

## ORIGINAL ARTICLE

# The therapeutic effect of playing with crickets on children in the senior class

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## ABSTRACT

This study focuses on the trend of younger onset in mental health issues among Chinese populations and investigates the intervention efficacy by using crickets as a therapeutic medium for senior kindergarten children. Using a convenience sampling method, 60 children aged 5–7 years from a kindergarten in Heze, Shandong Province, were selected to interact with adult male *Gryllus bimaculatus*. Data were collected through teacher observations using a self-developed structured questionnaire. Playing with crickets has a positive impact on four aspects of children's lives including living habits, emotional state, social interaction, and learning outcomes. The binary logistic regression model shows that social interaction, emotional state, and learning outcomes have a significant positive promoting effect on children's psychological adjustment. Among them, social interaction has the most significant effect, while living habits have a significant negative correlation with children's psychological adjustment. In response to adverse effects, this study proposes strategies for integrating insect-interaction activities, such as cricket engagement, into kindergarten curricula.

**Keywords:** preschool children, insect-assisted therapy, cricket, intervention, mental health

## INTRODUCTION


Animal-assisted therapy (AAT) is a therapeutic approach that promotes improvements in an individual's psychological, physiological, and social functioning through the establishment of secure attachment relationships between humans and animals (Dufresne-Cyr, 2023; Gan & Zhu, 2024). Its application scope is expanding from traditional companion animals such as cats, dogs, birds, and fish to novel media like insects, which offer lower rearing costs, smaller space requirements, and shorter life cycles. Based on the legislative impetus of the "Healing Agriculture Research, Development, and Promotion Act" and the "Insect Industry Fostering and

Support Act", South Korea has taken the lead in establishing a standardized system for "insect healing." This system enables citizens to use "pet learning insects"—such as the small white (*Pieris rapae*), the Chinese yellow swallowtail (*Papilio xuthus*), the Emma field cricket (*Teleogryllus emma*), the Japanese rhinoceros beetle (*Trypoxylus dichotomus*), and the domestic silkworm (*Bombyx mori*)—as mediums. Through processes like live rearing, artistic creation, and interactive games, these insects generate enjoyable experiences, enhance understanding of nature, and provide psychological stability (National Institute of Agricultural, 2013).

Empirical research on the therapeutic effects of insects

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has been predominantly conducted by South Korean academic circles, with documented benefits spanning both middle-aged and elderly populations as well as adolescent groups. Among middle-aged and older adults, intervention cycles lasting 8 to 12 weeks have demonstrated significant alleviation of depression, stress, and anxiety levels, as well as insomnia symptoms. These interventions also promote physiological indicators such as blood oxygen saturation and blood pressure to remain within healthy ranges, enhance socio-emotional well-being including happiness, pleasure, attachment, life reflection, social connection, social identity, and social capital, and improve cognitive functions such as spatial orientation, delayed recall, problem-solving, and observational learning (Kim *et al.*, 2018b; Kim *et al.*, 2022; Kim *et al.*, 2023; Ko *et al.*, 2016). For adolescent groups, structured courses spanning 4 to 10 sessions have also proven effective in alleviating daily stress and anxiety levels, improving sleep quality, regulating salivary cortisol circadian rhythms, and enhancing self-esteem, social interaction skills, life respect awareness, life satisfaction, subjective well-being, subjective quality of life, and self-worth. These interventions further contribute to the optimization of emotions, temperament, and personality, while promoting the development of cognitive functions such as orientation, memory, and language (Bae *et al.*, 2015; Jeon *et al.*, 2017; Jun *et al.*, 2016; Kim *et al.*, 2014; Kim *et al.*, 2018a; Kim *et al.*, 2019; Kim *et al.*, 2022).

Mental health issues among the Chinese population have become increasingly prominent, demonstrating a trend toward younger age groups. The 2024 Adolescent Mental Health Survey Report (Gu, 2024) indicates that 34.06% of adolescents nationwide exhibit depressive symptoms, with fluctuations observed across psychological indicators including well-being, self-efficacy, academic self-concept, prosocial behavior, life satisfaction, sense of meaning in life, and life enrichment. More critically, at the preschool stage, 94.3% of senior kindergarten children already experience varying levels of stress due to factors such as adult rewards and punishments, academic rules, peer relationships, individual needs, and environmental adaptation (Zhou, 2022). This suggests the necessity for psychological interventions to shift toward early prevention stages. In the 1980s, American Entomologist E. O. Wilson proposed the biophilia hypothesis, which posits that humans have an innate affinity for and attention bias toward living forms, especially animals. This tendency stems from the fact that early humans needed to pay close attention to animal signals during evolution so as to ensure their survival and safety. As evolution proceeded, humans gradually developed an instinctive tendency to focus on specific natural stimuli, such as animals, and gain a sense of pleasure from them, which helps individuals restore their attention and regulate

their emotions (Barbiero & Berto, 2021). Based on the biophilia hypothesis, this study selected the cricket—a classic Chinese singing insect that can provide both auditory relaxation and recreational entertainment—as a therapeutic medium (Wu, 2001). Its unique physiological structure, including the sound-producing organs in its wings, as well as its distinctive coloration, fits well with young children's innate perceptual needs for cuteness and novelty. Within a localized context, this study examines its intervention efficacy on the learning outcomes, emotional states, social interactions, and lifestyle habits of senior kindergarten children, while also putting forward targeted implementation strategies for integrating insect appreciation activities into kindergarten curricula. This study not only fills the gap in empirical research on insect-assisted therapy for preschool children in China and enriches the localized research findings of animal-assisted therapy, but also provides new medium options and practical pathways for the early intervention of young children's psychological stress, thus offering a reference for the design and implementation of nature-based therapeutic activities in early childhood education.

## METHODS

### Participants

From May 15 to June 15, 2024, convenience sampling was used to select students from two senior kindergarten classes at a kindergarten in Heze, Shandong. The inclusion criteria were: (1) Aged 5–7 years; (2) Normal physical and mental development, with no congenital physiological diseases, autism spectrum disorders, or other conditions that impair social interaction, cognition, or participation in normal group activities; (3) No history of insect allergies or severe fear of insects, and able to interact normally with crickets; (4) Full participation in the 30-day program.

### Methods

The experiment utilized adult male two-spotted field crickets (*Gryllus bimaculatus*) (He, 2020; Ying & Liu, 1995), a species widely distributed in southern China. Each cricket was housed individually in a dedicated cage to prevent intraspecific competition. Every participating child was provided with one cricket and, under the guidance of teachers, participated in 30-minute daily group observation sessions during class. These sessions included activities such as listening to chirping sounds and participating in traditional cricket fighting activities. Additionally, 30 min of daily care tasks were conducted between classes, comprising feeding with rice, fruits, and vegetables, as well as cage cleaning. Any deceased individuals were promptly replaced to ensure uninterrupted intervention.

## Tools

The therapeutic outcomes for each participating child before and after the course were recorded by teachers through a self-developed structured questionnaire (seen in the Supplementary). This scale was validated in a pilot study (Cronbach's  $\alpha = 0.894$ , Kaiser-Meyer-Olkin = 0.763) and consists of 35 items across four dimensions: learning outcomes (6 items), emotional states (10 items), social interactions (10 items), and lifestyle habits (9 items). These items assess both positive and negative impacts. All data were anonymized through coding, with only the research team having access to the original data.

## Statistical methods

Data were entered using MATLAB. After removing outliers, missing entries were imputed using multiple imputation methods, and categorical variables were standardized using one-hot encoding. Next, positive and negative impact scores were calculated for the four questionnaire dimensions (learning outcomes, emotional states, social interactions, and lifestyle habits), and net scores for each dimension were derived by calculating the difference between these scores for analysis. Finally, using age, gender, and the net scores of the four dimensions as independent variables, a binary logistic regression model was employed to analyze their impact on the psychological changes in young children following their interaction with crickets.

## RESULTS

### **Multiple response analysis of young children's interaction with crickets across four dimensions: learning outcomes, emotional states, social interactions, and lifestyle habits**

A multiple response analysis conducted on the options for positive impacts across the four dimensions revealed the corresponding results, which are presented in Table 1. Specifically, in the dimension of learning effectiveness, the item of “cultivating observational and experimental skills” achieved the highest response rate, which accounted for 35% of the total responses. In the dimension of emotional state, the item of “increasing curiosity and a sense of joy” showed the highest response rate, which was recorded as 25.6%. In the dimension of social interaction, the item of “enhancing communication and cooperation with peers” presented the highest response rate, which reached 23.2%. Similarly, in the dimension of lifestyle habits, the item of “cultivating the habit of careful observation” obtained the highest response rate, which was calculated as 23.5%.

### **Descriptive analysis of net scores across four dimensions**

An analysis of the net scores across the four dimensions reveals that the “Lifestyle Habits” dimension has the

greatest positive impact, followed by “Emotional State” and “Social Interaction” with “Learning Outcomes” ranking last (seen in Table 2).

### **Binary logistic regression model**

To investigate the psychological changes in young children following cricket-playing activities, this study employed a binary logistic regression model to analyze the effects of multiple factors—including age, gender, learning outcomes, emotional state, social interaction, and lifestyle habits—on whether participants believed that insect characteristics influenced their psychological regulation. The results are shown in Table 3.

#### *Age*

The regression coefficient for age was less than 0.0001, indicating that age has no significant effect on the dependent variable. In other words, the age of the preschool children is not a significant factor in this study.

#### *Gender*

The regression coefficient for gender was 0.3018, indicating that gender has a certain influence on the dependent variable. Boys are more likely than girls to be influenced by insect characteristics in terms of psychological regulation.

#### *Learning outcomes*

The regression coefficient associated with the net score of learning outcomes was calculated to be 0.0696, which indicates that the continuous improvement of learning outcomes will slightly increase the likelihood that insect characteristics exert a positive influence on young children's psychological regulation. Specifically, the gradual advancement of learning outcomes makes it much easier for young children to consciously perceive the positive impact that insect characteristics have on their individual psychological state. Although this identified effect is relatively small, which further suggests that the influence of learning outcomes on psychological regulation is comparatively limited, it still clearly demonstrates that there exists a stable positive relationship between learning outcomes and the psychological changes experienced by young children.

#### *Emotional state*

The regression coefficient corresponding to the net score of emotional state was measured as 0.7744, which demonstrates that the improvement of emotional state can significantly increase the probability that insect characteristics exert an effective influence on the psychological regulation of young children. That is to say, the continuous changes in emotional state make it more possible for young children to clearly perceive the specific impact that insect characteristics have on their own psychological state, while positive emotional

**Table 1: Multiple response analysis**

Dimension	Response		Percentage of cases (%)
	Number of cases	Percentage (%)	
<b>The positive impact on learning outcomes</b>			
Promoting scientific literacy	46	33.6	85.2
Boosting interest and motivation	43	31.4	79.6
Developing observational and experimental skills	48	35.0	88.9
Total	137	100.0	253.7
<b>The positive impact of emotional states</b>			
Increasing curiosity and enjoyment	52	25.6	96.3
Relieving anxiety and stress	34	16.7	63.0
Improving emotional stability and resilience	36	17.7	66.7
Promoting emotional expression and communication	40	19.7	74.1
Cultivating an optimistic and positive attitude toward life	41	20.2	75.9
Total	203	100.0	375.9
<b>The positive impact of social interactions</b>			
Fostering closer relationships with family and friends	45	21.7	83.3
Improving communication and collaboration skills with peers	48	23.2	88.9
Increasing the willingness to share and help others	43	20.8	79.6
Expanding the social circle and meeting new people	35	16.9	64.8
Fostering an attitude of respect and acceptance toward others	36	17.4	66.7
Total	207	100.0	383.3
<b>The positive impact of lifestyle habits</b>			
Developing the habit of careful observation	50	23.5	92.6
Promoting the development of healthy lifestyle habits	37	17.4	68.5
Improving self-care skills	41	19.2	75.9
Developing the habit of setting up scheduled tasks	45	21.1	83.3
Fostering a sense of tidiness and environmental awareness	40	18.8	74.1
Total	213	100.0	394.4

**Table 2: Mean net scores for each dimension**

Dimension	Mean net scores	Standard Deviation
Learning outcomes	1.37	0.116
Emotional states	2.37	0.228
Social interactions	2.35	0.228
Lifestyle habits	2.63	0.204

**Table 3: Regression coefficients for variables**

Variable name	Regression coefficient	P-value	standard errors	Wald
Age	<0.0001	0.462	0.410	0.541
Gender	0.3018	0.868	0.420	0.027
Net learning outcomes score	0.0696	0.070	0.427	3.283
Net emotional state score	0.7744	0.016	0.787	5.832
Net social interactions score	1.8997	0.260	0.789	1.270
Net lifestyle habits score	-0.8886	0.217	0.634	1.527

changes can effectively contribute to strengthening young children's perception of the psychological effects that are generated by insect characteristics.

#### *Social interaction*

The regression coefficient for the net score of social interaction was 1.8997, which indicates that the increase

in social interaction can significantly raise the probability that insect characteristics exert a positive influence on young children's psychological regulation. This implies that when young children are engaged in observing and playing with insects, they can more effectively perceive the impact that the insects' physical appearance and behavioral features impose on their own psychological state. Social interaction plays an extremely strong role in the process of psychological regulation, and it may promote positive psychological responses of young children to insect characteristics by means of strengthening emotional support and improving their social skills.

#### *Lifestyle habits*

The regression coefficient corresponding to the net score of lifestyle habits was calculated as -0.8886, which indicates that there exists a significant negative correlation between the improvement of living habits and the influential effect of insect characteristics on children's psychological regulation. This negative influence can be interpreted to suggest that the improvement of certain specific living habits, such as keeping a regular daily routine, may effectively weaken the psychological regulatory effects that are produced by insect characteristics on children.

#### **Model validation**

Our model demonstrates outstanding performance. With an AUC of 0.8171, it significantly surpasses the 0.5 baseline of random guessing and exceeds the 0.7 threshold for acceptable fit. This indicates that the selected independent variables effectively explain the variation in the dependent variable. Consequently, the model exhibits high accuracy in predicting whether the subjects are 'affected'.

## **DISCUSSION**

### ***Analysis of the impact of cricket therapy on learning outcomes among senior kindergarten children***

This 30-day intervention study revealed that interaction with crickets exerts bidirectional regulatory effects on preschool children's physical and psychological development. Regarding learning outcomes, direct observation of crickets made abstract concepts from picture books more concrete about their morphological characteristics and ecological habits, thereby enhancing children's scientific understanding of insects. Simultaneously, simple experiments involving cricket responses to different environments improved children's scientific inquiry skills. However, risks of classroom attention distraction and concentration decline were observed, potentially attributable to immature prefrontal cortex limitations in maintaining goal-directed behavior under

sustained sensory stimulation (Banich *et al.*, 2024).

### ***Analysis of the effects of cricket therapy on the emotional state of senior kindergarten children***

In terms of emotional state, the high heterogeneity of crickets in appearance and behavior naturally triggers cognitive conflict in young children, sparking cross-species curiosity and exploratory drive. The continuous, monotonous "chirping" emitted by crickets exhibits distinct "white noise" characteristics at the audio level. Psychological research indicates that white noise effectively masks sudden environmental stimuli, reduces external distractions, thereby lowering anxiety levels and enhancing focus. Thus, the presence of crickets not only captures children's attention but also facilitates emotional soothing and attention regulation through the "soundscape" environment. Simultaneously, through caring for and observing crickets, children gain a sense of accomplishment from successfully tending to them and discovering behavioral changes. Through daily care and observation, children developed a stable bond with their crickets, fostering a sense of being "needed." This positive experience gradually enhances their sense of self-worth, directly boosting life satisfaction and self-esteem, thereby achieving positive psychological regulation.

### ***Analysis of the impact of cricket therapy on social interaction among senior kindergarten children***

Traditional social support usually derives from interpersonal interactions with family members, peers, and teachers, whereas animal-assisted therapy transcends species boundaries and facilitates the development of secure attachment relationships between humans and animals, thus forming a unique form of cross-species social support. Its core advantage lies in its non-judgmental and low-pressure nature: animals do not make subjective evaluations of young children's behaviors or expressions, nor do they involve such complex issues as competition, conflict or exclusion that frequently arise in human interactions, which enables animals to provide children with stable and pure emotional bonds and psychological support. Meanwhile, as low-risk mediating animals, crickets are suitable for young children to conduct continuous observation and exploration. They also enable children to cultivate empathy in low-pressure interactions by paying attention to the living conditions of crickets. For instance, in the process of feeding crickets and observing their growth, children can understand the basic needs of living creatures and gradually develop concern and empathy for other forms of life. Crickets can also act as a kind of "social currency" that encourages young children to initiate communication and cooperation with their peers.

By collectively discussing the behavioral phenomena they observe and the practical problems encountered during feeding, and by dividing tasks and collaborating to complete feeding and cleaning duties, children can gain a strong sense of support and belonging from the group, as well as a sense of accomplishment derived from problem-solving. Bandura's social learning theory emphasizes that children's social behaviors are acquired through observation and imitation in social interactions. While traditional research has mostly focused on interpersonal contexts, this study provides a natural cross-species social context that allows young children to improve their indirect imitative learning by observing the interactive behaviors of crickets. This also offers a new research perspective for social domain education in early childhood education.

### ***Analysis of the impact of cricket therapy on the lifestyle habits of senior kindergarten children***

The biophilia hypothesis also suggests that ongoing contact with nature helps foster healthy lifestyle habits. The crickets effectively activated children's naturalistic intelligence, enabling keen identification and insight into unique biological characteristics, behavioral patterns, and ecological relationships. This transferred to improved observation and perception of subtle changes in phenological rhythms and interpersonal relationships in daily life. Yet excessive cricket engagement disrupted routines, manifesting as midday hyperactivity and mealtime resistance.

To address the aforementioned negative impacts, the following strategies are recommended when integrating cricket- and other insect-based interaction activities into kindergarten curricula: adopt integrated activity design, deconstruct cricket interaction into segmented task modules to moderate stimulation intensity and reduce children's cognitive load; hold micro-funeral ceremony, bury the dead cricket and build a tombstone to help children understand life and death correctly; organize feeding teams to take turns to feed, clean and observe, to improve cooperation and avoid conflict with peers; establish a cricket observation schedule, clearly define the time for appreciation and play, and use a timer to strictly control the time, in order to develop children's time planning ability and develop healthy routines; strengthen the home-school cooperation mechanism, invite parents and children to complete the observation record named Cricket Diary together, which can enhance the parent-child relationship, ensure the participation of activities, consolidate the learning results and monitor the addiction tendency; develop differentiated curricula by combining cricket appreciation with role-playing, story conception and picture book creation to accommodate the interests of different children.

### ***The regulatory role of gender in cricket therapy on early childhood development***

The study also identified moderating effects of gender in how cricket interaction influences child development. Across nearly all differentiated indicators, male children demonstrated significantly higher levels of both positive and negative manifestations compared to female children. The gender moderation effect may be attributed to sociocultural expectations. Previous research indicates gender differentiation in attitudes toward insects emerges around age 6 (Ayuko, 2007). Within the Chinese cultural context, crickets are traditionally perceived as "men's toys," where female engagement with such organisms may be considered inappropriate. Parents and educators may unconsciously provide more encouragement for exploratory behaviors in boys while emphasizing "maintaining cleanliness" or "safety precautions" for girls, indirectly suppressing deeper female participation.

### ***Limitations of the study***

The sample of this study was restricted to senior kindergarten children enrolled in a single kindergarten within a county-level region, and the research methods relied mainly on teacher observations and a self-designed scale, which may entail a certain degree of subjective bias among respondents. Meanwhile, the lack of a control group in this study has also exerted a certain impact on the rigor of the research conclusions. Future research is recommended to expand the sample in terms of size, grade level, and geographical coverage, adopt a controlled experimental design, and employ well-established assessment scales such as the Beck Anxiety Inventory and the Fatigue Severity Scale, as well as non-invasive physiological indicators including blood pressure, cortisol,  $\alpha$ -salivary amylase, heart rate variability, and functional magnetic resonance imaging. In addition, future studies may select more popular and environmentally suitable insect species for educational settings, such as butterflies, fireflies, rhinoceros beetles, and stag beetles, and conduct long-term follow-up and systematic evaluation of their therapeutic effects.

## **CONCLUSION**

Interacting with crickets contributes to the development of senior kindergarten children in four key dimensions, namely learning outcomes, emotional states, social interaction, and lifestyle habits, among which it can exert a particularly positive influence on their observation skills, curiosity, communication and cooperation as well as careful habits.

The improvement of emotional states and the increase in social interaction are capable of affecting children's psychological regulation, and such effects present a

distinctive characteristic that the impact on boys is significantly stronger than that on girls.

## DECLARATION

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### Author contributions

Chengquan Cao: Conceptualization, Guidance trial, Writing; Jianqiu Kang: Conceptualization, Writing—Original draft preparation, Writing—Reviewing and Editing, Supervision; Xinyao Liu: Data curation, Formal analysis; Xin Wei: Methodology, Theoretical guidance, significant revisions; Zhenyu Wang: Implementation of the entire trial; Xueli Chen: English translation and manuscript submission; Jinrui Song: Review & editing.

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### Ethical approval

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### Informed consent

Informed consent was obtained by the affected young children and their parents.

### Conflict of interest

The authors declare no competing interest.

### Use of large language models, AI and machine learning tools

The authors did not use any large language models, AI, or machine learning tools in the preparation of this manuscript.

### Data availability statement

No AI tool was used.

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