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Metacognition and the 5Cs of Positive Youth Development Programs: A Review of Metacognitive Interventions

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Metacognition and the 5Cs of Positive Youth Development Programs: A Review of Metacognitive Interventions

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Abstract

Positive youth development (PYD) programs have increased positive outcomes for adolescents, however research on the underlying change processes in these programs remains limited. The 5Cs (Competence, Confidence, Character, Caring and Connection) of PYD are a framework of desirable outcomes for youth programs. Change to metacognition is proposed as a mechanism by which PYD programming accomplishes these outcomes. This review describes findings from metacognitive interventions with PYD-relevant outcomes in adolescents aged 10-24. Fifteen electronic databases were searched using keyword phrases related to "metacognitive intervention" and "adolescents". Seventeen studies met inclusion criteria. Included studies addressed 2 of the 5 goals of PYD programs (competence and confidence). Four studies included Randomized Control Trial and nine studies used quasi-experimental designs. Statistically significant improvements to study outcomes were seen in every study but one, with most studies examining cognitive competencies. Themes in the studies included 1) explicit instruction in metacognition and 2) measurement of metacognition. Metacognitive changes may, at least in part, explain the effects of PYD programs. Researchers should consider including metacognitive measures to explore their relationship to program outcomes. Understanding the change underlying PYD interventions will enhance researchers' and practitioners' ability to facilitate constructive and positive development in youth.

Keywords: Metacognition; Positive Youth Development; 5Cs; Intervention; Adolescence

Introduction

Positive youth development (PYD) frameworks offer unique insights into how young people may thrive throughout their adolescence and beyond. Expanding these frameworks to include metacognitive theory and practice is an opportunity to enhance goal attainment during PYD programs. The 5Cs of PYD (Competence, Confidence, Character, Caring, and Connection) represent a programmatic framework firmly grounded in ecological perspective, enabling youth to cultivate these attributes and positively impact themselves, their families, and their communities. Metacognition, encompassing knowledge about cognitive states, processes, and their regulation, can enhance PYD programming. From this standpoint, the increased understanding and regulation of cognition regarding PYD activities is crucial for identifying and advancing the comprehension of youth program goals and outcomes for all stakeholders.

In this article, we will explore the impact of metacognitive interventions on outcomes related to positive youth development and discuss how attention to and measurement of metacognition in PYD programs potentially catalyzes positive change in adolescents' lives. This is the first article to connect the 5Cs model of PYD to metacognition.

Overview of the History of Positive Youth Development Programming

Positive youth development (PYD) programs are designed to support various systems responsible for youth development, such as family, neighborhood, and school. These programs have been successful in reducing risks to adolescent sexual and reproductive health, decreasing juvenile delinquency, and promoting academic success (Agee, 1979; Gavin et al., 2010; Gold & Mann, 1982).

In the 1990s, interest in youth's individual strengths, the malleability of human development, and resilience to strained social conditions were the foundational interrelated concepts of positive youth development (Lerner et al., 2015). PYD was conceptualized as programs and organizations focusing on building and facilitating the holistic development of youth (Hamilton, 1999; Lerner et al., 2011). One example of such is the Positive Action program, which includes adolescent, family, and school-level interventions to improve self-concept, positive and healthy actions for body and mind, and socioemotional positive actions for self-management and interpersonal skills. This program is linked to improved academic achievement and school attendance while reducing substance use, disruptive behaviors, and dropout rates (Allred, 1998; Lerner et al., 2011).

More current perspectives on the developmental processes within PYD are framed within relational and developmental systems perspectives (Damon, 2004; Larson, 2000; Lerner et al., 2011; Lerner et al., 2015). These models view the strengths of adolescents (e.g., intentional self-regulation, school engagement) and ecological assets (e.g., social networks, access to resources) as predictors of positive youth-development goals (i.e., competence, confidence, character, caring, and connection). In addition, positive youth development is seen as a positive contributor to youths' adaptive functioning (in terms of self, family, community, and civil society contributions) and a negative contributor to risk or behavioral problems (e.g., delinquency and substance use; Lerner et al., 2005).

A Metacognitive Perspective of Examining Adolescent Development in PYD Contexts

Jacobs and Paris (1987) define metacognition as "shared knowledge" between, for example, program facilitators and participants, about "cognitive states or processes" in a particular domain or activity. The reciprocal sharing of metacognition developed within PYD programs may yield new skills, capacities, and courses of action for participating youth.

During PYD programs, adolescents may consider how their thoughts and mental processes influence their approaches to handling challenging or new circumstances (Kuhn, 2009; Rusk et al., 2013). Whether

the facilitator or a worksheet communicates the information gained in an intervention, metacognitive processing occurs to varying degrees, regardless of the ability of the youth to communicate back what they now understand. However, youth sharing their understanding with the facilitator or peers allows for affirmation and correction of ideas about how an activity may be approached. In gaining exposure to new ideas and strategies (facilitated by programming content, facilitators, and peers), youth may develop new or more profound ways of thinking, impacting their likelihood of engaging in constructive actions and self-regulating behaviors (Kuhn, 2009; Rusk et al., 2013). These actions and behaviors, reflected in PYD programming goals of enhanced competence, connectedness, confidence, caring, and character, have been shown to be responsible for risk reduction and positive contributions to self and community (Lerner et al., 2011).

The authors suggest that metacognition is an underlying mechanism of change between adolescent strengths and the goals of the PYD intervention. Flavel (1979) initially conceived metacognitive knowledge as one's knowledge of one's cognitive strengths and limitations, including internal and external contexts that impact these cognitions. This knowledge was separated into person knowledge, task knowledge, and strategy knowledge, as well as their interaction. While this and other closely related definitions exist in the literature, Jacob and Paris believe their operationalization of metacognition allows for the observation and measurement of metacognition and avoidance of unwarranted inferences of unconscious aspects of metacognition (Brown et al., 1986; Brown et al., 1983; Flavell, 1979; Jacob & Paris, 1987). As previously mentioned, *metacognition* can be defined as "shared knowledge" about "cognitive states or processes." A 2011 review article by E. R. Lai points out that much of the current literature divides metacognition into two components: cognitive knowledge and cognitive regulation. More details on the operationalization of this term are in Table 1 below. This table has been adapted from several studies (Flavell, 1979; Lai, 2011; Muteti et al., 2021).

Table 1. *Metacognition Components and Subcomponents*

Metacognitive Component	**Knowledge of Cognition**			**Regulation of Cognition**		
Subcomponent	Declarative	Procedural	Conditional	Planning	Monitoring	Evaluation
Description	Thinking about one's knowledge	Thinking about how to use one's knowledge	Thinking when and why to use one's knowledge	Planning for action	Monitoring one's process	Evaluating one's process and making revisions

Objectives and Goals of Positive Youth Development Programming

The authors chose to subsume 12 objectives of PYD under the categories of the overall program goals of PYD, known as the Five "C"s (Competence, Confidence, Character, Caring, and Connection) (Catalano et al., 2004; Eccles & Gootman, 2002; Lerner, 2005; Little, 1993). This breakdown can be seen in Table 2 below. Although Lerner and colleagues have since brought forth a 6th C—contribution—authors of the current manuscript chose 5Cs as Lerner and colleagues suggest that the 5Cs, within a young person, would make possible and predict the 6th C (Lerner et al., 2005; Lerner et al., 2011). The following definitions of the 5Cs are adapted from Lerner and colleagues' 2005 study. *Competence* involves the ability of the youth to successfully navigate life in the multitude of contexts they inhabit, such as schools, workplaces, families, religious institutions, friend groups, and after-school programs. *Confidence* involves the youth

believing they can overcome challenges and take on new tasks. *Character* is the youth's ability to comply with prosocial norms regarding behavior and decisions concerning right and wrong and the ability to do so when no one is monitoring them. *Caring* involves having social concern and empathy for others. C*onnection* is marked by positive associations with the contexts and people of youths' lives that allow youth to improve their lives and those around them.

Table 2. *12 Objectives Subsumed into the 5Cs of PYD*

The 5Cs	**The 12 Objectives**
Competence	cognitive social behavioral emotional
Confidence	self-efficacy clear & positive identity belief in the future self-determination
Character	prosocial norms spirituality
Caring	moral competence
Connection	prosocial bonding

Systematic Review of Metacognitive Interventions

This systematic review was based on the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) standardized reporting guidelines.

Search strategy

Keyword phrases were selected by identifying terms relevant to the review. This is the first article to connect the 5Cs model of PYD to metacognition. The focus of this article is to show the effects metacognitive interventions have on outcomes related to PYD. PYD researchers may consider implementing metacognitive perspectives into their interventions and programming to improve the goals and outcomes in youth development programming. Showing existing metacognitive interventions and their connection to PYD was a priority in the review. Thus, this systematic search included only metacognitive interventions. The search terms were executed using our institution's library tool. All databases were selected at once in this library tool, keywords were searched, and results populated. Duplicates were removed. The final search terms were as follows: "metacognitive intervention" or "metacognition intervention," and "adolescent" or "teenager" or "teen" or "youth." The following fifteen databases were searched on January 15, 2022. The search was updated on the September 22, 2022: PsycINFO, Complementary Index, Academic Search Index, MEDLINE, Supplemental Index, ERIC, CINAHL Complete, Cochrane Central Register of Controlled Trials, Directory of Open Access Journals, ScienceDirect, Psychology & Behavioral Sciences Collection, PsychArticles, Journals@OVID, SocINDEX, and Business Source Index.

Eligibility criteria

Population. To be included in this review, studies had to include an intervention targeting the adolescent population's metacognition. Adolescence was defined as ages 10–24 years. This age range considers a more modern cultural understanding of life phases and adolescent growth, with intentions to secure funding and investments across a more extensive range of youth-development settings. The previous definition of

adolescence as 10–19 years of age was created in the mid-twentieth century (Sawyer et al., 2018). Sawyer and colleagues point to "delayed timing of role transitions, including completion of education, marriage, and parenthood" in Western society as contributing factors in the motivation for broadening the age range.

Intervention. An *intervention* was defined as a content-based plan with a proposed process to modify a target outcome (Hodges et al., 2011). These interventions were intended to manipulate the metacognition of the participants. No constraints were placed on the type of problem for which intervention was needed. This was done to provide insights from numerous fields.

Outcome. No constraints were placed on the outcomes researchers sought to affect with a change in metacognition. This was also done to provide insights from numerous fields. All outcomes were categorized within the 5Cs of PYD and the 12 objectives of PYD.

Study Desig*n*. The review included several types of studies (randomized control trials or RCT, case studies, and quasi-experimental). Qualitative studies were not excluded because this method provides data relevant to the connection between metacognition and PYD outcomes in empirically tested interventions. Studies must have been published in a peer-reviewed journal without restriction on authors' language or country of origin.

Study Selection. Identified programs were judged for inclusion criteria and coded for characteristics, including the 12 objectives and 5Cs of PYD, components of metacognition taught, and types of evaluation design. Inter-rater reliability was not formally tested; instead, the lead coder (and first author) consulted continuously with the second author to discuss perspectives and determine agreed coding.

Findings

Searches of fifteen electronic databases yielded 299 articles. After duplicate removal, 200 were identified for the title, abstract, and keyword screening against inclusion criteria. Twenty-nine articles were screened for full-text review. Seventeen articles were subsequently identified for inclusion in the review. The most common reason for exclusion was that the studies in the articles were not interventions (N = 6), the study was out of the adolescent age range (aged 10 to 24) (N = 3), or there was no mention of age (N = 2). For an overview of the screening process, see the PRISMA diagram in Figure 1.

Overview of Metacognitive Intervention Studies

The 17-included studies were published between 1985 and 2022. Five studies were one group only pre-post studies, eight were quasi-experimental, and 3 were RCT designs. In addition, one study had a quasi-experimental component and an RCT component, yielding nine quasi-experimental and 4 RCT versus control comparisons. All studies were of the pre-post study design. Six studies included participants with a mean age of 18 or a range of 18 or older (but under 24). Nine studies included participants aged 17 or younger (no younger than 10). Two of the studies included participants ranging in age from 10 to 24. More specifics of the intervention design, sample demographics, intervention components, findings, 5C's, and metacognitive components can be found in Table 3.

Study Design

One Group Design. The following results come from the reviewed metacognitive interventions with a single-group design. In a study aiming to improve the acquisition of curriculum-related metacognitive strategies, youth saw a significant increase in their mathematics-strategy use (Hessels et al., 2009). Another study found that those in cognitive-functional therapy saw improvement in occupational performance and strategy behavior for occupational tasks (Levanon-Erez et al., 2019). Participants that were in narrative-imagery therapy to reduce stress from cystic fibrosis saw improved anxiety, emotional functioning, and reduced negative meta-worry (Russell et al., 2021a; Russell et al., 2021b). Moreover, in a program to improve mathematics performance for biology students, those who had previously failed math-course

exams all passed the math test after intervention while documenting new connections made across and within math topics (Zan, 2000).

Randomized Control Trials. In the 4 studies that used an RCT comparison, significant improvements were seen in the treatment group (compared to the control group) within each intervention. Two of the studies focused on developing English language learners' listening skills, in which significant improvements in listening and comprehension were observed (Bozorgian et al., 2022a; Bozorgian et al., 2022b). One study measured English language learners' paragraph-level writing production and found significant improvement in using writing-linking devices and punctuation (Briemaster & Etchgaray, 2017). In the study using both a quasi-experiment and RCT treatment group, the randomized treatment showed significant increases in fraction concept knowledge relevant to the control group (Hacker et al., 2019).

Figure 1. *PRISMA Diagram of Database Search and Record Screening*

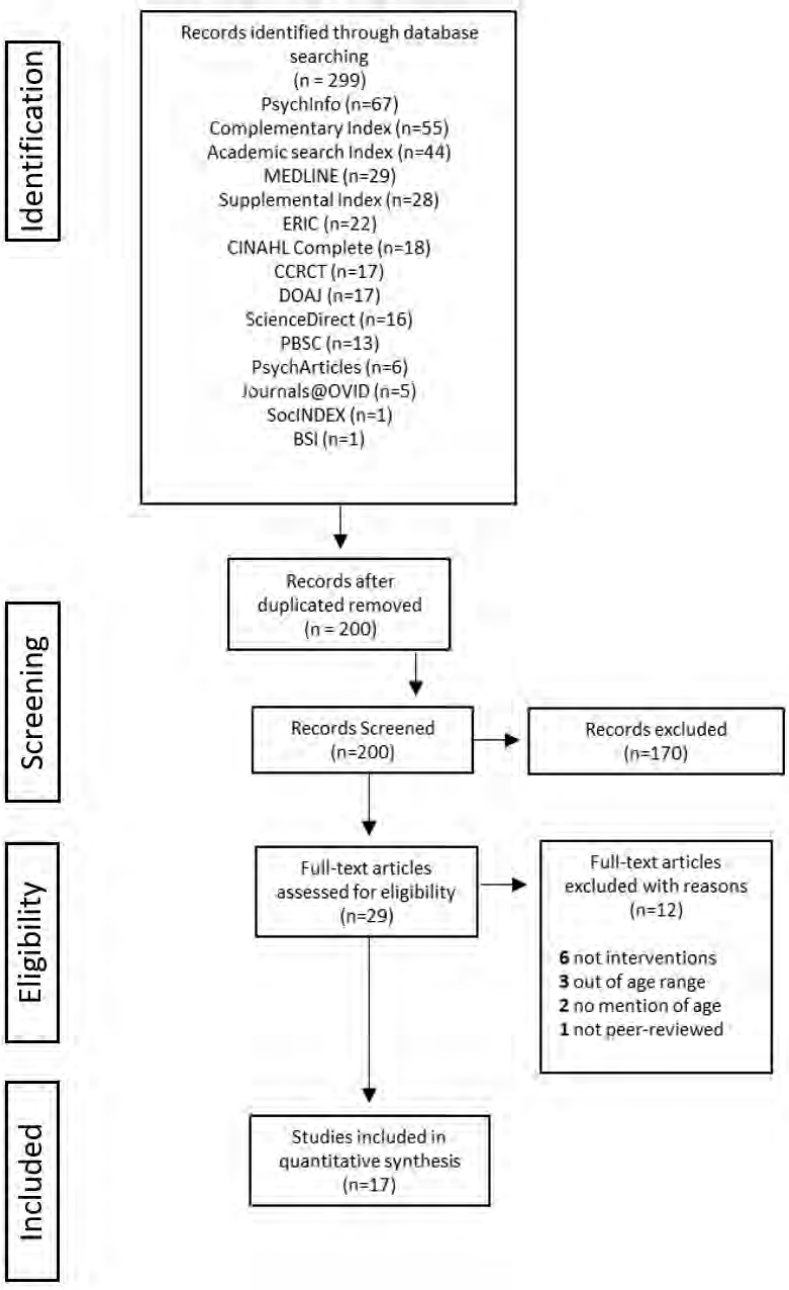

Table 3. *Characteristics of Intervention Studies Included in this Review*

Author	Intervention Design	Sample Demographics	Intervention Component	Findings	4Cs Category of Findings	Metacognitive Categories
August-Brady, 2005	Quasi-Experimental	80 students in a baccalaureate nursing program, n = 45 control, n = 35 treatment, (age M = 22.7), 94% women	Concept mapping to affect approach to learning and self-regulation of learning	Significant post-test scores for deep approach to learning in the treatment group (F(1) = 5.62, p = 0.02). Significant posttest increases in adaptive control belief in treatment group (F(1) = 8.70, p = 0.004).	Competence: *cognitive*	Knowledge: *Declarative Procedural*
Berger, Kipfer & Bucher, 2008	Quasi-Experimental	84 students, (age M = 18), Experimental group 1 (n = 30), experimental group 2 (n = 32), control group (n = 22)	Cognitive-Metacognitive program to improve activation of cognitive and metacognitive strategies in learning and reasoning	Significant improvements, posttest, for EG1 (metacognitive enhancement group) compared to control group in mathematics problem solving F(1,36) = 14.86, p < .01 and text comprehension F(1, 23) = 8.26, p = .01	Competence: *cognitive*	Knowledge: *Declarative Procedural Conditional* Regulation: *Planning Monitoring Evaluation*
Bozorgian, Fallahpour, Alinasab Amiri, 2022	Randomized Control Trial	61 students, aged 10 to 14, 100% female, (n = 27) treatment, (n = 34) control	Development of English language learners' listening for person, task, and strategy knowledge through process-based activities	Significant improvements in experimental groups posttest scores in overall listening performance and comprehension (Z = -2.05, p = .04), compared to control group.	Competence: *cognitive*	Regulation: *Planning Monitoring Evaluation*
Bozorgian, Yaqubi & Muhammadpour, 2022	Randomized Control Trial	60 students, aged 15 to 25, 100% male, (n = 30) treatment, (n = 30) control, with low working memory capacity	Development of English language learners' listening for person, task, and strategy knowledge through process-based activities	Significant improvements in listening performance F(1,49) = 7.5, p = .009 for those in treatment group, posttest.	Competence: *cognitive*	Regulation: *Planning Monitoring Evaluation*
Briesmaster & Etchegaray, 2017	Randomized Control Trial	19 students aged 13 to 14. Control group (n = 10), Experimental group (n = 19)	Aim to develop coherence and cohesion in the paragraph level writing production of English as a first language learner	For the experimental group, significant improvement in using writing linking devices (F(1.27) = 14.351, p-value = .001) and punctuation marks (F(1.27) = 6.669, p-value = 0.016, post-test.	Competence: *cognitive*	Regulation: *Planning Monitoring Evaluation*
Hacker, Kiuhara & Levin, 2019	Part 1: Cluster-Based Randomized Control Trial. Part 2: Quasi-Experimental	Part 1: (n = 59) – 4th through 6th graders. 5 treatment, 5 control groups. Part 2: (n = 32) – 5th through 6th graders. No age mentioned.	Self-regulated strategy development for teaching concepts of fractions	Part 1: Significant post-test increases (for intervention compared to control group) in knowledge of fractions (effect size - Hedges g = 0.60) mathematical reasoning (g = 1.82), argumentative elements of written (g = 3.20), total words (g = 1.04) written for response. Part 2: Significant increase to fraction knowledge and computational accuracy (effect size - Cohen's d = 0.70)	Competence: *cognitive*	Knowledge: *Declarative Procedural Conditional* Regulation: *Planning Monitoring Evaluation*
Hessels, Hessels-Schlatter, Bosson & Balli, 2009	Pre-post design	5 youth, age 12 to 13	Acquisition of cognitive and metacognitive strategies curriculum-related (mathematics problem solving and text comprehension) and curriculum-unrelated tasks (cooking activity)	Significant increase in mathematics strategy use, which was related to improved performance. Increase strategy use in letter writing, crossing out steps and greater accuracy in cooking task. Within-task pre to posttest differences significant (Wilcoxon tests, alpha = 5%).	Competence: *cognitive*	Knowledge: *Conditional* Regulation: *Planning Monitoring Evaluation*
Hooper, Wakely, de Kruif & Swartz, 2006	Quasi-experimental	38 – 4th graders, 35 – 5th graders	Aiming to improve self-regulation and metacognition about writing activities	Significant improvements in spelling (effect size = .26 to 1.23) and reduced semantic errors (ES = .29 to .84).	Competence: *cognitive*	Regulation: *Planning Monitoring Evaluation*

Lamash & Josman, 2021	Quasi-experimental	56 youth aged 11 to 19, with ASD, (n = 23) control, (n = 33) intervention	Cognitive orientation occupational performance. In-person and virtual training program to teach acquisition of executive function concepts for performing complex daily activities such as shopping	Intervention group significantly improved in post-test accuracy F(1, 53) = 14.23, p < .001 and total strategies usage F(1, 53) = 4.55, p < .05 in shopping task relative to the control group.	Competence: *cognitive, behavioral*	Knowledge: *Declarative Procedural Conditional* Regulation: *Planning*
Levanon-Erez, Kampf-Sherf, Maeir, 2019	Pre-post design	22 youth aged 12 to 17, with ADHD	Cognitive-functional therapy to improve self-awareness and strategy behavior for occupational tasks	Significant improvements in occupational performance Cohen's effect size (d > 1.0), executive functioning (d > .7), and strategy behavior (d = 1.24).	Competence: *cognitive*	Regulation: *Planning Monitoring Evaluation*
Milliner & Dimoski, 2021	Quasi-experimental	129 participants, aged 18 to 21. Conditions: strategy training and additional input (STI, n = 43), strategy training (ST, n = 48), and control group (CG, n = 38)	Process-based experiential learning tasks and guided reflections to teach learning strategies to low-proficiency second language learners	No significant group differences.	Competence: *cognitive* Confidence: *self-efficacy*	Knowledge: *Declarative Procedural Conditional* Regulation: *Planning Evaluation*
Russell, Strodl, Connolly & Kavanagh, 2021	Pre-post design	13 youth patients aged 10 to 17, diagnosed with cystic fibrosis	Narrative imagery therapy with metacognitive strategy use, designed to reduce distress from cystic fibrosis (CF) by encouraging management of challenges with coping strategies and highlighting pursuits and successes in life. Patients and parents work together in therapy	Significant improvements in anxiety (d = 0.64) and emotional functioning (d = 0.62), and depression (d = 0.47). Qualitative results: Participants report study helped youth look toward the future and look at the bigger picture in life.	Competence: *emotional* Confidence: *belief in the future*	Knowledge: *Declarative Procedural Conditional* Regulation: *Planning*
Russell, Strodl & Kavanagh, 2021	Pre-post design	132 youth patients aged 10 to 18, diagnosed with cystic fibrosis	Social robot delivering narrative imagery therapy designed to reduce distress from CF by encouraging management of challenges with coping strategies and highlighting pursuits and successes in life. Parents excluded and social robot is used to allow youth to freely express themselves and avoid pressure from parents	Significant post-treatment improvements in anxiety (d = 0.90).	Competence: *emotional*	Knowledge: *Declarative Procedural Conditional* Regulation: *Planning*
Schmidt & Ford, 2003	Quasi-experimental	79 undergraduate students, (mean age = 22), n = 42 intervention, n = 37 control	Through web-page creation computerized activities, intervention encourages more frequent and more accurate reflection on learning process through monitoring and controlling creation of webpage	Metacognitive activity accounted for 14% greater declarative knowledge (), 5% in performance on a skill-based measure (), and 12% of self-efficacy (), post-test, compared to the control group.	Competence: *cognitive* Confidence: *self-efficacy*	Knowledge: *Declarative* Regulation: *Monitoring*

Terlecki & McMahon, 2018	Quasi-experimental	251 liberal arts undergraduate students, no mention of age, 3 groups: Cognition course (n = 33), metacognition course (n = 67), introduction to psychology (n = 121).	Comprehensive course in metacognition to improve metacognitive awareness, regulation and skill	Significant increase in metacognitive awareness, post-test, $F(1,32) = 12.62$, $p<.001$ and abilities $F(1, 31)=7.21$, $p=.01$ for students in metacognition course condition.	Competence: *cognitive*	Knowledge: *Declarative Procedural Conditional* Regulation: *Planning*
Wang & Sperling, 2021	Quasi-experimental	133, 7th grade students (mean age = 13), 3 conditions: control, confidence rating, confidence rating + monitoring instruction	Program to increase math scores, confidence bias, absolute accuracy, metacognitive awareness, self-regulated strategy use, and mathematics self-efficacy	No significant difference in math performance across 3 conditions. Significant increase in posttest confidence bias for CR + MI group ($F(1,44) = 6.28$, $p < .05$, $\eta2 = .13$).	Competence: *cognitive* Confidence: *self-efficacy*	Regulation: *Monitoring*
Zan, 2000	Pre-post design	27 biology students at undergraduate university level, no mention of age	Program to improve mathematics performance for biology students who fail math courses	Qualitative report. Previous to intervention, students attributed failing courses to external causes such as test difficulty. After intervention, students attributing failing courses to due to internal and controllable causes such as insufficient prior knowledge. All students that had previously failed, after the intervention, passed math course.	Competence: *cognitive*	Knowledge: *Procedural Conditional* Regulation: *Planning Monitoring Evaluation*

Quasi-Experimental Studies. In eight of nine studies involving quasi-experimental designs, statistically significant results were seen. Studies saw improvements in (a) self-regulation and metacognition about writing activities, which included reduced spelling and syntax errors (Hooper et al., 2006); (b) higher-order cognitive learning skills and self-regulation of learning among nursing students (August-Brady, 2005); (c) accuracy and efficiency during occupation performance tests for performing complex daily tasks for youth on the autism spectrum (Lamash & Josman, 2021); (d) declarative knowledge, self-efficacy, and metacognitive activity in web page creation of computerized activities (Schmidt & Ford, 2003); (e) metacognitive awareness in a comprehensive course on metacognition (Terlecki & McMahon, 2018); (f) knowledge of fractions and mathematical reasoning (Hacker et al., 2019); (g) math problem solving and text comprehension (Berger et al., 2008). In addition, there was a significant increase in post-test confidence bias in mathematics performance for a sample of underconfident youth (Wang & Sperling, 2021). No improvements were seen in confidence (self-efficacy) in a listening intervention for low-proficiency second language learners (Milliner & Dimoski, 2021).

PYD Program Goals: 5Cs as Outcomes

Competence. All of the interventions tested outcomes related to competence. Some studies examined multiple competencies at once. Fifteen studies examined cognitive competencies, 2 emotional competencies, and 1 behavioral competency. Table 3 shows whether each study contained a control group.

For Cognitive Competency outcomes, youth participating in the intervention showed statistically significant improvements. Improvements were seen in (a) self-regulatory learning of higher-order cognitive skills, (b) mathematical foundations and problem solving, (c) text and listening comprehensions, (d) and writing production (August-Brady, 2005; Berger et al., 2008; Bozorgian et al., 2022a; Bozorgian et al., 2022b; Hessels et al., 2009; Hooper et al., 2006; Lamash & Josman, 2021; Levanon-Erez et al., 2019). For studies of Emotional Competencies, improvements were seen in management and reduction of anxiety and negative worry (Russel et al., 2019; Russel et al., 2021). In the one study that measured Behavioral Competencies,

statistically significant improvements were seen in occupational and daily living performance (Lamash & Josman, 2021).

Confidence. Four studies examined outcomes related to confidence. Three studies tested Self-Efficacy and one examined Belief in the Future. In the studies that measured Self-Efficacy, for those who participated in the intervention, statistically significant increases were seen in the following areas: (a) self-efficacy in creating web page activities in class, and (b) confidence bias in math performance (Terlecki & McMahon, 2018; Wang & Sperling, 2021). In the study addressing Belief in the Future, qualitative reports after intervention showed that some participants had reduced fear of living with their diagnosed illness in the future and were more often reminded to look forward to the future (Russell et al., 2021a).

Character, Caring, and Connection. No studies investigated outcomes related to character, caring, or connection.

Metacognitive Categories

Eleven studies contained intervention components that taught knowledge of cognition. Within knowledge of cognition, 9 studies had intervention components addressing declarative knowledge, 9 procedural knowledge, and 9 conditional knowledge. Sixteen studies contained intervention components that taught regulation of cognition, of which 13 addressed planning, 11 monitoring, and 10 evaluations.

Emergent themes

Explicit Metacognitive Training. Intervention facilitators or instructors, in 13 studies, gave explicit reference to metacognition to intervention participants. Table 4 shows more detail of these explicit references. Across these studies, intervention elements included the use of concept mapping, goals, skills, and strategies of metacognition in the context of activation of cognitive and metacognitive strategies in learning and reasoning (August-Brady, 2005; Berger et al., 2008). These types of intervention approaches enhanced participants' outcomes, including listening, comprehension, and writing skills (i.e., coherence and cohesion) among English learners (Bozorgian et al., 2022a; Briesmaster & Etchgaray, 2017). In the area of mathematics, explicit reference to metacognition enhanced the development of teaching concepts of fractions, increased math scores, confidence bias, and absolute accuracy in students in general, as well as improved mathematics performance for biology students (Hooper et al., 2006; Zan, 2000). Explicit metacognition training also improved metacognitive awareness, acquisition of curriculum-related cognitive and metacognitive strategies, self-regulation and metacognition for writing activities, cognitive orientation for occupational performance, process-based experiential learning tasks, and web page creation of computerized activities (Hacker et al., 2019; Hessels et al., 2009; Lamash & Josman, 2021; Schmidt & Ford, 2003; Terlecki & McMahon, 2018; Wang & Sperling, 2021).

Measuring Metacognition. Eleven of the 17 studies measured the change in metacognition in their intervention. Assessment tools for measuring this change are in Table 4. Different measures of metacognition were used across these eleven studies. However, the Metacognitive Awareness Inventory was used in a study on gaining metacognitive skills and the Junior Metacognitive Awareness Inventory was used in a study on mathematics performance (Terlecki & McMahon, 2018; Wang & Sperling, 2021).

Table 4. *Inductive Themes from Review*

Author	Theme 1: Explicit Metacognitive Training		Theme 2: Tool for Assessment of Change in Metacognition
August-Brady, 2005	Facilitators describe the benefits and utilizing concept maps		Self-regulation of learning: The Strategic Flexibility Questionnaire (SFQ)
Berger, Kipfer & Buchel, 2008	Teacher explains goals and strategies of lessons		No assessment
Bozorgian, Fallahpour, Amiri, 2022	Instructors discussed metacognitive strategy use with participants		Measured attitudes toward metacognitive intervention
Bozorgian, Yaqubi & Muhammadpour, 2022	No specific mention of metacognition to participants		Metacognitive Awareness Listening Questionnaire (MALQ)
Briesmaster & Etchegaray, 2017	Teacher interviews students focusing on metacognitive strategy use		Domain relevant measures of planning, monitoring and evaluation
Hacker, Kiuhara & Levin, 2019	Provides explicit instruction for stages of learning. Used to teach students metacognitive components for self-regulated learning.		No assessment
Hessels, Hessels-Schlatter, Bosson & Balli, 2009	Metacognitive strategy use reflection after each intervention exercise		Author created a measure of metacognitive activity
Hooper, Wakely, de Kruif & Swartz, 2006	Teacher models behavior with specific explanation of planning, evaluation and monitoring		No assessment
Lamash & Josman, 2021	Direct discussion of benefits of metacognitive intervention		WebNeuro software: includes measures of memory, attention, sensory-motor, verbal, executive functioning, and emotional recognition
Levanon-Erez, Kampf-Sherf, Maeir, 2019	No explicit instruction		Self-regulated skills interview Behavior Rating Inventory of Executive Function
Milliner & Dimoski, 2021	Explicit instruction – raising learners' awareness of strategies to be learned, modeling by teacher		No assessment
Russell, Strodl, Connolly & Kavanagh, 2021	No explicit instruction		No assessment
Russell, Strodl & Kavanagh, 2021	No explicit instruction		No assessment
Schmidt & Ford, 2003	Trainees introduced to concept of metacognition and given a handout of relevant skills		Author created measure of metacognitive activity
Terlecki & McMahon, 2018	Authors believe that not only can metacognitive strategies be taught but also that explicit training is necessary to influence the metacognition of all learners		Metacognitive Awareness Inventory (MAI) Metacognitive Rubric (MR)
Wang & Sperling, 2021	Explicit monitoring instructions		Junior Metacognitive Awareness Inventory (Jr. MAI) Self-Regulated Learning (SRSI-SR)
Zan, 2000	Teachers directly navigate metacognitive strategy use with students		Open-ended questions about metacognitive study skills (planning, monitoring, and evaluation)

Discussion

Review of Findings

This review aims to (a) examine the effects of metacognitive intervention on the goals associated with PYD programs, and (b) discuss whether the metacognitive process, couched within PYD programs, may catalyze positive change in adolescents' lives. This is the first review linking metacognition intervention research to the 5Cs of PYD.

Of the 17 metacognitive intervention studies included in the review, only four used randomized control trials (RCTs). These RCTs, a leading tool in studying cause and effect, provide a reliable foundation for our findings. Studies with a RCT design (with features such as control groups, experimentation, randomization, and allocation concealment) allow for higher confidence in limiting bias of results. It is crucial for metacognitive interventionists working with adolescent populations to enact more RCTs, enhancing the internal validity of results and building trust in the efficacy of metacognitive interventions.

Themes from Review

This study emerged with two themes: explicit metacognitive training and metacognition measurement.

Explicit metacognitive training, a powerful tool, entails increasing participants' knowledge of what/how/why thought process(es), behavior(s), and/or attitude(s) are expected to change during and after metacognitive training. This knowledge is theoretical and linked to tangible improvements in metacognitive awareness, regulation, and skill use (Burchard & Swerdzewski, 2009; Terlecki & McMahon, 2018). Participants can conceptualize the uses and benefits of their activities while focusing on their current and changing thoughts in the session. This underscores the transformative potential of metacognitive training, inspiring us to continue our research and application in PYD programs.

Regarding the measurement of metacognition, PYD researchers may benefit from examining the degree to which increasing metacognition explains lasting cognitive and behavioral changes resulting from PYD participation. We suggest that PYD interventions already contain metacognitive components and in measuring and evaluating such, we can illuminate ways in which youths' consciousness, attitudes, and behaviors change throughout the intervention. Measuring and understanding the change and growth involving subcomponents of metacognition will allow for targeted improvements in the development and delivery of the intervention curriculum and the specialized needs of the individuals, groups, and communities involved.

Gaps in Metacognitive Intervention Literature

This review of metacognitive interventions with adolescents found evidence supporting two of the PYD intervention goals: competence and confidence. However, no studies focused on building character, fostering caring attitudes, or promoting social connections as targeted outcomes. This emphasis on competencies and confidence may be due to the context of educational psychology within which metacognitive interventions typically reside. Educational psychology primarily aims to improve learning, often associated with competencies (such as math or reading) and the confidence to approach new tasks.

The lack of focus on character, caring, and social connection in metacognitive interventions underscores the need for these interventions to address additional outcomes recognized as important for adolescent development and well-being. PYD literature and practice stress the importance of teaching youth prosocial societal and cultural norms and enabling them to form bonds and connections with people, communities, and institutions. Despite this, the identified metacognitive interventions primarily concentrate on academic and occupational competencies relevant to a technologically oriented workforce, such as writing, reading, math, and workplace strategy behavior. While improving confidence, particularly

self-efficacy in completing activities and belief in the future, is crucial for older adolescents and emerging adults in achieving success in school or work, the absence of interventions focusing on connection, caring, and character presents an opportunity for future metacognitive interventions to target ideological and behavioral changes that promote cooperation and compassion.

To address this gap, researchers could incorporate metacognitive components into interventions that teach, for example, moral competencies. Moral competency is the "youth's ability to assess and respond to the ethical, affective, or social-justice dimensions of a situation" (Catalano et al., 2004, p. 105). This competency has been subsumed under Caring from the 5Cs. In Swanson and Hill's 1993 study of moral metacognition (i.e., awareness of environmental influences, information to consider during moral reasoning, and strategies for difficult decision-making), moral reasoning (measured by concepts such as fairness, trustworthiness, empathy, altruism, respectfulness, etc.), and moral behavior (breaking promises, stealing, telling a lie, etc.), researchers found that higher moral metacognition was related to both advanced moral reasoning and increased moral behavior.

Limitations of Current Study

We note several limitations of this review. We categorized the 12 objectives of PYD into the 5Cs of PYD, without a preexisting system; other categorizations may exist. Additionally, the outcomes of each study were categorized by the current authors and not the authors of the interventions. It is possible that other authors may categorize their study outcomes as a different objective or goal than what was done in this review. There was no inter-rater reliability conducted but rather continuous conversation and eventual agreement on the categorizations. Taking all of these limitations into account, implications are necessarily tentative.

Implications

This review provides support for the idea that metacognition can facilitate change in Positive Youth Development (PYD) interventions. It is important for researchers to understand changes in metacognition, as it can enhance comprehension of the individual changes experienced during a specific intervention. In metacognitive interventions, improvement in metacognitive abilities directly influenced outcomes related to the 5Cs. These interventions aimed to bring about changes related to the 5Cs of PYD, and the success in producing changes in attitudes and behaviors may be linked to changes in knowledge and regulation of the relevant cognitions targeted in the intervention. These changes then pave the way for the acquisition of skills in important areas of youth development.

Although current PYD interventions do not focus on metacognition, there is solid evidence that enhancing metacognitive abilities positively contributes to the goals of PYD. Future work could involve creating a metacognitive tool kit that provides a comprehensive framework for translating program activities and goals to stakeholders. This could lead to a better understanding of how intervention elements may impact specific goals, ultimately increasing engagement and buy-in. By explicitly incorporating a metacognitive framework into the design and implementation of program aims, it is possible to bridge the gap between program facilitators and the intervention goals, thus offering a clearer understanding of what each program component is meant to convey and achieve (Lang, Wyer & Haynes, 2007; Martin, Mullan & Horton, 2019). This, in turn, can enhance facilitator training and program implementation.

In their review paper, Shek and colleagues (2019) highlight that the 5Cs of PYD are rarely measured as objectives or outcomes in PYD intervention programs. Many programs focus heavily on addressing problem behaviors and promoting community contribution, neglecting the measurement of the 5Cs. The authors of this article suggest that there is a need for empirical studies to measure metacognition as a mechanism of change between participation in interventions and the 5Cs of PYD. By evaluating metacognition within PYD interventions, researchers can gain insight into how young people's awareness

and understanding of their thoughts change throughout the intervention process. The authors argue that young people's plans, actions, and development are influenced by their thought processes, which are in turn shaped by various influential systems, such as family, school, and peer groups. PYD programs aim to complement these influences. Understanding changes in young people's thinking can enhance their ability to develop positively and constructively. Metacognitive abilities enable young people to assess the effectiveness of intervention curricula in different situations and apply this knowledge to new and challenging circumstances in life. Furthermore, for interventionists, this perspective allows for the assessment of their program elements in terms of knowledge and regulation of cognition, providing a measurable framework for change. Additionally, there is an opportunity for metacognitive researchers, who are primarily based in educational psychology departments, to see how their work can be expanded to contribute to a more comprehensive understanding of youth development.

Families may also benefit from participating metacognitive interventions with their youth. The benefits are seemingly reciprocal in that families may use metacognitive toolkits and/or therapeutic techniques that affect the youth's competence, confidence, character, caring, and/or connection, while simultaneously informing themselves of the types of knowledge and regulation of cognitions involved in reaching those five goals of PYD.

Finally, we have demonstrated a direct link between metacognitive interventions and the enhancement of competence and confidence. However, there is a shortage of interventions that target character, caring, and connection. Future research could identify current PYD programs designed to bolster youth character, caring, and connection, and then assess the impact of increasing metacognitive awareness and ability.

IDEAS

This article aims to be helpful for research and practice related to PYD programming. The authors present ideas to enhance PYD programs for youth, particularly those from communities intentionally disinvested and disenfranchised by economic, local, and national priorities. The authors draw from their experiences as participants and as a creator of PYD programs, and seek to pass on and improve the skills and attributes they gained.

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