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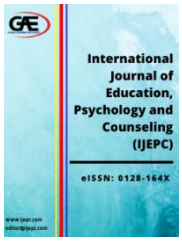

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A PILOT STUDY ON INTEGRATING COGNITIVE BEHAVIOURAL THERAPY AND BIOFEEDBACK IN COUNSELLING JUVENILE CLIENTS AT A MALAYSIAN REHABILITATION CENTRE

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Abstract:

This pilot study, conducted in a Malaysian juvenile rehabilitation institution, explored the implementation and effectiveness of a structured counselling protocol that integrates Cognitive Behavioural Therapy (CBT) with Heart Rate Variability (HRV) biofeedback to address emotional deregulation and behavioural difficulties among adolescents with traumatic backgrounds, impulsivity, and poor self-regulation. Using a qualitative case study design, ten male adolescents aged 14 to 17 participated in eight structured sessions involving CBT techniques such as the ABC model, cognitive restructuring, visualization, and imagery descripting, combined with HRV biofeedback to support real-time physiological regulation. Data were collected through observation, session notes, client journals, and HRV recordings. Thematic analysis revealed significant outcomes including increased emotional awareness, improved engagement, reduced impulsivity, and enhanced self-efficacy. Participants showed progress in linking thoughts to emotional and physiological responses and began applying coping strategies in real-life situations. The biofeedback component notably increased motivation and insight, especially among those initially resistant to traditional talk therapy. Overall, the integrated CBT-biofeedback approach promoted greater autonomy in emotional and behavioural regulation, demonstrating its clinical potential as a holistic and sustainable therapeutic model for high-risk adolescent populations in rehabilitation settings.

Keywords:

Cognitive Behavioural Therapy (CBT), Biofeedback, Heart Rate Variability (HRV); Juvenile, Counselling, Emotional Regulation

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Introduction

Adolescents placed in juvenile rehabilitation institutions frequently grapple with multifaceted emotional, cognitive, and behavioural challenges, often rooted in environments characterized by trauma, neglect, abuse, or toxic peer associations (Shamala & Zain, 2023; Kermen, 2018). These youth are not merely individuals in need of discipline they are survivors of disrupted attachments, chronic stress, and systemic failure. Their emotional dysregulation and impulsivity are not merely behavioural issues but are often symptomatic of deeper psychological wounds that have gone unaddressed. In Malaysia, institutions such as Sekolah Tunas Bakti (STB), administered by the Department of Social Welfare, operate primarily within a structured and corrective framework. While these systems provide routine and basic rehabilitative support, they often fall short in addressing the nuanced psychosocial needs of the young individuals in their care (Luna et al., 2022; Tran et al., 2017). Discipline and structure, though necessary, are not sufficient to rebuild the fragmented inner worlds of adolescents whose developmental trajectories have been profoundly altered by adversity.

This gap highlights the urgent need for trauma-informed, evidence-based interventions like Cognitive Behavioural Therapy (CBT), which has gained empirical support for its effectiveness in addressing mood and behavioural disorders in adolescents (Efstathiou, 2021; Berking et al., 2008; Bomyea et al., 2020; Ekeblad et al., 2023). CBT aims to restructure negative thought patterns and promote healthier emotional responses and decision-making. Among youth populations, CBT has shown efficacy in reducing anxiety, depression, anger, and conduct problems (Alavi et al., 2018; Butler et al., 2006; Hofmann et al., 2012). However, the traditional model of CBT which relies heavily on verbal articulation and introspection may be limited in its accessibility for adolescents with underdeveloped emotional literacy or those who are resistant to verbal therapy due to mistrust, shame, or cultural stigma. Recognizing this limitation, contemporary therapeutic practices have turned toward multimodal approaches. One promising innovation is the integration of Heart Rate Variability (HRV) biofeedback into therapeutic settings (Heiss et al., 2021). The EmWave device, developed by the HeartMath Institute, is designed to provide real-time feedback on physiological responses, teaching users to regulate their autonomic nervous system through paced breathing and visual feedback (Whited et al., 2014). This biofeedback empowers clients with immediate, tangible experiences of emotional control, reinforcing the internalization of self-regulation skills (NCT05136586, 2021; Rose et al., 2021; Uzun & Yıldırım, 2018).

The combination of CBT and HRV biofeedback presents a compelling dual-modality approach that simultaneously targets cognitive distortions and physiological arousal. For adolescents in juvenile institutions many of whom struggle with hyper vigilance, mistrust, or dissociation this integrative model provides both an experiential and reflective pathway to healing (Rosaura Polak et al., 2015; Slutsker et al., 2010). Moreover, the interactive and visual components of HRV tools like EmWave may enhance motivation, engagement, and therapeutic alliance, especially among youth who may feel alienated from traditional clinical models. Ultimately, rehabilitative interventions must move beyond punishment and compliance toward compassion, understanding, and empowerment. The healing of incarcerated youth demands more than structured routines; it requires a systemic commitment to treating them as whole human beings with emotions, histories, and the potential for transformation.

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Literature Review

Cognitive Behavioural Therapy (CBT) and Behavioural Change

Cognitive Behavioural Therapy (CBT) was introduced in the 1960s by Aaron T. Beck, who emphasized the influence of distorted thoughts on emotional responses and behavioural outcomes. As a form of psychotherapy grounded in both cognitive and behavioural theory, CBT promotes the idea that changes in thinking patterns can lead to significant improvements in emotions and behaviours (Collard, 2023). Originally developed to treat depression, CBT has since been adapted for a wide range of psychological and behavioural problems, making it one of the most researched and widely applied therapeutic modalities globally. In the context of adolescent behavioural problems, CBT has proven effective in helping individuals recognize and modify maladaptive thought patterns that drive impulsive, aggressive, or delinquent behaviours (Denecke et al., 2022; Nakao et al., 2021). This is especially relevant for youth in juvenile rehabilitation settings, where many exhibit poor emotional regulation, cognitive distortions, and limited coping strategies (Landenberger & Lipsey, 2005; Siemionow, 2020). CBT interventions aim to enhance self-awareness, improve decision-making skills, and promote behavioural accountability qualities often underdeveloped in institutionalized adolescents.

Multiple studies have supported the application of CBT with adolescent offenders. Lipsey, Landenberger, and Wilson (2007), in a comprehensive meta-analysis, concluded that CBT-based programs resulted in significant reductions in reoffending behaviours among juvenile delinquents. The most effective programs integrated structured cognitive interventions with behavioural practice and consistent reinforcement. Similarly, Wilson, Bouffard, and MacKenzie (2005) highlighted that CBT was more effective than other treatment approaches when delivered with fidelity, particularly in institutional settings where behaviour change is a primary goal. In the Southeast Asian context, though local research is less extensive, emerging case studies suggest that CBT-based interventions can positively influence emotion regulation, problem-solving, and interpersonal skills among at-risk Malaysian youth. A variety of core techniques are employed in CBT, each targeting specific cognitive and behavioural mechanisms. One key technique is cognitive restructuring, which teaches clients to identify and challenge irrational beliefs or automatic negative thoughts. For instance, a juvenile client may hold the belief "*I'm a failure and nothing will change*," leading to learned helplessness and poor behavioural control. Through CBT, such thoughts are examined and reframed into more realistic alternatives, such as "I have made mistakes, but I can learn to do better." This process helps reduce emotional reactivity and fosters a sense of self-efficacy.

Another commonly used strategy is behavioural activation, which involves encouraging clients to engage in positive, goal-directed activities that improve mood and reduce avoidance behaviours (Euteneuer et al., 2017; Huguet et al., 2016). This is particularly relevant for adolescents who exhibit low motivation or depressive symptoms. In addition, problem-solving training is often incorporated into CBT with juveniles, enabling them to analyze challenging situations, generate alternative solutions, and evaluate the consequences of different choices skills that are essential for reducing recidivism and improving peer relationships (Amani et al., 2022; Ngo et al., 2020; Silverman et al., 2019). Other than that, CBT also emphasizes anger management and impulse control techniques, including helping clients recognize physiological signs of anger, identify triggers, and use relaxation strategies such as deep breathing or guided imagery to regulate their emotional responses (Lee & Ahmad, 2017). For adolescents with

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underdeveloped emotional vocabulary, these strategies are taught through simple language and experiential learning. Lastly, role-playing and social skills training allow clients to rehearse pro-social behaviours in a safe environment, which builds confidence and increases the likelihood of generalization in real-life situations. Despite its many strengths, CBT is not without limitations. In particular, it relies on the client's ability to engage cognitively and reflectively in the therapeutic process. For some adolescents in juvenile institutions especially those with trauma histories, low attention spans, or learning difficulties traditional CBT may be challenging (Chipalo, 2021; Cohen et al., 2012) . This highlights the need to integrate more interactive and somatic methods such as biofeedback to complement CBT and improve treatment responsiveness.

Biofeedback and Emotional Self-Regulation

Biofeedback is a psychophysiological intervention that enables individuals to gain awareness and control over physiological processes typically considered involuntary, such as heart rate, muscle tension, and skin conductance. One of the most commonly used forms is Heart Rate Variability (HRV) biofeedback, which involves training individuals to regulate their heart rhythms through focused breathing, attention regulation, and emotional self-awareness (Aritzeta et al., 2022; Moon-Ji & Wan-Ju, 2021). HRV refers to the variation in time intervals between heartbeats and serves as a reliable indicator of autonomic nervous system flexibility. Higher HRV is associated with greater emotional resilience and self-regulatory capacity, while low HRV is linked to stress, anxiety, and emotional deregulations (Umair et al., 2021; van der Zwan et al., 2019). Among juvenile clients in institutional settings, emotional regulation challenges are frequently observed and often expressed through impulsivity, aggression, and behavioural defiance. Many of these adolescents have experienced trauma, disrupted attachment, and chronic stress, which can impair their physiological and emotional regulation systems. Biofeedback offers an experiential and body-based learning process that helps these youth become more aware of their internal states and provides strategies for shifting from a reactive to a more coherent physiological condition.

Research has shown promising results for HRV biofeedback in supporting emotional regulation among adolescents. For example, McCraty and Zayas (2014) found that adolescents who received HRV training exhibited reduced symptoms of anxiety, anger, and depression, as well as increased engagement in academic and social activities. Similarly, Zucker et al. (2009) reported that adolescents using HRV biofeedback demonstrated improved emotional control and reduced physiological stress responses. These findings suggest that biofeedback may serve as an effective tool to enhance emotional self-regulation, particularly for populations that struggle with traditional verbal-based therapies. In juvenile rehabilitation contexts, biofeedback is particularly beneficial due to its accessibility and nonverbal approach. Adolescents with low verbal proficiency or limited introspective abilities often find traditional talk therapy less engaging. In contrast, biofeedback provides real-time visual and auditory feedback that reflects changes in physiological state, which can be empowering and motivating. For example, a client may observe how focused breathing and positive imagery can lead to greater HRV coherence, reinforcing the connection between emotion, thought, and bodily regulation.

Biofeedback sessions are typically introduced through teaching clients simple breathing techniques, attention focusing, and emotional recall exercises. These sessions help them develop internal awareness of stress responses and cultivate skills to manage physiological

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arousal. Over time, clients learn to recognize the onset of emotional deregulation and apply self-regulation techniques in real-life scenarios. This somatic awareness creates an essential foundation for emotional intelligence and behavioural change. When integrated with cognitive-behavioural approaches, biofeedback enhances the effectiveness of cognitive strategies by reinforcing physiological self-regulation. For instance, once a client has developed the ability to lower physiological arousal through breathing and attention control, they are in a better state to apply CBT skills such as identifying cognitive distortions or engaging in problem-solving. The combination of top-down (cognitive) and bottom-up (physiological) strategies provides a holistic intervention that strengthens emotional resilience and supports sustained behavioural transformation among juvenile clients.

Methodology

This study adopted a qualitative case study approach to explore the implementation and effectiveness of a structured counselling protocol integrating Cognitive Behavioural Therapy (CBT) with heart rate variability (HRV) biofeedback among adolescents in a juvenile rehabilitation setting. The participants consisted of ten male adolescents aged 14 to 17 residing in a government juvenile institution. The intervention was designed and delivered over eight sessions using a structured protocol divided into clearly defined stages, allowing for a gradual and responsive therapeutic process.

Multistage Counselling Process Integrating Cognitive Behavioural Techniques and Biofeedback

The intervention was designed and implemented through a systematic, multistage process within the counselling framework. The approach began by establishing a strong therapeutic alliance, identifying key problems, and collaboratively setting goals that were realistic and measurable. Subsequently, cognitive behavioural techniques were integrated with heart rate variability (HRV) biofeedback to help clients become more aware of their thought patterns and physiological responses, allowing them to regulate their emotions more effectively. Techniques such as visualization, descripting, and cognitive restructuring were applied to challenge irrational beliefs and reduce the impact of "hot thoughts." To consolidate these skills, the intervention incorporated repeated practice and real-world application, supported by ongoing biofeedback to track progress and foster a sense of self-efficacy. Finally, in the closing phase, the process was designed to empower clients to become their own therapists, employing the strategies and techniques learned to maintain progress and cope with future stressors independently. This multistage approach underscores a comprehensive framework for strengthening self-regulatory capacities in a clinical context.

Preparation Stage I: Breaking the Ice

The initial stage focused on building rapport and creating a safe emotional environment for clients. Counsellors engaged the adolescents through light-hearted conversation, storytelling, and informal dialogue to ease tension and reduce resistance. An informal screening process was conducted to understand the client's emotional and behavioural challenges, using short interviews or simple questionnaires. This stage also included the introduction of the biofeedback tool, where clients were shown how heart rate variability reflects emotional states. Demonstrations were kept simple and relatable, using real-time feedback to help clients connect emotions like "*stress*" or "*calm*" to visible physiological reactions. This experiential approach laid the foundation for trust and openness.

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Preparation Stage II: Clarifying Problems and Goals

Once rapport was established, the second preparatory phase focused on clarifying key personal challenges and setting therapeutic goals. Guided questioning was used to identify common issues such as impulsivity, anger, or low emotional control. Counsellors collaborated with clients to set SMART goals specific, measurable, achievable, relevant, and time-bound that matched their developmental capacity. Clients were introduced to the cognitive approach of CBT using visual aids such as the CBT triangle and simple metaphors to explain how thoughts influence emotions and behaviours. HRV baseline data were collected to establish each client's starting point in terms of physiological regulation.

Beginning Stage I: Identifying Specific Problems

At this stage, counsellors helped clients analyse specific examples from their daily lives, such as peer conflicts or family stress, to uncover underlying thought patterns. The ABC Model (Activating Event, Belief, and Consequence) was applied to make connections between triggering events, beliefs, and emotional or behavioural responses. Socratic questioning and empathetic reflection were used to encourage critical thinking. During these discussions, biofeedback was used to monitor real-time HRV changes, helping clients become aware of their physiological responses to stressful thoughts and situations.

Beginning Stage II: Setting New Goals for Thinking and Behaviour

Clients were guided to set clear goals for how they wanted to think, feel, and behave differently in future situations. Visualization exercises were introduced, allowing clients to mentally rehearse success in managing challenges. These visualizations were supported by HRV biofeedback, which helped reinforce calm states and physiological coherence while clients imagined positive outcomes. The integration of visual imagery and emotional awareness aimed to build confidence and emotional control simultaneously.

Middle Stage I: Challenging and Changing Inference

In this sub-stage, cognitive restructuring was introduced to help clients challenge irrational or unhelpful beliefs. Counsellors guided clients in identifying common distortions such as overgeneralization or catastrophizing, and replacing them with more realistic alternatives. As clients worked through this cognitive shift, biofeedback exercises were used to support relaxation and calmness, reducing the emotional intensity of the restructuring process and promoting deeper learning.

Middle Stage II: Changing Hot Thoughts

This phase addressed emotionally charged "hot thoughts" that triggered impulsive or defensive reactions. Clients learned thought-stopping techniques and were taught how to interrupt automatic negative thinking patterns. Biofeedback played a key role in helping clients observe and regulate their physiological responses when confronting these reactive thoughts. Through repeated practice, clients began to develop a sense of control over their emotional responses.

Middle Stage III: Imagery Re-scripting

In this sub-stage, clients were guided through rescripting exercises to transform distressing or traumatic memories. Using visualization, they were encouraged to replace negative images with empowering, calming alternatives. The process was handled with sensitivity and reassurance, with biofeedback used to monitor HRV and maintain emotional safety throughout.

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This technique was particularly effective in reducing the emotional charge associated with past experiences.

Middle Stage IV: Working Through

This phase emphasized the application of new skills in real-life contexts. Clients were encouraged to use learned strategies such as deep breathing, cognitive reframing, and behavioural rehearsal when facing actual challenges. Counsellors provided feedback and reinforcement, while HRV tracking was used before and after these real-life situations to assess clients' ability to self-regulate under pressure. Homework tasks were given to strengthen consistency and reinforce progress outside the session environment.

Ending Stage: Coaching the Client to Become Their Own Counsellor

The final stage focused on consolidating gains and preparing clients for long-term self-regulation. Counsellors reviewed each client's progress, highlighting their personal growth and resilience. Clients were introduced to relapse prevention strategies, including recognizing early warning signs and planning for high-risk situations. They were encouraged to continue using CBT tools and biofeedback independently. HRV tracking was discussed as a personal self-monitoring technique. Ultimately, the aim was to empower each adolescent to manage emotions and behaviour with autonomy and confidence.

Counselling Skills Integrated Throughout the Intervention

Throughout the implementation of the structured counselling protocol, a range of core counselling skills were applied to support therapeutic goals and meet the developmental needs of juvenile clients. These skills played a vital role in building rapport, facilitating cognitive and emotional insight, managing resistance, and fostering behavioural change (Ezy Maulany et al., 2023). One of the foundational skills applied from the earliest stage was rapport-building (Mohamad et al., 2010). Counsellors employed humour, active listening, and non-judgmental communication to create a safe, trusting environment. This was particularly crucial for adolescent clients, many of whom entered the sessions with low trust in adults and prior negative experiences with authority. Activities such as storytelling, casual dialogue, and ice-breakers helped ease resistance and enabled clients to feel heard and respected (Laird, 1983; Naparan, 2020).

As the sessions progressed, counsellors made extensive use of Socratic questioning to guide clients toward self-discovery and insight (Glaser & Kirschenbaum, 1980; Murdock & Connery, 2009). This technique involved asking open-ended, reflective questions to help clients explore their automatic thoughts, challenge negative beliefs, and develop alternative interpretations. The process encouraged critical thinking and enabled clients to take ownership of their thought patterns rather than simply receiving advice (Braun et al., 2015; Wharne, 2022). Exploratory and motivational interviewing skills were used to clarify clients' goals and to elicit their internal motivation for change. Counsellors affirmed client strengths, used reflective listening to understand emotional undercurrents, and encouraged goal setting based on clients' own values. These techniques were essential during the preparation and early beginning stages of the intervention, as they helped to align clients' personal aspirations with the therapeutic direction. During the middle phases, more advanced skills were employed, including cognitive restructuring, visualization guidance, and emotion regulation coaching. Cognitive restructuring required counsellors to support clients in identifying and reframing irrational thoughts, using real-life examples and supportive dialogue (Murdock & Connery, 2009). Visualization

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techniques were used to guide clients through imagery-based exercises, particularly during goal setting and rescripting sessions. These practices helped clients develop internal pictures of success and reduce emotional distress tied to negative memories. Emotion coaching involved teaching and modelling calming strategies such as deep breathing, grounding techniques, and mindfulness (Chan et al., 2024).

These were especially effective when combined with biofeedback training, allowing clients to monitor and self-regulate their physiological states in real-time. Counsellors demonstrated emotional containment during distressing sessions and reinforced clients' efforts with positive affirmations. Behavioural coaching was emphasized in the latter stages of the intervention (Konopka et al., 2018). Counsellors encouraged clients to apply learned skills in real-life situations, provided feedback, and celebrated small victories. Role-playing was used to rehearse pro-social behaviour, resolve conflicts, and prepare for emotionally triggering events. Counsellors also helped clients reflect on their actions, reinforcing the use of adaptive coping strategies outside of therapy. Finally, empowerment techniques were used to foster long-term independence. As the sessions concluded, counsellors guided clients in creating maintenance plans and recognizing early signs of emotional dysregulation. Clients were encouraged to take on the role of their own "internal counsellor," drawing from the strategies and tools they had learned. Positive reinforcement and strengths-based language were used consistently to build self-efficacy and resilience. In addition to the structured protocol content, the effectiveness of the counselling sessions was also supported by the consistent application of core counselling skills across all stages of the intervention. These skills were not applied randomly but were purposefully integrated based on the therapeutic goals of each phase. The counsellor adapted communication style, engagement strategies, and intervention techniques in accordance with the client's emotional readiness and cognitive development. Table 1 below outlines the specific counselling skills used at each intervention stage, along with their intended functions and sample statements that reflect actual counsellor-client interactions during sessions.

Table 1.0
Counselling Skills Applied by Intervention Stage, Function, and Sample Counsellor Statements

Intervention Stage	Counselling Skill	Function
Preparation Stage I	Rapport-Building	To establish trust and reduce resistance in the early sessions.
	Active Listening	To validate feelings and show empathy.
	Non-Judgmental Communication	To create a safe and accepting space for self-expression.
Preparation Stage II (Clarifying Problems and Goals)	Exploratory Questioning	To help clients express concerns and define their challenges.
	Motivational Interviewing	To encourage commitment and build intrinsic motivation.
	Socratic Questioning	To guide clients in identifying thought patterns and core beliefs.

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Beginning Stage I (Identifying Problems)	Psych education (CBT Triangle, ABC Model)	To explain the relationship between thoughts, feelings, and behaviours.
	Visualization Guidance	To help clients imagine successful scenarios and reinforce hope.
	Empowering Language	To build confidence and reinforce a growth mind-set.
Middle Stage I (Cognitive Restructuring)	Cognitive Restructuring	To help clients challenge and reframe distorted thinking.
	Emotional Support	To provide reassurance during emotionally intense reflection.
Middle Stage II (Managing Hot Thoughts)	Thought-Stopping Techniques	To interrupt automatic negative thoughts and emotional reactivity.
	Emotion Regulation Coaching	To teach calming strategies such as deep breathing and grounding.
Middle Stage III (Imagery Rescripting)	Trauma-Sensitive Guidance	To process distressing memories in a safe and supportive way.
	Positive Imagery Facilitation	To replace negative mental images with empowering alternatives.
Middle Stage IV (Working Through)	Behavioral Coaching	To support application of new skills in real-life situations.
	Reinforcement and Feedback	To encourage progress and build self-efficacy.
Ending Stage (Relapse Prevention and Empowerment)	Self-Empowerment Skills	To help clients take ownership of their growth and emotional regulation.
	Maintenance Planning	To prepare clients for long-term independent use of skills.

Discussion

The Importance of Emotional Awareness and Engagement

Emotional awareness is a foundational element in the counselling process, particularly among adolescents in juvenile rehabilitation settings (Ibrahim et al., 2022; Ritkumrop et al., 2022). It refers to the ability to identify, understand, and express one's emotional states. For many juvenile clients, this capacity is often underdeveloped due to a history of trauma, neglect, or inconsistent caregiving environments (Luna et al., 2022). These young individuals may struggle to differentiate between emotional cues such as anger, fear, or sadness, which frequently results in impulsive behaviour, reactive aggression, or emotional shutdown.

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Therefore, fostering emotional awareness is not only a therapeutic goal but also a necessary precondition for deeper psychological work. In the context of this study, emotional awareness was prioritized during the early stages of the intervention protocol. The combination of CBT techniques and HRV biofeedback created opportunities for clients to explore their inner states in both cognitive and physiological dimensions. For instance, the use of the ABC model helped clients recognize the link between activating events, beliefs, and emotional consequences, while biofeedback provided tangible feedback about how their bodies reacted during emotional stress (Minen et al., 2019). This integration enabled clients to shift from vague statements such as "I feel bad" to more specific emotional insights like "*I feel anxious when I think I'm being judged*." This clarity laid the groundwork for targeted cognitive restructuring in later sessions.

Client engagement is closely linked to emotional awareness (Arbab Siyar et al., 2021). When clients begin to understand their emotional experiences, they are more likely to engage actively in the counselling process. In this study, initial resistance commonly observed in institutional settings gradually decreased as clients became more curious about their emotional reactions and gained a sense of control through biofeedback. The experiential nature of biofeedback in particular made therapy more interactive and less abstract, which enhanced motivation and trust in the process (van der Zwan et al., 2019). This is especially important in working with juvenile populations, who often exhibit resistance to traditional talk-based approaches. Furthermore, increased emotional awareness enabled clients to participate more meaningfully in visualization, role-playing, and goal-setting activities (Frijda, 1993). Once clients could identify what they were feeling and why, they could begin to imagine alternative responses and internalize new behavioural choices. This readiness for change reflected not only cognitive insight but also emotional engagement both of which are essential for sustainable behavioural transformation. In short, the development of emotional awareness was both a therapeutic milestone and a catalyst for deeper engagement and progress throughout the intervention.

Strengthening Emotional Regulation and Cognitive Restructuring

Emotional regulation refers to an individual's ability to monitor, manage, and modify emotional responses in accordance with situational demands (Arbab Siyar et al., 2021). Among adolescents in juvenile rehabilitation, poor emotional regulation often manifests as impulsive aggression, verbal outbursts, or emotional withdrawal. These behaviours are typically driven by maladaptive thought patterns and unresolved emotional tension (Suganya et al., 2022). As such, a key objective of the intervention in this study was to enhance clients' ability to regulate their emotions, particularly through the combined use of cognitive behavioural strategies and biofeedback-based physiological awareness. The CBT component of the protocol provided a structured approach to identify and challenge cognitive distortions (Alavi et al., 2018). Techniques such as cognitive restructuring, the use of thought records, and the ABC model allowed clients to uncover irrational beliefs and examine their impact on emotional and behavioural outcomes (Suganya et al., 2022). For example, beliefs like "*I can't control myself*" or "*Everyone is against me*" were deconstructed in sessions through Socratic questioning and reframed into more adaptive alternatives. This shift from automatic negative thoughts to balanced thinking empowered clients to choose more constructive responses to stressors.

At the same time, biofeedback supported the emotional regulation process by helping clients become more aware of the physiological markers of distress, such as increased heart rate variability (Ratanasiripong et al., 2012). The real-time feedback provided during sessions gave clients an immediate, visible reflection of their internal state (Minen et al., 2019). They learned

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how certain thoughts triggered physiological arousal, and how conscious breathing and attention-shifting could restore calm. This dual approach not only increased insight but also provided clients with concrete tools to manage difficult emotions. The synergy between cognitive restructuring and physiological regulation was particularly evident in sessions involving anger management and hot thought interventions (Lehrer, 2018). Clients who previously reacted impulsively began using breathing techniques before responding to provocation, and several reported applying these skills during conflicts with peers or authority figures. Counsellors also observed greater emotional stability and reduced escalation during role-play scenario, this behavioural shift suggests that clients were not only gaining intellectual understanding of their emotional triggers but also acquiring the capacity to regulate their internal states in real time. These findings are consistent with literature asserting that CBT is effective in reducing externalizing behaviours among adolescents (Lipsey et al., 2007), and that HRV biofeedback enhances emotion regulation (Zucker et al., 2009). The integration of these two methods created a comprehensive intervention that addressed both the cognitive and physiological dimensions of self-regulation. Ultimately, clients were able to internalize skills that supported not just momentary calm but also long-term behavioural transformation.

Bridging Cognitive and Physiological Self-Regulation

One of the most significant strengths of this intervention was its capacity to integrate both cognitive and physiological dimensions of self-regulation. Traditionally, cognitive behavioural therapy (CBT) emphasizes the restructuring of thought patterns to influence emotional and behavioural outcomes (Bilbrey et al., 2022). However, this top-down approach may not be sufficient for clients who are highly reactive at the physiological level or who have difficulty accessing cognitive reflection during emotional arousal. Conversely, biofeedback offers a bottom-up method by addressing the body's stress response directly through the autonomic nervous system. By combining these two approaches, the intervention created a more comprehensive and responsive therapeutic experience (Lehrer, 2018). Throughout the sessions, clients were able to develop an awareness of how their thoughts affected their emotions, and how those emotions, in turn, manifested physiologically. This awareness was made possible through real-time heart rate variability (HRV) feedback, which visually demonstrated the impact of stress-inducing thoughts (Webb-Murphy et al., 2010; Weise et al., 2008). For example, during cognitive restructuring activities, when clients recalled distressing memories or discussed triggering situations, biofeedback revealed increased physiological arousal. Counsellors then guided clients through breathing techniques and grounding exercises, resulting in observable shifts toward physiological coherence. This real-time regulation experience enhanced clients' sense of control and reinforced the cognitive strategies taught. The integration of both self-regulation systems was particularly evident during imagery rescripting and role-play activities.

Clients were supported in revisiting emotionally charged experiences and constructing new internal narratives while maintaining a state of calm. The simultaneous use of visualization, thought replacement, and physiological self-soothing enabled clients to reprocess emotional material without becoming overwhelmed. This combined approach is supported by contemporary trauma-informed frameworks, which emphasize the need to engage both cognitive and somatic systems in order to create lasting change (Bilbrey et al., 2022; Jongsma et al., 2023; Webb-Murphy et al., 2010). Clients' verbal reflections also illustrated this integration. Several reported that they had begun to recognize internal warning signs of emotional escalation and could apply techniques such as controlled breathing and thought-

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stopping before reacting. These behaviours reflect a maturing of both emotional intelligence and physiological self-awareness, leading to more adaptive choices in daily life. By bridging cognitive restructuring with physiological regulation, the intervention addressed multiple levels of emotional processing. This dual engagement enhanced the sustainability of the behavioural changes observed, as clients were not only learning what to think but also how to feel and respond differently under pressure. In working with adolescent populations especially those with histories of trauma or deregulation this integrated method offers a powerful model for holistic change (Amani et al., 2022).

Conclusion

This study highlights the effectiveness of an integrated intervention combining Cognitive Behavioural Therapy (CBT) and Heart Rate Variability (HRV) biofeedback in fostering self-regulation among adolescents in juvenile rehabilitation (Shamala & Zain, 2023). Emotional awareness played a central role, enabling clients to identify, express, and understand their emotional experiences. By recognizing the connections between thoughts, emotions, and physiological responses, participants moved from vague or reactive emotional expressions to more specific and insightful reflections (Kermen, 2018). This increased clarity enhanced engagement, trust in the therapeutic process, and motivation to participate in counselling (Luna et al., 2022; Tran et al., 2017). The combined use of CBT and HRV biofeedback significantly improved emotional regulation and cognitive restructuring. CBT tools such as the ABC model and cognitive reframing supported clients in challenging maladaptive beliefs (Efstathiou, 2021; Berking et al., 2008; Bomyea et al., 2020; Ekeblad et al., 2023), while biofeedback offered real-time awareness of physiological states and how they are impacted by stress and negative thinking (Heiss et al., 2021; Whited et al., 2014). This integration enabled participants to not only understand their emotions cognitively but also apply practical skills like deep breathing and thought-stopping to manage real-life emotional surges (NCT05136586, 2021; Rose et al., 2021; Uzun & Yıldırım, 2018). Observable improvements in anger control and social behaviours indicated that clients were beginning to internalize these skills beyond therapy (Alavi et al., 2018; Butler et al., 2006; Hofmann et al., 2012). The combination of top-down (cognitive) and bottom-up (physiological) strategies allowed clients to confront emotional content safely, facilitating deeper emotional processing (Rosaura Polak et al., 2015; Slutsker et al., 2010). Overall, this holistic intervention supports sustainable change in trauma-exposed youth populations.

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