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Systematic Review

Well-Being Technologies and Positive Psychology Strategies for Training Metacognition, Emotional Intelligence and Motivation Meta-Skills in Clinical Populations: A Systematic Review

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Abstract: The holistic growth and psychological well-being of people with special needs and disabilities remain high on the priority agenda for sustainable and inclusive education. Digital well-being technologies and especially "smart technologies", are ready to revolutionize mental health interventions by meeting trainees' needs and providing them with more positive and transformative mental, emotional, and social experiences. Meta-skills refer to a set of consciousness-raising competences that incorporate meta-cognitive, social–emotional, and motivational attributes, allowing individuals to intentionally achieve a state of optimal functioning. Although positive psychology and well-being technologies are considered promising intervention approaches, there is less knowledge regarding the effectiveness of such interventions among people with special needs and disabilities, especially in the crucial domain of meta-skills development. Thus, the current systematic review aims to examine positive psychology strategies as well as the synergy with well-being technologies in the development of metacognition, emotional intelligence, and motivation meta-skills in populations with special training needs and disabilities. The PRISMA methodology was utilized to answer the research questions. A total of forty-nine studies met the inclusion criteria. The results indicated that positive psychology strategies improved a wide range of meta-skills, including self-regulation, emotional control, behavioral control, inhibition control, self-awareness, intrapersonal skills, interpersonal skills, adaptation, goal setting, and self-compassion. Artificial intelligence tools, wearables, smart applications, immersive technologies (virtual and augmented reality), neurofeedback and biofeedback technologies, as well as digital games were found to effectively assist such training programs. The results of the current review may provide positive feedback in the discussion about digitally-aided mental health interventions for training the meta-skills of mental and emotional health.

Keywords: positive technologies; artificial intelligence; immersive technologies; virtual reality; augmented reality; metaverse; chatGPT; neurofeedback; biofeedback; wearables; serious games; metacognition; emotional intelligence; motivations; neurodevelopmental disorders; mental and mood disorders; learning difficulties; special education

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1. Introduction

Positive psychology can be briefly described as the branch of psychology that investigates the nature of human well-being, including the factors of personal growth, the psychological mechanisms of well-being, and the intentional activities that may lead humans to achieve optimal functioning in every area of human life [1]. Positive psychology researchers outline that the cultivation of positive thoughts and feelings, personal strengths, and virtues is considered a prerequisite for an autonomous, self-actualized, and meaningful life [2].

According to Seligman and Csikszentmihaly [3], when people's lives become barren and pointless, it is highly probable to experience a deterioration in their quality of life, predicting an increased risk of developing pathologies. Populations with neurodevelopmental disorders, mental, emotional, and behavioral disorders, as well as those with learning difficulties, are among the populations that are at a high risk of experiencing a lower quality of life and well-being [4].

Common effects of living with a chronic disorder (especially when subjects are not effectively treated and supported) may include lower positive affectivity, intense negative emotions (i.e., fear, shame, sadness, and hopelessness), and often uncontrollable anxiety. The everyday challenges (i.e., stigma, discrimination, social exclusion) may make them feel left out and rejected, which in turn may gradually distort their self-concept and strangulate their self-esteem [5]. Internal motivations are considered a key factor in personal growth. However, people with disabilities often exhibit difficulties in the internalization of motivation [6].

A growing number of surveys indicate the importance of promoting positive health, optimism, and wellness for people with disabilities [7]. According to Wehmeyer [8], positive psychology could lay the foundations for making a future society more sustainable and inclusive for people with special needs, allowing them to be more autonomous, productive, and satisfied [9].

Positive psychology deals with clinical conditions in two ways: as a means of prevention and intervention. Positive psychology aims to suspend deterioration and strengthen the growth of human well-being through evidence-based knowledge and strategies that promise to make human life more positive, controllable, and worth living [3]. Moreover, the approach adopted is considered more inclusive for people with disabilities because positive psychology avoids emphasizing a deficit model. On the contrary, it adopts an optimistic view. More specifically, positive psychology does not focus on the negative consequences derived from pathological conditions. Conversely, positive psychology aims to deal with pathological conditions as a potential source of healing. To reach that objective, positive psychology recognizes the importance of systematic training in equipping individuals with functional skills and strategies that allow the conscious transformation of weaknesses into opportunities for self-improvement [8].

Information and communication technologies (ICTs) have become increasingly used in tracking, assessing, modifying, and training those aspects of human psychophysiology that guarantee optimal mental and affective functioning. Internet-based therapies, and emerging technologies including artificial intelligence (AI), internet of things (IoT), virtual reality (VR), and augmented reality (AR) are a small sample of the technologies that are expected to gain a respectable place in mental health training [10,11].

The terms positive and well-being technologies refer to the digital technologies used to initiate positive behavioral changes and mental and emotional health. A digital tool can be characterized as positive technology or well-being technology in cases where its development and application have the explicit goal of fostering human flourishing by promoting positive emotions, resilience, and overall happiness. In addition, positive technologies aim to help trainees develop skills for enhancing well-being. Mobile applications, virtual reality therapies, positive gaming technologies, wearable technologies and biofeedback, chatbots, as well as educational technologies inspired by positive psychology are common examples of promising, yet underexplored, positive technologies [10–14]. Smart positive technologies refer to smart or intelligent systems that are designed to promote well-being. Smart positive technologies are designed to detect signals of well-being, assess collected data, suggest and deliver personalized well-being strategies, track users' responses, and evaluate the effectiveness of interventions. Common examples of smart positive technologies are the following: mobiles that make use of AI and machine learning for creating personalized well-being interventions; intelligent agents that utilize natural language processing and machine learning to engage users in meaningful conversations; personalized feedback

systems based on AI; smart wearables for well-being; virtual reality systems supported by AI [10–14].

The term meta-skills is an umbrella term that conveys a set of trainable consciousness-raising skills that allow individuals to voluntarily get into a state of optimal functioning and performance. Meta-skills incorporate a wide range of meta-cognitive, meta-emotional, and self-motivational skills necessary for being self-motivated, self-regulated, and adaptive in challenging situations [15,16]. Meta-skills are the skills that enable one to be aware of, consciously monitor, and control cognitive and psychophysiological mechanisms to achieve the optimal balance between internal resources and external demands [17]. Meta-skills include the meta-ability to be open and accept change with a positive attitude [18]. Individuals whose meta-skills are systematically trained, develop this kind of perception that allows them to perceive weaknesses as opportunities for personal growth. Apart from increased self-awareness, individuals are equipped with a wide range of strategies that can be flexibly applied to turn weaknesses into strengths [19]. Emotional intelligence meta-skills include the accurate perception and effective management of emotions, either of oneself or others [20]. Social-based meta-skills are those skills that allow positive communication, collaboration, and social interaction, accompanied by increased conflict resolution skills [21]. Motivation-based meta-skills enable individuals to be self-determined in making choices because of the joy of doing something [22]. Meta-skills are acknowledged as significant predictors of well-being and positive functioning [21–23].

A growing body of research provides evidence that positive psychology interventions have the significant potential to be applied in a wide range of fields, including clinical psychology, educational psychology, counseling, and psychotherapy [24]. A significant number of studies have already demonstrated the effectiveness of positive psychology practices in non-clinical populations, as a means to accelerate well-being along with intelligence, academic performance, employability, and personal well-being [25].

However, according to new policies, more emphasis should be given to the research examining the interventions promoting the psychological well-being of people with special needs and disabilities [26]. The rapid development of emerging technologies in the field of positive psychology is another important, yet underexplored, topic especially when these digital interventions are designed for populations with special needs [13]. As mentioned, human well-being relies on a set of meta-skills that allow humans to develop self-regulated and adaptive behaviors [17].

Although a significant number of studies have already provided evidence about the beneficial effects of positive psychology interventions in various aspects of health, the effectiveness of such interventions in the crucial domain of meta-skills development remains underexplored [7–9,18,23,25,26]. The same applies as regards the role of digitally assisted positive psychology interventions in the meta-skills training of people with different disorders [10–14,18,24].

The current systematic review poses the following central research questions:

1. Can the implementation of positive psychology strategies train meta-skills in populations with special training needs, such as those with mental and emotional disorders?
2. Can the employment of digital technologies effectively assist the implementation of positive psychology interventions for meta-skills training in those sensitive populations?

In addition, we will shed light on the main meta-skills trained after the implementation of positive psychology interventions with and without the assistance of well-being technologies. We will also discuss the challenges as well as the opportunities for various types of positive technology interventions used in the selected studies.

In this study, we hypothesize that:

1. The employment of positive psychology strategies will effectively train metacognition, emotional intelligence, and motivational meta-skills among people with mental, emotional, and related psychological problems.
2. In addition, it is hypothesized that the synergy of digital technologies with positive psychology techniques will serve the meta-skills training objective.

Thus, the objective of the present systematic review is to investigate whether positive psychology techniques with the synergy of well-being technologies can assist the training of people with special needs and disabilities.

The study begins with a theoretical section that analyzes the meta-skills framework along with the potential of positive psychology to support the training of cognitive, emotional, social, and behavioral meta-skills. In addition, the potential benefits of digital technologies to assist the effective implementation of positive psychology strategies for meta-skills training are also explored. In the following sections, the results of the selected studies are analyzed through the lens of the study's objectives. Finally, we discuss the opportunities and the risks derived from the use of innovative technologies.

2. Materials and Methods

2.1. Study Design

From August 2023 to December 2023, three researchers carried out a systematic research effort using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, which provides the guidelines for the processes of identification, selection, assessment, and synthesis of the studies in a systematic review. The PRISMA 2020 checklist (available in the Supplementary Materials) was utilized to monitor that the methodological steps were followed [27]. The systematic review protocol was registered with the Open Science Framework (osf.io/vjucz, accessed on 5 February 2024) [28].

2.2. Eligibility Criteria

The current review mainly focused on experimental studies, with a special focus on randomized controlled trials. Quasi-experimental studies were also included, provided that they met the objectives and the quality criteria. Secondary sources, including narrative reviews, systematic reviews, and meta-analyses, were excluded in our attempt to be consistent with the data extraction process and avoid the scope of the study becoming vast. In addition, the number of primary resources could be capable of providing sufficient data as regards the objectives of the paper. However, we tried to make use of the knowledge provided by relevant resources, including systematic reviews. Protocols and design frameworks that did not assess the feasibility of the suggested interventions were not included.

This review focused on studies that recruited populations with clinical conditions, including neurodevelopmental disorders and mental, affective, and behavioral disorders. In addition, people with learning disabilities were also included. Less emphasis was placed on populations with chronic conditions such as diabetes, stroke, and heart disease. We included such studies in cases where patients suffered from psychological symptoms (i.e., elevated anxiety and depression). We also prioritized studies that focused on children and young people, since childhood and adolescence are recognized as the most crucial developmental periods when it comes to the construction and adaptability of self-beliefs. However, studies with adults and older people were also included.

We selected studies that utilized positive psychology strategies as the main intervention. In addition, we included studies that employed digital technologies as a tool for applying positive psychology techniques with the main aim of improving well-being meta-skills among clinical populations. In Table 1, the inclusion and exclusion criteria are summarized.

2.3. Information Sources

Four academic search engines were utilized to search for relevant studies. Web of Science, Scopus, Pubmed, and Scholar Google are among the largest databases that are recommended for systematic reviews. They provide peer-reviewed papers of high quality. Their interfaces are easy to use, and they offer advanced search opportunities. In addition, these databases include studies from the most needed disciplines for the current review, such as positive psychology, computer sciences, and well-being technologies.

Table 1. The eligibility criteria according to which studies were identified.

Inclusion	Exclusion
(a) Experimental studies (i.e., Randomized Controlled Trials). (b) Published after 2013 (c) Positive psychology interventions with or without the assistance of positive technologies (d) Studies evaluated aspects of meta-cognition, emotional intelligence, and motivation (e) Participants with clinical symptoms	(a) Systematic reviews, meta-analyses, and book chapters (b) Protocols or design frameworks (c) Design frameworks without testing (d) Non-clinical populations

2.4. Search Strategy

This research was focused on papers published in the last 10 years, from 2013 until 2023. The authors attempted to break down the topic and the main research questions into broad concepts, which led us to the main keywords used in academic databases. We tried to consult database thesauri to collect relevant keywords. Web of Science, Google Scholar, and Scopus do not employ a thesaurus or regulated vocabulary. Pubmed employs MeSH (Medical Subject Headings), which is the National Library of Medicine's controlled vocabulary thesaurus. Our search strategy included terms related to positive psychology techniques such as strength-based techniques, positive mental imagery, positive affirmations, gratitude, kindness, savoring, kindness, forgiveness, mindfulness, empathy, and compassion, positive cognitive behavioral therapy, laughter therapy, optimistic interventions, and self-determination interventions.

In addition, the search also included keywords related to internet-based programs, digital technologies, and positive smart technologies including artificial intelligence such as AI relational agents, ChatGPT, smart mobile applications, and immersive technologies (i.e., mixed reality, augmented reality, and virtual reality).

To answer the question about the meta-skills trained after positive psychology interventions, we narrowed our search using keywords related to metacognition, emotional intelligence, and self-motivation, including attention regulation, self-regulation, emotional regulation, adaptivity, emotional awareness, self-awareness, social awareness, positive thinking, and stress management.

The selected databases allowed us to integrate the central searching keywords with the use of boolean operators. Thus, it was easier for us to receive more relevant papers. Furthermore, the database search limit significantly helped us narrow our research to meet our objectives. In addition, a hand-written terminology list was kept, which included the words and combinations of words that had already been searched, as well as any new keywords noticed in search results that the authors wanted to try in their searches later. Table 2 presents the general search strategy followed.

2.5. Selection Processes

The first step was to specify the eligibility criteria. Afterward, an advanced search was done using the databases' filters and boolean operators. Immediately after the selection of the candidate studies, we started further processing. At the abstract/title screening stage, priority was given to studies that included the predefined terms in the title as well as in the abstract. Afterward, deduplicate papers were removed, and references that did not meet the eligibility criteria were excluded. Mendeley Desktop 1.19.8 software was utilized to remove the duplicate references.

Table 2. The central search terms utilized in the academic search engines.

The Central Searching Terms in Search Strings
"Positive psychology interventions" OR "gratitude intervention" OR "positive mental imagery" OR "strengths-based intervention" OR "savoring" OR "resilience" OR "empathy" OR "compassion" OR "positive affirmations" OR "mindfulness" OR "growth mindset" OR "laughter therapy" OR "optimistic intervention" OR "forgiveness" OR "self-determination"
AND
"online" OR "digital" OR "artificial intelligence" OR "chatbot" OR "wearables" OR "intelligent assistants" OR "immersive technologies" OR "virtual reality" OR "augmented reality" OR "digital serious games" OR "smart mobile applications" OR "brain-computer interfaces" OR "metaverse" OR "chatGPT" OR "neurofeedback" OR "biofeedback"
AND
"positive thinking" OR "emotional regulation" OR "self-regulation" OR "self-awareness" OR "emotional awareness" OR "social awareness" OR "emotional recognition" OR "impulse control" OR "attentional regulation" OR "adaptability" OR "stress management"

The remaining studies were further processed in the full-text screening stage. At this stage, the full-text documents were retrieved, and an in-depth evaluation of the content followed. The evaluation was also based on additional criteria, such as the methodological steps used in each study. Two reviewers independently identified the eligible studies. The reviewers were asked to make the following decisions: accepted, rejected, or unsure. In case the reviewers were unsure or disagreed, a discussion followed with the contribution of the third reviewer. After the assessment of the studies, the reviewers collected the essential information and classified the data in tables. A synthesis of the results followed. The synthesis was qualitative, providing a critical summary, analysis, and assessment of the body of evidence included in this review.

2.6. Data Collection

Data from each chosen paper was collected by two independent reviewers. The most essential data included the authors' information, the country where the study was conducted, the participants' characteristics (i.e., number of participants, gender, health condition, and mean age), the type of positive psychology technique, the design of the experiment, the type of positive technology strategy, the duration of intervention, the measurements, and the main outcomes as regards meta-skills training. The data extracted from each paper are presented in tables (see Tables A1 and A2 in the Appendix A).

2.7. Risk of Bias Assessment

As regards the randomized controlled trials, the Cochrane Collaboration's Risk of Bias Version 2 tool (ROB-2) was utilized for the identification of possible bias. RoB-2 is structured on five bias domains. Specifically, it seeks to identify bias in the randomization processes, deviations from the planned intervention, and bias because of missing outcome data. The fourth domain includes bias in the measurement of the outcome, and the fifth domain of bias concerns the selection of the reported results. The evaluators could decide whether there was a low, moderate, or high risk of bias [29].

The non-randomized experimental studies were evaluated with the Risk of Bias for Non-randomized Studies of Interventions tool (ROBINS-I), which is structured on seven domains of bias: confounding, selection of participants, intervention, divergence from planned intervention, missing data, measurement of outcomes, and selection of the reported results. The risk of bias judgments was the following: "low risk", "moderate risk", "serious risk" and "critical risk" of bias [30].

Each paper was independently evaluated by two authors, and conflicts were resolved with the support of the third reviewer.

2.8. Study Selection

The application of inclusion and exclusion criteria resulted in the identification of 1205 documents as eligible. 289 papers appeared more than once and, thus, they were eliminated. The titles and abstracts of the 916 remaining papers were assessed in the next stage. After this initial evaluation process, a total of 518 studies were removed. Afterward, the full-text PDFs were retrieved. However, it was not feasible for a total of 43 to be retrieved. The remaining 355 studies were further processed in the full-text screening stage. A total of 306 papers were not included because of methodological concerns (i.e., no relevant study design) or deviations from the predefined inclusion requirements.

After an in-depth screening, a total of 49 studies were selected. The papers were classified into two categories. The first included 18 studies investigating conventional positive psychology interventions for meta-skills training among people with various disabilities. The remaining 31 studies examined digitally-aided positive psychology interventions for meta-skills training among people with disabilities. The screening operations through the different phases of the systematic review are presented in Figure 1.

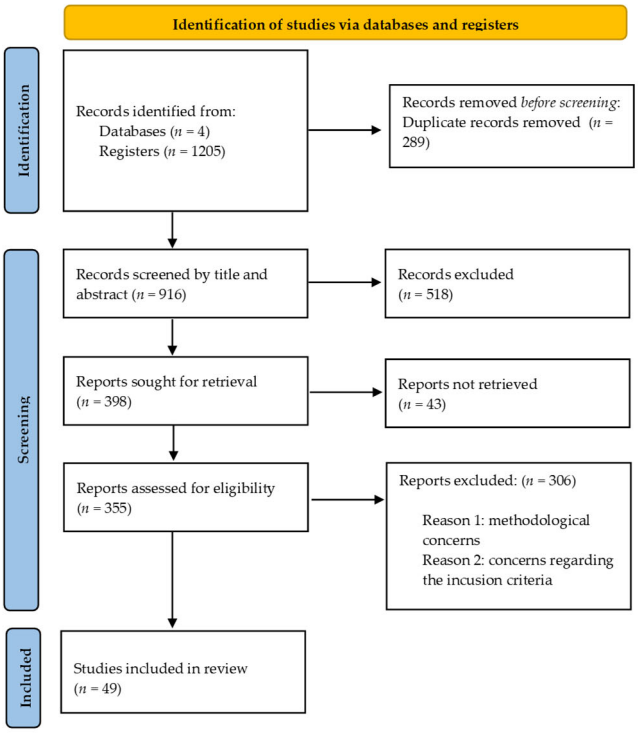

Figure 1. The PRISMA flow diagram.

2.9. Study Characteristics

In the 49 chosen studies, a total of 3109 subjects participated in positive psychology interventions with the assistance of digital technologies (n = 1843) or in conventional positive psychology interventions (n = 1266). As regards the gender of the participants, 1582 subjects were female, 1365 were male, 4 participants reported being non-binary, and the remaining 158 subjects were not determined (due to anonymity). Most participants were adults. Specifically, 10 studies focused on children (5–12 years old), 9 studies on teenagers (10–13 years old), 20 studies on adults (20–39 years old), 5 studies on middle-aged adults (40–59 years old), and 3 studies on seniors (over sixties). Two studies employed participants of different ages. The duration of the interventions was between a single session and 16 weeks. Twenty-nine studies were randomized controlled trials, while the remaining twenty studies were non-randomized experimental studies.

The selected studies were conducted in the USA (n = 13), Netherlands (n = 5), Australia (n = 4), Iran (n = 4), Canada (n = 3), UK (n = 3), Spain (n = 2), Germany (n = 2), China (n = 2),

Korea (n = 2), Italy (n = 1), Finland (n = 1), Portugal (n = 1), Israel (n = 1), Norway (n = 1), Greece (n = 1), Sweden (n = 1), Brazil (n = 1), and Romania (n = 1).

As mentioned in the methodology section, this study focused on studies conducted in the last ten years, from 2013 until 2023. It is noteworthy that the years 2020 and 2021 were the most productive, especially for digital-aided interventions. It can be assumed that COVID-19 significantly increased the need for digitally aided positive psychology interventions, probably due to the increased anxiety and isolation.

The selected studies revealed that positive psychology strategies with or without the assistance of positive technologies can be effectively applied in a wide range of clinical conditions, such as neurodevelopmental disorders (i.e., ADHD, ASD), intellectual disabilities, mood disorders (i.e., depression, bipolar disorder), anxiety disorders (i.e., post-traumatic stress disorder, generalized anxiety disorder, phobias, obsessive-compulsive disorder, panic disorder), other psychiatric disorders (i.e, psychosis) as well as learning difficulties (i.e, dyslexia).

2.10. Quality of Selected Studies

The evaluation of the 49 chosen studies indicated that the quality of the main part of the research was consistent with the quality standards for selecting papers in systematic reviews. Out of a total of 29 randomized controlled trials, 25 had a low risk of bias, 3 studies had a moderate risk, and one paper was characterized as high risk. The concerns mainly referred to the processes of selecting participants and randomization, as well as the choice of reported results. In our evaluation, the size of the sample was another factor that influenced our decisions. As regards the remaining 20 non-randomized studies, the assessment indicated 14 low-risk studies, 4 studies with a moderate risk, and 2 studies with a serious risk.

3. Background Knowledge

3.1. Motivations, Metacognition, and Emotional Intelligence: The Meta-Skills Axes for Self-Conscious, Self-Controlled and Positive Minds

Metacognition meta-skills refer to a set of consciousness-raising skills, that allow one to intentionally observe, regulate, and adapt cognitive and emotional operations, discern functional from dysfunctional states of mind, and consciously self-induce those positive states that awaken the positive aspects of self (Figure 2). Metacognition meta-skills enable individuals to accept changes with an open and positive attitude, directing attention to goals rather than obstacles. Metacognitive training encourages individuals to identify both their strengths and weaknesses and to intentionally apply strategies that compensate for their weaknesses [19]. Metacognition strategies also aim to balance psychophysiological operations as a means of achieving relaxation, serenity, and happiness [17].

Figure 2 presents the main metacognition meta-skills required for mental and affective well-being. Metacognition raises an individual's awareness of both the internal and external environment, thus allowing the effective regulation of various cognitive functions known for their regulatory role including attentional control, inhibition control, emotional control, and behavioral control. Self-awareness and self-control operations rely on the balanced functioning of a set of mental meta-operations [17,19]. More specifically, this set of meta-processes includes the individual's meta-ability to (a) make meta-representations by reflecting on and thinking in a more abstract and introspective manner, (b) apply real-time conscious self-monitoring, (c) objectively evaluate personal strengths and weaknesses taking into account the internal resources and the external demands required in a task or a situation, (d) adjust in changing circumstances to achieve personal goals, (e) perceive and identify mental states, beliefs, and intentions of both others and himself or herself, (f) think critically by filtering information, (g) accept thoughts and feelings either positive or negative, letting go of past mistakes, expectations, or relationships that are detrimental to well-being, (h) transfer and apply strategically past experiences, knowledge and skills to new situations [15,17–19].

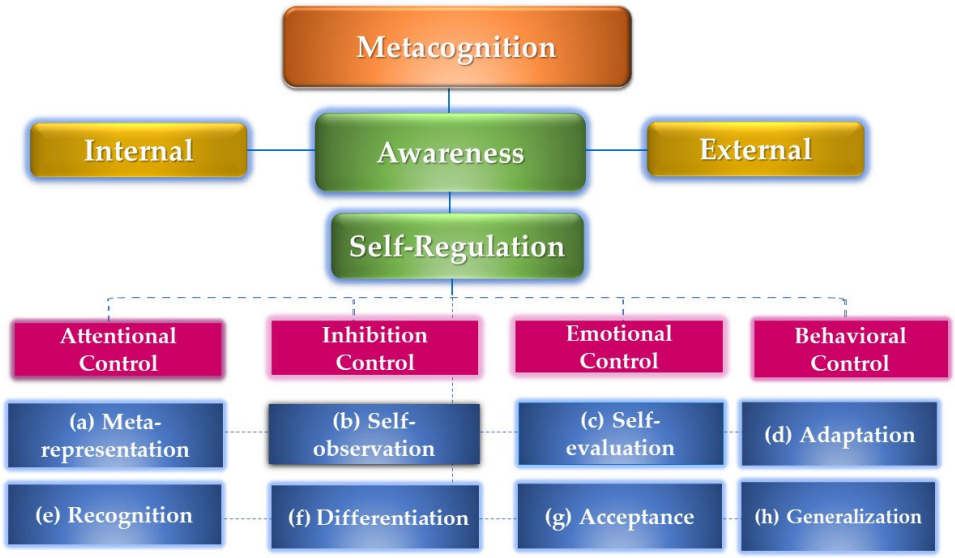

Figure 2. The main metacognition meta-skills for mental and affective well-being.

Emotional intelligence meta-skills (Figure 3) allow the objective perception, evaluation, and expression of emotion, both in oneself and others. Emotional meta-skills allow one to regulate emotions, both in oneself and others. Emotional intelligence meta-skills allow individuals to deliberately employ positive feelings as a means to increase intrinsic motivation, thus achieving an optimal psychological balance [31–33].

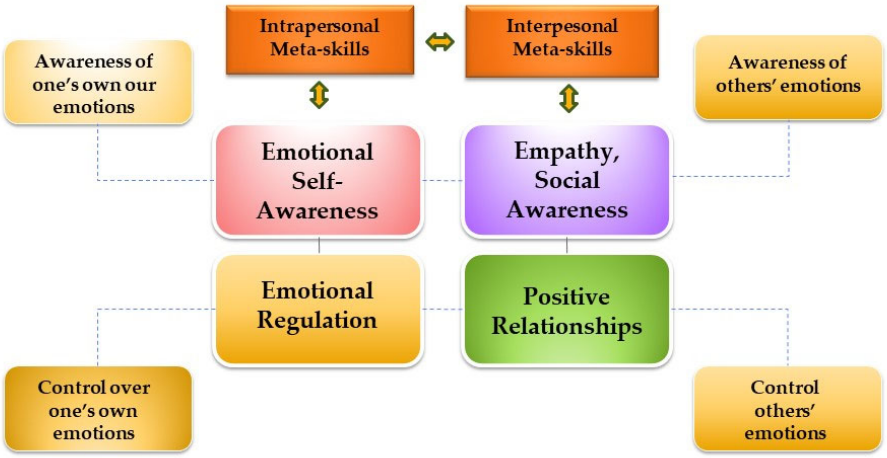

Figure 3. The emotional meta-skills required for positive minds.

Figure 3 presents the emotional meta-skills that are closely related to emotional health. These meta-skills concern both the relationship with the self (intrapersonal) and with others (interpersonal) [15,17,19]. In the domain of emotions, the individual should be able to raise awareness and increase control over emotions [18]. More specifically, one should be able to be aware of his or her own emotions as well as others' emotions. In addition, the individual should be trained to control both his or her own emotions as well as others' emotions [25]. Awareness and control over emotions can allow the individual to cultivate the emotional and social meta-skills required for being resilient with functional relationships [25,31–33].

Positive motivations implicitly or explicitly have the potential to alter humans perception, directing them to make effective decisions and urging them to externalize self-regulated behaviors [34]. Motivations have a major impact on mental and emotional states, determining to a significant extent the individuals' readiness to respond to new challenges [34]. Highly motivated individuals are more likely to be open to change, flex-

ible in modifying dysfunctional thinking patterns and behaviors, persistent, and self-determined [35,36]. Intrinsic motivations increase humans' inherent desire to cultivate personal strengths, satisfy self-needs (i.e., belongingness), and seek personal growth [22].

Thus, metacognition, emotional intelligence, and motivations are considered essential foundations of meta-skills development, which in turn may guarantee human optimal functioning and well-being (Figure 4). Figure 4 shows the building blocks of meta-skills development, namely meta-cognition, emotional intelligence, and motivations, which constitute the core axes for cultivating conscious and positive minds. Metacognition, motivations, and emotional intelligence are not three independent forces. On the contrary, they work in conjunction. For instance, the internalization of motivations encourages people to raise self-awareness, be self-controlled and positive in challenging situations [17,25,31–35].

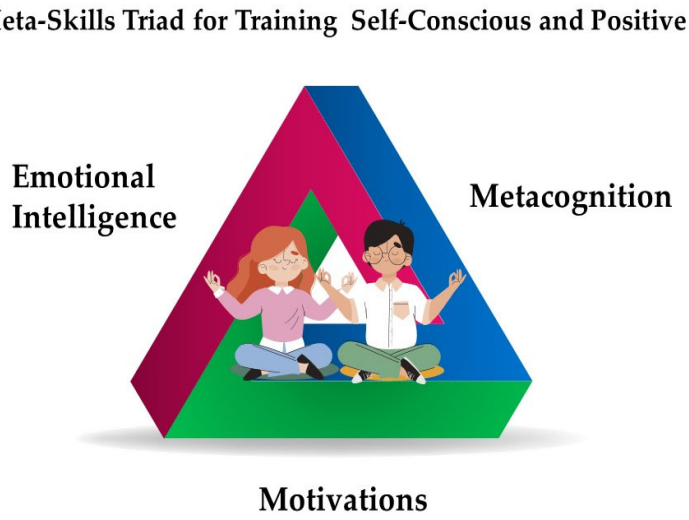

Figure 4. Meta-cognition, emotional intelligence, and motivations constitute the core axes of meta-skills required for conscious and positive minds.

3.2. Positive Psychology Strategies for Meta-Skills Training

Strengths-focused techniques aim to help subjects identify and leverage existing personal strengths and capabilities rather than solely address challenges. Trainees are encouraged to set realistic goals that correspond to their strengths, increasing the likelihood of goal achievement. Recent studies confirm that the implementation of strength-based techniques can be feasible in clinical settings [37].

Gratitude techniques cultivate a cognitive-affective state that emerges in social interactions when a person recognizes that he or she received a valuable benefit from another person because of his or her good intentions. In clinical practice, gratitude practices can be a catalytic healing force. Gratitude techniques help subjects experience higher levels of positive thoughts and feelings (i.e., joy, enthusiasm, love, and happiness), allowing them to inhibit destructive impulses [38].

Savoring techniques intend to encourage subjects to consciously and voluntarily direct their attention on the present moment positive aspects of life, reflect upon and appreciate every small part of sensory, mental, emotional, and social experiences. Savoring techniques motivate subjects to be open, focus on positive expectations, and be in a state of positive alertness [39].

Mindfulness techniques mainly train subjects to intentionally direct their attention to the present moment with openness and discernability, and self-induce a mental state of relaxed awareness, utilizing mindful attention as the main force of effortless self-regulation [40]. Recent studies indicate that mindfulness interventions that integrate positive psychology elements have a significant potential to increase positive cognitions, positive feelings, positive behaviors, and positive social interactions [25].

Neuro-linguistic programming techniques focus on the retraining of the subconscious operations that are closely linked with values, self-beliefs, habits, implicit bias, and implicit memories, which determine to a significant extent individuals' conscious thoughts and decisions. Neuro-linguistic programming employs a wide range of strategies that allow trainees to engage in positive states of mind that promote behavioral change. NLP strategies recognize the importance of using positive language, the transformative role of mental imagery training, and the catalytic role of reframing situations and problems [41].

Positive self-affirmation techniques refer to the act of accepting one's worth and value. Positive affirmations encourage individuals to sustain a positive but realistic view of themselves. Affirmations can cultivate positive cognitions, which in turn allow subjects to be more motivated to focus on goals [42].

Self-hypnosis techniques allow individuals to intentionally induce a state of trance (a relaxed and more positive state of mind) to less effortfully deal with deep-rooted beliefs and learned weaknesses. Thus, hypnosis techniques (i.e., positive post-hypnotic suggestions) provide trainees with the advantage of being aware of and controlling the deeper causes of negativity that are often hidden in subconsciousness [43].

Positive role models and role-playing techniques allow trainees to change perspectives and adopt new and more positive behaviors. Trainees learn to interact and adapt their actions to suit the characters and scenarios they encounter [41].

Humor and laughter techniques profoundly influence psychophysiological processes. Laughter enhances learning and creativity by increasing internal motivation. Humor therapy encourages the development of positive relationships, the initiation of social interchanges, and positive communication, reducing the risk of conflict. Laughter techniques boost the creation of positive emotional and social connections, lowering defenses and establishing rapport, thus allowing individuals to be more focused and active listeners [44]. As shown in Figure 5, positive psychology includes a wide range of strategies.

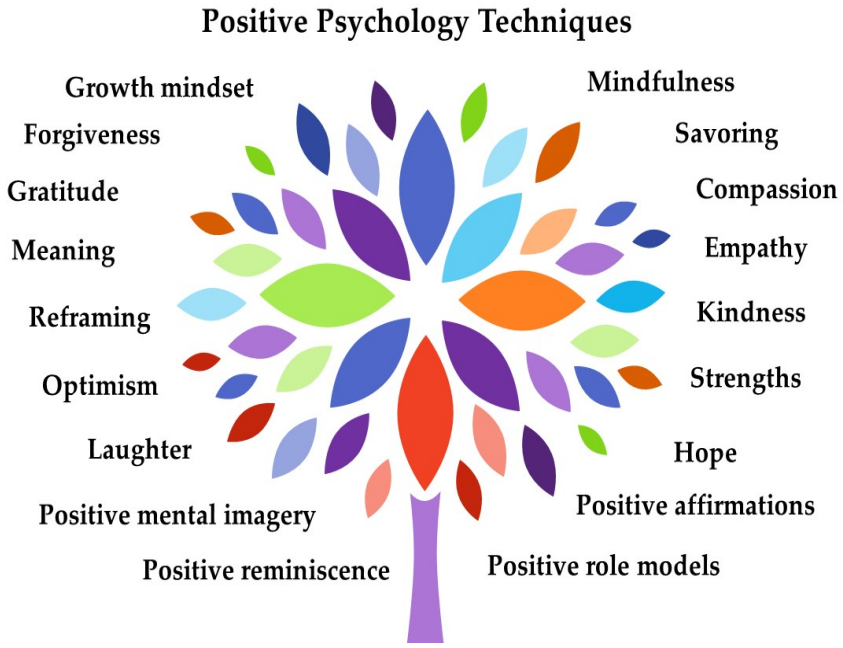

Figure 5. The main training elements in positive psychology interventions.

3.3. The Potential Benefits of Smart Technologies in Positive Psychology Interventions for Training Meta-Skills

3.3.1. Artificial Intelligence-Based Positive Technologies

Artificial intelligence in the following years will be ready to take a leading role in psychological health interventions. Researchers agree that AI, with continuing improvements, will be an integral part of digitally assisted positive psychology interventions,

providing tools for both measuring well-being and designing more personalized intervention programs for the enhancement of resilience and well-being among populations with different needs and characteristics [11]. The employment of the Internet of Things (IoT), wearable technologies, and smart mobile devices boosts the development of intelligent positive technologies capable of offering ubiquitous services to populations with clinical and non-clinical conditions [11].

AI-based tools, with the support of machine learning algorithms, are capable of assessing users' states of mind, suggesting personalized interventions, monitoring users' progress, and rendering them with real-time feedback. AI-powered apps can identify patterns in behavior and adjust accordingly to intervention programs. Based on users' personal preferences and interests, AI-based apps can appropriately trigger users' motivation to maintain efforts toward the intervention's goals. AI-based training programs allow distance training and protect the anonymity of patients who either live in peripheral regions or are afraid of stigmatization [45].

AI-powered platforms that employ AI assistants provide users with assessments of their current state of well-being. In addition, AI-powered positive technologies engage users with relevant knowledge about the importance of well-being and positive thinking in various domains of human life, encouraging users to set positive and realistic training goals and suggesting positive psychology strategies that fit with their psychological needs in real time.

Among the most well-known AI-powered tools are chatbots, also known as conversational agents. It is about human-machine interactive interfaces that host a meaningful text- or speech-based dialogue between a computer program and a human user [46]. AI-powered conversational agents can take on various roles, such as the role of a coach, teaching users skills and strategies, and offering guidance, support, and feedback. Using conversations, chatbots encourage users to express themselves, reveal hidden thoughts, and emotions, and engage in meaningful interaction [47]. ChatGPT is a sophisticated language model that uses deep learning methods to generate replies to natural language inputs that resemble those of a human [48].

3.3.2. Neuro/Bio-Feedback-Assisted Positive Technologies

Wearables refer to electronic devices with wireless communications features that may be worn as clothes, accessories, or take more intrusive forms such as smart tattoos or microchips. These devices are equipped with sensors, processors, and communication capabilities that enable users to gather and exchange healthcare data with connected devices or networks. Among the most common wearable technologies, we can mention smartwatches, fitness trackers, smart glasses, smart clothing, health trackers, and VR headsets [49]. There is a wide range of sensors that are commonly utilized to assist mental health interventions (i.e., heart rate monitors, EEG sensors, galvanic skin response sensors, motion sensors, and facial recognition sensors) [11,49].

Wearable technologies with the employment of sensors (i.e., heart rate monitors and EEG sensors) have a significant potential to assist positive psychology interventions by monitoring the physiological activity that indicates whether the user is in a relaxed, anxious, hyperactive, or distractive state (i.e., measuring heart rate variability, respiration rate and body temperature) and providing users with relevant and simplified visualizations of the collected health [11]. By providing feedback, sensors help users to be motivated, to reflect on their present state of being, and to make appropriate decisions and actions for regulating psychophysiological disturbances that influence cognition, mood, and behavior data [49]. In addition, wearables such as smartwatches can be used to consolidate positive thinking and functional behaving patterns, especially in populations that tend to exhibit dysfunctional thinking and behaving patterns such as neurodevelopmental disorders [50,51].

Biofeedback can be defined as a therapeutic technique that employs electronic monitoring tools to provide users with real-time feedback regarding the physiological processes that take place within their bodies. The main aim of biofeedback is to train individuals to gain

voluntary control over their physiological functions, which in turn influence their mental and emotional health. Electromyography, electrodermal activity, electroencephalography, and heart rate variability are considered common types of biofeedback [52,53]. Biofeedback technologies are considered promising tools for positive psychology interventions because they have the potential to harness the mind-body connection, allowing users to improve disease conditions and even reach optimal health. Biofeedback technologies track users' physiological state and, then, provide them with relevant feedback. The input provided by biofeedback technologies can help users be aware, regulate, and adapt physiological operations that are responsible for mental and physical well-being. For instance, with the use of the data provided as well as the employment of positive psychology techniques (i.e., resilience, breathing, and mindfulness techniques), they can consciously reduce heart rate, respiration rate, and body temperature, resulting in an immediate improvement in mental and affective health [52,53].

Brain–computer interfaces (BCIs) refer to specialized systems that enable users to interact with digital applications with the power of their brain waves. With the arrival of consumer-grade electroencephalography (EEG) equipment, brain-controlled systems began to find fertile ground in intervention programs focused on training meta-skills that result in mental and affective well-being [54]. Non-invasive neurofeedback technologies, such as smart brain headbands, measure users' brainwaves via sensors, gather data, and provide visual feedback via smart mobile devices or virtual reality headsets. The visual feedback makes it easier for users to perceive their current mental and emotional state, motivating them to be involved in the training procedures. The collected data is also employed to encourage users to implement strategies within the digital environment for psychophysiological balance [55]. At the same time, users are encouraged to develop a wide range of meta-skills that promote positive changes, such as self-observation, regulation, and adaptation of thoughts and emotions. Users gradually develop the ability to employ feedback to self-induce and maintain the desired state of mind [40,56]. Recent studies provide promising evidence about the use of neurofeedback-aided positive psychology interventions for promoting human flourishing [57].

3.3.3. Virtual Reality, Augmented Reality, and Metaverse-Assisted Positive Technologies

Virtual reality and augmented reality are recognized as two technologies with significant potential to initiate positive behavioral changes in human beings since they can modify and reorganize perceptual operations through the intense sense of presence and emotional engagement that users experience within the digital environment [14]. The sense of being present and fully engaged fosters two fundamental meta-cognitive operations that take place and those are self-observation and self-reflection [14]. Subjects within VR environments are not just observers but, most importantly, active participants in scenarios designed to restructure deep-rooted, and often unhelpful, beliefs derived from past experiences. Users are gradually directed to more positive behaviors through the process of trial and error [14]. Behavioral change in VR and AR comes naturally as the distance between self and reality narrows, making internal conflicts a more manageable task [13,14]. VR and AR technologies allow users to detach from stressful events and memories and redirect the focus of attention to more positive aspects of "here and now" reality. The use of calming, positive, and vivid visual and auditory cues can significantly serve the aforementioned objective [40,58]. According to Yadev et al. [59], immersive technologies provide the ideal environments for inducing positive emotions and recalling positive memories. Researchers have already discovered that VR can generate feelings with great transformative potential such as the feeling of awe [60]. Immersive technologies allow users to perceive alternative realities, adopt different roles, and, thus, more easily change perspective. Within VR, subjects can interact with virtual characters that play different roles (i.e., teacher, mentor, advisor, friend). In addition, these virtual characters can be positive role models that promote the imitation of positive behaviors. Role-playing in VR can help subjects deal with biased cognitions, take others' perspectives, and comprehend both their own and

others' states of mind [61]. Finally, VR can enhance intervention outcomes by providing measurements such as eye movements and facial expression tracking [59].

Metaverse is defined as an immersive, three-dimensional virtual universe that is networked, socially interactive, and imitates the real world, allowing users to interact with other users and virtual agents through avatars [62]. The metaverse has already been recognized as a promising technology in the fields of psychology and mental health for promoting well-being and personal growth. Immersion, connection, embodiment, stimulation, safety, controlled environments, personalization, and customization are considered among the fundamental features that make the metaverse a promising technology for assisting positive psychology interventions among clinical populations [63]. According to Pizzolante et al. [64], metaverse and related social VR platforms can induce higher emotions, such as awe, and train a wide range of mental and affective health meta-skills.

3.3.4. Digital Game-Based Positive Technologies

Digital games, including serious games, are closely related to positive psychology principles since they are designed to foster positive emotional states, fulfillment, and personal growth [65]. Digital games offer enticing training environments replete with entertaining elements, rewards, and pleasant stimuli. Apart from their aesthetic quality, digital games are based on well-established pedagogical and psychological principles [66,67]. Players are exposed to situations and tasks that evoke positive emotions (i.e., excitement) that may compete with negativity and pessimism [68]. Serious games evoke a state of flow and an intense presence, encouraging players to transcend personal boundaries, and allowing the sense of agency to grow along with an increased capacity for mastery and control [67,69]. Players are exposed to adaptive gaming environments within which they learn to recognize and expand their strengths [65,66]. In addition, they are trained to manage gaming challenges with a positive attitude focusing on goals, strategies, and rewards rather than rising obstacles [66]. Most importantly, gamers develop a wide range of strategies that mainly focus on the flexible self-management of mental and emotional operations applied in real-time as the game progresses [67]. In general, games provide the ideal conditions for training self-motivated, self-controlled, and autonomous agents [66]. Apart from intrapersonal meta-skills, digital games can promote players' interpersonal meta-skills (i.e., positive communication and conflict resolution) through engagement, social pleasure, and positive interaction with others [65]. Figure 6 presents the most promising technologies for assisting positive psychology interventions.

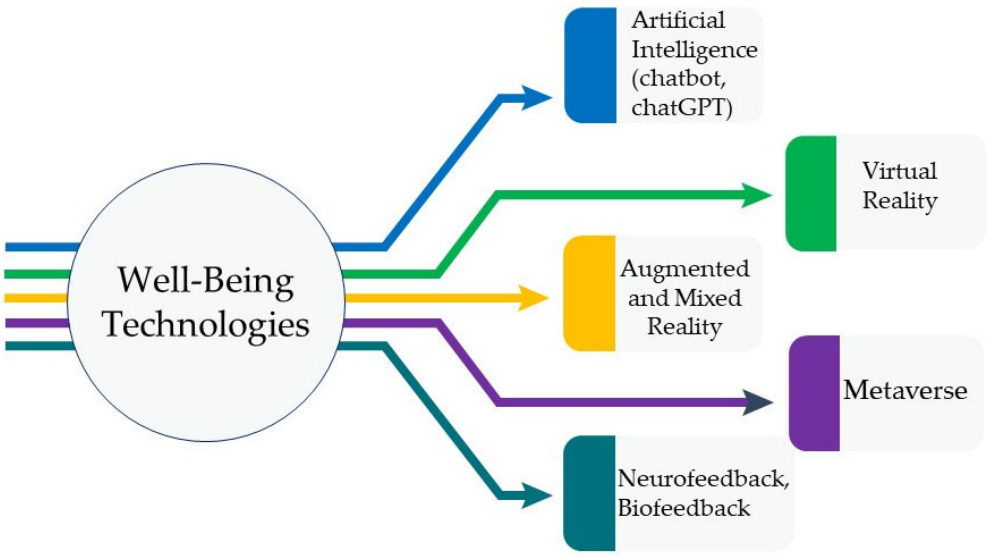

Figure 6. The most promising well-being technologies for positive psychology interventions.

4. Results

4.1. Positive Psychology Techniques for Training Metacognition, Emotional Intelligence, and Motivation Meta-Skills in Clinical Populations

The results from the selected studies indicated that positive psychology techniques can be effectively employed to train metacognition, emotional intelligence, and motivational meta-skills among people with neurodevelopmental disorders. In a randomized control trial, Ahmadi et al. [70] evaluated the impact of a 12-week reminder-focused positive psychiatry intervention among 12 adolescents with ADHD and post-traumatic stress disorder. The participants received training interventions that focused on gratitude, forgiveness, resilience, optimism, self-regulation, personal mastery, and self-efficacy. The results showed that subjects were more able to self-manage ADHD symptoms, and resilience skills increased. In addition, the collected and analyzed biomarkers showed that inflammation decreased.

Senior et al. [71] used a sample of 159 children with ADHD to evaluate a 12-week resilience-builder group intervention program. The program included training techniques that targeted proactive thinking, self-regulation, leadership skills, positive communication, mental flexibility, sportsmanship, and empathy. The results revealed moderate improvements in socio-emotional and behavioral meta-skills, such as adaptation skills.

The impact of a personal strengths intervention on self-determination skills among students with ADHD and learning disabilities was evaluated [72]. The training sessions included the following domains: self-awareness, character strengths, learning strengths, assertive communication, negotiation skills, self-reflection, and generalization. After 8 weeks of training, self-determination skills including autonomy, self-motivation, self-regulation, and self-realization improved [72].

Goal-setting, self-efficacy, and intrinsic motivation improvements were also observed in a strength-based program applied to two children with ADHD and ASD [73]. The children were encouraged to identify their strengths, set goals according to their interests, competencies, and self-efficacy, and finally apply strategies to achieve the selected goals. After 8 weeks of training, children reported being satisfied and more able to set realistic goals and apply strategies.

Positive hypnotic suggestions were found to improve attention regulation skills among people with ADHD. Virta et al. [74] investigated whether hypnotic suggestions could improve attention deficits in a sample of twenty-seven adults with ADHD. Participants in the experimental group received positive hypnotic suggestions. The suggestions encouraged subjects to be positive, attentive, accurate, and quick, to resist impulses and distractive stimuli. The researchers administered a neuropsychological test to measure participants sustained and selective attention before hypnosis, after the hypnotic induction, after hypnotic suggestions, and finally after the end of hypnosis. The results showed that the positive hypnotic suggestions significantly helped subjects to focus attention, be less distractive, and more flexibly resist impulses.

As regards intellectual disabilities, a training program was applied to 42 individuals. The basic training elements included gratitude, character strengths, positive reminiscence therapy, humor, acts of kindness, and positive relationship strengthening. After training, participants experienced a feeling of self-accomplishment and optimism [75].

Positive psychology techniques were found to be effective for people especially children with specific learning difficulties such as dyslexia. A socio-emotional positive psychology program was evaluated in a sample of 20 kids with dyslexia participating in the experimental group. The program aimed to train participants to employ coping and problem-solving strategies, identify and manage emotions, and keep themselves in a resilient state. The program also focused on support-seeking, highlighting the importance of positive relationships. The program combined explicit instruction with positive psychology techniques, including modeling, role-playing, positive self-talk, and reframing. The results revealed that participants improved a wide range of socio-emotional meta-skills [76].

In another study, conducted by Firth et al. [77], an inclusive school-based resilience intervention was applied among children with dyslexia. The program aimed to minimize maladaptive coping strategies (i.e., self-blame, giving up), reduce passivity and avoidance, and help subjects deal with learned helplessness. Students were trained to employ functional coping strategies such as positive thinking, perseverance, and dealing directly with problems. The results showed that participants were more able to understand the connection between thoughts and feelings, to use positive self-talk, to be more self-controlled, and to utilize more effective coping strategies.

Humor-based intervention programs were found to enhance motivation and academic achievements in mathematics when applied to children with learning disabilities. A total of 80 sixth-grade students took part in a humor-based program showing improvements in mood regulation, self-motivation skills, interpersonal skills, and creative thinking skills [78].

A growth mindset intervention was applied to 18 young people (14–16 years old) with learning disabilities for about 10 weeks [79]. The intervention included explicit instruction about the concept of a growth mindset, its relation to neuroplasticity, and the nature of human intelligence. Self-reflection practices encouraged them, for instance, to perceive the difference between learning and performance goals, and to understand the reasons for negative self-talk. The results showed improvements in academic self-concept, resilience, and positive attitude toward disability. However, the positive effects did not remain in the follow-up. Wanzek et al. [80] evaluated a group-based growth mindset program in a total of 360 elementary students with reading difficulties. The results showed improvements in reading meta-skills in terms of comprehension and flexibility.

The selected studies revealed that positive psychology training can be effectively implemented among gifted and talented people to deal with common challenges such as anxiety, obsessions, attention deficits, overexcitability, perfectionism, and social isolation [81]. Armstrong et al. [81] tested a 10-unit positive psychology program among 45 gifted children (6–12 years old). The program included psychoeducation with games and songs, discussion about strengths identification, emotional recognition training, perspective-taking games, drama activities, relaxation techniques, mental imagery training, positive role models, acceptance practices, humor, and dereflection activities. The results showed that children were more able to control intense emotions and perfectionism. In addition, hopeful thinking, and social connectedness improved.

In another study, 280 male gifted underachieving students participated in a growth mindset intervention to improve learning behaviors. The program focused on activities and discussions about neuroplasticity and self-development factors. The participants showed improvements in adaptation, motivation, persistence, and positive attitude [82].

Abbasian et al. [83] tested the efficacy of a flourishing training intervention on the anxiety and depressive symptoms of female gifted students. Twenty-five of a total of fifty students followed a training program focused on the cultivation of positive emotions, resilience, humor, solutions-oriented thinking, hope, spirituality, positive relationships, and perseverance. The experimental group showed significant improvements in self-regulation of anxiety and mood regulation compared with the control group that received no intervention.

Three studies focused on mood disorders. Sabzipour et al. [84] applied a positive self-talk intervention to 17 students with suicidal ideation for a total of 8 sessions. The results showed that positive self-talk helped participants regulate their mood. McCarty et al. [85] utilized a "positive thoughts and action" program in a sample of 58 adolescents. The participants were trained to set goals, think positively, change perspective, control automatic reactions, manage conflicts, and make positive decisions. Personal adjustment, self-esteem, and inhibition control were the main skills improved. Taghvaienia et al. [86] tested a 10-week positive psychology therapy among retired teachers with depression. The experimental group was focused on strengths identification, forgiveness, gratitude, hope, optimism, and social communication. The results indicated improvements in self-regulation compared to the control group, which remained untreated.

A positive psychology intervention focused on expressive writing was found to be an effective strategy for dealing with stigma among people with psychiatric disorders. Tang et al. [87] divided 54 adults into two groups. The experimental group was trained in expressive writing, whereas the control group received conventional psychiatric care. The experimental group showed better improvements in positive thinking, hope, and coping skills compared with the control group.

Figure 7 presents the main meta-skills trained after the implementation of positive psychology strategies. Subjects improved a wide range of metacognition, emotional intelligence, and motivation meta-skills. Participants improved their ability to inhibit impulses and control attention, memories, emotions, and behaviors. Subjects were more able to regulate anxiety and voluntarily induce a state of resilience. In addition, they could more flexibly transform negative to positive self-beliefs, enhancing self-concept, self-esteem, and self-efficacy. Social meta-skills improved too. Participants enhanced their ability to be engaged in social interaction, communicate effectively, and create positive relationships. Subjects were also found to be more motivated. The most significant improvements concerned the subject's ability to think positively and regulate mood [71–82].

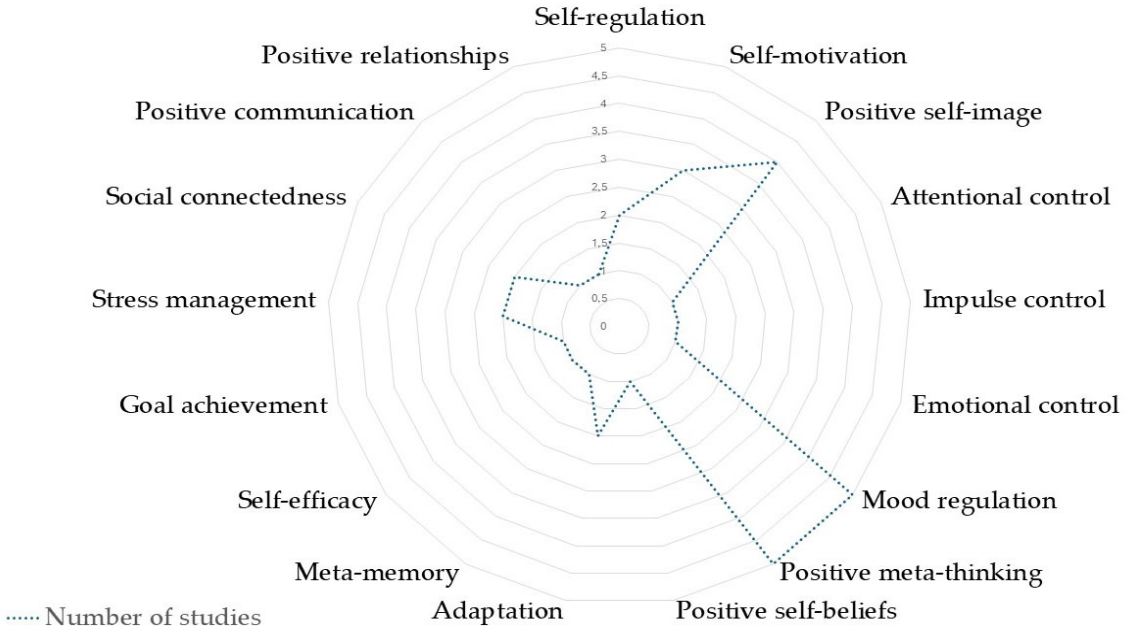

Figure 7. The number of studies that demonstrate the main meta-skills trained after the implementation of positive psychology interventions.

4.2. Well-Being Technologies in Positive Psychology Interventions for Training Meta-Cognition, Emotional Intelligence, and Motivation Meta-Skills in Clinical Populations

The results indicated that AI-powered positive psychology interventions can be effective tools for training meta-skills among people with clinical symptoms. Especially the use of AI chatbots was found to be promising. Jang et al. [88], for instance, evaluated the effectiveness of a conversational agent designed for people with attention deficits. The AI agent utilized dialogue, and empathetic responses to create positive relationships with users, provided them with relevant knowledge, and trained their self-help skills. The chatbot also utilized behavior change techniques, emotional control strategies, and mindfulness. A total of 46 participants with ADHD were randomized either into the chatbot group or the control group that read a book about managing ADHD. After 4 weeks of training, the chatbot group outperformed the control group in attention and emotional regulation skills.

In addition, chatbot-aided positive psychology programs were feasible for people with depression or experiencing elevated stress due to severe illnesses. In a randomized control trial, Greer et al. [89] assessed the effectiveness of a chatbot that was designed to teach and

help users practice positive psychology techniques including gratitude, positive reappraisal, savoring, mindfulness, personal strengths identification, and kindness. Twenty-five adults from a total of 45 participants took part in the experimental group. The results showed that the chatbot-aided intervention group was more able to observe and recognize positive events, self-manage stress, and evaluate situations with a more positive attitude.

Fitzpatrick et al. [90] applied a chatbot-aided positive psychology intervention to people with depression. The chatbot was designed to track mood, deliver positive conversations, help users set positive goals, and provide them with knowledge about cognitive distortions. In addition, the chatbot encouraged users to be involved in positive self-reflection. The intervention was found to significantly help participants to be self-reflective, self-regulated, and self-motivated. Help4Mood was another interactive intelligent system with an embodied virtual agent to assist patients with depression. Help4Mood gathered biometric information and included training elements of positive psychology. Thirteen participants in the experimental group were encouraged to recognize negative cognitions, reframe problems, and try to think of more positive interpretations of life-challenging events. Other techniques, including positive visualizations, relaxation, and grounding techniques supported the intervention. The results showed improved regulation of negative feelings, optimism, self-motivation, reduced worthlessness, and self-criticism [91]

AI chatbots were also effective in addressing catastrophic thinking among people with panic disorder. In a randomized control trial, Oh et al. [92], divided 41 participants into two groups. The experimental group (n = 21) utilized a mobile app chatbot designed to deliver cognitive behavioral therapy and help users think more positively and critically, whereas the control group read a book about panic disorder. The results indicated that the mobile app-based chatbot was more effective in training emotional control skills. In addition, patients could deal effectively with cognitive distortions and feelings of helplessness.

Artificial intelligence, combined with gaming technologies, was found to be a promising solution for people with mood disorders. A virtual coach was used within a serious gaming platform to build users' self-confidence and boost positive communication skills. The results indicated that such an intervention can help people with emotional dysregulation develop positive social interactions with elevated self-confidence [93].

AI-powered tools and smart mobile applications can effectively put a break to factors that deteriorate human well-being. Loneliness is one of the factors that damage the quality of life, especially among people with psychiatric disorders such as psychosis. Lim et al. [94] aimed to reduce loneliness, boost well-being, and encourage meaningful and positive social interactions among subjects with psychosis with the use of a digital smartphone application. The application assisted subjects (n = 12) to recognize and employ personal strengths as a tool for developing social relationships. The application included a mood tracker, gamified elements, and positive psychology videos. After 6 weeks of training, subjects improved their interpersonal skills. A significant increase was observed in social confidence, social connection, and the feeling of life enjoyment.

Another positive psychology digital intervention for people with bipolar disorder revealed positive but not significant differences. Geerling et al. [95] recruited 40 subjects with bipolar disorder to participate in a 7-week program to improve positive feelings and positive relationships. A smartphone mobile app trained participants in keeping a positive focus, expressing gratitude and savoring, discovering personal strengths, and creating positive relationships. The results revealed positive but not significant improvements in hopeful thinking, self-esteem, emotional self-expression, acceptance, and social connection.

The Virtual Hope Box is a smartphone application designed for people with behavioral disorders and an elevated risk of self-harm. The app provides personalized services and integrates tools for positive thinking, relaxation, coping, and distraction. Bush et al. [96], examining a sample of patients with depression, dysthymia, and post-traumatic disorder found that the app improved users' hope and emotional regulation skills.

Virtual reality was found to be an effective tool for delivering resilience techniques and positive mental imagery training among people with anxiety, mood dysregulation, and

depression, allowing them to develop meta-abilities such as positive future thinking, and perseverance in the face of challenges [97,98]. For instance, Habak et al. [98] investigated a mixed reality positive mental imagery program that immersed 79 patients with depression in spectacular and deeply relaxing landscapes. The results indicated that the VR-based positive visualizations helped subjects increase positive future thinking. Being able to expect a more positive future, subjects could more flexibly inhibit impulses, and self-manage intense emotions.

Except for positive future thinking, VR-aided positive psychology interventions helped subjects recall positive autobiographical memories. This is an important point, especially for people with depression who tend to recall negative memories over positive ones. Fernandez-Alvarez et al. [99] investigated whether VR Google Earth could enhance the retrieval of positive autobiographical memories among people with depression. The participants entered a virtual scenario, and they were guided to recall memories linked to intense positive emotions. Subjects were also asked to imagine the details of the retrieved memories with high precision, as the virtual reality took them to the place they had selected. The results showed that, indeed, VR significantly helped patients with depression improve their control over memory operations focusing on positive rather than negative memories. Being more able to focus on positive autobiographical memories, they were more able to control emotional dysregulation symptoms.

VR-aided positive reminiscence therapy was found to improve cognitive operations, specifically memory skills. In a pilot study, a VR-aided positive reminiscence intervention was delivered to a total of nine subjects with memory deficits. Participants were immersed in an environment that was relevant to positive and, most importantly, meaningful life memories. The results showed that the VR positive reminiscence program helped people with memory deficits to recall positive memories with increased flexibility [100].

VR-based positive mental imagery training combined with reward training was found to reduce anhedonia and increase pleasure and self-motivation skills. In a pilot study, six subjects with depression were exposed to positive scenes in a VR environment. The subjects were immersed in a predominantly positive-valenced environment that was gradually replaced by a neutral environment. The participants were trained to recall the most positive elements even when the VR environment was neutral. The results showed that subjects with mood dysregulation could more easily focus on positive stimuli elevating, thus, positive affect [101].

The results also revealed that virtual reality can be an ideal environment for delivering pleasurable tasks with a significant potential to encourage subjects to exhibit positive behaviors. In a study conducted by Paul et al. [102] people with depression received a VR-enhanced behavioral activation intervention. The results indicated that the intervention helped participants set realistic goals according to their strengths and interests.

Compassion techniques delivered by VR were found to be an effective intervention for dealing with well-established negative beliefs and self-criticism often observed in psychiatric disorders. In a study conducted with a sample of 100 patients with paranoid thoughts, a VR-based compassionate intervention was applied to train compassion for both oneself and others. In the VR-based self-compassion training, a compassionate virtual coach was utilized to support participants, whereas loving-kindness meditation was used to cultivate compassion for others. The results indicated that subjects were more able to experience self-compassion, self-criticism decreased, whereas positive beliefs and compassion for others increased [103]. Significant reductions in self-criticism were revealed in a similar VR self-compassion intervention with the additional use of embodiment as a means to increase training outcomes. Specifically, fifteen subjects with depression practiced either being compassionate for a virtual body or receiving compassion from themselves through another virtual body [104].

People with post-traumatic stress disorder (PTSD) often find it difficult to escape from the negative feelings connected to these traumatic and unforgotten memories. Trying to enhance positive thinking by providing positive cues (i.e., positive images) is not always

an effective solution. Positive psychology also applies strategies to curb the inhibitors of positive thinking. Van Gelderen et al. [105] applied VR-based eye movement desensitization and reprocessing therapy (EMDR) in a design with patients walking on a treadmill while interacting with personal trauma-related images and relaxing music. Eye Movement Desensitization and Reprocessing (EMDR) aimed to distract subjects from painful stimuli, encouraging them to reprocess and reconsolidate memories free of negativity. The results demonstrated that such interventions can effectively help people control the intensity of negative feelings derived from stressful memories.

Positive psychology techniques within serious game design with biofeedback assistance were found to help individuals with emotional dysregulation and intense impulsivity increase their emotional regulation and well-being. In a randomized controlled trial, 104 subjects were divided into an experimental group (n = 40) that received cognitive behavioral therapy (CBT), positive psychology techniques assisted by a serious game, and biofeedback, whereas the remaining subjects received the training program without the assistance of the serious game. The game presented an island. Initially, the landscape was sunny. The player was instructed by a voice to enter and remain relaxed, using breathing as a regulation tool. All of a sudden, rainy clouds appeared, and a storm started. If the players managed to be self-controlled, the storm started to disappear. Otherwise, the storm got stronger. The results demonstrated improvement in players' ability to self-control [106].

VR gaming, combined with biofeedback and mindfulness, was found to increase self-regulation among adolescents with ADHD [107]. Bossenbroek et al. [107] designed and assessed a VR-based serious game that utilized biofeedback among eight adolescents with ADHD. Players had to explore the relaxing underwater virtual environment, using their breathing as a tool to control their movement. The results demonstrated that players were more able to self-manage disruptive behavior and anxiety.

The results also indicated that the employment of positive emotional cues in virtual reality games encouraged subjects with ADHD to control attention, recognize other intentions, and be flexible [108]. Twenty adults with ADHD played a multi-round trust game in VR. Participants were asked to take on the role of investor and interact with four virtual trustees. After that, they were asked to evaluate the fairness of the trustee's behavior according to their emotional facial cues. The results demonstrated that participants had better mindreading skills only when trustees had happy faces [108].

Mobile serious games with a strengths-focused approach were found to be effective in training people with chronic disorders to identify and use their strengths. The app provided surveys, exercises, self-reflection tasks, and positive thinking prompts. Although the reported benefits from use varied, most participants mentioned that they improved self-management and self-mastery skills [109].

Neurofeedback was found to join hands with augmented reality to assist positive psychology interventions for people with mood disorders. A total of forty-one subjects with depression took part in an AR-based positive mental imagery intervention. Participants were divided into two groups: the AR group assisted by neurofeedback and the AR group without neurofeedback. The neurofeedback group was more motivated and self-regulated compared to the non-neurofeedback group [110].

Promising findings were revealed from the use of neurofeedback-assisted interventions among subjects with obsessive-compulsive disorder (OCD). Richter et al. [111] implemented, in a sample of 55 individuals with OCD, a meditation program with the assistance of a consumer-grade EEG-based biofeedback tool. The results indicated that the neurofeedback-assisted mindfulness group increased their ability to inhibit obsessions, impulses, and compulsiveness. Similarly, in a study conducted by Hawley et al. [112], seventy-one patients diagnosed with OCD followed a meditation intervention with a MuseTM device. EEG data, self-reports, as well as OCD measurements, demonstrated improved self-regulation of obsessive behaviors and less mind-wandering.

Positive outcomes were revealed for people with anxiety disorders [113,114]. A four-week neurofeedback-based (non-invasive wearable EEG device connected to a smartphone)

mindfulness program was implemented to increase cognitive control and neural efficiency among people with anxiety. Electrophysiological biomarkers indicated that the experimental group significantly improved attention and executive control compared to the control group that received conventional breathing training [113]. Schuurmans et al. [114] applied a six-week neurofeedback-assisted game-based mindfulness intervention in a total of seventy-seven adolescents with posttraumatic stress disorder, helping them to regulate stress symptoms more.

Wearables were found to effectively assist positive psychology interventions for the development of self-regulation skills. Doan et al. [50] investigated the effectiveness of a smartwatch application whose main aim was to encourage positive goal-setting, self-motivation, self-regulation, and independence among 24 children with ADHD. To assist with emotional regulation skills, the smartwatch application was designed to assess and train different zones of self-regulation. Specifically, the smartphone app, through notifications, asked users to select the zone of self-regulation wherein they identified themselves (i.e., sad, happy, frustrated, out of control). Afterward, the smartwatch app suggested positive psychology strategies that fit with the selected zone. It is noteworthy that caregivers could also run the app to monitor their children's goals and progress in participating in the process of goal setting. The results indicated that such wearable-aided applications can be beneficial for people with ADHD to improve self-awareness, self-regulation, emotional control, and emotional recognition skills.

Finally, it is important to mention various online programs that aim to deliver positive psychology interventions [115–117]. Heckendorf et al. [115] evaluated the efficacy of an online positive psychology program supported by a gratitude application in a sample of 132 patients with depression and anxiety. The participants made daily use of the app along with the online sessions. The participants were also in contact with an e-coach, from whom they received feedback and reminders. After a 5-week intervention, repetitive negative thinking was reduced. Benefits were also observed for adolescents with anxiety after an online solution-focused intervention. The intervention group (n = 38) was encouraged to self-reflect and set goals utilizing positive and solution-oriented language. Grounding techniques aim to distract participants from unwanted memories and negative emotions and encourage them to refocus on the present moment. After two weeks of training, subjects were more able to set positive goals, focus on solutions rather than problems, and be more realistic about their desired goals [116]. Moreover, online growth mindset interventions were found to be beneficial for adolescents with intellectual disabilities in terms of self-esteem, motivation, and perseverance [117].

Figure 8 presents the main meta-skills that were trained after the implementation of digitally assisted positive psychology interventions. Participants improved metacognition skills including positive meta-thinking, self-regulation, self-evaluation, and goal setting. In addition, they improved various social-emotional meta-skills such as emotional control and social connectedness. The most important improvements were observed in positive meta-thinking, mood regulation, stress management, and self-motivation [88–117].

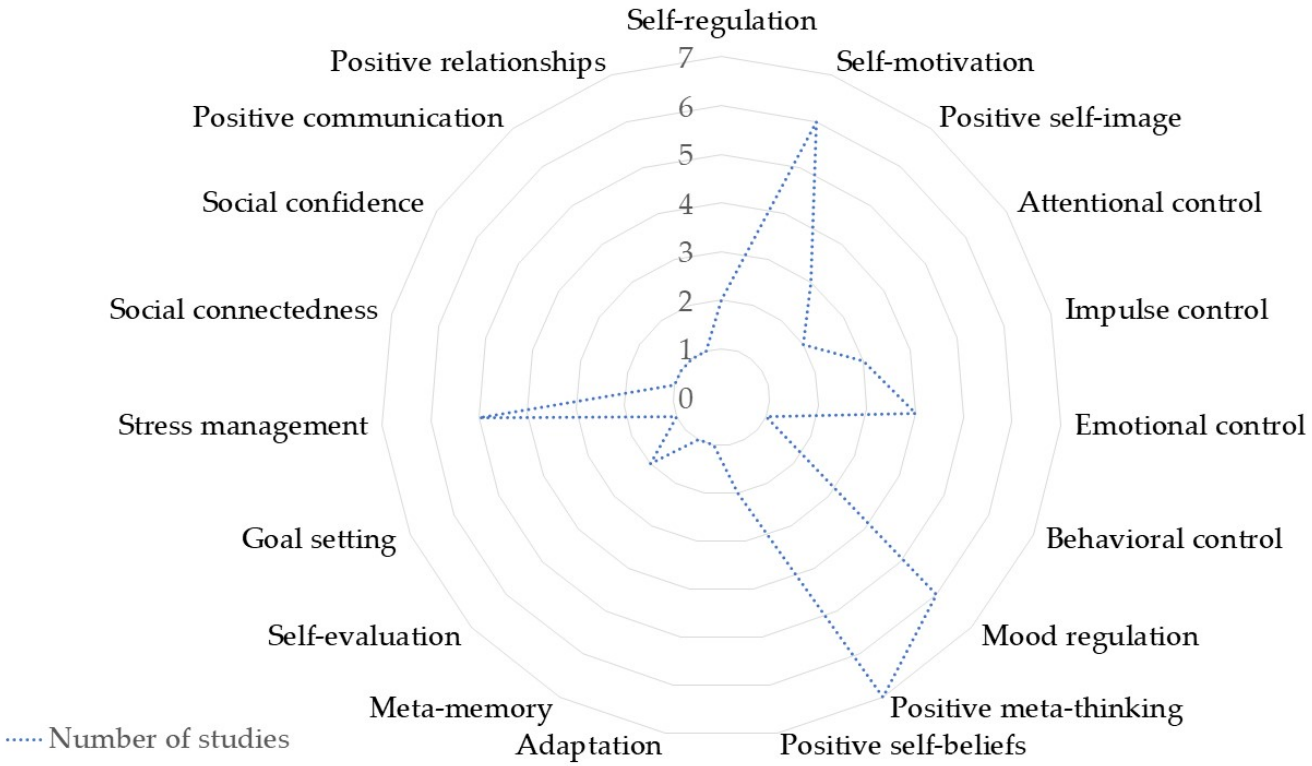

Figure 8. The number of studies that demonstrate the main meta-skills trained after digitally assisted positive psychology training.

5. Discussion

5.1. Major Findings and Final Considerations

The current review paper aimed to investigate the effectiveness of positive psychology interventions assisted by smart well-being technologies in the training of metacognition, emotional intelligence, and motivation meta-skills among people with various types of disorders. The results of the selected studies revealed that the use of positive psychology techniques can be an effective strategy for training a wide range of meta-cognitive, socio-emotional, and self-motivation skills required for both the effective self-management of clinical symptoms and the amelioration of self-satisfaction, autonomy, and wellness.

The selected studies revealed that positive psychology strategies with or without the assistance of positive technologies can be effectively applied in a wide range of clinical conditions, such as neurodevelopmental disorders (i.e., ADHD, ASD), intellectual disabilities, mood disorders (i.e., depression, bipolar disorder), anxiety disorders (i.e., post-traumatic stress disorder, generalized anxiety disorder, phobias, obsessive-compulsive disorder, panic disorder), other psychiatric disorders (i.e., psychosis) as well as learning difficulties (i.e., dyslexia).

The results showed that the employment of positive psychology strategies (i.e., gratitude) can help subjects diagnosed with neurodevelopmental disorders (i.e., ASHD and ASD) develop self-regulation and adaptation skills [70–72]. In addition, improvements were observed in self-determination skills, allowing subjects to be intrinsically motivated, and autonomous [72]. Positive post-hypnotic suggestions were found to improve attention regulation and impulse control [74]. Moreover, subjects with ADHD were more able to set more realistic goals and improve self-efficacy [73]. Resilience skills were also improved [70]. These improvements may explain why symptoms of distraction, hyperactivity, and impulsivity were significantly reduced [70].

Positive psychology techniques were found to improve meta-skills among people with learning difficulties. The use of positive role models, positive self-talk, and reframing helped subjects with dyslexia develop socio-emotional meta-skills. Self-esteem, self-concept,

and teamwork skills improved [76]. Solution-oriented strategies encouraged students with dyslexia to develop problem-solving skills and recognize the link between thoughts and emotions [76,77]. Humor-based strategies were found to help students with math difficulties self-manage intense math anxiety, develop interpersonal and creative thinking skills, and become more self-motivated [78]. Growth mindset interventions were effectively implemented among subjects with learning and reading difficulties, enhancing comprehension skills and mental flexibility [80].

Gifted and talented young people who participated in positive psychology training programs improved their self-motivation, self-regulation, emotional regulation, and adaptation skills [81,83]. After training, gifted students were more able to manage depressive symptoms [83]. They thought of more hope and improved social connectedness [82].

People with mood disorders such as depression improved their mood regulation skills after self-talk training, and forgiveness techniques [84]. They were more able to inhibit impulses and control automatic reactions [85].

Digital well-being technologies were also found to play a supportive role in facilitating the implementation of positive psychology strategies for the training of meta-skills among clinical populations. AI-powered tools such as AI chatbots were found to help people with ADHD, when combined with positive behavioral change techniques, improve attention and emotional regulation skills [88]. Positive results were also revealed for patients with mood disorders, stress disorders, and other psychiatric conditions. Positive psychology techniques delivered with the assistance of conversational agents revealed improvements in self-reflection skills, emotional self-expression, and acceptance among people with depression [90]. This type of training helped them to develop discernability skills that allowed the more flexible filtering of thoughts and feelings in favor of positive ones [89–91]. AI tools, when blended with social media and gaming technologies, were found to be promising for encouraging positive social interactions [93]. AI-based mobile applications were also observed to improve interpersonal skills and social confidence in psychosis [94]. However, more research is needed because, in some cases, the results did not indicate significant improvements [95].

Immersive technologies, including virtual reality, augmented reality, and mixed reality, were effective assistive tools in delivering positive psychological interventions. Mixed reality-based positive mental imagery training helped patients with depression intentionally direct themselves toward thinking of a more positive future [98]. VR-assisted positive reminiscence interventions encouraged people with depression to direct attention and retrieve positive memories, while similar interventions helped subjects with memory deficits improve meta-memory skills [99,100]. VR-based positive imagery blended with motivation training techniques improved mood regulation skills in depression [101]. VR-based compassion training helped people with paranoid thoughts modify their self-beliefs. VR-aided interventions that blended nature-based exposure, exercise, and eye movement desensitization and reprocessing were found to reprocess traumatic memories and reconsolidate them as more positive [105].

Serious games combined with biofeedback improved self-control skills among people with emotional dysregulation [106]. VR games with biofeedback and mindfulness techniques helped young people with ADHD regulate disruptive behaviors [107]. VR serious games that employed positive emotional cues (i.e., happy faces) were found to increase mindreading skills and decision-making [108]. Mobile-based serious games utilizing strengths-based techniques improved self-mastery skills among people with chronic disorders [109].

AR-based positive mental image training with the assistance of neurofeedback increased self-regulation and self-motivation skills in depression [110]. The use of non-invasive EEG devices with smartphone applications and gaming elements for the implementation of positive psychology techniques helped people with obsessions develop inhibition control and stress management skills.

The results of this review are in line with previous studies that recognize the effectiveness of positive psychology interventions in reducing symptoms of anxiety and depression and promoting various aspects of health [118]. In addition, digitally assisted positive psychology interventions that are applied in healthy young populations indicate that, indeed, interactive technologies may be promising educational tools for adolescents and young people [119,120].

We conclude that positive psychology strategies with the synergy of well-being technologies can improve a wide range of meta-cognition, emotional intelligence, and motivation meta-skills as presented in the following table (Table 3).

Table 3. The training benefits in metacognition, emotional intelligence, and motivation meta-skills.

The Training Benefits in Metacognition, Emotional Intelligence, and Motivation Meta-Skills	References
Positive meta-thinking	[76,81,86,87,89,95,98–100,105,115]
Positive cognitions and self-beliefs	[84,103,104]
Accurate perception	[115]
Positive self-expression	[115]
Self-regulation	[50,84,107,114]
Emotional control	[50,81,92,96,98,110]
Impulse control	[70,111–113]
Attentional control	[74,88,113]
Behavioral control	[113]
Mood regulation	[71,83–86,90,91,101,102,104,110]
Self-compassion	[103,104]
Belongingness	[105]
Openness	[99]
Adaptation	[77,82,108]
Recognition	[109]
Positive metamemory	[86,101]
Self-evaluation	[89,91]
Self-efficacy	[50,73]
Goal setting	[116]
Reasoning	[92,116]
Problem-solving	[116]
Goal-achievement	[73]
Stress management	[71,89,96,97,114,115]
Social confidence	[94]
Social Connectedness	[71,81,94]
Positive Communication	[86,93]
Positive relationships	[75,106]
Resilience, stress management skills	[76,79,116]
Positive self-image, self-esteem	[76,79,85,88,93,105]
Self-motivation, self-determination	[72,78,82,90,99,101,102,106,117]

We also conclude that positive psychology strategies assisted by well-being smart technologies helped participants effectively use external triggers as a resource for initiating positive, self-regulated, and adaptive behaviors and actions (Figure 9). As shown in Figure 9, external stimuli, particularly stressful ones, have the potential to trigger automatic reactions, implicit bias, negative self-beliefs, and unrealistic expectations that cause inner imbalance and inevitably lead to dysregulation of behavior. Positive psychology training assisted by well-being technologies can strengthen subjects' conscious control meta-skills, allowing them to effectively regulate stressful stimuli, inhibit impulses, achieve inner balance, and, finally, externalize self-regulated behaviors.

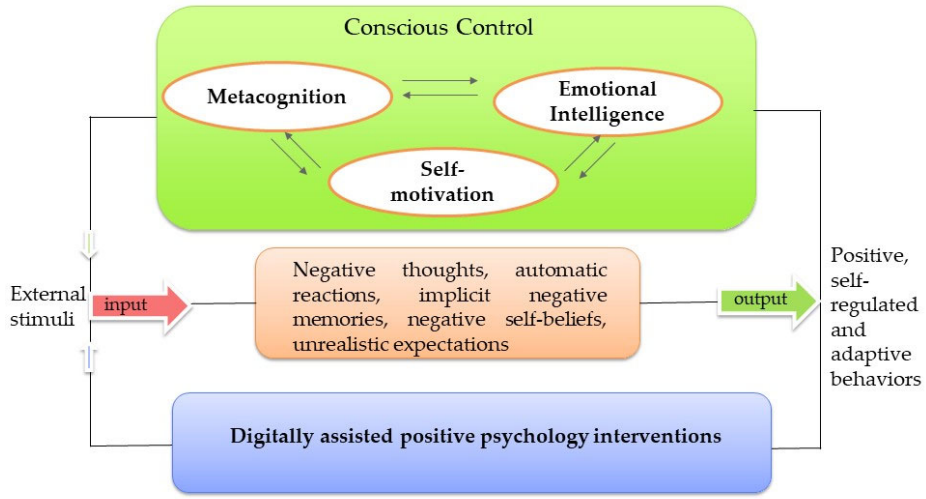

Figure 9. Digitally assisted positive psychology strategies and conscious control operations supported by metacognition, emotional intelligence, and self-motivations allowed subjects to effectively turn dysfunctional thoughts and emotions, into positive and self-regulated behaviors and actions.

It is important to mention that the results of this review indicated that positive psychology strategies assisted by well-being can improve metacognition, emotional intelligence, and motivational skills among people with various disorders. However, in several studies, improvements were not significant or did not remain after the intervention, indicating the need for further research [79,95]. In other cases, participants reported various limitations (i.e., not finding the intervention useful or enjoyable) [94]. The selected data allows us to confirm that all interventions were safe and that no severe adverse effects were mentioned. For instance, Coelho et al. [100] mentioned that the use of VR caused eye fatigue.

Although the selected studies did not reveal significant adverse effects, it is important to outline the risks that are commonly discussed in relevant literature. Positive psychology interventions may lead people to excessively focus on being optimistic, which may drive them to a lack of emotional honesty, thus increasing the tendency for emotional avoidance or repression. In addition, people may cultivate unrealistic expectations of happiness, leading them to disappointment whenever they feel unable to maintain a positive attitude. People may also exhibit narcissistic tendencies in the case of continuous, self-focused training [121]. However, it is important to highlight that the current review study focused on positive psychology strategies that trained a wide range of meta-skills enabling participants to be realistic, self-controlled, empathetic, and flexible. Thus, we support the idea that positive psychology interventions that cultivate self-awareness and self-regulation meta-skills can prevent the aforementioned adverse effects. However, the careful design of the interventions on a case-by-case basis can prevent adverse effects. This study also recognizes the importance of taking into account the critiques and criticisms of positive psychology in terms of theorizing and conceptual thinking, measurements and methodologies, the robustness of evidence, and replication [121,122].

The current review has several limitations. This study mainly focused on populations with mental, emotional, and behavioral disorders. We also included populations who are at high risk of experiencing symptoms of anxiety, and depression (i.e., learning difficulties). However, this review did not focus on studies that mainly focused on populations with chronic disorders (i.e., diabetes, dermatitis) unless the study investigated the impact of the intervention on psychological symptoms derived from the disorder. As regards the digitally assisted positive psychology intervention, we mainly focused on emerging technologies. We included studies delivering online program applications. However, we tried to explore the potential of additional innovative technologies.

The use of smart technologies (i.e., wearables, AI tools, immersive technologies) in positive psychology is in its early stages. More research is needed about the potential

benefits as well as the risks derived from the use of emerging technologies in such interventions. More evidence is needed about the use of such interventions in sensitive groups, such as people with various disorders. It is essential to gather more robust evidence with large-scale studies focusing on different types of technologies, techniques, populations, and meta-skills. In the current review, we tried to gather representative studies and, through systematic analysis, to conclude whether positive psychology techniques with the assistance of emerging technologies can be a promising tool for intervention among sensitive groups.

5.2. Digitally Assisted Positive Psychology Techniques: Opportunities, Challenges and Future Directions

Artificial intelligence is expected to play a leading role in future interventions aimed at promoting positive psychology and mental well-being among clinical populations [11]. By measuring well-being indicators, identifying implicit beliefs, suggesting personalized strategies, providing feedback, using positive language, and engaging users in reflective interactions, AI-powered tools can support users in developing a positive mindset endowed with the necessary metacognition, emotional intelligence, and self-motivation meta-skills. AI-powered coaches and conversational companions have the potential to distract users' attention from conventional thinking and behaving patterns, encouraging them to be self-reflective, focused on strengths, empathetic, and open toward positive behavioral changes [11,45,46,50,89,111,113].

The use of ChatGPT can be a promising technology in positive psychology interventions by providing relevant knowledge about the science of positive psychology, including the principles, the key concepts, the benefits, the strategies as well as the role of positive technologies. ChatGPT can also provide suggestions and guidance to users on how to apply positive psychology techniques (positive affirmations, relaxation exercises) in challenging situations. In addition, ChatGPT can assist users (patients, therapists, educators, and parents) in creating positive psychology interventions (i.e., worksheets). ChatGPT, through conversations with users, can motivate them to identify personal strengths, set positive and realistic goals, reframe problematic situations, direct focus on solutions, and perceive challenges as growth opportunities. The interaction with ChatGPT can create a sense of connection, which in turn can initiate positive behavioral changes [123].

Immersive technologies and the metaverse also have a significant potential to assist positive psychology interventions, especially when dealing with the root causes of psychopathologies. Immersive technologies provide the unique opportunity to manage self-beliefs, implicit memories, unrealistic fears, and expectations that simmer away under the surface of consciousness [41].

By modifying and reorganizing perceptual operations through the intense sense of presence and the emotional engagement that users experience within the digital environment, immersive technologies can support users in voluntarily initiating positive behavioral changes [14].

Metaverse can also play a significant role in designing future digitally assisted positive psychology interventions. Metaverse with the simulated environments can be a safe and controllable ecosystem for applying positive psychology techniques (i.e., mindfulness interventions, exposure techniques, positive imagery techniques). Metaverse can assist positive psychology interventions to train social meta-skills by hosting virtual support groups where patients facing difficulties can be connected, share their experiences, and support each other in a climate of social connectedness and belonging. Workshops and virtual classes on personal development, and positive psychology principles can take place within the metaverse encouraging users to invest in meta-skills training for personal growth. Game developers can design novel metaverse experiences that blend gamification and positive psychology techniques aimed at promoting happiness, well-being, and positive relationships among clinical populations. Therapists can also use the metaverse to

organize personalized or group virtual therapy sessions focused on positive psychology techniques [62–64].

Wearable technologies, by monitoring the physiological activity indicating whether the user is in a relaxed, anxious, hyperactive, or distractive state and providing users with relevant and simplified real-time feedback, can help users to be motivated, to reflect on the present state of being, and to make appropriate decisions and actions for regulating psychophysiological disturbances that prevent people from initiating positive behaviors [11,49].

The use of AI in positive psychology training may lead to ethical and legal concerns [48]. AI tools gather and utilize personal data about users' mental and emotional health. Thus, privacy protection and data security must be effectively guaranteed with clearly defined policies [124]. AI algorithms can not always discern reliable from unreliable information resulting in inaccurate or biased outcomes [48]. Intelligent agents can also exhibit deceptive behaviors, such as pretending to be human beings and having real-life stories, emotions, and memories. Moreover, the use of persuasive techniques to influence users' decision-making is another risk [125].

The over-dependence on smart technologies may be a possible risk that may undermine the trainees' motivation, engagement, and effort. This is an important point because the primary aim of positive psychology interventions is to train the meta-skills required for one to be self-conscious, self-regulated, and adaptive, capable of self-inducing those positive mental states that render them functional and self-satisfied [125].

AI tools must be appropriately designed to enhance therapeutic outcomes with the minimum risk of harm. As regards the implementation of AI-powered positive psychology interventions among people with disabilities, the design of AI tools should be adapted to the target group's needs to ensure safety. For instance, research has shown that people with schizophrenia may believe that AI agents are surreptitiously monitoring them. Thus, it is essential to take into consideration all the potential risks [126].

AI-based positive psychology training programs must be used as a complementary intervention and under the supervision of therapists, especially in populations with severe health issues. Remote digital screening in the absence of in-person clinical interviews may pose a risk for patients. AI-positive psychology programs should provide users with the opportunity to communicate both with virtual assistants and human coaches to maximize accuracy and safety [122].

Future research must focus on designing AI-powered interventions characterized by high accuracy and precision with the engagement of professionals from different fields (i.e., engineers, therapists, and psychologists). In addition, AI-powered technologies, such as conversational agents, should become more interactive, empathetic, and realistic in communication. In addition, AI agents should be further developed to identify the various subtleties of mood [124].

As regards immersive technologies' common risks, we can mention diverse effects due to cybersickness (i.e., symptoms of fatigue, nausea, eye strain, and disorientation [127]. Among the common challenges derived from the use of immersive technologies in intervention, we mention clinical specialist training, the high cost of the equipment, and the excessive requirements for designing and evaluating personalized training programs for people with various disorders [128].

Among the adverse effects that non-invasive wearable neurofeedback technologies can provoke, we can mention increased anxiety, an exaggerated alteration in mood, and mental fatigue. In addition, accurate assessments should be done to develop interventions on a case-by-case basis because different brainwave patterns should be trained accordingly with the patient's symptoms. Thus, neurofeedback-based positive psychology interventions should be conducted under the advice of licensed practitioners [129,130].

The results of the current review are in line with previous studies that outline the importance of applying positive psychology strategies in the educational context, especially in special education, to widen the perspectives of students along with their parents as well as

the educators and counselors who provide them with guidance and assistance [131] Family and educators should be capable of recognizing the positive traits that students with disabilities exhibit and harnessing these attributes to promote children's mental and emotional health [132]. Educators should be able to use this positive feedback as a significant resource for designing more personalized training interventions that provide students with more opportunities for inclusion. To meet this objective, educators, especially those working with children with disabilities, should be systematically trained in positive psychology techniques along with familiarization with well-being technologies. Such training would also help them to manage burnout symptoms [133]. It would be particularly important for educators to be provided with the appropriate assessment and intervention tools to more effectively apply positive psychology techniques in their classrooms. Parents and caregivers of people with disabilities can also participate in positive psychology programs, with or without the assistance of positive technologies. Indeed, previous studies have demonstrated that such interventions can also help parents develop positive psychology skills allowing them to be more empathetic, and more effectively assist their children with disabilities [134].

The research concerning positive technologies requires cross-disciplinary research engaging researchers from fields such as psychology (i.e., cognitive and positive psychology, neuropsychology), pedagogy, especially for positive education interventions, computer sciences, digital health science, and educational technologies field [11].

6. Conclusions

The current systematic review investigated the efficacy of positive psychology strategies and the synergy of digital well-being technologies on the training of metacognition, emotional intelligence, and motivation meta-skills in populations with mental, emotional, and behavioral disorders, including people with learning difficulties (i.e., dyslexia). The selected studies provided promising evidence indicating improvements in a wide range of meta-skills (i.e., self-motivation, self-regulation, and adaptation). The results of this review also indicated that well-being technologies, after careful design, can effectively assist meta-skills training through the employment of positive psychology techniques.

AI-powered devices, immersive technologies (i.e., virtual, augmented, mixed reality), non-invasive wearable neurofeedback technologies, biofeedback, and digital games were found to significantly assist the implementation of positive psychology strategies without causing harm among people with disabilities. However, future research should carefully examine the strengths and weaknesses derived from the use of emerging technologies.

Digital technologies supported the implementation of positive psychology interventions by providing multisensory, interactive, and engaging training environments, directing attention from negative to positive cues, enhancing positive imagery, and encouraging self-reflection operations. In addition, digital technologies offer unlimited access, ensuring anonymity, and protecting users from stigma. Apart from intervention, digital technologies provided assessments of the users' mental and emotional states and real-time feedback, allowing the adjustment of the interventions according to the participants' training needs. Technologies such as neurofeedback provided access to non-conscious operations, increasing training gains. The use of smart technologies (i.e., wearables, AI tools, and immersive technologies) in positive psychology is in its early stages. Although the selected studies revealed positive outcomes, more research is required about the potential benefits as well as the risks derived from the use of emerging technologies in such interventions. In addition, more evidence is needed about the use of such interventions in sensitive groups, such as people with different disorders.

The current review may provide positive feedback in the discussion about the implementation of digitally assisted mental health interventions for training new skills among sensitive groups, including those that face various psychological challenges. The results may assist patients, therapists, parents, and educators in designing and applying effective positive psychology interventions in different settings. Future research is needed to clarify

the potential benefits of innovative technologies (i.e., metaverse, chatGPT) in positive psychology interventions.

Well-being digital technologies are ready to revolutionize mental health interventions. However, digitally-aided positive psychology should be carefully designed, taking into consideration the ethical and legal issues, the adverse effects, the experts' training, the cost challenges, and the users' attitudes.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/psych6010019/s1, The Prisma 2020 checklist is included as Supplementary Materials. Registration Protocol: osf.io/vjucz (accessed on 5 February 2024).

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Appendix A

Table A1. Summary of the studies that employed positive psychology techniques to train metacognition, emotional intelligence, and motivation meta-skills in clinical populations.

Reference	Country	Positive Psychology Intervention	Sample	Clinical Condition	Duration	Type of Measurement	Research Design	Main Improvements
Boyes et al., 2020 [76]	Australia	Socioemotional well-being program	n = 40, (n_{exp} = 20, n_{clt} = 20), M = 26, F = 14, M_{age} = 10.45	DYS	9 weeks	ACS-2, ERQ-CA, CD-RISC-10, SDQ	RCT	Positive thinking skills, coping skills, self-esteem, resilience
Bishara, 2022 [78]	Israel	Humor	n = 80, F = 40, M = 40, 11–12 years old	LD	8 weeks	Questionnaires about attitude to humor in mathematics classes, about motivation, and a mathematics achievement test	Pilot study	Motivation to learn, intrinsic resilience, positive self-image, mathematics achievement
de Carvalho & Skipper, 2019 [79]	UK	Positive beliefs, growth mindset	n = 18, F = 9, M = 9, M_{age} = 14.9	SEND	10 weeks	ITIS, ARS, SPAS, PRAM II	Quasi-experimental study	Positive academic self-concept, positive attitude, and academic resilience
Wanzek et al., 2020 [80]	USA	Mindset intervention	n = 360, (n_{exp} = 120, n_{clt} = 120, n_{clt2} = 120) F = 184, M = 176,	RD	12 weeks	TOWRE-2, LWID, CTOPP, MINDSET	RCT	Improved reading skills
Ahmadi et al., 2020 [70]	USA	Reminder focused on positive psychiatry	M_{age} = 9 n = 11, (n_{exp} = 5, n_{clt} = 6), F = 6, M = 5, M_{age} = 11	ADHD, PTSD	6 weeks, 12 sessions	Snap, PERMA, biomarkers	RCT	Decreased reactivity, post-traumatic growth, well-being

Table A1. *Cont.*

Reference	Country	Positive Psychology Intervention	Sample	Clinical Condition	Duration	Type of Measurement	Research Design	Main Improvements
Senior et al., 2020 [71]	USA	Resilience-based group intervention	n = 159, M_{age} = 10.09, M = 127, F = 32	ADHD	12 weeks, 1 session per week	BASC-2, SSIS, HIF	Pilot study	Mood regulation, self-regulation, stress management, social skills, resilience
Farmer et al., 2014 [72]	USA	Personal Strengths Program	n = 7, children (n = 4) and adults (n = 3), F = 3, M = 4	ADHD, LD	8 weeks	SDSS	Multiple baseline design single-case design,	Increased self-determination skills
Ullenhag et al., 2020 [73]	Sweden	Strength-Based Intervention	n = 2, M = 2, 12 and 14 years old	ADHD, ASD	8 weeks	GAS, COPM	Pilot study, single-subject AB design	Increased self-efficacy, engagement, and goal achievement
Sabzipour et al., 2023 [84]	Iran	Positive self-talk training	n = 34, (n_{exp} = 17, n_{clt} = 17), M = 15, F = 19, M_{age} = 15.5	DEP	Eight 90-min sessions (two sessions a week)	BDI-II	Quasi-experimental research	Increased self-control over irrational internal dialogue, more positive cognitions and beliefs, reduced depressive symptoms
McCarty et al., 2013 [85]	USA	Positive Thoughts and Action Program	n = 120, (n_{exp} = 58, n_{clt} = 62), M = 48, F = 72, M_{age} = 12.8	DEP	Once a week for 12 weeks	BASC–2	RCT	Reductions in depressive symptoms, self-esteem
Firth et al., 2013 [77]	Australia	Positive cognitive restructuring techniques	n = 102 (with dyslexia: n = 23, F = 8, M = 15), F = 56, M = 46, M_{age} = 10.6	DYS	12 weeks, 10 sessions	LCS, ASS, RAASI	Pilot study	Adaptive coping skills, self-assertions, internal locus of control
Armstrong et al., 2018 [81]	Canada	Positive psychology program	n = 45, F = 25, M = 19, M_{age} = 7.53	G/T	10-unit program/ 3 sessions	Ch.I.P, I.S.A.	Pilot study	Social connectedness, emotional regulation, reduced perfectionism, hope
Taghinejad et al., 2021 [82]	Iran	Growth mindset intervention	n = 24 (n_{exp} = 12, n_{clt} = 12, M = 24, 12–15 years old	G/T	8 weeks	ASS, LBS, IBQ	Quasi-experimental study	Persistence, self-motivation, positive attitude, flexibility
Abbasian et al., 2022 [83]	Iran	Flourishing training program	n = 50 (n_{exp} = 25, n_{clt} = 25, F = 50, secondary students	G/T	14 sessions of 60 min	DASS-21	Quasi-experimental study	Mood regulation, self-management
Taghvaienia & Alamdari, 2019 [86]	Iran	Positive psychotherapy	n = 60, (n_{exp} = 30, n_{clt} = 30), F = 60, M_{age} = 61.79	DEP	10 sessions	PWBS-S, AHS, BDI-II	RCT	Positive metamemory skills, reduced depressive symptoms, appreciation, positive communication
Tang et al., 2023 [87]	China	Positive psychology expressive writing	n = 54, (n_{exp} = 27, n_{clt} = 27), F = 54, M_{age} = 33	SCZ	2 weeks	PDD, SCSQ, HHIS, SQLS	RCT	Hope, coping skills, positive thinking, quality of life

Table A1. *Cont.*

Reference	Country	Positive Psychology Intervention	Sample	Clinical Condition	Duration	Type of Measurement	Research Design	Main Improvements
Virta et al., 2016 [74]	Finland	Positive hypnotic suggestions	n = 58, (n_{exp} = 27, n_{clt} = 43), F = 43, M = 15, M_{age} = 33	ADHD	2 sessions	HGSHS: A, ASRS, SCL-90, CPT	RCT	Attention regulation
Tsiflikioti et al., 2023 [75]	Greece	Gratitude, positive reminiscence, kindness, humor, and character strengths	n = 42, (n_{exp} = 21, n_{clt} = 21), F = 37, M = 5, M_{age} = 71.62	MCI	3 weeks	PERMA-23	RCT	Positive relationships, self-accomplishment, meaning, positive emotions

RCT: Randomized Controlled Trial, DYS: dyslexia, LD: Learning Disabilities, RD: Reading Difficulties, SEND: Special Educational Needs and Disabilities, ASD: Autism Spectrum Disorder, G/T: Gifted/Talented, SCZ: Schizophrenia, MCI: Mild Cognitive Impairments, ACS-2: Adolescent Coping Scale 2, ERQ-CA: Emotion Regulation Questionnaire for Children and Adolescents, CD-RISC-10: 10-item Connor-Davidson Resilience Scale, SDQ: Strengths and Difficulties Questionnaire, ITIS: Implicit Theories of Intelligence Scale for Children, ARS: Academic Resilience Scale, SPAS: Student's Perception of Ability Scale, PRAM II: Preschool Racial Attitudes Measure II, TOWRE-2: Test of Word Reading Efficiency, LWID: Letter word identification, CTOPP: Phonological Processing–2nd Edition, MINDSET: Growth Mind-set Raw Scores, Snap: Swanson, Nolan and Pelham Teacher and Parent Rating Scale, PERMA: Positive Emotion, Engagement, Relationships, Meaning, and Accomplishment, SDSS: Self-Determination Student Scale, GAS: Goal Attainment Scaling, COPM: Canadian Occupational Performance Measure, BDI-II: Beck Depression Inventory, ACS: Adolescent Coping Scale, LCS: Locus of Control Scale for Children, ASS: Arc Self-Determination Scale, RAASI: Reynolds Adolescent Adjustment Screening Inventory, Ch.I.P: Child Identity and Purpose Questionnaire, I.S.A.: Interactive Symptom Assessment, LBS: Learning behaviors scale, IBQ: Intelligence beliefs questionnaire, DASS-21: Depression Anxiety Stress Scale, BASC-2: Behavioral Assessment System for Children (2nd edition), SSIS: Social Skills Improvement System Rating Scales, HIF: How I Feel, BASC–2: Behavior Assessment Scale for Children–Second Edition, PDD: Perceived Devaluation-Discrimination, SCSQ: Simplifed Coping Style Questionnaire, HHIS: Herth Hope Index Scale, SQLS: Quality of Life Scale for Schizophrenia, PWBS-S: Psychological Well-Being Scales-Short, OHI: Oxford Happiness Inventory, AHS: Adult Hope Scale, PERMA-23: PERMA Profiler questionnaire, HGSHS: A: Harvard Group Scale of Hypnotic Susceptibility, ASRS: Adult ADHD Self-report Scale, SCL-90: Symptom Check List, CPT: Continous Performance Test.

Table A2. Summary of the studies that employed digitally-assisted positive psychology techniques to train metacognition, emotional intelligence, and motivation meta-skills in clinical populations.

Reference	Country	Positive Psychology Techniques	Digital Design	Sample	Clinical Condition	Duration	Type of Measurement	Research Design	Main Improvements
Verberg et al., 2021 [117]	Netherlands	Growth mindset intervention	Online program	n = 119, (n_{exp} = 60, n_{clt} = 59), M = 69, F = 50, M_{age} = 15.83	ID, ADHD	6 weeks, 6 sessions lasting 25–45 min.	MPQ, BPM-Y,	RCT	Perseverance, self-motivation, self-love
Burton et al., 2016 [91]	Romania, Spain, and UK	Positive CBT, positive reframing, behavioral activation, positive visualizations	Embodied virtual agent	n = 27, (n_{exp} = 13, n_{clt} = 14), M = 9, F = 18, M_{age} = 35.3	DEP	10 sessions	BDI-2, DAS-SF, EQ-5D, QIDS-SR,	RCT	Mood regulation, decreased symptoms of sadness, pessimism worthlessness, self-criticism
Fitzpatrick et al., 2017 [90]	USA	Positive CBT, positive self-reflection, positive motivation	Fully automated conversational agent	n = 70, (n_{exp} = 34, n_{clt} = 36), M = 23, F = 47, M_{age} = 22.2	DEP, ANX	2 weeks (up to 20 sessions)	PHQ-9, GAD-7, PANAS	RCT	Self-motivation, engagement, mood regulation
Doan et al., 2020 [50]	USA	Resilience techniques	Smart Watch/Phone Application	n = 24, F = 3, M = 21 10–13 yeas old	ADHD	8 months workshops	Surveys, smartwatch data	Usability study	Self-regulation, emotional regulation, self-efficacy
Pinto et al., 2015 [93]	USA	Positive communication program	Avatar-based program	n = 60, (n_{exp} = 30, n_{clt} = 30), F= 60, M_{age} = 20	DEP	2 weeks	HADS, BIPQ	RCT	Self-confidence, positive communication

Table A2. *Cont.*

Reference	Country	Positive Psychology Techniques	Digital Design	Sample	Clinical Condition	Duration	Type of Measure-ment	Research Design	Main Improvements
Chen et al., 2023 [116]	China	Solution-focused brief therapy,	Online program	n = 76, (n_{exp} = 38, n_{clt} = 38), M = 17, F = 59, M_{age} = 16.45	ANX, PB, PD	2 weeks, 2 to 4 sessions	GAD-7, STAI-S, PHQ-9, CSS, SCAS-P, CSQ-8	RCT	Resilience skills, stress management, positive goal setting, problem-solving, positive reasoning
Oh et al., 2020 [92]	Korea	Positive CBT	Mobile app-based chatbot	n = 41, (n_{exp} = 21, n_{clt} = 20), M = 20, F = 21, M_{age} = 37.6	PD	4 weeks	PDSS, APPQ, HADS, BSQ, ACQ	RCT	Self-management skills, emotional control, rational thinking, decreased social phobia
Heckendorf et al., 2019 [115]	Germany	Gratitude intervention	Online Program and smartphone app	n = 262, (n_{exp} = 132, n_{clt} = 130), F = 152, M = 110, M_{age} = 42.2	ANX, DEP	5 weeks, 45–60 min.	PTQ, CES-D, GAD-7, CD-RISC, ISI, BSSS, GQ-6, LOT-R, CSQ-I	RCT	Positive perception, stress management, positive thinking, positive self-expression
Bush et al., 2017 [96]	USA	Hope and stress management intervention	Smartphone app	n = 118 (n_{exp} = 58, n_{clt} = 60), F = 60, M = 98, M_{age} = 46.5	SI	12 weeks	CSE, BSS, BRFL, INQ, PSS, C-SSRS	RCT	Emotional regulation, stress coping skills
Lim et al., 2019 [94]	Australia	Strengths-based, gratitude and kindness techniques	Smartphone app	n = 12, F = 3, M = 9 M_{age} = 20.50	PS	6 weeks	SCID-5-RV, PANSS, CDSS, SSPA, NART, UCLA-LS, SIAS, SPWB	Pilot study	Positive interpersonal skills, social confidence, and connectedness
Greer et al., 2019 [89]	USA	Gratitude, kindness, savoring, positive reappraisal	Vivibot chatbot	n = 45 (n_{exp} = 25, n_{clt} = 20), F = 36, M = 9, M_{age} = 25	ANX, DEP	4 weeks, 12 sessions	PROMIS, DES	RCT	Positive thinking, positive reappraisal, stress management
Habak et al. 2021 [98]	Australia	Positive Visualizations	MR platform VR headset	n = 79, F = 53, M = 23 male, NB = 3, M_{age} = 29.5	DEP	3 sessions	PANAS, BHS, SWEMWBS,	Usability study	Regulation of negative affect, positive future thinking
Jang et al., 2021 [88]	Korea	Behavioral change, mindfulness, emotional control techniques	Mobile app-based chatbot	n = 46 (n_{exp} = 23, n_{clt} = 23), F = 26, M = 20, M_{age} = 25.1	ADHD	4 weeks	CAARS, QIDS-SR, SAS, PSS	RCT	Attention regulation, self-concept, emotional stability, self-esteem
Chen et al., 2021 [101]	USA	Positive mental imagery training	Virtual Reality (Oculus Rift CV1)	n = 6, F = 5, M = 1, M_{age} = 24.6	DEP	7 weeks, 13 sessions	MASQ-AD, CAT-ANX	Pilot study	Self-motivation, positive meta-memories, mood regulation
Geerling et al., 2023 [95]	Netherlands	Gratitude, savoring, personal strengths	Mobile application	n = 40 (n_{exp} = 21, n_{clt} = 19), F = 30, M = 10, 16–66 years old	BD	7 weeks	HADS-A, ASRM, QIDS-SR, MCH-SF, EQ5D, PANAS, RPA, SPWB, SCS-SF	RCT	Optimistic thinking (No significant differences between groups)

Table A2. *Cont.*

Reference	Country	Positive Psychology Techniques	Digital Design	Sample	Clinical Condition	Duration	Type of Measurement	Research Design	Main Improvements
Brown et al., 2020 [103]	UK	Compassionate imagery	VR head-mounted display	n = 200 (n_{exp} = 100, n_{clt} = 100), M_{age} = 29, F = 78, M = 122	PPD	single one-hour session	GPTS-B	RCT	Positive self-beliefs, reduced self-criticism, self-compassion, compassion for others
Jessen et al., 2021 [109]	Norway	Strength-based techniques	Mobile app	n = 26, F = 25, M = 1, M_{age} = 48,	CD	4 weeks	SUS, PANAS, HRQoL	Explorative feasibility trial	Strengths recognition
Santana et al., 2023 [97]	Brazil	Positive imagery relaxation	VR	n = 52 (n_{exp} = 28, n_{clt} = 24), M_{age} = 29, F = 52	ANX	12 sessions	STAI, STAI-S	RCT	Courage, stress regulation
Falconer et al., 2016 [104]	UK	Self-compassion	VR	n = 15, M_{age} = 32, F = 10, M = 5	DEP, ADHD, OCD	4 weeks	PHQ-9, SDS, SCCS, VREQ	Pilot study	Mood regulation, reduced self-criticism, increased self-compassion.
Paul et al., 2022 [102]	USA	Behavioral activation, positive reinforcement	VR headset	n = 13 (n_{exp} = 5, n_{clt1} = 4, n_{clt2} = 4), M_{age} = 35.4, F = 7, M = 5, NB = 1	DEP	3 weeks/ 4 sessions	PHQ-9	RCT	Mood regulation, self-motivation skills
Fernandez-Alvarez et al., 2021 [99]	Spain	Positive reminiscence	VR head-mounted display (Oculus Rift DK2)	n = 24, F = 16, M = 18, M_{age} = 21.61	DEP	2 sessions of 30–45 min.	PHQ-9, PHQ-2 PANAS	Single-case, multiple baseline experimental design	Optimism, hope, serenity, openness to the future, self-motivation
van Gelderen et al., 2020 [105]	Netherlands	Eye movement desensitization and reconsolidation	VR 3MDR	n = 43, (n_{exp} = 22, n_{clt1} = 21), F = 1, M = 42, NB = 1, M_{age} = 42.18	PTSD	10 weeks (3 sessions per week)	CAPS-5, PCL-5, PABQ, ISEL, CLLF	RCT	Reduced avoidance behavior, belongingness, self-esteem, hope
Bossenbroek et al. 2020 [107]	Netherlands	Mindful breathing	Virtual reality, biofeedback, serious game	n = 8 F = 1, M = 7, M_{age} = 14.67	ADHD	4 weeks, 6 sessions. 15 min.	STAI, disruptive classroom behavior scale	Single-case experimental study	Self-regulation
Viczko et al., 2021 [110]	USA	Guided meditation	AR-based mobile phone app	n = 41 (n_{exp} = 22, n_{clt} = 19) M_{age} = 35.4	DEP, GAD ANX	Single session	BRUMS, EEG data collection,	RCT	Mood and emotional regulation
Coelho et al., 2020 [100]	Portugal	Positive Reminiscence	VR Headsets	n = 9, F = 6, M = 3, M_{age} = 85.6	MD, CD	4 sessions	EUROHIS-QOL-8, interviews	Pilot study (mixed methods)	Positive thinking, cognitive improvements
Schuurmans et al. 2021 [114]	Netherlands	Breathing training	Muse™ headband, iPad	n = 77 (n_{exp} = 40, n_{clt} = 37), F = 31, M = 46, M_{age} = 15.25	PTSD	6 weeks	TRIER-C	RCT	Self-regulation, stress management
Crivelli et al. 2018 [113]	Italy	Mindfulness Training	Muse™ headband with a smartphone	n = 40, (n_{exp} = 20, n_{clt} = 20), Mage = 22.84	ANX	4 weeks	MIDA battery, EEG recordings	RCT	Behavioral, and attention regulation, inhibition control
Richter et al. 2019 [111]	Canada	Guided Meditation	Muse™ headband, smartphone or tablet	n= 55 (n_{exp}= 27, n_{clt}= 28)	OCD	8-week	Y-BOCS, EEG assessment	RCT	Inhibition of obsessions and compulsiveness
Hawley et al., 2021 [112]	Canada	Positive mindfulness	Muse™ Headband, and smartphone	n = 71 (n_{exp} = 36, n_{clt} = 35), M_{age} = 26	OCD, DEP, ANX	8 weeks	EEG Recording, FFMQ, Y-BOCS	RCT	Positive self-management of obsessions reduced reactivity and distraction

Table A2. *Cont.*

Reference	Country	Positive Psychology Techniques	Digital Design	Sample	Clinical Condition	Duration	Type of Measure-ment	Research Design	Main Improvements
Lis et al., 2013 [108]	Germany	Positive cues	Virtual social serious game with virtual partners	n = 40 (20 ADHD, 20 healthy controls), M = 18, Fe = 22, M_{age} = 36	ADHD	1 session	Cognitive Task Battery	Quasi-experimental study	Socio-emotional adaptive skills
Mena-Moreno et al., 2022 [106]	Spain	Resilience, Positive CBT	App-based serious game with biofeedback	n = 104, (n_{exp} = 40, n_{clt1} = 64), F = 5, M = 98, M_{age} = 42.18	GD	16 weeks (15 sessions with the serious game)	DSM-5, SOGS, SCL-90-R, DERS, UPPS-P	RCT	Resilience, positive relationships, self-motivation, active engagement

ID: Intellectual Disabilities, DEP: Depression, SI: Suicidal Ideation, ADHD: Attention Deficit and Hyperactivity Disorder, ANX: Anxiety, PB: Phobia, PS: Psychosis, PD: Panic Disorder, BD: Bipolar Disorder, PPD: Paranoid personality disorder, CD: Chronic Conditions, OCD: Obsessive–Compulsive Disorder, CD: Cognitive Decline, PTSD: Posttraumatic Stress Disorder, MD: Memory Deficits, GD: Gambling disorder, GAD: Generalised Anxiety Disorder, RCT: Randomized Controlled Trial, F: female M: male NB: non binary, MPQ: Mindset and Perseverance Questionnaire, BPM-Y: Brief Problem Monitor-Youth, GAD-7: Generalized Anxiety Disorder-7, STAI-S: State and Trait Anxiety Inventory-Chinese, the Anxiety State, PHQ-9: Patient Health Questionnaire-9, CSS: Coping Style Scale, SCAS-P: Spence Children's Anxiety Scale -Parent, CSQ-8: Client Satisfaction Questionnaire, PTQ: Perseverative Thinking Questionnaire, CES-D: Centre forEpidemiological Studies Depression scale, CD-RISC: Connor-Davidson Resilience Scale, ISI: Insomnia Severity Index, BSSS: Berlin Social Support Scales, GQ-6: Gratitude Questionnaire-6, LOT-R: Life Orientation Test, CSE: Coping Self-Efficacy Scale, BSS: Beck Scale for Suicidal Ideation, BRFL: Brief Reasons for Living Inventory, INQ: Interpersonal Needs Questionnaire, PSS: Perceived Stress Scale, C-SSRS: Columbia-Suicide Severity Rating Scale, SCID-5-RV: Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, PANSS: Positive and Negative Syndrome Scale, CDSS: Calgary Depression Scale for Schizophrenia, SSPA: Social Skills Performance Assessfbrumment, NART: National Adult Reading Test, UCLA-LS: Revised UCLA Loneliness Scale, SIAS: Social Interaction Anxiety Scale, SPWB: Scales of Psychological Well-Being, PANAS: positive and negative affective schedule, BHS: Beck Hopelessness Scale, SWEMWBS: Short Warwick–Edinburgh Mental Well-Being Scale, PROMIS: Patient-Reported Outcomes Measurement Information System, DES: Differential Emotions Scale, CAARS: Conner's Adult ADHD Rating Scale, QIDS-SR: Quick Inventory of Depressive Symptomatology-Self-report, SAS: Self-rating Anxiety Scale, PSS: Perceived Stress Scale, MASQ-AD: Mood and Anxiety Symptoms Questionnaire, CAT-ANX: Computerized Adaptive Testing tool and anxiety inventory, HADS-A: Hospital Anxiety and Depression Scale, ASRM: Altman Self-Rating Mania Scale, MCH-SF: Mental Health Continuum, EQ5D: EuroQol 5 Dimensions, QPR: Questionnaire Process of Recovery, RPA: Responses to Positive Affect Questionnaire, SCS-SF: Self-Compassion Scale Short form, GPTS-B: Green Paranoid Toughts Scale Part B2, SUS: Strengths Use Scale, HRQoL: health-related quality of life, STAI: State-Trait Anxiety Inventory, STAI-S: State Anxiety Inventory, SDS: Self-Rating Depression Scale, SCCS: Self-Compassion and Self-Criticism Scale, VREQ: Virtual Reality Experience Questionnaire, PHQ-2: Patient Health Questionnaire–2, 3MDR: Multimodular motion-assisted memory desensitization and reconsolidation, CAPS-5: Clinician-Administered PTSD Scale for DSM-5, PCL-5: PTSD Checklist for the DSM-5, PABQ: Posttraumatic Avoidance Behaviour Questionnaire, ISEL: Interpersonal Support Evaluation List, CLLF: Cantril's Ladder of Life Future, SOGS: South Oaks Gambling Screen, SCL-90-R: Symptom Checklist-Revised, DERS: Difficulties in Emotion Regulation Scale, ERQ: Emotion Regulation Questionnaire, UPPS-P: Impulsive Behavior Scale, CBT: Cognitive behavioral therapy, BDI-2: Beck Depression Inventory II, DAS-SF: Dysfunctional Attitudes Scale Short Form, EQ-5D: EuroQol 5D, QIDS-SR: Quick Inventory of Depressive Symptoms-Self Report, HADS: Hospital Anxiety and Depression Scale, BIPQ: Brief Illness Perception Questionnaire, PDSS: Panic Disorder Severity Scale, APPQ: Albany Panic and Phobia Questionnaire, HADS: Hospital Anxiety and Depression Scale, BSQ: Body Sensations Questionnaire, ACQ: Anxiety Control Questionnaire, FFMQ: Five facets of mindfulness questionnaire, Y-BOCS: Yale-Brown Obsessive Compulsive Scale, BRUMS: Brunel Mood Scale, TRIER-C: Trier Social Stress Task for Children.

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