International Journal of Applied Positive Psychology (2024) 9:1537–1561
https://doi.org/10.1007/s41042-024-00180-3

RESEARCH PAPER

Believing in an Enticing World: Testing a Positive Psychological Intervention Aimed at Increasing Character Strengths and Well-Being via World Beliefs

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Accepted: 3 July 2024 / Published online: 19 August 2024

Abstract

The Enticing world belief factor—encompassing beliefs that the world is interesting, beautiful, abundant, and worth exploring—has been hypothesized to promote subjective well-being and several character strengths (e.g., curiosity). The present pre-registered longitudinal-experimental study tests a 9-day intervention aiming to increase Enticing world belief in 247 high school and university students (aged 14–35). Results show that the intervention increased Enticing world belief from pre to post. However, these changes did not persist at a 2-week follow-up. Although we did not find the predicted positive total effects of the intervention on optimism, life satisfaction, well-being, curiosity or love of learning from pre to post, we did find positive indirect effects on all of these variables via changes in Enticing world belief. We discuss inferential limitations regarding the observed effects as well as possible reasons for the lack of positive total effects on well-being measures and character strengths.

Keywords Primal World Beliefs · Well-being · Life Satisfaction · Character Strengths · Positive Psychology · Interventions

Enticing world belief—"the belief that the world is beautiful, fascinating, meaningful, brimming with opportunities, and worth exploring" (Clifton & Kim, 2020, p. 2)—covaries strongly with curiosity, love of learning, optimism, well-being, and life satisfaction (Clifton et al., 2019; Clifton & Meindl, 2022; Stahlmann & Ruch, 2022). Although several psychologists (e.g., Beck, 1970; Dweck, 2017; Geukes et al., 2018) have hypothesized that world beliefs, such as Enticing world belief, causally influence such personality and well-being indices, existing findings are so far solely correlational. Thus, there is a clear need for studies which directly test these causal

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relationships (e.g., Clifton et al., 2019; Clifton & Meindl, 2022; Stahlmann & Ruch, 2022). In the present research, we examine whether a 9-day targeted intervention can increase Enticing world belief in a group of high-school and university students. Further, we test whether this predicted change leads to corresponding increases in both character strengths curiosity and love of learning as well as optimism, subjective well-being, and life satisfaction.

1 Theoretical Background

1.1 The Relevance of Primal World Beliefs

Individuals differ in the way they see the fundamental characteristics of the world. These beliefs have been labeled as *world beliefs* (Sutton & Douglas, 2005), *Weltanschauungen* (Sharpe & Viney, 1973) or *worldviews* (Koltko-Rivera, 2004), defined as "a set of assumptions about physical and social reality" (Koltko-Rivera, 2004, p. 3). World beliefs have gained much attention in psychological research over decades. However, research has mainly focused on a small subset of world beliefs (e.g., *belief in a just world*, Bartholomaeus & Strelan, 2019; *dangerous worldview*, see Perry et al., 2013) or on beliefs about topics within the world, such as God or freewill, rather than the world as a *whole*. Consequently, this area of research has lacked a "unifying framework […] for systematically investigating [overall world beliefs'] structure and their distinct psychological effects" (Stahlmann et al., 2020, p. 1).

To identify the main fundamental beliefs about the overall character of the world that people hold and disagree on, Clifton et al. (2019) conducted an extensive exploratory qualitative analysis including numerous tweets, historical texts, political speeches, and so forth. Multiple exploratory factor analysis resulted in the extraction of 26 so-called primal world beliefs or *primals*. These beliefs are conceptualized as continuous bipolar dimensions, such as the belief that the world is *Good* versus *Bad*. They are simple, general, adjectival, and goal-relevant, and are distinct from historical, factual, metaphysical, and incidental world beliefs (e.g., "The world consists of 118 chemical elements"; Clifton et al., 2019).

Several researchers have hypothesized that the study of such world beliefs is key to understanding how individuals think, feel, and act (Dweck, 2017; Fleeson & Jayawickreme, 2015; Geukes et al., 2018). Some researchers have suggested that primals function as lenses through which individuals interpret new experiences subsequently influencing their personality, well-being, and behavior (Clifton, 2020b; Poulin & Silver, 2019). For instance, individuals might be more strongly motivated to explore, discover, and learn something new if they see the world as being safe and full of interesting things. Meanwhile, the experience of joy, satisfaction and other positive emotions might be difficult in a world seen as barren, but more likely in a world seen as full of resources and opportunities (Clifton, 2020a). Consistent with this reasoning, research has shown substantial correlations between world beliefs and a number of personality traits (Clifton et al., 2019; Stahlmann & Ruch, 2022), behaviors (Bartholomaeus & Strelan 2019; Dalbert & Stoeber, 2005), and measures of well-being (Beck, 1967; Janoff-Bulman, 1989). Recent empirical findings have especially

emphasized the importance of Enticing world belief for positive personality traits including character strengths and subjective well-being, particularly among children and adolescents (Clifton & Meindl, 2022). This belief is strongly associated with the character strengths curiosity and love of learning, as well as optimism, well-being, and life- and job satisfaction (Clifton et al., 2019; Stahlmann & Ruch, 2022). Furthermore, it is negatively correlated with negative emotions and depression (Clifton & Meindl, 2022). However, a major limitation in this literature concerns the lack of experimental research, making it unclear whether primals, such as Enticing world belief, have a causal contribution to personality and well-being. If primals can influence personality and well-being as this theoretical work suggests, a crucial question is then how, if at all, these primals can be changed.

2 The Changeability of Primal World Beliefs

For some time, trauma researchers have theorized that individuals typically hold positive beliefs about the world, but adverse life experiences can worsen these beliefs (Janoff-Bulman, 1992; Park & Folkman, 1997). Yet, empirical evidence for world beliefs' mutability due to negative experiences is ambivalent (Kaler et al., 2008). Longitudinal studies have found most primals to have relatively high temporal stability (Clifton et al., 2019; Ludwig et al., 2023; Hämpke et al., in press). Moreover, several studies have indicated only small or even null effects of major adverse events such as serious illness or trauma on relevant primals (Poulin & Silver, 2019; Schuler & Boals, 2016; Ginzburg, 2004; Kerry et al., 2023; Ludwig et al., 2023).

But just because primals do not change in predictable ways to reflect individuals' background and major life experiences, this does not mean that primals cannot be changed. Clifton (2020b) suggests that chronic or acute positive experiences as well as designed experiences, such as interventions, might be possible sources of change. Several studies have already successfully demonstrated the changeability of beliefs similar to primals through interventions.

One of the most prominent examples of successful belief-change interventions is cognitive-behavioral therapy. According to Beck's (1967, 1970) highly influential Cognitive Theory of Depression, patients' negative core beliefs about themselves, others, and the world guide information processing resulting in selective attention to negative experiences confirming patients' negative view. In cognitive-behavioral therapy, modifications in these core beliefs are addressed to change individuals' appraisal and subsequently improving their health. While very little research examines changes in beliefs about others or the world through cognitive-behavioral interventions (Dozois & Rnic, 2015; Zoellner et al., 2011), numerous studies reported successful modifications of negative self-beliefs leading to decreased symptoms of diverse psychological disorders (e.g., Dozois et al., 2014; Gregory & Peter, 2017; Halford et al., 2002).

Another example of successful belief-change intervention are so-called growth mindset interventions, which teach the belief that personal abilities, attributes, and traits can change (Burnette et al., 2022). Research in educational contexts showed that student developed the belief that their general intellectual ability is changeable

rather than fixed after participating in growth mindset interventions, which subsequently lead to improved academic performance among some students (Burnette et al., 2018; Sisk et al., 2018).

The effectiveness of such belief-change interventions can be explained by several mechanisms and program elements including among others the following: (1) *Changes in self-awareness or attention.* Belief-change interventions require individuals to redirect their attention, memories, and expectations to the positive or neutral elements to counteract negative biases (Beck, 1970; Ho et al., 2014). (2) *Self-reinforcement*. Interventions often contain self-reinforcing tasks which are easy to integrate into daily life and include motivational practices to secure long-lasting benefits (Seligman et al., 2005; Rees et al., 2005). (3) *Educational elements*. Transmitting information on the benefits of an intervention and the psychological effects of thoughts are central motivating parts of belief-changing interventions (Rhew et al., 2018; Sin et al., 2011).

In line with these findings, Clifton (2020a) suggests that a psychological intervention that has attentional, motivational, experiential, and educational aspects might work best to change primals. Additionally, this intervention should combine everyday objects or experiences with a specific overall quality of the world. Until now, no empirical research has tested the effectiveness of such interventions.

3 The Present Study

To summarize, high Enticing world belief might promote personality development and well-being (e.g., Stahlmann & Ruch, 2022). However, there is a lack of interventions targeting Enticing world belief and examining its causal contributions. To address this gap, the present research examines if a 9-day intervention targeting Enticing world belief and using attentional, educational, motivational, and experiential aspects can increase the belief itself. This study additionally investigates whether the intervention results in higher curiosity, love of learning, optimism, life satisfaction, and well-being, mediated by the increase in Enticing world belief. A longitudinal field experiment with an active-control condition and pre-test, post-test, and follow-up surveys has been conducted over a period of four weeks. Since children and adolescents in particular might benefit from perceiving the enticing aspects of the world (Clifton & Meindl, 2022) and younger individuals have been shown to be more sensitive to changes in belief-system components given their dynamic social surroundings (Gouveia et al., 2015) and the effectiveness of positive psychology interventions in general (Koydemir et al., 2021), high school and university students were included only.

Based on studies showing significant associations between Enticing world belief, optimism, curiosity, engagement in life, love of learning, well-being, and life satisfaction (e.g., Stahlmann & Ruch, 2022), we predicted that:

Hypothesis 1 A 9-day intervention targeting Enticing world belief (vs. a control group treatment) leads to an increase in Enticing world belief (H1a), optimism (H1b),

curiosity (H1c), love of learning (H1d), well-being (H1e), and life satisfaction (H1f) from pre to post.

Based on assumptions that world beliefs causally contribute to personality development and well-being outcomes (e.g., Geukes et al., 2018), we additionally hypothesized that:

Hypothesis 2 The change in Enticing world belief from pre to post mediates the effect of the intervention targeting Enticing world belief on changes in optimism (H2a), curiosity (H2b), love of learning (H2c), well-being (H2d), and life satisfaction (H2e).

Due to missing research on the longer-term effectiveness of interventions targeting primals we further explored the effects of the intervention after a period of two weeks (RQ). In exploratory analyses, we additionally examined whether specific participants' characteristics, such as study engagement or previous well-being, buffer the intervention's effectiveness, as suggested by previous research on positive psychological interventions (e.g., Carr et al., 2021; Lyubomirsky et al., 2011).

4 Method

In this section, we report how we determined our sample size, the characteristics of our study sample, all data exclusions, the study procedure, and all materials and measures. Additional information on these contents can be found in the Online Supplement (https://osf.io/qtpfk/).

4.1 Participants

According to an a priori power analysis at least $N=250$ participants were needed to detect a large direct effect of the intervention ($\gamma_{condition}=0.50$) and a large interaction effect of condition X time ($\gamma_{timeXcondition}=0.50$) with a power of at least $(1\text{-}\beta)=0.80$ and $(1\text{-}\beta)=0.70$, respectively (see further details, Online Supplement D). Participants had to be at least 13 years old, high school or university students, and must speak German as native or second language. Participants were recruited either via their school class, social media, and lectures. The classes of participating high school students received 100€ for their participation and took part in a voluntary workshop on personality development. The other participants had the opportunity to register for a gift coupon, or to earn course credit.

Of 984 participants who started the first survey, 372 completed it. 288 eligible participants finished the second and 279 the third survey, respectively. Data from 57 participants were excluded as they did not agree to the informed consent ($n=23$), they were younger than 13 years old ($n=1$) or older than 35 years old ($n=3$)[1], they

[1] Participants above 35 years were excluded. They are expected to not represent the target group of high school and university students, who are considered to benefit more from higher levels of Enticing world

were not randomized ($n=1$), or they were not students ($n=29$)[2,3]. The final sample consisted of 247 participants aged between 14 and 35 years ($M=21.90$, $SD=3.95$, 194 girls, 44 boys, 9 non-binary). The experimental and control conditions consisted of 120 and 127 participants, respectively. The complete flow of participants is illustrated in Fig. 1. 202 participants were university students, 9 apprentices, and 36 high school students. Of the 36 high school students, 15 attended the same class at a single high school, while the remaining students were in different classes at other schools.

4.2 Instruments

4.2.1 Enticing World Belief

Enticing world belief was measured by the Enticing World Belief subscale of the 18-item Primals Inventory (PI-18; Clifton & Yaden, 2021; α=.73-.79; see Online Supplement C for reliabilities). Participants rated their agreement with seven statements from 0=*strongly disagree* to 5=*strongly agree*, e.g., "In life, there's way more beauty than ugliness". As a German translation of only three items exists (Stahlmann et al., 2020), the remaining items were translated using the forward-backward translation method.

4.2.2 Optimism

Optimism was measured with the two-item Optimism-Pessimism Short-Scale-2 (SOP2; Kemper et al., 2014; α=.79-.83). Participants indicated the extent to which they consider themselves optimistic and pessimistic (e.g., from 0=*not at all optimistic*, 6=*very optimistic*).

4.2.3 Life Satisfaction

Life satisfaction was measured using the single-item General Life Satisfaction Short Scale (L-1; Beierlein et al., 2015): "All things considered, how satisfied are you with your life these days?"(0=*not at all satisfied* to 10=*completely satisfied*).

4.2.4 Curiosity and Love of Learning

Curiosity and love of learning were measured using German translations of the subscales *curiosity* (4 items; α=.69-.71) and *love of learning* (4 items; α=.84-.86) of the Revised Brief Values in Action Inventory of Strengths-Youth (R-VIA-Youth; Weber & Harzer, 2022). Participants rated the degree to which extent statements, such as "I

belief (Clifton & Meindl, 2022) and to be more sensitive to changes in belief-system components given similar life developments and dynamic social surroundings typical of adolescence or young adults (Gouveia et, 2015). This criterion was not pre-registered.

[2] Participants who were doing an apprenticeship were also included.

[3] No participants were excluded because of more than three wrong answers in the manipulation check and little variance in their answers (see pre-registration).

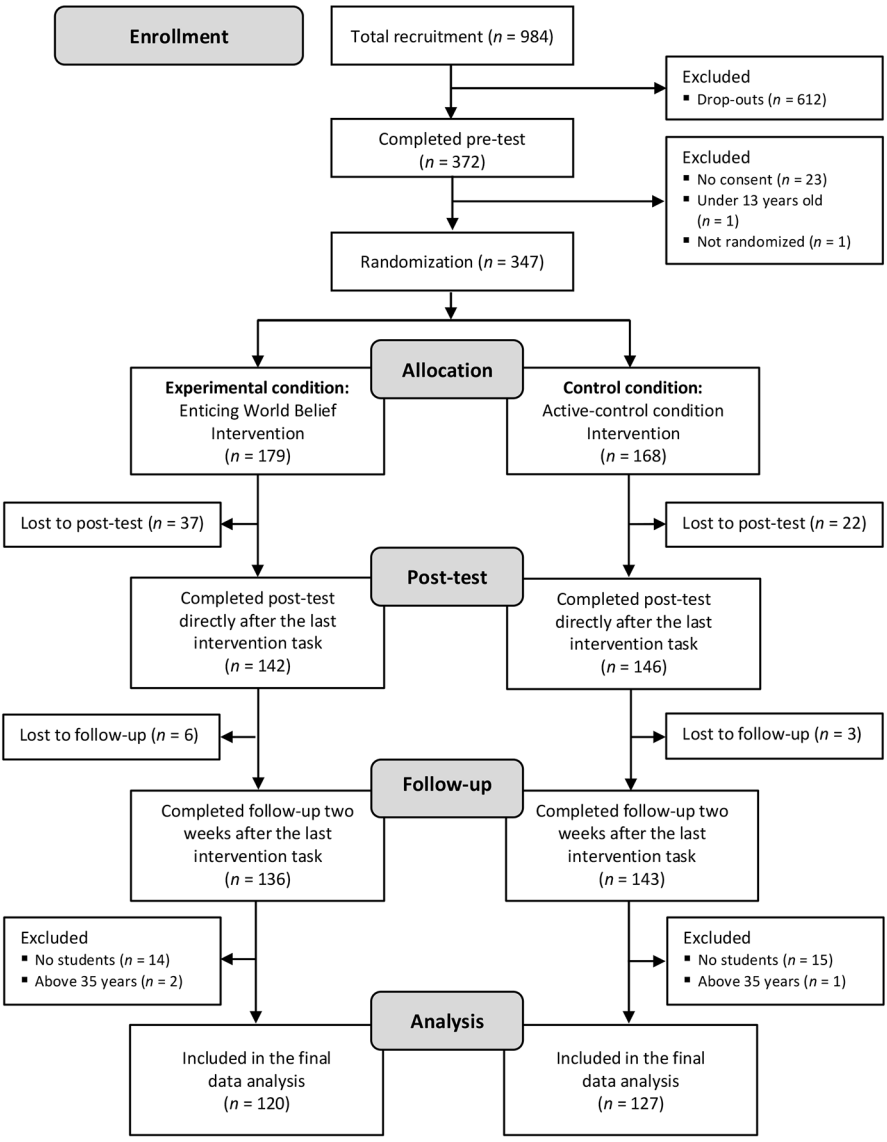

Fig. 1 Study recruitment flow chart

always have many questions about many things" (curiosity) or "I love to learn how to do different things" (love of learning), describe their personality from 0=*not like me at all* to 4=*very much like me*.

4.2.5 Well-Being

Well-being was measured using the German World Health Organization Well-Being Index – Version 2 (WHO-5; Brähler et al., 2007; 5 items, α=.79 –.87). Participants

indicated how often they have experienced a series of different feelings over the last two weeks from 0=*at no time* to 5=*all of the time*, such as "Over the last two weeks, I have felt cheerful and in good spirits".

4.2.6 Manipulation Check

Participants were asked to select among different topics all those that describe the content of the tasks they completed (i.e., "What were the tasks that you have completed over the last two weeks about?").

4.2.7 Variables for Exploratory Purpose

Perceived Easiness Perceived easiness was measured using a self-written item asking participants to rate the easiness of each task from 0=*very difficult* to 6=*very easy* (i.e., "How easy was it for you to complete this task?"). The ease of retrieval might have influenced participants' perception of the world (e.g., Schwarz & Strack, 1999) and thus the effectiveness of the intervention.

Engagement with the Task Engagement with the task was measured using two self-written items asking participants to indicate their interest in the reflection tasks (i.e., "How much did you like the tasks you had over the last two weeks?") and the effort they put into answering them (i.e., "How much effort did you put into answering the daily reflection questions?") from 0=*not at all* to 6=*very much*. Engagement with an intervention can be a prerequisite for the effectiveness of positive psychological interventions (e.g., Lyubomirsky et al., 2011). Due to a low reliability of r=.47, items were analyzed individually.

Previous Journaling Experiences Previous journaling experiences were measured using a self-written item asking participants to write down their experiences with similar tasks in a blank space (i.e., "Have you done anything similar to the last weeks' tasks before?"). We aimed to explore if participants' previous journaling experiences influenced the effectiveness of the intervention.

Negative External Influences Negative external influences were measured using a self-written item asking participants to indicate the extent to which they experienced negative events over the last few weeks (i.e., "In the last few weeks I have experienced negative events in my life that have put a strain on me") from 0=*not at all*, 6=*very much*. People with previous negative life experiences, such as traumas, might benefit most from positive psychology interventions (Carr et al., 2021).

Conscientiousness Conscientiousness was measured using the Conscientiousness subscale of the Big Five inventory by Van Eijck and De Graaf (2004; α=.82). Participants indicated their agreement with six self-descriptions (e.g., "sloppy") from 0=*not at all*, 6=*very much*. Items were translated using the forward-backward translation method. We included this measure as higher levels of conscientiousness might lead to a more conscientious treatment adherence (De Vibe et al., 2015).

Sensitive Openness to Stimuli Sensitive openness to stimuli was measured by the Sensitive Openness to Stimuli subscale of the German Highly Sensitive Person Scale for Students (HSP, Tillmann et al., 2018; α=.70). Participants indicated to which extent five statements apply to their personality, such as "I am empathetic", from 0=*does not apply at all*, 3=*applies completely.* People with higher sensitive openness to stimuli might benefit more from positive experiences (Pluess et al., 2017), which the intervention tends to elicit.

4.3 Study Design and Procedure

This longitudinal-experimental field study was preregistered on the Open Science Framework (https://doi.org/10.17605/OSF.IO/H4AK3) and consisted of an *experimental condition* and an *active control condition*. To secure sufficient motivation to participate the study was announced as a diary study with reflection tasks. Data were collected on ESF Survey and in two German high school classes. On ESF Survey and in both high school classes, participants were randomized at the individual level. Overall, the study took about one hour over a period of four weeks and consisted of 12 different parts, including three 6- to 8-minutes online surveys and nine daily intervention tasks.

The study procedure is illustrated in Fig. 2. At the beginning of the study, participants were asked to provide informed consent and fill out the first survey.[4] Participants whose data was not collected within their school classes were asked for their e-mail address and randomly allocated to one of the two conditions within this step. Then, all participants filled out the first intervention task. While the online participants received this task via e-mail according to their condition, participants in both high school classes were given an envelope that randomly contained either the nine tasks of the experimental condition or those of the control condition. In the following eight days, all participants completed one task per day for 2–5 min, which the online participants received via e-mail and the high school students pulled out of their envelope. After each task, participants rated its perceived easiness. The open answers to the tasks were not collected to avoid reactance. After the last task and two weeks later, participants were asked to complete the second and third survey, respectively. Then, participants were informed about the background of this research. All instructions, measures, and tasks were given in German. To match participants data, participants entered an anonymous code in each survey and intervention task.

4.4 Intervention

Online Supplement A presents the full task instructions for both conditions. The intervention tasks were selected and tested in both a quantitative and qualitative prestudy (Online Supplement B). In the experimental condition, the intervention tasks were adapted from the Leaf Exercise (Clifton, 2020a) and let participants reflect on different sub-facets of Enticing world belief. In the first part of the tasks, partici-

[4] If participants were below 16 years old, one of their parents provided informed consent.

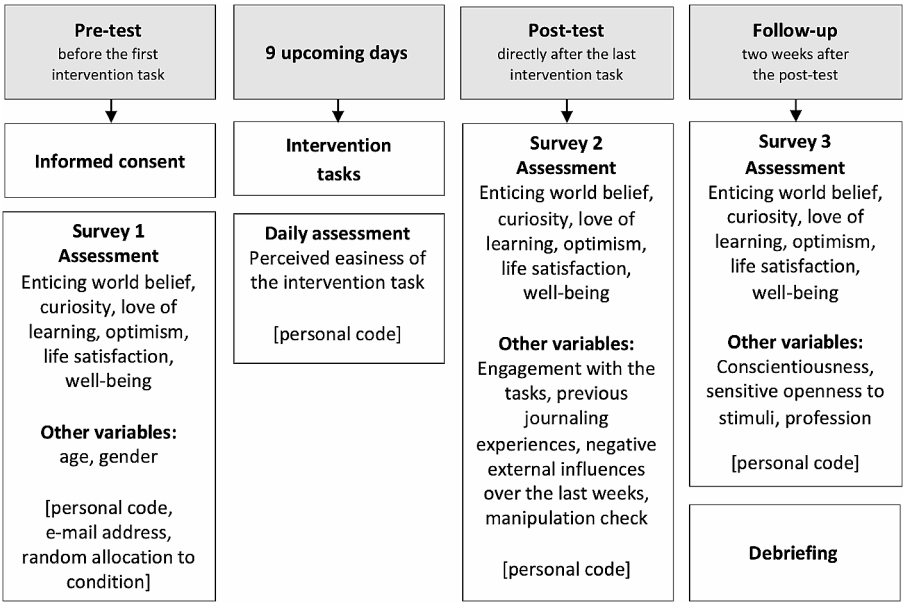

Fig. 2 Study procedure. *Note*. Only participants whose data were not collected in the high school classes were asked to enter their e-mail address in the first survey to receive the subsequent intervention tasks via e-mail. Besides the main variables of interest (e.g., Enticing world belief), other variables were assessed for exploratory purpose and sample description

pants were asked to think about positive experiences or objects (e.g., favorite place) and describe it shortly. Then, a short educative information text illustrated that this positively experienced quality is typical of this world (e.g., "Imagine that each of the 8 billion people in this world is asked to name a beautiful place: how many beautiful places there must be in the world!"). Afterwards, participants were asked to either describe the kind of world they live in that has this experienced quality to offer or to think about what this experienced quality says about the world.

In the control condition, participants were asked to describe their daily schedule or neutral experiences of the last couple of days, such as the last song they listened to. By using an active control condition with almost equating expectations for the relevant outcomes, we aimed to display the cover story as realistically as possible and reduce the likelihood that differential motivation, expectations, and placebo effects were responsible for differential improvements (Boot et al., 2013). Each task was introduced by a short information on the topic so that the conditions' tasks were roughly similar in lengths.

4.5 Data Analysis

All data analyses were performed with R (R Core Team, 2023; see Online Supplement E for packages). A series of independent sample *t*-tests or Fisher's Exact tests was conducted to examine whether the conditions as well as the final sample vs. the

excluded participants differed in demographics, outcomes at pre-test, and exploratory variables.

To test hypotheses H1a-H1f and the exploratory research question RQ, multilevel regression models (MLMs) were calculated with time on level 1 nested within individuals on level 2. The MLMs were chosen to account for non-independence of data. Since we intended to detect changes from pre- to post-test or follow-up rather than developmental trajectories between the three measurement occasions, we integrated two dummy-coded time variables. The first time variable contrasted pre-test and post-test, with pre-test and follow-up coded as 0 and post-test coded as 1. The second time variable contrasted pre-test and follow-up, with pre-test and post-test coded as 0 and follow-up coded as 1. Since each level-1 time variable consisted of two data points only, a random intercept but no random slope could be calculated. The condition was measured as a dummy-coded level-2 variable, with the control and experimental condition coded as 0 and 1, respectively. To control for the non-independence of participants belonging to the same high school class, we used the fixed effects approach entering the class as dummy-coded control variable at level 2, with participants recruited online coded as 0, and those recruited in class coded as 1.[5] This approach is recommended when the primary focus of the analysis is on the lowest two levels of clustering while the level-3 cluster is incidental (McNeish & Wentzel, 2017). Since we preregistered directional effects for the hypotheses H1a-H1f, we computed one-tailed tests and *p*-values for the interaction effects of post-test X condition on the outcome variables to investigate the changes from pre- to post-test in dependence of the condition. Other reported *p*-values are two-tailed.

To test the mediation hypotheses H2a-H2e, we used ANCOVA models which treat the pre-test measures of the mediator and the outcomes as covariates (see MacKinnon, 2008; Valente et al., 2021). Again, class was entered as dummy-coded control variable to control for non-independence of participants in the same class, with participants recruited online coded as 0, and those recruited in class 1. The average causal mediation effect was estimated and tested for significance via *bca*-corrected bootstrapping (Efron, 1979) using 10,000 simulations. We used ANCOVA mediation models instead of difference score mediation models because the latter have been criticized for their lack of reliability when the correlation between a measure at two time points is high (e.g., MacKinnon, 2008).

In further exploratory analyses, we added *z*-centered variables to the MLMs to test cross-level interaction effects between these variables and the post-test variable, identifying potential moderators of the intervention's effectiveness. To facilitate the interpretation of cross-level interaction effects, we reversed the dummy-coding of the condition variable compared to the previous MLMs, such that the experimental and control condition was coded as 0 and 1, respectively. In these exploratory variables, we did not include the second time variable contrasting pre-test and follow-up to keep the models as simple as possible. Moreover, we conducted exploratory ANCOVA mediation analyses to test whether lower levels of perceived easiness suppressed the expected positive effects of the intervention on outcomes at post-test.

[5] Since the data from only one of the two high school classes could be used after data exclusion, one dummy variable was included only.

5 Results

5.1 Preliminary Analyses

Means, standard deviations, and correlations between all numeric variables are presented in Online Supplement F. The conditions did not differ in most demographics, outcomes at pre-test, and exploratory variables (Online Supplement G). However, the experimental condition scored lower in life satisfaction at pre-test (M=6.37, SD=2.02) compared to the control condition (M=6.87, SD=1.76), $t(245)$=- 2.08, p=.039, d=0.26. Moreover, the experimental condition perceived the tasks less easy (M=3.85, SD=0.86) than the control condition (M=4.81, SD=0.71), $t(244)$=-9.55, p<.001, d=1.22.

The final and excluded participants differed significantly in distribution of sex, p=.007, and profession, p<.001. Specifically, the group of the final participants included a higher proportion of girls (79% vs. 72%) and non-binary participants (4% vs. 0%) and compromised less high school students (15% vs. 35%) and employed participants (0% vs. 56%) compared to the excluded group. The excluded participants further scored lower in engagement, interest, conscientiousness, and sensitive openness to stimuli in comparison to the final sample (Online Supplement G).

5.2 Hypotheses H1a-H1f: Testing Direct Effects

Hypotheses H1a-H1f predicted that the 9-day intervention targeting Enticing world belief (vs. a control group treatment) should lead to an increase in Enticing world belief, optimism, curiosity, love of learning, well-being, and life satisfaction from pre to post. In support of H1a, the MLM in Table 1; Fig. 3 show a significant interaction effect between condition and post-test on Enticing world belief at post-test, b=0.14, SE=0.05, p=.003, suggesting that the experimental condition experienced a significantly higher increase in Enticing world belief from pre to post, $b_{experimental}$=0.22, $SE_{experimental}$=0.04, $p_{experimental}$<.001, than the control group, $b_{control}$=0.08, $SE_{control}$=0.04, $p_{control}$=.033.

Contrary to hypotheses H1b-H1f, the analyses revealed no significant interaction effects of condition X post-test on optimism, curiosity, love of learning, well-being, and life satisfaction at post-test, all ps>.05 (Table 1; Fig. 3), suggesting that the experimental condition did not experience a relative increase in these outcomes from pre to post when compared to the control condition. Further analyses indicated that optimism increased equally in both conditions from pre to post, $b_{experimental}$=0.24, $SE_{experimental}$=0.06, $p_{experimental}$<.001, $b_{control}$=0.24, $SE_{control}$=0.06, $p_{control}$<.001. Neither the experimental nor the control condition showed an increase in curiosity or love of learning from pre to post, all ps>.05. However, while the experimental condition remained stable in well-being, b=0.45, SE=0.32, p=.158, and life satisfaction, b=0.13, SE=0.12, p=.247, from pre to post, the control condition increased significantly in well-being, b=1.58, SE=0.31, p<.001, and life satisfaction, b=0.34, SE=0.11, p=.003. Descriptive data sorted by conditions are presented in Online Supplement H.

Table 1 *Multilevel analyses (fixed effects) predicting outcomes between pre-, post- and follow-up test*

Outcome	Predictor	b	SE b	β	t	df	*p*	95%CI		$R^{2(f)}_{t}$
								LL	UL	
EWB	(Intercept)	3.66***	0.06		65.37	325.76	<.001	3.55	3.77	.03
	Condition[a]	-0.03	0.08	-0.02	-0.38	329.36	.705	-0.18	0.12	
	Post-test[b]	0.08*	0.04	0.06	2.15	490.00	.033	0.01	0.15	
	Follow-up[c]	0.04	0.04	0.03	1.15	490.00	.252	-0.03	0.11	
	Class[d]	-0.15*	0.08	-0.12	-2.01	244.00	.045	-0.30	0.00	
	Condition X Post-test[e]	**0.14****	**0.05**	**0.08**	**2.76**	**490.00**	**.003**	**0.06**	**Inf.**	
	Condition X Follow-up	**0.03**	**0.05**	**0.02**	**0.55**	**490.00**	**.583**	**-0.07**	**0.13**	
Optimism	(Intercept)	3.70***	0.10		38.77	326.39	<.001	3.51	3.89	.02
	Condition[a]	-0.05	0.13	-0.02	-0.35	330.01	.723	-0.31	0.22	
	Post-test[b]	0.24***	0.06	0.11	3.93	490.00	<.001	0.12	0.37	
	Follow-up[c]	0.31***	0.06	0.14	4.95	490.00	<.001	0.19	0.43	
	Class[d]	0.06	0.13	0.03	0.49	244.00	.623	-0.19	0.32	
	Condition X Post-test[e]	**0.00**	**0.09**	**0.00**	**-0.03**	**490.00**	**.489**	**-0.15**	**Inf.**	
	Condition X Follow-up	**-0.11**	**0.09**	**-0.04**	**-1.20**	**490.00**	**.230**	**-0.28**	**0.07**	
Curiosity	(Intercept)	2.77***	0.05		51.00	339.60	<.001	2.66	2.87	.01
	Condition[a]	0.02	0.08	0.01	0.23	343.80	.818	-0.13	0.17	
	Post-test[b]	0.00	0.04	0.00	0.00	490.00	1.00	-0.07	0.07	
	Follow-up[c]	0.04	0.04	0.03	1.15	490.00	.250	-0.03	0.12	
	Class[d]	-0.13	0.07	-0.10	-1.75	244.00	.082	-0.27	0.02	
	Condition X Post-test[e]	**0.08**	**0.05**	**0.05**	**1.39**	**490.00**	**.083**	**-0.01**	**Inf.**	
	Condition X Follow-up	**-0.08**	**0.05**	**-0.05**	**-1.50**	**490.00**	**.135**	**-0.19**	**0.02**	
Learning	(Intercept)	2.65***	0.06		42.91	338.41	<.001	2.53	2.78	.06
	Condition[a]	0.02	0.09	0.02	0.25	342.54	.801	-0.15	0.19	
	Post-test[b]	0.04	0.04	0.03	0.92	490.00	.356	-0.04	0.12	
	Follow-up[c]	0.04	0.04	0.03	0.92	490.00	.356	-0.04	0.12	
	Class[d]	-0.37***	0.08	-0.25	-4.38	244.00	<.001	-0.53	-0.20	
	Condition X Post-test[e]	**-0.02**	**0.06**	**-0.01**	**-0.30**	**490.00**	**.619**	**-0.12**	**Inf.**	
	Condition X Follow-up	**-0.08**	**0.06**	**-0.04**	**-1.36**	**490.00**	**.175**	**-0.20**	**0.04**	
Well-being	(Intercept)	12.49***	0.40		31.51	372.46	<.001	11.72	13.27	.03
	Condition[a]	-0.26	0.56	-0.03	-0.46	378.00	.644	-1.35	0.83	
	Post-test[b]	1.58***	0.31	0.17	5.09	490.00	<.001	0.97	2.18	
	Follow-up[c]	1.31***	0.31	0.14	4.22	490.00	<.001	0.70	1.91	

Table 1 (continued)

Outcome	Predictor	b	SE b	β	t	df	*p*	95%CI		R^2_t (f)
								LL	UL	
	Class[d]	0.41	0.52	0.04	0.79	244.00	.431	-0.61	1.43	
	Condition X Post-test[e]	**-1.13**	**0.44**	**-0.09**	**-2.53**	**490.00**	**.994**	**-1.85**	**Inf.**	
	Condition X Follow-up	**-0.66**	**0.44**	**-0.05**	**-1.48**	**490.00**	**.140**	**-1.53**	**0.21**	
Satisfaction	(Intercept)	6.81***	0.16		42.41	341.03	<.001	6.50	7.12	.04
	Condition[a]	-0.48*	0.23	-0.13	-2.13	345.27	.034	-0.92	-0.04	
	Post-test[b]	0.34**	0.11	0.09	3.03	490.00	.003	0.12	0.56	
	Follow-up[c]	0.31**	0.11	0.08	2.82	490.00	.005	0.10	0.53	
	Class[d]	0.40	0.22	0.11	1.85	244.00	.065	-0.02	0.82	
	Condition X Post-test[e]	**-0.21**	**0.16**	**-0.04**	**-1.28**	**490.00**	**.899**	**-0.47**	**Inf.**	
	Condition X Follow-up	**-0.06**	**0.16**	**-0.01**	**-0.35**	**490.00**	**.724**	**-0.37**	**0.26**	

Note. Relevant results investigating the hypotheses H1a-H1f and the exploratory research question are printed in bold. EWB=Enticing world belief, Learning=Love of learning. CI=confidence interval; *LL*=lower limit; *UL*=upper limit. R^2_t (f)

[a] 0=control condition, 1=experimental condition

[b] 0=pre-test, 1=post-test. 0=follow-up

[c] 0=pre-test, 0=post-test. 1=follow-up

[d] 0=recruited online, 1=recruited in class

[e] This *p*-value is one-tailed

* $p<.05$. ** $p<.01$. *** $p<.001$

5.3 Hypotheses H2a-H2e: Testing Mediations

In support of H2a-H2e, the change in Enticing world belief from pre to post should mediate the effect of the intervention on changes in optimism, curiosity, love of learning, well-being, and life satisfaction. In line with H2a-H2e, the mediation analysis indicated significant indirect effects of condition on all the outcomes at post-test through a change in Enticing world belief (Table 2). However, the analyses did not show a significant total effect of condition on optimism, curiosity, and love of learning at post-test, all *p*s>.05, nor any significant direct effect when the mediator was added to the predictions, all *p*s>.05. Furthermore, the analyses revealed significant negative total effects of condition on well-being at post-test, *b*=-1.20, SE=0.41, *p*=.004, and life satisfaction at post-test, *b*=-0.36, SE=0.14, *p*=.011, and significant negative direct effects of condition on both outcomes at post-test, well-being: *b*=-1.37, SE=0.42, *p*=.001; life satisfaction: *b*=-0.45, SE=0.14, *p*=.002. As the MLMs above showed, the experimental condition remained stable in well-being (M_{t1} = 12.28; M_{t2} = 12.72) and life satisfaction (M_{t1} = 6.37; M_{t2} = 6.50) while the control condition increased significantly in well-being (M_{t1} = 12.55; M_{t2} = 14.13) and life satisfaction (M_{t1} = 6.87; M_{t2} = 7.20) from pre to post.

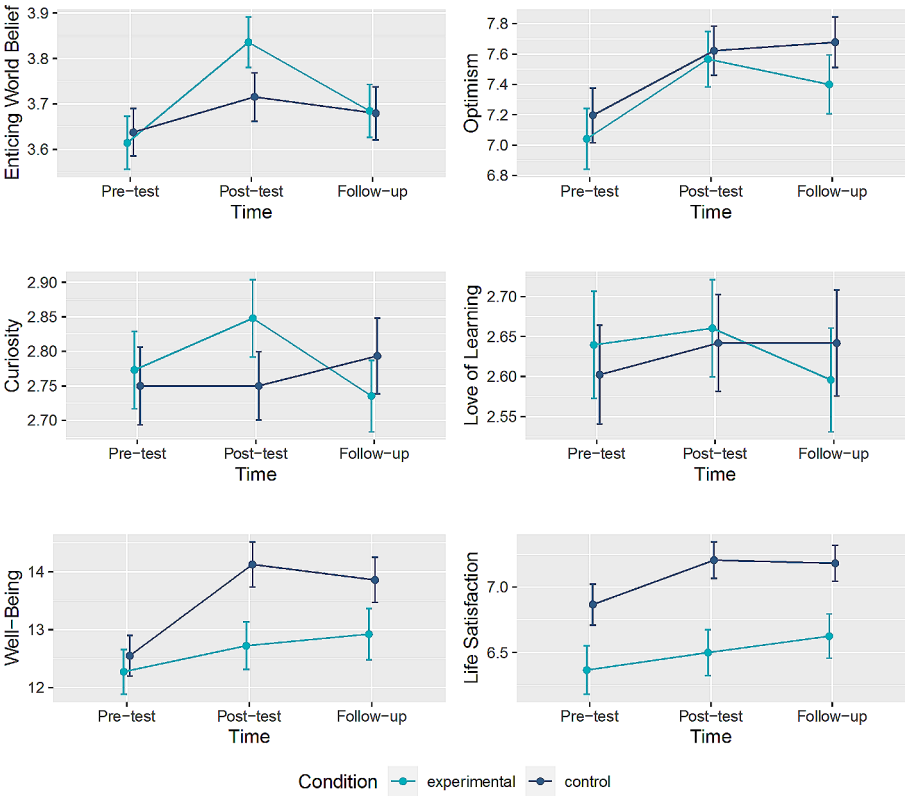

Fig. 3 Line graphs showing the development in outcome variables from pre to follow-up. *Note*. Colored bands denote error bars

Table 2 Simple mediation analyses testing the effect of condition on outcomes at post-test through changes in Enticing world belief

Outcome	a	b	c'	c	est. ab	95% CI		*p*
						LL	UL	
Optimism t_2	0.14^{**}	0.68^{***}	-0.03	0.06	0.09^{**}	0.02	0.19	.005
Curiosity t_2	0.13^{**}	0.19^{**}	0.06	0.08	0.03^{*}	0.00	0.06	.014
Love of Learning t_2	0.13^{**}	0.26^{***}	-0.04	0.00	0.04^{*}	0.01	0.07	.005
Well-being t_2	0.14^{**}	1.26^{*}	-1.37^{**}	-1.20^{**}	0.17^{*}	0.03	0.37	.014
Life Satisfaction t_2	0.14^{**}	0.59^{**}	-0.45^{**}	-0.36^{*}	0.08^{**}	0.02	0.18	.003

Note. Unstandardized effects are presented. Condition was dummy-coded with 0 = control condition and 1 = experimental condition. Class was entered as dummy-coded covariate with 0 = recruited online and 1 = recruited in class. *a* = path between condition and mediator, *b* = path between mediator and outcome, *c'* = direct effect of condition on outcome, *c* = total effect of condition on outcome, *LL* = lower limit, *UL* = upper limit

* $p < .05$. ** $p < .01$. *** $p < .001$

Thus, the intervention only had a positive *indirect* effect on the outcomes: The intervention had a positive effect on increases in Enticing world belief from pre to post which were correlated with increases in optimism, curiosity, love of learning, well-being, and life satisfaction from pre to post. However, since the intervention did not have a positive total effect on increases in optimism, wellbeing, life satisfaction, or character strengths relative to the control condition, causal inference cannot be drawn from these results.

To test the duration of indirect effects, we further performed exploratory mediation analyses testing the mediation effect of condition on the outcomes at the two-week follow-up via Enticing world belief at post-test when controlling for pre-test, post-test and follow-up (see three-wave ANCOVA mediation in Valente & MacKinnon, 2018). However, no significant indirect effects were found (all *p*s>.05).

5.4 Research Question: Testing a 2-Week Follow-Up

From pre-test to follow-up, neither experimental nor control condition increased in Enticing world belief, curiosity, or love of learning, all *p*s>.05 (Fig. 3; Table 1). This suggests that the positive effect of the intervention on Enticing world belief at post-test did not persist over two weeks, nor did the intervention lead to increases in curiosity and love of learning after two weeks. However, both conditions increased equally from pre to follow-up in optimism, $b_{experimental}$=0.20, $SE_{experimental}$=0.06, $p_{experimental}$=.002, $b_{control}$=0.31, $SE_{control}$=0.06, $p_{control}$<.001, well-being, $b_{experimental}$=0.65, $SE_{experimental}$=0.32, $p_{experimental}$=.042, $b_{control}$=1.31, $SE_{control}$=0.31, $p_{control}$<.001. and life satisfaction, $b_{experimental}$=0.26, $SE_{experimental}$=0.12, $p_{experimental}$=.025, $b_{control}$=0.31, $SE_{control}$=0.11, $p_{control}$=.005, all condition X follow-up interactions *p*s>.05.

5.5 Exploratory Analyses

5.5.1 Did Participants' Characteristics Moderate the Effectiveness of the Intervention?

Exploratory moderation analyses revealed that the increase in Enticing world belief from pre to post was smaller for those in the experimental condition who hold higher levels of Enticing world belief, *b*=-0.29, SE=0.05, *p*<.001, and well-being at pre-test, *b*=-0.02, SE=0.01, *p*=.029, as well as for those who experienced more negative external influences, *b*=-0.05, SE=0.02, *p*=.018. Moreover, the increase in optimism was smaller for more conscientious participants in the experimental condition, *b*=-0.25, SE=0.12, *p*=.040. Furthermore, the increase in well-being from pre to post was smaller for those in the experimental condition who had higher levels of well-being at pre-test, *b*=-0.26, SE=0.07, *p*<.001. It was additionally shown that the increase in life satisfaction from pre to post was smaller for participants in the experimental condition who experienced higher levels of well-being at pre-test, *b*=-0.08, SE=0.03, *p*=.004, and for those who were younger, *b*=0.08, SE=0.03, *p*=.019. The full regression tables can be in the Online Supplement I.

5.5.2 Can Perceived Easiness Explain the Lack of the Positive Effect of the Intervention on Increases in Well-Being and Life Satisfaction at Post-Test?

Since ease of recall can influence well-being indices (e.g., Schwarz & Strack, 1999), we tested in exploratory mediation analyses whether lower levels of perceived easiness suppressed the expected positive total effect of the intervention on increases in well-being and life satisfaction. The mediation analysis indicated a significant negative indirect effect of condition on well-being at post-test through perceived easiness, b=-0.56, SE=0.23, p=.014. The total effect of condition on well-being at post-test was also significant, b=-1.19, SE=0.42, p=.005, while the direct effect became non-significant when the mediator was added to the predictions, b=-0.62, SE=0.49, p=.205. The intervention tasks seemed to be perceived less easy than the control activity tasks, which subsequently led to suppression of increases in well-being from pre to post. A second mediation analysis with life satisfaction as the dependent variable found no significant indirect effect of perceived easiness b=-0.07, SE=0.07, p=.291. The total effect of condition on life satisfaction was significant, b=-0.35, SE=0.14, p=.015. Again, the direct effect became non-significant after adding the mediator to the prediction, b=-0.28, SE=0.17, p=.098.

6 Discussion

In this longitudinal-experimental study we examined whether a 9-day targeted intervention can increase Enticing world belief in high-school and university students. We further tested whether the intervention led to corresponding increases in curiosity, love of learning, optimism, life satisfaction, and well-being, mediated by the increase in Enticing world belief. Results revealed two key findings: First, the intervention succeeded in increasing self-reported Enticing world belief. This increase in Enticing world belief was greater in the experimental than in the control condition from pre to post. However, this effect did not persist over two weeks. Second, while the intervention had a small positive indirect effect on self-reported increases in optimism, curiosity, love of learning, well-being, and life satisfaction via the increase in Enticing world belief from pre to post, overall the intervention did not lead to significant increases in these outcome variables relative to the control group.

The positive effect of the intervention on Enticing world belief is in line with previous research that emphasized the malleability of beliefs through belief change interventions (e.g., Burnette et al., 2022), albeit the effect (β=0.08) was small (Cohen, 1988). Given that the intervention only had a positive *indirect* but not a positive *total* effect on well-being indices and character strengths, the resultsraise two questions: On the one hand, results might demonstrate the suitability of the present intervention in addressing primals rather than well-being or personality. On the other, the positive effect of the intervention on Enticing world belief but not on other outcomes might be an indicator for demand effects causing the effect found; while the control condition mainly focused on neutral experiences, the experimental condition was continuously asked to write about how enticing the world is.

However, besides these two possible explanations, further factors should be considered to understand the lack of positive total effects of the intervention on the other outcomes: Regarding character strengths curiosity and love of learning, results showed neither a positive nor a negative total effect of the intervention. These findings might be explained by differences in content between the current and previous interventions aimed at enhancing character strengths. Such successful previous interventions were often set in groups and longer in time, provided a high level of interpersonal contact (Quinlan et al., 2012), and encompassed a variety of tasks training the strengths directly (e.g., Schutte & Malouff, 2022).

Regarding the well-being indices, results indicated that participants in both conditions increased equally in optimism from pre to post. However, only the control condition experienced significant gains in well-being and life satisfaction while the experimental condition remained stable in well-being and life satisfaction from pre to post. Although this study was not advertised as a happiness-enhancing program, demand effects explaining these increases in the control condition cannot be ruled out, especially considering the diversity of tasks participants in the control condition had to perform. Previous research showed that control group activities with similar writing tasks can lead to participants self-reporting higher well-being and life satisfaction (Goldstein, 2007). Although participants' writing has not been assessed, the control condition's reflections on *neutral* daily life activities might have also taught the participants to appreciate the little things in life, that may have let to increases in the well-being outcomes. Here, it should also be noted that the control condition already started the intervention with higher life satisfaction. However, regardless of the reasons, the fact that a control task which was not designed to be effective resulted in larger increases in well-being outcomes suggests that the experimental manipulation lacked efficacy.

Furthermore, the significant *positive indirect effects* and significant *negative direct effects* of the experimental condition on increases in well-being and life satisfaction in the mediation analyses suggest searching for alternative reversed mediators which match the sign of the direct effect (Zhao et al., 2010). Exploratory analyses revealed that lower levels of perceived easiness suppressed the expected positive total effect of the intervention on increases in well-being. In line with previous findings on the effects of ease of recall on well-being (e.g., Schwarz & Strack, 1999), the experimental condition found the completion of the tasks more difficult which subsequently resulted in a smaller increase in well-being relative to the control condition. While the control condition had to reflect on simple *personal* aspects in their daily life, the experimental condition might have had difficulties to name *abstract* positive characteristics of the world.

However, perceived easiness did not explain the lack of the positive total effect of the intervention on life satisfaction. Thus, additional suppressing influences must be considered. As some participants in the experimental condition noticed that the reflection tasks made them feel forced to only recognize the positive aspects of the world while ignore the negative sides, psychological reactance may further account for the results. According to previous research, experienced thought control can lead to negative feelings (e.g., Ma et al., 2019).

Regarding the longer-term effects of the intervention, the increase in Enticing world belief did not persist over two weeks. Previous research showed that positive psychological interventions tend to have a greater impact in the long run when they

are implemented over a longer duration, allowing for more practice and habit development (Sin & Lyubomirsky, 2009), or when individuals maintain engagement in the intervention activities beyond the intervention period (Lyubomirsky et al., 2011). Possibly, continuous reflection on one's belief and its integration in daily life is necessary to successfully change the belief on a longer-term basis.

However, both experimental and control condition experienced a gain in self-reported optimism, well-being, and life satisfaction from pre-test to follow-up. The emergence of increased well-being and life satisfaction in the experimental condition may have been delayed (Pennebaker & Chung, 2007). As both conditions experienced these gains – which could not be explained by increases in Enticing world belief from pre to post – future replications with different control-group activities and investigations of potential mediators are needed to draw further conclusions on causality.

6.1 Limitations

There are several limitations to be considered. First, the final sample and excluded participants differed significantly in interest and engagement. Even if exploratory analyses did not find moderating effects of either variable, the study's small sample size results in insufficient power to draw confident conclusions from these moderation analyses. Self-selection due to motivational differences could have influenced the effectiveness of the intervention (e.g., Lyubomirsky et al., 2011) and even increased possible demand effects. Second, the sample diversity (e.g., sex, age) is limited in the present study. Third, as already discussed the intervention tasks in the experimental condition were perceived more difficult than those in the control condition. This disparity may have suppressed the expected positive total effects of the conditions on well-being indices and restricts conclusions regarding causal inferences. A final limitation concerns the measures of the outcomes which were all self-reported. Thus, influences of response biases and demand effects cannot be ruled out to explain the present findings. For instance – besides the already discussed reasons – another possible explanation for all indirect effects can be that some participants in the experimental condition were aware of the investigated hypotheses, leading them to answer higher on Enticing world belief, character strengths and well-being indices. In contrast, other participants of the experimental condition did not grasp the study's hypotheses or wanted to go against expectations. This latter group provided similar ratings for Enticing world belief at pre, post and follow-up but due to finding the exercise somewhat boring they also expressed slightly lower levels on the other outcome variables.

6.2 Theoretical Implications and Future Research

This research has two valuable theoretical implications: First, the results suggested that primals – at least their state component – can be changed by longitudinal interventions constructed upon existing belief change interventions. Thus, these findings provide first empirical support to Clifton's (2020a) assumption that interventions with attentional, motivational, experiential, and educational elements work best to move primal world beliefs. However, given the short-term change of the investigated primal only, it remains unclear if the trait component of primals can be changed by interventions on a long-term

basis. Second, this study is one of the first to test the causal impact of a specific primal on personality and well-being by manipulating participant's belief experimentally in a longitudinal study. A significant body of research (e.g., Geukes et al., 2018) has hypothesized causal effects of world beliefs on personality, well-being, and behavior. However, previous studies on primals often used correlational (Stahlmann & Ruch, 2022) or longitudinal data (Hämpke et al., in press) which only indirectly test this hypothesis.

Although we moved Enticing world belief successfully in this study, we were unable to show the belief's potential causal effect on personality and well-being indices. As discussed, it remains unclear how much influence demand effects had on our results and what exactly led to the increase of Enticing world belief. By using more similar control conditions with positive valenced tasks, future studies could reduce possible demands effects and provide more stringent test of causality. Moreover, more nuanced investigations of the single intervention tasks are important. Future studies could examine participants' written answers to gain insights into the working mechanisms of the different tasks (we were unable to collect written answers here, due to data privacy rules for German schools), reveal demand effects and find explanations for the intervention's positive indirect but lacking positive total effect on character strengths and well-being indices. The content of answers given in writing-interventions can be central for the effectiveness of such interventions (Pennebaker & Beall, 1986).

6.3 Practical Implications

On a practical level, this study extends existing positive psychology interventions, which have mainly focused on gratitude, optimism, hope, or savoring (Carr et al., 2021), to world beliefs. It provides valuable first insights into the benefits of incorporating daily reflections to teach students the world's beauty and possibilities. Especially in times of crises, such tasks could potentially offer valuable guidance for perceiving the world from a positive perspective. The positive indirect effects of the intervention on changes in character strengths and well-being indices suggest that the intervention may have had benefits for some people that were related to changes in world beliefs. The results further give hints for the development of interventions targeting world beliefs in cognitive therapy or other helping professions. However, given the results of the exploratory moderation analyses, previous level of well-being, task difficulty, and reactance possibilities should be considered before application to avoid negative effects and demotivation.

7 Conclusion

Previous research hypothesizes that the belief in an enticing world might promote character strengths and well-being. Therefore, this longitudinal-experimental study conducted with high school and university students investigates whether a 9-day intervention targeting Enticing world belief increases the belief itself, as well as character strengths and subjective well-being outcomes. The results demonstrate that daily reflection on the enticing aspects of the world indeed raised Enticing world belief on a short term, which was linked to increases in self-reported optimism, curiosity, love of learning, well-being, and life satisfaction from pre to post. However, the intervention compared to the control group

treatment did not have the expected positive total effect on optimism, curiosity, love of learning, well-being, and life satisfaction. Thus, although the theoretically hypothesized causal effects of primal world beliefs on personality and well-being could not be found in this study, the interesting, mixed results suggest exciting opportunities moving forward. As an outlook, further primals interventions in educational and clinical contexts are needed to investigate world beliefs and their association with higher well-being and character strengths.

Acknowledgements We would like to thank Rive Cadwallader for her help with the translation and back-translation of the Primals scale into the German language. A special thanks is also due to the school psychologist and the teachers at the Southern German high school who supported the data collection in the school classes.

Author Contribution Conceptualization: Janna Hämpke, Sandra J. Diller, Nicholas Kerry, Dieter Frey; Methodology: Janna Hämpke, Sandra Diller, Nicholas Kerry, Jeremy D.W. Clifton, Dieter Frey; Formal analysis and investigation: Janna Hämpke; Writing - original draft preparation: Janna Hämpke; Writing - review and editing: Sandra Diller, Nicholas Kerry, Jeremy D.W. Clifton, Dieter Frey; Funding acquisition: Jeremy D.W. Clifton, Dieter Frey; Resources: Jeremy D.W. Clifton, Dieter Frey; Supervision: Sandra J. Diller, Nicholas Kerry, Dieter Frey.

Funding Information This research was funded by the Templeton Religion Trust (Grant #10298, awarded to Jeremy Clifton). It was further funded by the Center for Leadership and People Management of the University of Munich.
Open Access funding enabled and organized by Projekt DEAL.

Data Availability **Open science**: The dataset, R code, and the complete study materials are openly available on Open Science framework (https://osf.io/qtpfk/).

Declarations

Ethics Approval This research was approved by the Institutional Review Board of the University of Pennsylvania (approval #828675). All participants and their legal guardians – if participants were below 18 years – gave written informed consent in accordance with the Declaration of Helsinki (2013). They were asked if they understood the instructions and informed that their participation was voluntary, and that they had the right to withdraw from the study at any time. After the end of the study, participants and their legal guardians were fully debriefed. All data were anonymized and saved confidentially.

Consent to Participate and publication Informed consent was obtained from all individual participants included in the study. Written informed consent was obtained from the legal guardians if participants were below 18 years old.

Competing interests The authors have no competing interests to declare that are relevant to the content of this article.

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