

Article

Associations Between Digital Life Balance, Eco-Emotions and Readiness to Change for Sustainability

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Abstract

Given the growing impact of the climate crisis on mental health, it is necessary to explore the domain of eco-emotions, the affective responses to environmental change. In keeping with this, the present exploratory study aimed to investigate the association between Digital Life Balance (DLB) and eco-emotions, while also examining whether Readiness to Change (RtC) dimensions were involved in possible indirect associations within exploratory cross-sectional statistical mediation models. Data were collected through the use of an anonymous online survey, and the final sample consisted of 257 participants (59.9% cisgender women; 39.3% cisgender men; 0.8% people belonging to the LGBTQIA+ community; mean age = 32.99, SD = 14.640). From a methodological perspective, correlation analysis, MANOVA and exploratory cross-sectional statistical mediation models were performed. The results showed small positive correlations between DLB and eco-emotions in terms of anger, isolation, anxiety, and sorrow. Exploratory statistical mediation models suggested possible uncorrected indirect associations involving perceived importance of the environmental problem (PI; RtC). However, these specific indirect associations did not remain significant after Benjamini–Hochberg correction for multiple testing. Accordingly, the findings should be interpreted as small, preliminary, unadjusted cross-sectional associations between subjective online–offline balance, selected eco-emotions, and sustainability-related psychological readiness. In conclusion, this work provides an initial basis for future longitudinal and covariate-adjusted studies examining how subjective digital–offline balance may be linked to eco-emotional experiences and sustainability-related psychological readiness.

Keywords: digital life balance; eco-emotions; readiness to change; sustainability; climate change

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1. Introduction

Throughout history, Earth has been exposed to multiple climate fluctuations and changes, which have profoundly influenced humanity and all the other species' development [1]. Those natural climate variations, in the past, were linked to astronomical or geological factors [2], instead of the current climate crisis that we are witnessing, which is

primarily caused by human activities due to the use of fossil fuels, pollution, and deforestation that led to the greenhouse effect and, consequently, to global warming [3]. As the planet warms, extreme phenomena are becoming more common and intense, including fires, storms, floods, droughts, and prolonged heatwaves [4–6].

In keeping with this, the Sixth Assessment Report of the IPCC, discussed during COP28, reported that the climate crisis is advancing at an alarming pace, which is leading to rapid, dangerous and potentially catastrophic effects on the environment and our Planet's inhabitants including humans [3]. In detail, IPCC estimated that by the end of the century, between 50% and 75% of the world's population could be exposed to life-threatening climatic conditions in terms of environmental disasters such as ocean acidification, desertification, freshwater and agricultural resource loss [7].

In general, climate change crisis has negative effects even for humans' both physical and mental health, as it is reported that rising temperatures and prolonged heatwaves are associated with higher incidence of heat exhaustion, heat stroke, dehydration, and increased hospitalizations for cardiovascular and respiratory conditions (e.g., asthma, chronic obstructive pulmonary disease, lung cancer, and vector-borne diseases) [3,7–9]. Moreover, on a psychological and emotional level, climate crisis is making a profound impact due to chronic stressors (e.g., prolonged drought, rising temperatures, and gradual environmental degradation) that may contribute to generalized anxiety, feelings of helplessness, aggression, substance abuse, and even suicidal ideation [10]. Moreover, extreme weather events such as floods, wildfires and hurricanes have been consistently linked to higher incidences of Post Traumatic Disorder (PTSD), depression and anxiety among affected populations [10]. These mental health consequences highlighted the importance of the role of emotions in psychological well-being and in the individual's capacity to cope with environmental stressors.

Emotions, defined as complex, transient mental states that respond to internal or environmental stimuli, provide mechanisms through which people interpret stressors, regulate coping, and guide behavior [11,12]. They are not only indicators of psychological distress but also adaptive mechanisms that guide behavior, influence cognitive processing, and mediate resilience or vulnerability to external challenges [13,14]. Emotional responses can therefore shape how people perceive risks, engage in coping strategies, and develop pro-environmental attitudes [15].

Within this research context, scholars have grown interested in emotions linked to climate changes, coining terms such as “climate emotions” and “ecological emotions” (that are generally referred as “eco-emotions”) [16]. Eco-emotions are defined as the affective responses fundamentally linked to environmental conditions and anthropogenic environmental change [16,17]. In detail, eco-emotions include a wide range of feelings and affective experiences provoked by the climate crisis; they comprise negative emotions such as fear for the future, sadness and grief over ecological loss, guilt, anger, but also positive ones as hope, resilience and motivation toward pro-environmental engagement [18,19].

Furthermore, eco-emotions should not be interpreted as inherently maladaptive or exclusively pathological responses to the climate crisis. Rather, they represent complex affective experiences whose psychological and behavioral meaning may vary depending on their intensity, regulation, perceived agency, efficacy beliefs, and contextual conditions. In this regard, the taxonomy of climate emotions proposed by Pihkala [17] emphasized that climate-related affective responses are connected in complex ways with psychological well-being, resilience, and climate action, suggesting that the same emotional domain may involve both vulnerability and adaptive engagement.

On the one hand, negative eco-emotions may become maladaptive when they are experienced as overwhelming, persistent, or disconnected from perceived agency and ef-

ficacy. Under these conditions, emotions such as anxiety, sorrow, or powerlessness may contribute to distress, rumination, helplessness, withdrawal, or “eco-paralysis” [17,20,21]. This is consistent with evidence showing that climate anxiety can be negatively associated with mental well-being, particularly when individuals perceive environmental threats as uncontrollable or lack sufficient coping resources [22].

Additionally, eco-emotions may also play an adaptive and motivational role. Affective responses to climate change can increase risk perception, moral concern, and personal relevance, thereby supporting pro-environmental attitudes and behaviors when accompanied by perceived agency, efficacy, and supportive social contexts [22,23]. In particular, Stanley et al. [24] showed that different eco-emotions may have distinct psychological and behavioral correlates: eco-anger was more strongly associated with pro-climate activism and personal pro-climate behaviors, whereas eco-anxiety and eco-depression showed less adaptive associations with well-being and engagement. Moreover, the study by Baroni et al., [25] highlighted how eco-anxiety can instead represent a proactive factor for the implementation of sustainable behaviors. According to these findings, it is therefore possible to speculate that the proactive or more paralyzing activation of eco-emotions may also depend on psychological determinants that may or may not support the above activation. In this regard, it is possible to hypothesize that one of the psychological determinants closely associated with eco-emotions is the construct of readiness to change [26]. Complementary evidence converges on the idea that emotions are central drivers of climate perceptions, policy support, and sustainable behaviors [23], and meta-analytic work on collective action indicates that affective injustice/anger reliably predicts mobilization [27].

1.1. Eco-Emotions and Readiness to Change

Readiness to Change (RtC) is conceptualized as a multidimensional psychological construct that reflects both a state and a process through which individuals cognitively, emotionally, and behaviorally engage in modifying their habits in response to perceived environmental issues [26]. The construct includes seven interconnected dimensions: perceived importance of the problem, motivation, self-efficacy, perceived effectiveness of the proposed solution, social support, action and involvement, and perceived readiness [26]. Empirical findings indicate that these components significantly predict pro-environmental behaviors, such as the use of sustainable transportation or the consumption of novel food [28,29]. In addition to behavioral outcomes, RtC is linked to broader psychosocial orientations as individuals who perceive environmental challenges as a matter of collective responsibility tend to report higher readiness levels, highlighting the role of communitarian values in fostering ecological engagement [30]. Similarly, those characterized by elevated environmental sensitivity, understood as an enhanced emotional and perceptual responsiveness to ecological stimuli, exhibit stronger readiness across multiple RtC dimensions [31]. Recent contributions have also examined the relationship between RtC and eco-emotions. Specific RtC dimensions, including perceived importance, action, and involvement, are significantly associated with eco-anxiety, a form of distress arising from concern over the climate crisis [25]. Taken together, these findings suggest that the proactive or more paralyzing activation of eco-emotions may also depend on psychological determinants that may or may not support such activation. The concept that RtC may serve as a psychological associated factor of eco-emotional experiences as well as a facilitator of sustainable behavior is supported by these data; however it is still important to take other affecting elements into account as the influence of digital environments has become increasingly relevant. In fact, factors such as the frequency and nature of online exposure to environmental content have been shown to affect both the intensity and the qualitative nature of eco-emotions, pointing out the need for integrative models that account for the interplay between digital influences and the experience of eco-emotions.

1.2. Social Media Use, Digital Life and Eco-Emotions

The last few decades have seen a real transformation brought about by the massive spread of digital technologies, as smartphones, computers, smartwatches, and the like, which are not just simple tools, but redefine the very modes of social interaction, cultural production, and personal identity construction: in this sense, digital connectivity has become a central element of contemporary society [32]. However, the growing adoption of connected devices has promoted a structurally networked society, in which the pervasive flow of information and digital interdependence are shaping a new social morphology [33,34]. In particular, the pervasive influence of social media on everyday life has prompted growing research interest in the relationship between technology use and digital life balance, acknowledging their role as significant modulators of human emotions [35–37]. In this context, recent studies highlighted the growing exposure of young adults to climate change-related content on social platforms, a phenomenon that is accompanied by intense and ambivalent emotional responses [38,39]. Social media can spread environmental information, ecological awareness and educate people about the climate change crisis, as well as mobilize activism, but it could also be a constant and persistent flow of alarming news that intensifies negative eco-emotions [40–42]. Frequent use of social media may in fact have an impact on eco-emotions, intensifying emotional reaction: recent study on youth climate distress highlighted that the pervasive flow of environmental news and online comments can fuel feelings of discouragement and fatalistic worldviews, aggravating anxiety and the perception of imminent catastrophe [43]. In this regard, several scholars reported that the exposure to climate change-related content on social media platforms is a responsible factor for the rise of eco-anxiety, particularly among young individuals [38,44–46].

In detail, among young activists, previous authors observed the risk of eco-burnout, a psychophysical exhaustion linked to climate activism: qualitative research describes activist burnout as a state of existential crisis, in which ecological commitment becomes so overwhelming as to generate isolation, chronic stress, cynicism, and frustration due to the perception of limited results [47].

The negative dynamics linked to prolonged exposure to digital platform content reported above, can worsen pre-existing psychological vulnerabilities or contribute to the development of new emotional issues, in fact, association has been found with increased depressive and anxious symptoms [48], as well as Fear of Missing Out (FoMO) and increased social anxiety in individuals who use these platforms compulsively [49,50].

Within this context, Digital Life Balance (DLB) construct provides a useful theoretical framework. In detail, DLB is described as “a harmonic balance between digital life and real life” [36] and it refers to an optimal balance between online and offline activities, constituting a functional and healthy use of ICTs, where digital resources enrich (rather than replace) real experiences; conversely, a pronounced digital imbalance (with the online sphere prevailing over the offline ones) can result in a dysfunctional technology use and to a form of disharmony conducive to stress and digital dependence. Higher level of DLB is associated with higher indicators of subjective eudaimonic well-being and a reduction in dysfunctional behaviors related to the use of ICTs, such as social media addiction, gaming, or problematic smartphone use [36]. Instead, a lower level of DLB, therefore a digital imbalance, has been linked to states of anxiety, loneliness, and FoMO [51]. Recent literature on digital emotional well-being provides a theoretical basis for interpreting the association between DLB and eco-emotions. Digital well-being involves affective, cognitive, and social components of online experience, with emotional regulation and adaptive coping playing a central role in distinguishing digital competency from digital dependency [52]. This framework is relevant to climate-related digital exposure, as social media platforms shape emotional responses through affordances that facilitate the expression, shar-

ing, consumption, and evaluation of affectively charged content [37]. Empirical evidence further indicates that social media use is positively associated with environmental anxiety across countries [53] and with climate anxiety and climate doom in a U.S. adult sample [54]. Accordingly, DLB may characterize a more regulated online–offline lifestyle in which climate-related digital exposure is associated with eco-emotional activation, particularly when accompanied by perceived importance of environmental problems and readiness to change.

From our perspective, the concept of imbalance between online and offline life implied in the DLB construct may be particularly relevant for interpreting emotional experiences related to the climate crisis. Higher levels of DLB may reflect a condition in which digital activities do not fully replace everyday offline experiences, allowing individuals to maintain more direct contact with their physical and social environment. From this perspective, environmental problems may be perceived not only as information mediated by digital channels, but also as issues concretely present in everyday life.

This hypothesis can be further explored by considering the relationship between DLB and mindfulness-related traits, understood as greater awareness of the present moment and better self-regulation in everyday experience [55]. More broadly, higher levels of mindfulness have been associated with ecological behaviors through mechanisms involving greater awareness of bodily and environmental experiences. Moreover, connectedness to nature appears to mediate the relationship between mindfulness and pro-environmental behavior [56,57]. In this sense, it is possible to hypothesize that individuals with higher levels of DLB may show greater sensitivity to environmental issues.

At the same time, good DLB does not imply the absence of social media use. Individuals who show a better balance between online and offline life may still encounter environmental content through digital platforms. Recent multi-country evidence suggests that social media use is positively associated with environmental anxiety, whereas its relationship with environmental knowledge appears to vary more across countries [53]. Consequently, a balanced digital life may nonetheless coexist with exposure to climate-related online content capable of eliciting negative eco-emotions, such as anxiety, sorrow, anger, or perceived isolation.

1.3. Aim of the Study

In light of the above, the present exploratory study aimed to investigate the relationship between DLB and eco-emotions, while also examining, in exploratory cross-sectional statistical mediation models, whether RtC dimensions were involved in possible indirect associations between DLB and eco-emotions. Building on the literature on digital well-being, climate emotions, and sustainability-related behavioral change, we formulated the following hypotheses:

H1. *DLB is positively associated with eco-emotions reflecting climate-related concern and awareness, particularly anger, anxiety, sorrow, and isolation.*

H2. *DLB is positively associated with RtC dimensions, especially perceived importance of the problem, motivation, and perceived readiness, as a balanced integration between online and offline life may be linked to greater awareness of environmental issues and stronger psychological preparedness for change.*

H3. *Exploratory cross-sectional statistical mediation models would suggest possible indirect associations between DLB and eco-emotions through RtC dimensions, with perceived importance of the problem expected to show a potentially relevant, but preliminary, role.*

Given the cross-sectional and exploratory nature of the study, these hypotheses were tested as theoretically grounded associations rather than as causal pathways. Temporal ordering was not tested, and reverse or reciprocal associations remain plausible.

2. Materials and Methods

2.1. Participants

Data were collected through the administration of an online survey mostly promoted on social media. The participation was completely anonymous and voluntary in accordance with the Italian privacy and informed consent regulations (Law Decree DL-101/2018) and EU Regulation (2016/679). In detail, the following inclusion criteria were applied: (a) being 14 years old or older and (b) proficiency in the Italian language. The lower age threshold was set with reference to the online data-processing consent procedure. In Italy, pursuant to Article 8(1) of Regulation (EU) 2016/679 and Article 2-quinquies of Legislative Decree No. 196/2003, as amended by Legislative Decree No. 101/2018, minors aged 14 years or older may provide consent to the processing of their personal data in relation to the direct offer of information society services. Accordingly, the online information and consent procedure was designed to be clear, accessible, age-appropriate, and understandable for minors, and it explicitly informed participants about the study aims, voluntary participation, anonymity, and data-processing procedures. Participants younger than 14 years were not eligible. A power analysis using G*Power (version 3.1.9.7) [58,59] was carried out to have the optimal sample size. Specifically, the power analysis highlighted the need for a sample composed of at least 67 participants for achieving an 80% power and an effect size equal to 0.3 (f^2) for the correlation analysis. Moreover, the optimal sample size was also tested by estimating the power of a linear multiple regression model (fixed model, R^2 increase) assuming medium effect size ($f^2 = 0.15$) and power of 0.80. The analysis pointed out the need for a sample composed of 55 participants to detect a robust effect. The final sample was composed of 257 participants (59.9% cisgender women; 39.3% cisgender men; 0.8% people belonging to the LGBTQIA+ community; mean age = 32.99, SD = 14.640). The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Comissão de Ética do Centro de Estudos Sociais (CE-CES) (University of Coimbra 02319461) on 24 October 2022.

2.2. Measures and Instruments

Inventory of Climate Emotions (ICE) [60]: composed of 60 items scored on a 5-point Likert scale. It measures 8 distinct affective responses associated with climate change: climate anger (e.g., “I feel angry because the current political and economic systems damage the climate”; Cronbach’s $\alpha = 0.95$), climate contempt (e.g., “I am weary of constantly hearing about climate change”; Cronbach’s $\alpha = 0.92$), climate enthusiasm (e.g., “Public engagement in climate issues gives me hope”; Cronbach’s $\alpha = 0.91$), climate powerlessness (e.g., “I often feel uncertain about how I can personally mitigate climate change”; Cronbach’s $\alpha = 0.81$), climate guilt (e.g., “I feel guilty for not contributing enough to reduce climate impacts”; Cronbach’s $\alpha = 0.93$), climate isolation (e.g., “I sometimes feel among the few who truly grasp the implications of climate change”; Cronbach’s $\alpha = 0.92$), climate anxiety (e.g., “Thinking about climate change makes me feel as if facing a terminal condition”; Cronbach’s $\alpha = 0.94$), and climate sorrow (e.g., “I grieve for the opportunities and natural resources that are being irreversibly lost due to climate change”; Cronbach’s $\alpha = 0.91$). In the original development study, the 60-item version was derived from exploratory factor analysis and included eight subscales. In Study 2 of the original validation, the initial 60-item CFA model showed room for improvement, scaled $\chi^2(1682) = 2660.36$, $p < 0.001$, CFI = 0.88, TLI = 0.88, RMSEA = 0.044, 90% CI [0.041, 0.047], SRMR = 0.09. Finally, in the present

study, all the dimensions assessed by the instrument were characterized by a high internal reliability (Anger: Cronbach's $\alpha = 0.951$, McDonald's $\omega = 0.952$; Contempt: Cronbach's $\alpha = 0.826$, McDonald's $\omega = 0.844$; Enthusiasm: Cronbach's $\alpha = 0.860$, McDonald's $\omega = 0.863$; Powerlessness: Cronbach's $\alpha = 0.729$, McDonald's $\omega = 0.728$; Guilt: Cronbach's $\alpha = 0.819$, McDonald's $\omega = 0.828$; Isolation: Cronbach's $\alpha = 0.869$, McDonald's $\omega = 0.866$; Anxiety: Cronbach's $\alpha = 0.912$, McDonald's $\omega = 0.915$; Sorrow: Cronbach's $\alpha = 0.924$, McDonald's $\omega = 0.923$). However, since no validated Italian version of the ICE was available at the time of data collection, the original scale items were translated into Italian for the purposes of the present study.

Digital Life Balance Scale (DLB) [36]: composed of 4 items, each rated on a seven-point Likert scale and adapted from the Work–Life Balance Scale [61]. It is designed to measure individuals' perceived balance between their online and offline lives, as it captures both harmonic (balanced) and disharmonic (unbalanced) patterns of engagement with digital technologies. DLB items include: "I currently have a good balance between the time I spend online and the time I have available for offline activities." (item 1), "I have difficulty balancing my online and offline activities." (item 2), "I feel that the balance between my online and offline activities is currently about right." (item 3), and "Overall, I believe that my online and offline life are balanced." (item 4). Total scores range from 4 to 28, with higher scores indicating a stronger sense of digital balance. DLB should be interpreted as a global indicator of subjective digital–offline balance, not as a measure of screen time, problematic platform-specific use, or exposure to climate-related digital content. However, previous literature results pointed out a significant link between a lower DLB and the problematic use of the Internet and Social Media [36]. The scale showed a one-factor structure with excellent model fit, as indicated by $\chi^2/df = 4.38$, $p = 0.012$, CFI = 0.99, TLI = 0.99, RMSEA = 0.0048, and SRMR = 0.0097, and excellent internal consistency, McDonald's $\omega = 0.89$. Also in the present study, the instrument was characterized by a good internal reliability (Cronbach's $\alpha = 0.942$, McDonald's $\omega = 0.943$).

The Readiness to Change Scale (RtC) [26]: composed of a 29-item self-report questionnaire rated on a 5-point Likert scale. The instrument assesses individuals' subjective readiness to initiate behavioral change across seven distinct dimensions: perceived importance of the problem (e.g., "This change is very important for me"; McDonald's $\omega = 0.78$), motivation to change (e.g., "I am determined to change my habits"; $\omega = 0.83$), self-efficacy (e.g., "I am confident in my ability to change habits"; $\omega = 0.87$), perceived effectiveness of the solution (e.g., "I think there are effective ways of dealing with this change"; $\omega = 0.81$), social support (e.g., "I feel supported by the people close to me in this change"; $\omega = 0.74$), action (e.g., "I am already doing something to solve my problem"; $\omega = 0.83$), and perceived readiness (e.g., "I am ready to change"; $\omega = 0.82$). The higher the total scores are, the greater the psychological preparedness and engagement toward behavioral modification. In the original validation study, the seven-factor structure was supported by confirmatory factor analysis, showing acceptable-to-good model fit, $\chi^2/df = 3.075$, $p < 0.001$, CFI = 0.93, TLI = 0.92, RMSEA = 0.054, and SRMR = 0.046. The seven dimensions showed adequate internal consistency, with McDonald's ω ranging from 0.74 to 0.87. Furthermore, in the present study, all the factors measured by the instrument had a high internal reliability (Perceived importance of the problem: Cronbach's $\alpha = 0.919$, McDonald's $\omega = 0.920$; Motivation: Cronbach's $\alpha = 0.947$, McDonald's $\omega = 0.949$; Self-efficacy: Cronbach's $\alpha = 0.909$, McDonald's $\omega = 0.912$; Effectiveness of proposed solution: Cronbach's $\alpha = 0.905$, McDonald's $\omega = 0.905$; Social support: Cronbach's $\alpha = 0.905$, McDonald's $\omega = 0.909$; Action: Cronbach's $\alpha = 0.952$, McDonald's $\omega = 0.953$; Perceived readiness: Cronbach's $\alpha = 0.916$, McDonald's $\omega = 0.919$).

2.3. Data Analysis

Primarily, the investigated variables were considered normally distributed with values of skewness and kurtosis of ± 2 and ± 7 , respectively [62]. Moreover, in line with the study's aim correlations and a MANOVA were performed, by considering the DLB as independent variable and eco-emotions as dependent variable. No covariates were included in the model. Therefore, all findings should be interpreted as unadjusted associations. The multivariate model was conducted as an exploratory follow-up analysis including the types of eco-emotions that showed significant bivariate associations with DLB. Moreover, exploratory cross-sectional statistical mediation models were performed to examine whether RtC dimensions were involved in possible indirect associations between DLB and eco-emotions. In detail, DLB was set as the predictor variable, RtC dimensions as mediators, and eco-emotions as output variables. Furthermore, considering that the present dataset was also used by Baroni et al. [35], we applied the Benjamini–Hochberg False Discovery Rate (FDR) correction to control for Type I error inflation [63]. Statistical Package for the Social Sciences (SPSS) software (version 23) and the JASP package (version 0.19.0.0) were used to conduct statistical analysis.

3. Results

As displayed in Table 1, all the investigated factors were normally distributed in accordance with Hair's guidelines [62]. In keeping with this, Pearson's correlations were performed.

Table 1. Descriptive statistics.

Factors	Mean	Sd	Skew.	Kurt.	Min.	Max.
DLB	17.451	6.307	−0.089	−0.958	4.000	28.000
Ang	15.615	3.564	−1.195	1.500	4.000	20.000
C	10.568	3.526	0.729	0.136	4.000	20.000
E	13.821	3.112	−0.838	0.771	4.000	20.000
P	11.743	3.167	0.156	−0.357	4.000	20.000
G	11.938	3.046	−0.680	0.081	4.000	18.000
I	9.444	3.351	0.205	−0.336	4.000	20.000
Anx	12.101	4.332	−0.201	−0.825	4.000	20.000
S	14.802	3.645	−1.037	0.962	4.000	20.000
PI	13.416	3.804	−0.765	0.247	4.000	20.000
M	13.805	3.777	−0.835	0.298	4.000	20.000
SE	17.198	3.835	−0.654	1.098	5.000	25.000
EPS	13.774	3.411	−0.907	0.873	4.000	20.000
SS	13.907	3.315	−0.424	0.463	4.000	20.000
A	13,023	4.092	−0.741	−0.163	4.000	20.000
PR	13.770	3.761	−0.923	0.328	4.000	20.000

Notes: DLB, Digital Life Balance; Ang, Anger; C, Contempt; E, Enthusiasm; P, Powerlessness; G, Guilt; I, Isolation; Anx, Anxiety; S, Sorrow; RtC, Readiness to Change; PI, Perceived importance of the problem; M, Motivation; SE, Self-Efficacy; EPS, Effectiveness of the proposed solution; SS, Social Support; A, Action; PR, Perceived Readiness; Sd, Standard deviation; Skew., Skewness; Kurt. Kurtosis.

For what concerns the correlation analyses, the results pointed out significant and positive correlations between DLB and eco-emotions in terms of anger ($r = 0.178$; $p < 0.01$; Adjusted p value = 0.034), isolation, ($r = 0.141$; $p < 0.05$; Adjusted p value = 0.049), anxiety ($r = 0.154$; $p < 0.05$; Adjusted p value = 0.042), and sorrow ($r = 0.142$; $p < 0.05$; Adjusted p value = 0.049) (Table 2). Moreover, significant correlations have also been observed be-

tween DLB and RtC dimensions such as perceived importance of the problem ($r = 0.167$; $p < 0.01$; Adjusted p value = 0.034), motivation ($r = 0.168$; $p < 0.01$; Adjusted p value = 0.034), and perceived readiness ($r = 0.162$; $p < 0.01$; Adjusted p value = 0.034) (Table 2).

Table 2. Correlation analysis results.

Eco-Emotions Variables										RtC Variables					
Factors	Ang	C	E	P	G	I	Anx	S	PI	M	SE	EPS	SS	A	PR
DLB	0.178 **	−0.038	0.092	0.056	−0.040	0.141 *	0.154 *	0.142 *	0.167 **	0.168 **	0.072	0.039	−0.043	0.089	0.162 **
	(0.034)	(0.539)	(0.255)	(0.506)	(0.523)	(0.049)	(0.042)	(0.049)	(0.034)	(0.034)	(0.375)	(0.539)	(0.539)	(0.255)	(0.034)

Notes: DLB, Digital Life Balance; Ang, Anger; C, Contempt; E, Enthusiasm; P, Powerlessness; G, Guilt; I, Isolation; Anx, Anxiety; S, Sorrow; RtC, Readiness to Change; PI, Perceived importance of the problem; M, Motivation; SE, Self-Efficacy; EPS, Effectiveness of the proposed solution; SS, Social Support; A, Action; PR, Perceived Readiness; *, $p < 0.05$; **, $p < 0.01$; (...), Benjamini–Hochberg Adjusted p value.

Moreover, the multivariate general linear model results were consistent with a small association between DLB and selected eco-emotions ($F = 2.587$; $p = 0.037$; Partial $\eta^2 = 0.039$), in particular for those related to anger ($F = 8.302$; $p = 0.004$; Adjusted p value = 0.016), isolation ($F = 5.194$; $p = 0.023$; Adjusted p value = 0.023), anxiety ($F = 6.173$; $p = 0.014$; Adjusted p value = 0.023), and sorrow ($F = 5.214$; $p = 0.023$; Adjusted p value = 0.023) (Tables 3 and 4).

Table 3. Multivariate test results: digital life balance and eco-emotions.

Index	Value	F	df1	df2	p	Partial η^2
Pillai's trace	0.039	2.587	4	252	0.037	0.039

Table 4. Univariate test results: digital life balance and eco-emotions.

Index	F	p	Partial η^2
Anger	8.302	0.004 (0.016)	0.032
Isolation	5.194	0.023 (0.023)	0.020
Anxiety	6.173	0.014 (0.023)	0.024
Sorrow	5.214	0.023 (0.023)	0.020

Notes: (...), Benjamini–Hochberg Adjusted p value.

Regarding the mediation analysis, for what concerns of the association between DLB and isolation through the RtC dimensions, the results pointed out a non-significant association between the variable above (estimate = 0.010; Std. error = 0.009; $p = 0.292$). However, both the total association (estimate = 0.022, Std. error = 0.010, $p = 0.022$) and the total indirect association through the set of RtC dimensions (estimate = 0.013, Std. error = 0.005, $p = 0.009$) were significant in the exploratory model (Table 5; Figure 1A). Nevertheless, no specific RtC dimension showed a significant corrected indirect association, indicating that this result should be interpreted as a preliminary overall indirect pattern rather than evidence for a specific mediator.

Table 5. Mediation analysis: digital life balance, isolation, and readiness to change.

Factors	Estimate	Std. Error	z-Value	<i>p</i>	95% CI	
					Lower	Upper
Direct effects						
DLB à Isolation	0.010	0.009	1.053	0.292	−0.008	0.027
Indirect associations						

DLB à RtC:PI à Isolation	0.010	0.005	1.940	0.052 (0.634)	−0.0001027	0.020
DLB à RtC:M à Isolation	0.0002614	0.004	0.070	0.945 (0.945)	−0.007	0.008
DLB à RtC:SE à Isolation	0.002	0.002	1.028	0.304 (0.903)	−0.002	0.006
DLB à RtC:EPS à Isolation	0.00006143	0.0006495	0.095	0.925 (0.945)	−0.001	0.001
DLB à RtC:SS à Isolation	0.003	0.004	0.682	0.495 (0.903)	−0.005	0.011
DLB à RtC:A à Isolation	−0.0006604	0.001	−0.461	0.645 (0.903)	−0.003	0.002
DLB à RtC:PR à Isolation	−0.002	0.003	−0.540	0.590 (0.903)	−0.007	0.004
Total associations						
DLB à Isolation	0.022	0.010	2.288	0.022	0.003	0.042
Total indirect associations						
DLB à Isolation	0.013	0.005	2.617	0.009	0.003	0.022

Notes: DLB, Digital Life Balance; RtC, Readiness to Change; PI, Perceived importance of the problem; M, Motivation; SE, Self-Efficacy; EPS, Effectiveness of the proposed solution; SS, Social Support; A, Action; PR, Perceived Readiness; (...), Benjamini–Hochberg Adjusted p value.

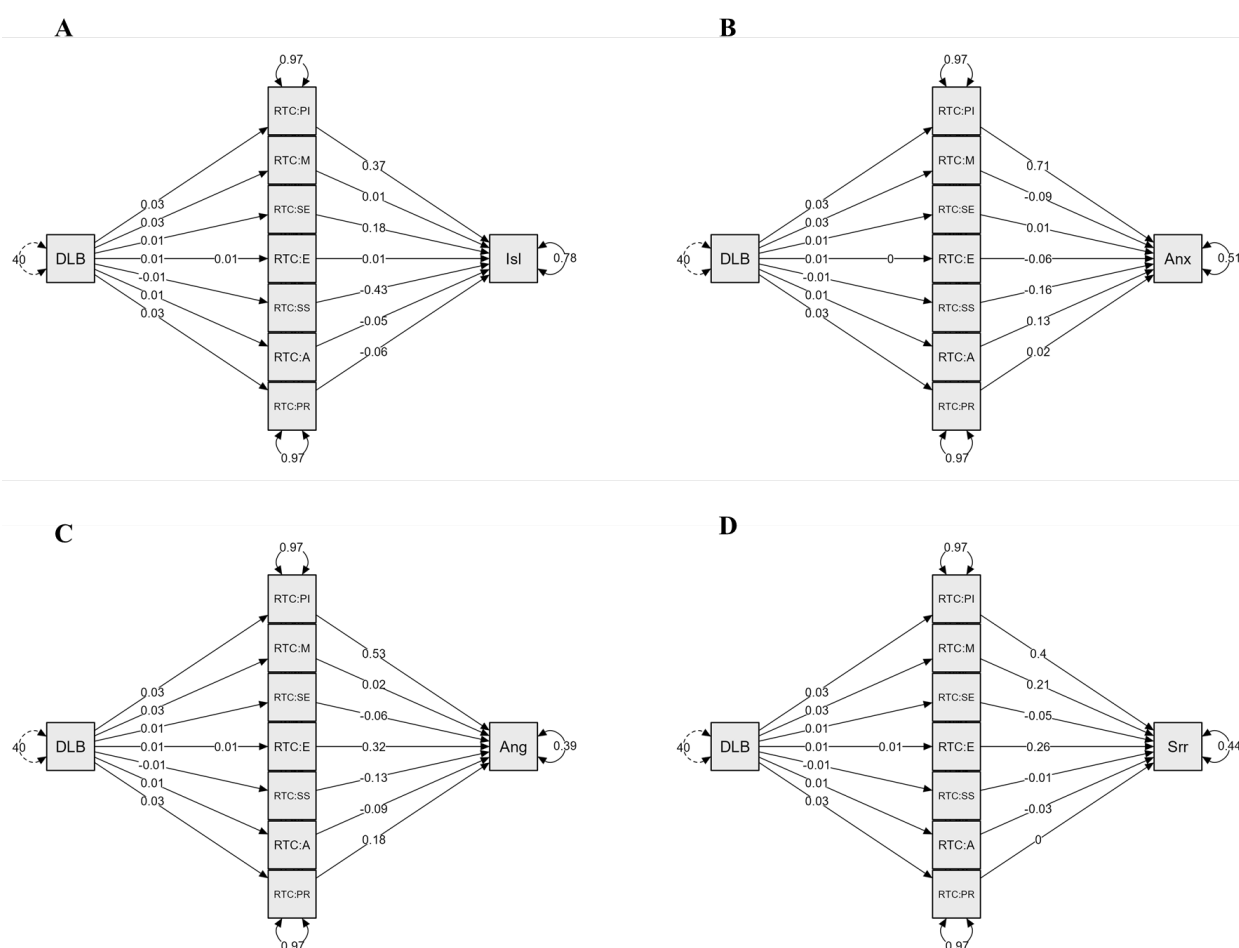


Figure 1. Path plots of mediation analysis related to digital life balance, eco-emotions, and readiness to change. Notes: (A), digital life balance, isolation, and readiness to change; (B), digital life balance, anxiety, and readiness to change; (C), digital life balance, anger, and readiness to change; (D), digital life balance, sorrow, and readiness to change; RtC, Readiness to Change; PI, Perceived importance of the problem; M, Motivation; SE, Self-Efficacy; E, Effectiveness of the proposed solution; SS, Social Support; A, Action; PR, Perceived Readiness; Isl, Isolation; Anx, Anxiety; Ang, Anger; Srr, Sorrow.

The exploratory statistical mediation model did not show a significant direct association between DLB and anxiety after including the RtC dimensions (estimate = 0.005; SE = 0.007; $p = 0.527$). The total indirect association was significant in the uncorrected model

(estimate = 0.020; Std. error = 0.007; $p = 0.005$) (Table 6 and Figure 1B). Among the specific indirect associations, perceived importance of the problem showed the largest estimate (estimate = 0.019; Std. error = 0.007; $p = 0.012$), but this association did not remain significant after Benjamini–Hochberg correction (Adjusted p value = 0.084). Therefore, this result should be interpreted as a preliminary uncorrected pattern rather than evidence of a robust specific mediator.

Table 6. Mediation analysis: digital life balance, anxiety, and readiness to change.

Factors	Estimate	Std. Error	z-Value	<i>p</i>	95% CI	
					Lower	Upper
Direct effects						
DLB à Anxiety	0.005	0.007	0.633	0.527	−0.010	0.019
Indirect associations						
DLB à RtC:PI à Anxiety	0.019	0.007	2.512	0.012 (0.084)	0.004	0.033
DLB à RtC:M à Anxiety	−0.002	0.003	−0.724	0.469 (0.887)	−0.008	0.004
DLB à RtC:SE à Anxiety	0.00008862	0.0007308	0.121	0.903 (0.903)	−0.001	0.002
DLB à RtC:EPS à Anxiety	−0.0003782	0.0007994	−0.473	0.636 (0.890)	−0.002	0.001
DLB à RtC:SS à Anxiety	0.001	0.002	0.663	0.507 (0.887)	−0.002	0.004
DLB à RtC:A à Anxiety	0.002	0.002	1.109	0.268 (0.887)	−0.001	0.005
DLB à RtC:PR à Anxiety	0.0005487	0.002	0.238	0.812 (0.903)	−0.004	0.005
Total associations						
DLB à Anxiety	0.024	0.010	2.494	0.013	0.005	0.044
Total indirect associations						
DLB à Anxiety	0.020	0.007	2.826	0.005	0.006	0.033

Notes: DLB, Digital Life Balance; RtC, Readiness to Change; PI, Perceived importance of the problem; M, Motivation; SE, Self-Efficacy; EPS, Effectiveness of the proposed solution; SS, Social Support; A, Action; PR, Perceived Readiness; (...), Benjamini–Hochberg Adjusted p value.

In line with the above, regarding the link between DLB and anger, the exploratory statistical mediation model showed a significant total indirect association in the uncorrected model (estimate = 0.020; Std. error = 0.008; $p = 0.010$) (Table 7 and Figure 1C). In detail, the perceived importance of the problem (RtC) was the dimension with the largest estimate (estimate = 0.014; Std. error = 0.006; $p = 0.014$), despite it lost its significance following the Benjamini–Hochberg False Discovery Rate correction (Adjusted p value = 0.098). Thus, the finding should be interpreted as preliminary and not as evidence of a confirmed mediating mechanism.

Table 7. Mediation analysis: digital life balance, anger, and readiness to change.

Factors	Estimate	Std. Error	z-Value	p	95% CI	
					Lower	Upper
Direct effects						
DLB à Anger	0.008	0.006	1.305	0.192	−0.004	0.021
Indirect associations						
DLB à RtC:PI à Anger	0.014	0.006	2.447	0.014 (0.098)	0.003	0.025
DLB à RtC:M à Anger	0.0004343	0.003	0.163	0.870 (0.870)	−0.005	0.006
DLB à RtC:SE à Anger	−0.0007260	0.0008933	−0.813	0.416 (0.628)	−0.002	0.001
DLB à RtC:EPS à Anger	0.002	0.003	0.614	0.539 (0.628)	−0.004	0.008
DLB à RtC:SS à Anger	0.0008735	0.001	0.660	0.509 (0.628)	−0.002	0.003
DLB à RtC:A à Anger	−0.001	0.001	−0.980	0.327 (0.628)	−0.004	0.001
DLB à RtC:PR à Anger	0.005	0.003	1.709	0.087 (0.304)	−0.0006627	0.010
Total associations						

DLB à Anger	0.028	0.010	2.893	0.004	0.009	0.047
Total indirect associations						
DLB à Anger	0.020	0.008	2.578	0.010	0.005	0.035

Notes: DLB, Digital Life Balance; RtC, Readiness to Change; PI, Perceived importance of the problem; M, Motivation; SE, Self-Efficacy; EPS, Effectiveness of the proposed solution; SS, Social Support; A, Action; PR, Perceived Readiness; (...), Benjamini–Hochberg Adjusted p value.

Finally, the exploratory statistical mediation model for sorrow showed a significant total indirect association in the uncorrected model (estimate = 0.017; Std. error = 0.007; p = 0.023) (Table 8 and Figure 1D). Perceived importance of the environmental problem showed the largest specific indirect estimate in the uncorrected model (estimate = 0.011; Std. error = 0.005; p = 0.024). However, this specific indirect association did not remain significant after Benjamini–Hochberg False Discovery Rate correction (adjusted p = 0.168).

Table 8. Mediation analysis: digital life balance, sorrow, and readiness to change.

Factors	Estimate	Std. Error	z-Value	p	95% CI	
					Lower	Upper
Direct effects						
DLB à Sorrow	0.005	0.007	0.800	0.424	−0.008	0.019
Indirect associations						
DLB à RtC:PI à Sorrow	0.011	0.005	2.253	0.024 (0.168)	0.001	0.020
DLB à RtC:M à Sorrow	0.006	0.003	1.600	0.110 (0.385)	−0.001	0.012
DLB à RtC:SE à Sorrow	−0.0005241	0.0008121	−0.645	0.519 (0.946)	−0.002	0.001
DLB à RtC:EPS à Sorrow	0.002	0.003	0.611	0.541 (0.946)	−0.004	0.007
DLB à RtC:SS à Sorrow	0.00006414	0.0003972	0.162	0.872 (0.990)	−0.0007143	0.0008425
DLB à RtC:A à Sorrow	−0.0003936	0.001	−0.374	0.708 (0.990)	−0.002	0.002
DLB à RtC:PR à Sorrow	0.00002601	0.002	0.012	0.990 (0.990)	−0.004	0.004
Total associations						
DLB à Sorrow	0.022	0.010	2.292	0.022	0.003	0.042
Total indirect associations						
DLB à Sorrow	0.017	0.007	2.280	0.023	0.002	0.032

Notes: DLB, Digital Life Balance; RtC, Readiness to Change; PI, Perceived importance of the problem; M, Motivation; SE, Self-Efficacy; EPS, Effectiveness of the proposed solution; SS, Social Support; A, Action; PR, Perceived Readiness, (...), Benjamini–Hochberg Adjusted p value.

4. Discussion

The present exploratory study aimed to examine the relationship between DLB and eco-emotions, while also testing exploratory cross-sectional statistical mediation models involving Readiness to Change (RtC) dimensions. Results showed small positive associations between DLB and selected eco-emotions, namely anger, isolation, anxiety, and sorrow. These findings suggest that subjective online–offline balance may coexist with climate-related emotional awareness. However, the associations were small, unadjusted, and cross-sectional; therefore, they should be interpreted as preliminary and should not be taken as evidence that DLB causes or uniquely explains eco-emotional responses.

Accordingly, the positive association between DLB and selected eco-emotions should be interpreted as an exploratory co-occurrence between subjective online–offline balance and climate-related emotional responses. The present data do not allow us to determine whether this association reflects climate-related digital exposure, offline environmental experience, information quality, or other unmeasured individual differences. This pattern was also consistent with the exploratory multivariate analysis.

In detail, the results pointed out that participants reporting higher DLB also reported slightly higher scores on selected eco-emotions, particularly those associated with moral concern and environmental awareness. In general, the findings align with recent research emphasizing that functional emotional activation can accompany greater cognitive engagement and social connection around climate issues [23,24]. In particular, eco-anger, often linked to perceptions of injustice and collective action tendencies, emerges as a constructive affective response [24]. However, the present findings do not allow us to determine whether higher DLB is associated with selective exposure to environmental content, adaptive processing of climate-related information, reduced emotional overload, or greater pro-environmental action. These mechanisms should be examined in future studies using direct measures of climate-related media exposure, information quality, digital literacy, and actual pro-environmental behavior. Similarly, the associations between DLB and eco-anxiety, isolation, and sorrow can be cautiously situated within the broader literature on climate-related digital communication. In detail, studies have shown that digital media can function both as amplifiers of distress and as platforms for environmental learning and collective mobilization [41,42]. However, the present study did not assess the quality, trustworthiness, emotional tone, or platform-specific characteristics of climate-related digital content. Therefore, the observed association between DLB and eco-anxiety should be interpreted only as a small cross-sectional co-occurrence. Previous evidence suggests that eco-anxiety may, in some contexts, be associated with proactive sustainable behaviors rather than only with paralysis or maladaptive distress [25], but whether this applies to individuals with higher DLB remains an open question for future research. One plausible, yet speculative, interpretation is that higher DLB may reflect or help preserve a stronger connection with offline life, instead of allowing digital experience to substitute direct everyday experience. In this sense, individuals with higher DLB may be more likely to encounter and interpret environmental problems through concrete daily experiences, such as heat, pollution, degradation of local environments, or changes in natural landscapes. This interpretation is consistent with evidence showing that perceived personal experience of climate change is positively related to climate change beliefs and is embedded in pathways involving awareness of consequences, ascription of responsibility, and personal norms [64]. However, this interpretation should be treated cautiously. A balanced digital life does not necessarily prevent exposure to emotionally intense or alarming climate-related content on social media. Recent evidence indicates that social media use may increase environmental anxiety even when it does not consistently increase environmental knowledge [53]. Therefore, the present findings are compatible with multiple explanations, including digital exposure, offline environmental salience, broader environmental attitudes, or unmeasured demographic and psychological differences. Furthermore, rather than being a sign of psychopathological withdrawal, feelings of eco-isolation and eco-sorrow may be a reflection of heightened existential sensitivity and emotional attunement to environmental crises. These results resonate with the conceptualization of eco-emotions as both distressing and adaptive affective states [17,18], capable of driving pro-environmental reflection and action when appropriately regulated.

Beyond emotional correlates, DLB was also positively associated with three RtC dimensions: perceived importance of the problem (PI), motivation for change, and perceived readiness. Specifically, participants reporting higher DLB also reported higher perceived importance of the environmental problem, greater motivation for change, and greater perceived readiness, a pattern that should be interpreted descriptively given its small, unadjusted, and cross-sectional nature. This relationship can be cautiously situated within previous research on sustainable behavior, Readiness to Change, and Digital Life Balance, which has highlighted associations among eco-emotional responses, motivational readiness, and subjective online–offline balance [27,37]. However, in the present

study, this pattern should be interpreted descriptively and does not demonstrate that digital harmony facilitates reflective processing or prevents emotional avoidance.

Moreover, the exploratory statistical mediation models provided only preliminary evidence of possible indirect associations. In the uncorrected models, perceived importance of the environmental problem showed the largest specific indirect estimates for anxiety, anger, and sorrow. However, these specific indirect associations did not remain significant after Benjamini–Hochberg correction for multiple testing. Therefore, the results suggest a possible pattern involving perceived importance that requires replication in larger, preferably longitudinal and covariate-adjusted samples.

From a theoretical standpoint, this pattern is conceptually compatible with theoretical frameworks in which problem recognition and perceived importance are relevant to motivational processes; however, it should not be interpreted as evidence of a mediating mechanism. Within the Health Action Process Approach (HAPA) [65], risk perception serves as a motivational precursor to behavioral change: a minimal level of perceived threat is required before individuals begin to consider the benefits of taking action. Although HAPA emphasizes self-efficacy and outcome expectancies as proximal predictors, it acknowledges that perceived risk indirectly contributes to motivation by creating emotional urgency. Similarly, the SOCRATES model [66], rooted in the Transtheoretical Model [67], posits that readiness to change evolves through stages of problem recognition and evaluation of consequences.

Therefore, the present findings support considering perceived importance of the environmental problem as a useful candidate variable for future longitudinal and covariate-adjusted research. This interpretation is consistent with previous work suggesting that eco-emotions may be associated with sustainability-related motivation [35], although the present cross-sectional data do not allow us to determine whether DLB contributes to functional eco-emotional activation. Moreover, no robust specific indirect association emerged for the other RtC components, including self-efficacy, social support, perceived effectiveness of the proposed solution, and action. Although perceived importance of the environmental problem showed the largest uncorrected indirect estimates in some models, no specific indirect association remained significant after correction for multiple testing. Therefore, the present findings do not identify a robust mediating mechanism, but suggest that perceived importance may be a relevant variable to examine in future longitudinal and covariate-adjusted research. Future studies could also assess digital literacy, climate-related media exposure, and offline environmental experience to clarify the possible mechanisms linking subjective online–offline balance and eco-emotional responses.

Taken together, these findings suggest that subjective digital–offline balance is weakly associated with selected eco-emotions and readiness-related dimensions. One possible interpretation is that individuals reporting higher DLB may also show greater climate-related emotional awareness. However, this interpretation remains speculative, as the present study did not directly measure climate-related media exposure, information quality, doomscrolling, misinformation, algorithmic exposure, platform-specific use, nature connectedness, or direct offline environmental experience. Accordingly, the observed associations should not be interpreted as evidence that DLB promotes adaptive processing of climate-related information or protects individuals from emotional overload. In addition, the exploratory statistical mediation models suggested possible uncorrected indirect patterns involving perceived importance of the environmental problem, but these specific indirect associations did not remain significant after Benjamini–Hochberg correction. Future longitudinal and covariate-adjusted studies are needed to clarify whether these associations reflect digital exposure, offline environmental salience, broader environmental attitudes, demographic or psychological differences, or their interaction.

5. Implications and Future Directions

The findings of this exploratory study may offer preliminary directions for future research on digital well-being, eco-emotions, and sustainability-related psychological readiness. Given the small, unadjusted, and cross-sectional nature of the observed associations, the present results suggest that future studies should more directly examine the conditions under which subjective online–offline balance may be associated with eco-emotional experiences. In particular, future research could investigate whether more specific digital and environmental variables help explain the associations observed in the present study. These variables may include climate-related media exposure, digital literacy, perceived information quality, doomscrolling, misinformation, algorithmic exposure, nature connectedness, and direct experience of environmental degradation. Assessing these factors would allow future studies to determine whether the relationship between DLB and eco-emotions is mainly linked to digital exposure, offline environmental salience, broader environmental attitudes, or their interaction. Future longitudinal and covariate-adjusted studies are also needed to clarify whether DLB remains associated with eco-emotions after accounting for demographic, psychological, and environmental-attitudinal factors. Diary-based, longitudinal, or experimental designs could help distinguish between online and offline pathways and better examine the temporal ordering of these associations. Finally, future studies should include behavioral outcomes to determine whether eco-emotional activation and readiness to change translate into actual pro-environmental engagement, beyond self-reported psychological readiness.

6. Strengths and Limitations

The present study has some limitations. Primarily, because of the cross-sectional design of the study, cause-and-effect relationships cannot be inferred, temporal ordering remains untested, and reverse or reciprocal associations are plausible. Future studies should use longitudinal or experimental designs to better clarify the directionality of the associations between DLB, RtC, and eco-emotions. Additionally, the results are not generalizable considering the use of a non-probabilistic sampling methodology. Moreover, because the present study did not directly assess offline nature contact, direct experience of environmental degradation, or the amount and type of climate-related social media exposure, the proposed interpretation of DLB as a construct linking offline environmental salience and online climate information remains speculative. Future studies should include specific measures of nature connectedness, perceived personal experience of climate change, and climate-related social media exposure to test this dual pathway more directly. In line with this, future studies are also needed for confirming the explorative results emerged in the present study, by also using and controlling the analysis with other factors in terms of, for example, age, gender, education level, political orientation, direct climate-change exposure, baseline mental health, general anxiety, environmental values, activism, and actual time spent online. Moreover, collecting self-report data may be associated with both social desirability and recall biases. Additionally, the results pointed out small correlation values as well as small proportion of variance and effect size. Accordingly, the interpretation of the findings is primarily speculative and exploratory; in this regard, further studies with larger sample sizes are needed to confirm or refute the findings of this study. Later investigation could use alternative data, such as implicit measures or psychophysiological signals, to improve the accuracy and richness of the findings. Furthermore, the results may not be generalizable due to the use of a snowball sampling method and the failure to investigate socio-cultural and socio-demographic factors that could have affected the observed results. Finally, due to the small sample size, the application of the Benjamini–Hochberg False Discovery Rate correction pointed out no corrected significant specific

indirect associations involving RtC dimensions in the link between DLB and eco-emotions. Therefore, further studies with a larger sample size are needed. However, this is the first study that investigates the associations of Digital Life Balance on eco-emotions, while also taking into account psychological determinants such as Readiness to Change. Accordingly, the present study may contribute preliminary evidence to this emerging area, while underscoring the need for replication in larger, longitudinal, and covariate-adjusted samples.

7. Conclusions

The present study examined small, preliminary, unadjusted cross-sectional associations between the balance of digital and offline activities and emotional responses to climate change, as well as possible indirect associations examined in exploratory statistical mediation models. Results showed that a more balanced engagement between online and offline activities was positively associated with selected eco-emotions, namely eco-anger, eco-anxiety, eco-sorrow, and eco-isolation. At the same time, higher DLB was also associated with greater perceived importance of the problem, as well as higher motivation and readiness to change. However, these findings do not demonstrate that DLB causes greater eco-emotional awareness or readiness to change. Exploratory mediation models suggested possible uncorrected indirect associations involving perceived importance of the environmental problem; however, these specific indirect associations did not remain significant after Benjamini–Hochberg correction for multiple testing. In this sample, higher DLB was associated with slightly higher self-reported scores on selected eco-emotions and readiness-related dimensions, suggesting that subjective online–offline balance may coexist with greater climate-related emotional involvement and sustainability-related psychological readiness. In conclusion, this work may provide preliminary groundwork for future longitudinal and covariate-adjusted studies aimed at clarifying the associations between subjective digital offline balance, eco-emotions, and psychological domains related to Readiness to Change.

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