at it from a pedagogical angle, assuring the two-dimensional structure as well. Finally, (iv) Borchers et al. [58], coming from a psychological-pedagogical background, confirmed the two-factor second order structure in a study conducted in West Africa. Bogner [24] expanded the repeatedly confirmed 2-MEV scale with items measuring the Appreciation of Nature and found a clear three-dimensional structure. The current study is adding to this literature. It confirms the three-factor structure of the 2-MEV-APR as described by Bogner [24].

The 2-MEV+APR scale is a valid and reliable instrument to measure the environmental values Preservation of Nature, Utilization of Nature and Appreciation of Nature. The proposed reduction of the 2-MEV+APR item set to a set of 20 items, omitting one appreciation item which covers the relationship to pets, seems reasonable [24]. With the 20-item assessment, the three factors PRE, UTL and APR explain 43.24% of the total variance. The appreciation item "I consciously watch or listen to birds" (APR\_1) holds the highest communality with 0.68. The communality of a factor gives information about the extent to which every single variable is explained by the factors. Communalities represent a loss of information; its value indicates the extent to which the factors explain the original data [52].

The high relevance of this appreciation item was also found in Bogner [24]. The utilization item “The quiet nature outdoors makes me anxious” (UTL\_13) holds the lowest factor loading (see Table 2). This may be a starting point for further examinations. This item is the only affective one in the Utilization subscale, which directly inquires about personal emotions of the participants. One possible explanation for the low communality and factor loading of this item may be the participants’ doubts to reveal their anxieties. Furthermore, Ireland has a low population density compared to other European countries. Quiet nature may be nothing unusual or frightening for Irish primary and secondary school students, assuming that they grew up in Ireland. This assumption may also be supported by the high factor loadings of the Appreciation items which evaluate the enjoyment of listening to birds and the sounds of nature (APR\_1, APR\_7; see Table 2).

The Appreciation of Nature adds another important aspect to the 2-MEV architecture. As Utilization covers the anthropocentric part of environmental values, it includes the preferences to dominate, harm or even exploit nature [24]. The addition of items covering the Appreciation of Nature enables a more precise evaluation of the Utilization value [23]. Including these items allows to capture the Utilization of Nature as a source of relaxation and tranquility. Therefore, the inclusion of the additional value Appreciation of Nature was statistically validated. Seven variables strongly load onto this factor ( $\geq 0.567$ ), whereby the loadings of these items onto other factors are negligible. The selected items, therefore, seem to reliably measure Appreciation of Nature.

#### 4.3. Relationship between MESC and 2-MEV+APR

In contrast to Bogner and Wiseman [19], we observed no negative correlation between PRE and UTL and no differences in UTL mean scores for female and male students. A positive correlation between PRE and APR was found for the total sample as well as for girls and boys only. People who demonstrate an appreciative attitude towards nature may also have a higher tendency to preservative, pro-environmental thoughts and actions [25,59]. This result is also important for the further development of educational purposes. The strong emphasis on negative examples and impacts of the exploitative usage of nature seems to be insufficient in promoting protective behavior among adolescents [60,61]. A promising approach to encourage pro-environmental behavior is the emphasis of an appreciative attitude towards nature [59,62,63].

Morningness clearly appears associated with a higher appreciation and a higher preservation of nature. This result was found for the total sample as well as for males only. Within the subsample of females-only, none of these relationships manifested. As the gender distribution of our study was not equally balanced (consisting of 67% male and 33% female students), a bias regarding the overrepresented male participants may exist. Together with the fact that girls scored higher mean values on preservation and appreciation of nature than boys (independent of morningness–eveningness), the described gender specifics might need further elaboration in future studies.

People with a high morning preference scored high on appreciative and preservative attitudes towards nature. Rising early may allow individuals to experience the calm and awakening nature, especially during weekends. Goulet et al. [64] reported that morning and evening people are exposed to different amounts of light exposure. Morning individuals showed more daily bright light exposure ( $>1000$  lux) than evening persons [64], indicating that the former spend more time outdoors [65]. The motivation why morningness people spend more time outdoors—whether that might be because of the appreciation of nature in its own right or because of other leisure activities—has not been studied yet. While the fact that morning types spend more time outdoors does not implicate that they spend this time in nature, at least the chance to encounter nature is given. It needs to be noted that modern life in cities hampers the contact to nature, however, nature encounters can still occur in popular leisure localities such as parks or bathing lakes. Those potential experiences of an intact nature may be a trigger for an environmentally friendly mindset and ensuing appreciative and protective actions. In contrast, evening people, sleeping longer than morning people, especially on the weekends, might feel distracted



by the sunrise lightening their room and the dawn song of birds, both deteriorating their sleep. As a consequence, they might develop a neutral or negative attitude towards the environment. These are, however, still speculations and need to be scrutinized by further empirical work. One might argue that evening people can gain their positive experiences in nature in the evening hours, e.g., enjoying sunset. However, two lines of evidence contradict this: First, in central/northern Europe, the sunset is early in comparison to usual bed times of adolescents. Therewith, even morning people are still awake when the sun goes down. Second, evening pupils differ from morning people in their media usage. They spend more time with digital media in the evening (rather than going out for nature experience) [40].

The associations between morningness–eveningness and individual and behavioral traits found in previous studies may give further indications of the relationship between MESC and 2-MEV+APR. Those studies revealed that people with morning preferences tend to be more proactive, more conscientious and more future-oriented in their time perspective [30,33,36]. These personality and individual difference traits suggest that morningness may also be related to a higher pro-environmental attitude [26,31,33]. Moreover, personal habits concerning the usage of spare time may provide a further explanatory approach for the found relationships. Compared to evening persons, morning types spend more time with physical activity and less time with electronic media [40]. As physical activities are often performed in nature, morning people might spend a greater amount of their leisure time outdoors. As such, they might have more contact with the environment, both, qualitatively and quantitatively, fostering mostly positive emotions. As a consequence, appreciative and preservative attitudes towards the environment might arise. A study by Ewert et al. [66] also suggested that among others appreciative and consumptive outdoor activities in early-life may influence adults' attitude towards the environment. As outlined before, evening people tend to spend more time with electronic media [40]. This manner may reduce their opportunities of outdoor activities and nature-encounters, diminishing the probability of pro-environmental attitudes. However, this line of research has to be further developed to enable characterizations of morning and evening oriented people concerning their leisure activities and time spent outdoors.

#### 4.4. Conclusions

Our results show that students preferring morning hours tend to possess a higher appreciative and preservative attitude towards nature. This is an important finding when planning and implementing educational programs, such as outreach programs. Therefore, one recommendation may be to take this individual difference trait into account when applying educational programs dealing with environmental aspects, because it seems likely that morning people should achieve better scores on such teaching programs. On the basis of our results on morningness students, further questions arose which may be a possible starting point for future research: Do morningness students also have greater knowledge about and interest in the environment and environmental problems in particular? Do these students perform more or less pro-environmental behavior than their eveningness preferring classmates? Does the students' socioeconomic background influence their morningness–eveningness and environmental values? The results may be of special interest for the conception of outreach programs as their beginning can be flexibly adapted in many cases. Furthermore, outreach programs can be tailored towards morningness students with concrete learning opportunities such as bird watching in the morning hours, or towards eveningness students with activities supporting an appreciative attitude towards nature in the evening hours. Consequences of these assumptions might interfere with effects of environmental education interventions on environmental values, as some previous studies reported a lack or a partial lack of effects (e.g., Sellmann and Bogner [67], Liefänder and Bogner [68], Dierker and Bogner [69]). Finally, it is important to note that students' responses on questionnaires on their environmental preferences may be influenced by social desirability [70]. A combination of questions covering morningness–eveningness and environmental

values may provide a realistic picture of students' attitudes and hereby offering an option to fine-tune programs accordingly.

Morningness–eveningness or circadian preference has been measured with a self-report instrument. Future studies may use objective measures, but usually the correlations between objectively measured sleep–wake behavior and the scores on the questionnaires are above 0.5 [71], suggesting that these questionnaires are reliable. Another aspect to be covered in future studies may be the changes in sleeping behavior during the adolescent lifespan. A recent study in Germany showed that adolescents become evening oriented during puberty, but turn back towards morningness around the age of 17–20 years [27]. Within this context, a long-term analysis monitoring the relationship between morningness–eveningness and the environmental values might unveil changes in the environmental values according to the changes in circadian preferences.

Like many others, this study on the 2-MEV was mainly conducted on secondary school students. Data from various school types, ages, social backgrounds and countries would contribute to a better representativeness and greater understanding of environmental values. Environmental education programs are often implemented on secondary school students [72–74]. In the future, an investigation of primary students' environmental values might be of great importance. Knowledge about the environmental values of younger children might help applying environmental education programs not only in secondary schools, but also in earlier stages of school education [68]. This approach may prepone and intensify students' awareness for the environment and lead to a better engagement with nature long term.

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