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Exploring the Effects of Emotional Valence on Cognitive Performance in School Children: An Experimental Study

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Abstract

Background: Emotions constitute a fundamental factor in the development of cognitive function within educational and clinical environments, exerting a substantial effect on cognitive processes, especially in homework and examination tasks that often provoke diverse emotional conditions, including boredom, frustration, and irritability in schoolchildren. Empirical studies have exposed that emotions possess the ability to either hinder or enhance a person's memory function. Therefore, the present study elucidated the investigation of how positive and negative emotions impact working memory and lexical decision-making in school-aged children within a Pakistani context.

Method: This study employed a pretest-posttest, between-group experimental design using a simple randomized sampling technique to recruit four hundred schoolchildren whose ages ranged from 10 to 14 years (M = 12.5, SD = 4.4) who were enrolled in various schools in Jhelum, Pakistan, from August 18 and November 12, 2020. These students were equally divided into experimental and control groups to receive neutral, positive and negative mood induction techniques. The study used three standardized psychological instruments to examine working memory, lexical decision, and emotional valence in the pretest and posttest phases.

Results: The findings highlighted that the experimental groups exhibited substantial improvements in working memory, word accuracy, problem-solving accuracy, and lexical decision accuracy in comparison to the control groups. Furthermore, this study's results showed that the positive emotion group demonstrated shorter reaction times and superior accuracy in contrast to the negative emotion and other groups. While the negative emotion group exhibited longer reaction times in the post-trial inspection.

Conclusions: This study concluded that emotion induction techniques significantly affect lexical decision-making and working memory in schoolchildren. Further, positive emotion induction led to improved cognitive performance, especially enhanced levels of task accuracy and reaction time in Pakistani schoolchildren, while negative emotion induction had mixed effects. This study ensured an understanding of the underlying mechanisms of emotional induction and the potential applications of these results in educational settings.

Keywords: Emotional valence, positive emotions, negative emotions, cognitive processes, working memory, lexical decisions, and education settings.

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Background

Emotions play a pivotal role in shaping cognitive functions and exerting a profound impression on motivation and the evolution of personality characteristics in schoolchildren (Lemaire, 2021). Emotions can also be classified into two primary domains, including negative and positive, each with a considerable impact on students' academic performance and physiological and mental health in the educational environment. Positive emotional states, referred to as sensations of delight, ecstasy, and enthusiasm, consistently provide many cognitive advantages to school-aged children (Czapka et al., 2022; Devis & Montag, 2020; Rczy & Orzechowski, 2021).

Empirical evidence exhibited that these positive emotional states not only augment cognitive ability but are also helpful in the regulation of attention, stimulate creative ideation, support memory retrieval, and invigorate the motivation for academic learning and active involvement in academic activities. However, negative emotional states, including melancholy, anger, sadness, or fear, can substantially impede the growth of cognitive ability in children. It may have deleterious consequences that lead to impairments in working memory, reduced ability to sustain attention, and difficulties in the exercise of critical thinking and problem-solving abilities (Czapka et al., 2022). Additionally, many previous studies highlighted that persistent exposure to anxiety and stress, especially in the environment of examinations, interrupts the faculty of attention, obstructs memory recall or retrieval in evaluative assessments, and disrupts inclusive educational achievement (Devis & Montag, 2020). Moreover, negative emotional experiences have the ability to reduce students' motivation and their inclination to actively participate in the academic process (Rczy & Orzechowski, 2021). Additionally, deleterious emotions states can contribute to enhance mental health issues and declined cognitive ability (Czapka et al., 2022).

It is of dominant importance to recognize that differences in people can significantly regulate the effect of emotions on cognitive development (Chainay, 2023). Study findings exhibited that children with lower working memory abilities experience intensified cognitive demands when exposed to the induction of either negative or positive emotions, which leads to an impairment of their problem-solving skills. Furthermore, these studies centered on the fields of memory and learning have disclosed that people with higher working memory abilities have an improved capacity to control their emotional reactions when encountered with emotionally charged stimuli (Liu, 2022).

Working memory refers to the capacity to temporarily store and manipulate information to accomplish different cognitive and emotional tasks that also serves as an imperative contributor augments to our cognitive knowledge, problem-solving abilities, and decision-making abilities. The multicomponent framework of working memory elucidates three essential components: the phonological loop, the visuospatial sketchpad, and the central executive. This theoretical approach provides deep insight into the interaction between emotions and these distinct features of working memory. It postulates that emotions possess the ability to regulate the central executive function of working memory and, moreover, the retention and encoding of emotionally relevant knowledge. Additionally, the visuospatial sketchpad and the phonological loop are both fundamental components of working memory, which can similarly be focused on modulation using emotional states (Fachinello et al., 2021).

Lexical decision involves determining whether a given set of letters forms a valid word or not. Positive and negative emotional states can influence language-processing tasks like lexical decisions in school-aged children. According to the automatic vigilance model of lexical decision, emotional stimuli automatically capture attention and lead to quicker response times. Moreover, due to their inherent significance and potential relevance to the individual, emotionally salient words or stimuli, be they positive or negative, are processed preferentially using this approach

A lexical decision task is a cognitive process that involves examining whether a provided sequence of letters creates a valid word or not. Both positive and negative emotional exposure can have an effect on language-related tasks and lexical decisions. Lexical decision's automatic vigilance model revealed that emotional stimuli possess the capacity to automatically grab the attention of others, which results in faster and more spontaneous response times. Additionally, because of their inherent potential significance to people, emotionally stimulated stimuli or words, whether they hold a negative or positive emotional valence, are provided special processing using this mechanism (Wen et al., 2022). Moreover, the broaden-and-build principle postulates that positive emotions may augment cognitive flexibility, thus enabling people to proficiently engage in a variety of cognitive tasks as desired (Abida et al., 2023). Furthermore, the diffusion model highlighted that emotional valence is likely to influence the pace of evidence accumulation as well as decision criteria. Particularly, positive emotions tend to be liked by swifter response times. On the other hand, negative emotions can stimulate a more risk-averse model of decision-making, determined through avoidance motivation (Maire et al., 2017).

Empirical evidence has found that people normally exhibit faster response times when

provoked with emotionally arousing stimuli in comparison to neutral stimuli (Arriagada & Ferreira, 2022). Positive words naturally provoke more precise and rapid responses than neutral words from participants. In contrast, words associated with negative emotions can yield a more different effect on lexical decision performance. However, a few studies have highlighted that words bearing negative inferences can, on occasion, expedite lexical decisions, leading to swifter answer times. This phenomenon may be attributed to the heightened attentional and arousal concentration provoked by using negative emotional states. Furthermore, a person's personality attributes, emotional stability, and expertise in emotional regulation can manage the way in which emotional valence impacts lexical decision processes (Sylvester et al., 2021).

This concept is further supported through existing literature that recommends that emotional meanings' manipulation in words can have an effect on response times and precision metrics in the lexical decision task (Mohammed & Lyusin, 2022). Additionally, individual memory for knowledge has revealed augments following experiences with both negative and positive emotions, highlighting the influence of emotional content in the processes of memory retrieval and consolidation (Murakami et al., 2023). Moreover, it is notable that emotional arousal and valence exert substantial influences on participants' neural responses and performance in different tasks, such as but not limited to the Lexical Decision Task, attentional allocation, social judgement, problem-solving, decision-making processes, and the regulation of behaviour (Yüvrük et al., 2020; Fielding et al., 2020).

The present study explored the effect of emotion induction on working memory and lexical decision-making in school-aged children. More precisely, we just included sixth- and seventh-grade students because of their relatively advanced emotional maturity and cognitive comprehension competence. The first hypothesis postulates that positive and negative emotional valence will augment working memory performance and improve accuracy and reaction time in the lexical decision task for children. Additionally, our study anticipates that children subjected to emotion induction, whether positive or negative, will exhibit notably superior performance in both working memory and lexical decision tasks when compared with participants in the non-emotion and neutral induction control groups. To provoke emotional conditions, this study used video clips featuring different emotional content. The utilization of videos as a medium for mood induction is known as one of the most efficacious methods for both adult and child populations (Maffei & Angrilli, 2019).

Method

Research design

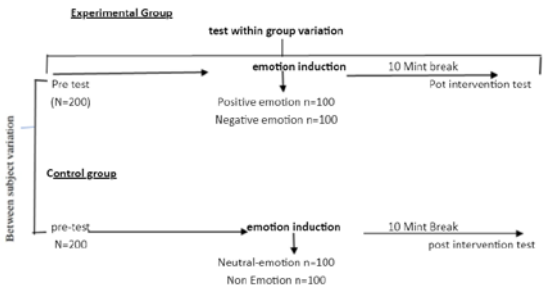
This study had a double-blind, parallel-group pretest and posttest, simple randomized controlled trial design. This research used a parallel-group design to make comparisons between a control condition and an experimental condition.

Trial Design

A total of 400 school students were equally divided into experimental and control groups. They were recruited from various schools and further divided into two primary categories. Two hundred participants were equally exposed to distinct mood induction techniques in the experimental group. One hundred participants underwent positive mood induction to provoke positive emotions, and the rest of 100 participants experienced negative mood induction to provoke negative emotions.

Conversely, the control group also encompassed two hundred participants, with one hundred undergoing neutral mood induction and the other one hundred exposed to non-mood induction techniques. Volunteer participants who fulfilled the predetermined inclusion criteria were invited to participate in an initial testing phase (T-0) to evaluate eligibility. Participants were randomly assigned to one of four emotion conditions: positive, negative, neutral, or non-mood, based on the study's inclusion criteria in the T-0 phase.

In the pretesting phase (T-1), standard psychological instruments, including assessments of working memory, lexical decision task accuracy, and reaction time, were administered. Later, mood-induction techniques were introduced after a 10-minute interval in each group. To further ensure the efficacy of the mood induction techniques, they were examined using the brief mood introspection scale. Within the post-test phase (T-2), following exposure to the emotional induction techniques, participants were re-examined using the same psychological instruments employed in the pretesting phase. An outline of the complete trial design is illustrated in Figure 1, encapsulating the key stages of the study across pre- and post-research design.



Participants

Four hundred school students, whose ages ranged from 10 to 14 (M = 12.5, SD = 4.4) years, were recruited from both government schools situated in Jhelum, Pakistan, between August 18 and November 12, 2020. They were equally divided into experimental and control groups. This experiment was performed on Psychopy software to perform working memory, lexical decision task accuracy, and reaction time task in four different group participants. A simple randomized sampling technique was employed based on a pre- and post-research design. The following inclusion criteria were set: volunteer participants enroll in 6^{th} and 7^{th} grades to perform mood induction techniques. Exclusion criteria were also applied to those students who were unavailable, exhibited substantial reading or mathematical expression difficulties as evaluated by the class teacher, or faced substantial disruptions that hindered compliance with informed consent or study protocol stipulations. Furthermore, participants with a history of mental health issues and visual impairments were not considered eligible to participate in the study.

Measures

Working Memory

These tasks were developed to examine working memory using different reasoning tasks (Baddeley & Logie, 1999; Krantz et al., 2017). The arithmetic and recall word tasks were used to examine working memory. In recall words, participants recalled the words from the presented list. For the arithmetic tasks, children were asked to determine the correctness of the provided mathematical problems. Higher scores exhibited high working memory, and low scores on the scale showed low working memory. The present study has shown high reliability and validity for the present sample.

Lexical Decision

A lexical decision task was used, which was developed in Krantz et al. (2017). The lexical decision task encompassed a string of letters that presented a real word or a non-word (e.g., dog vs. hra). A total of 60 words and 60 pseudo-words were used as stimuli to determine lexical decisions in schoolchildren. There was no time limit for the participants' responses. For the groups undergoing positive and negative emotion induction, positive words (such as angel, beautiful, etc.) and negative words (such as suicide, punishment, etc.) accompanied by attractive and unattractive faces were presented. In contrast, for the neutral and non-mood induction groups, randomly selected words with neutral meanings (such as doldin, maple, etc.) were presented. These tasks have high reliability and validity for the present study data.

Brief Mood Introspection Scale

The Brief Mood Introspection Scale was devised to examine the specificity of alterations in emotional valence following the emotion induction procedure (Carvalho et al., 2012; Mayer & Gaschke, 1988). The response rate was a four-point Likert scale designed to assess the pleasant to unpleasant and arousal to calm dimensions, each statement encompassing one of four emotional states. Prior research has exhibited that this scale is sensitive to mood shifts following induction and revealed associations with other factors associated with positive mood, including flourishing (r = 0.26), self-esteem (r = 0.43), self-liking (r = 0.46), and the sense of personal coherence (r = 0.51), while also deviating from loneliness (r = 0.32) (Totan, 2014). In the present study, the scale's reliability was confirmed with pleasant-unpleasant reliability at 0.83 and calm-arousal reliability at 0.58, revealing its internal consistency for the schoolchildren sample.

Intervention

Emotion induction

The emotion induction procedure adhered to the cognitive-affective framework, which was customized and tailored to suit the requirements of the healthy participants (Carvalho et al., 2012; Mark & Steven, 2011). In the present experiment, standardized 40-second silent film clips were obtained from the standardized Emotional Movie Database and classified based on arousal and valence ratings as per the guidelines of Carvalho et al. (2012).

Four groups underwent the procedure: (1) a negative emotional induction group presented with horror film clips developed to induce low valence and high arousal. (2) While a positive emotion induction group exposed to uplifting film clips developed to provoke high arousal and high valence that was devised to induce feelings of joy, excitement, and happiness. (3) A neutral emotional induction group exposed to scenic film clips that were designed to induce low arousal and moderate valence; and (4) a non-emotional group did not receive any mood induction because it was just for comparison in the present experiment. In the experiment, the entire time of the emotion induction videos and clips amounted to 2 minutes for each group.

Furthermore, the effectiveness of the emotion induction techniques was ensured by following this procedure, as participants were tasked with completing a written, standardized questionnaire. This questionnaire involved inquiries intended to examine alterations in valence encouraged through the emotion induction procedure. Participants were asked on a four-point Likert scale ranging from *1* (not at all) to *4* (extremely) about the extent to which they felt sad, happy, or neutral based on the explicit emotion that had been induced through standard procedure. Lastly, participants underwent a debriefing session and communicated gratitude for their participation. To avoid practice effects, participants first rated their present emotional state subjectively. Then, they engaged in working memory and lexical decision tasks during the pretesting session. Following this, an emotion induction was administered based on their assigned emotional condition, utilizing relevant video clips. The effectiveness of this induction was assessed using the Brief Mood Introspection Scale. In cases of negative emotion induction, deep breathing exercises and counselling were employed to help participants remain focused and manage their emotions. After assessing emotions, the same set of participants in both the experimental and control groups performed the online working memory and lexical decision tasks once again.

Procedure

This study was approved by an institutional ethical review of the Department of Psychology at Government College University, Lahore, Pakistan, and adhered to the guidelines of the American Psychological Association. Four hundred school participants were recruited from different schools in Jhelum, Pakistan. Verbal and written informed

consent was obtained from participants and their parents. All participants and their guardians provided written informed consent for trial participation. Permission to conduct was obtained from the higher authorities of different schools. Participants were also assured that their personal information would be kept confidential and used only for research purposes. The participants were made aware that they were contributing to a pre-post study conducted within a single session to optimize room occupancy time. The whole experiment was performed through PsychoPy software to take responses to all tasks and scales. Each participant underwent this experimental process separately in the experimental room, which was assigned computer labs within the school. To minimize any potential effect of the experimenter on the results, participants were randomly assigned to one of four emotional conditions: positive, negative, neutral, or non-mood. Apart from providing a brief introduction to the experimental session, the experimenter did not interact with the participants, and all instructions were displayed on the computer screen. Participants were informed that they would be contributing to a pre-post study conducted within a single session to optimize the use of room occupancy time. To avoid any practice effects of the Brief Mood Introspection Scale, participants were initially asked to provide subjective ratings of their present emotional state. Following this, they performed the working memory and lexical decision tasks during the pretesting session. Subsequently, an emotion induction was administered to each participant based on their assigned emotional condition, utilizing video clips related to the corresponding emotions. The effectiveness of the emotion induction was assessed using the Brief Mood Introspection Scale. Deep breathing exercises were employed to help participants remain focused on the present moment, and counselling was provided to console participants in the negative emotion induction group. After assessing the emotions, the same set of participants in both the experimental and control groups were instructed to perform the online working memory and lexical decision tasks once again.

Figure 2. Consort chard

The Consolidated Standards of Reporting Trials (CONSORT) have been applied for reporting pretest-posttest experimental research design for reporting parallel group randomized

Results

This study was designed to examine the effect of negative and positive emotional valence on working memory and lexical decision tasks. Specifically, we aimed to determine whether these emotions can either impair or improve task performance by enhancing accuracy and reducing reaction time. The study involved two groups: an experimental group and a control group. Data collection took place in two distinct phases, namely pre-test and post-test.

The pre-testing session involved inducing emotions in participants, resulting in increased task accuracy for working memory and lexical decision tasks in both the negative and positive emotion induction groups. However, in the negative emotion induction group, the post-testing phase showed longer reaction times for the lexical decision task, while the positive emotion induction group exhibited shorter reaction times. The control group, which experienced neutral emotion induction, did not show significant differences in task accuracy but displayed a slight decrease in reaction time during the post-testing phase. On the other hand, the non-emotion induction group showed significant improvements in task accuracy and a decrease in reaction time during both pre-testing and post-testing phases. Overall, the experimental group showed greater enhancements in task accuracy and shorter reaction times during post-testing compared to the control group that underwent neutral emotion induction.

The independent variables (IV) were working memory word accuracy, working memory problem accuracy, lexical decision reaction time, and lexical decision accuracy. The dependent variable was the groups (positive emotion, negative emotion, neutral emotion, and non-emotion). The results of the two-way factorial ANOVA indicated significant differences among the groups and an interaction effect between the groups and pre-post testing on working memory word accuracy, working memory problem accuracy, and lexical decision accuracy. However, there were no significant differences in reaction time among the groups,

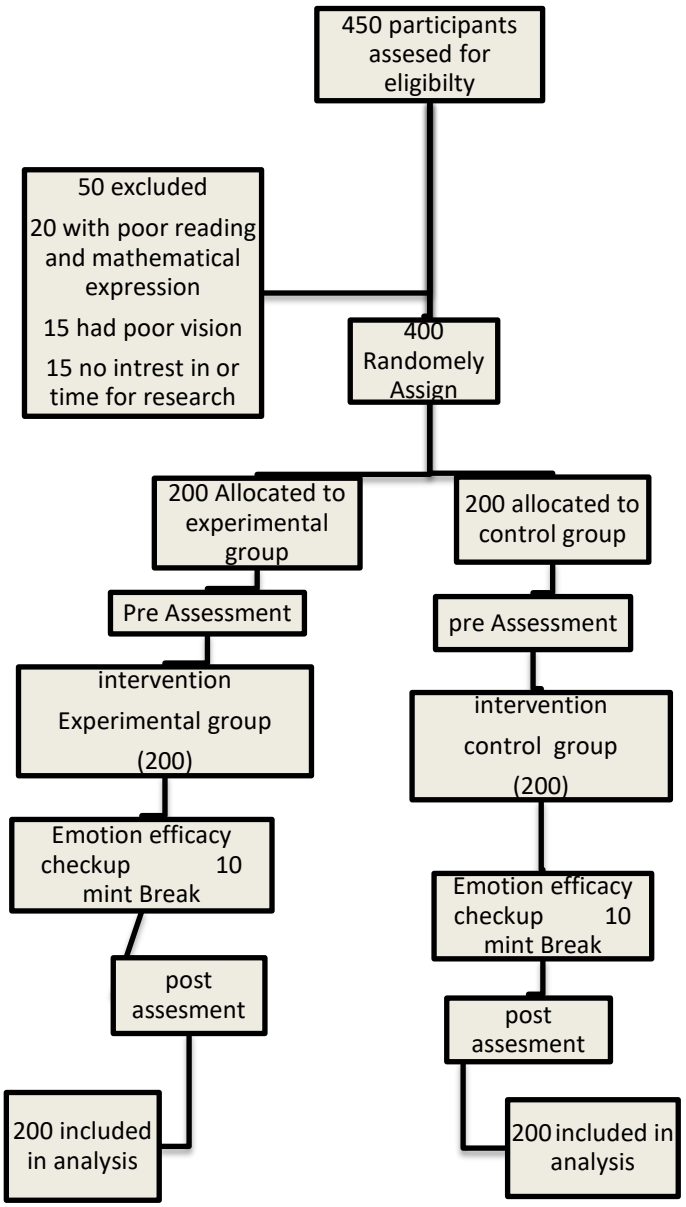


Table 1

Mean differences between Experimental (Negative and Positive emotion induction) and Control group (Neutral and non-emotion) on Working Memory Word Accuracy, Working Memory Problem Accuracy, Lexical decision Reaction time and Lexical Decision Accuracy in school children (N=400).

Variables	Neutral group (n=100)		Non-emotion (n=100)		Negative Group (n=100)		Positive Group (n=100)		Groups		Pre-post		Pre-post *Group	
	M	SD	M	SD	M	SD	M	SD	F	*P*	F	*P*	F	*P*
WMWA														
Pre	0.67	0.22	0.48	0.26	0.4	0.25	0.59	0.21	21	0.001	4.5	0.034	0.51	0.67
Post	0.67	0.21	0.54	0.26	0.48	0.23	0.65	0.15						
WMPA														
Pre	0.48	0.11	0.5	0.09	0.44	0.14	0.57	0.18	5.77	0.001	0.7	0.401	2.48	0.06
Post	0.47	0.11	0.5	0.1	0.52	0.16	0.53	0.21						
LDRT														
Pre	1889.05	2379.3	1537.95	1784.3	1496.22	458.56	1443.15	230.15	1.11	0.343	1.94	0.164	0.99	0.394
Post	1460.5	362.5	1320.45	378.27	1554.82	319.32	1422.01	178.47						
LDA														
Pre	0.78	0.06	0.7	0.14	0.69	0.09	0.74	0.11	44.8	0.00	0.4	0.526	14.08	0.00
Post	0.77	0.08	0.7	0.11	0.61	0.083	0.84	0.08						

Note: WMWA=Working Memory Word Accuracy, WMPA=Working Memory Problem Accuracy, LDRT=Lexical Decision Reaction Time, LDA=Lexical Decision Accuracy

Pre-post testing, or the interaction between pre-post testing and the groups.

Effect of Emotions on Working Memory Word Accuracy. A two-way factorial ANOVA was conducted, revealing a significant effect of emotions on the groups (F=21.0, p=.001, ηp2 =), as well as a significant effect of Pre-post (F=4.5, p=.034, ηp2 =). However, the group*pre-post interaction did not reach significance (F=0.51, p=.067, ηp2 = .199). In the control group (neutral emotion induction), participants did not show any significant improvement between the pre-condition (M=0.67, SD=.22) and post-condition (M=.67, SD=.22). On the other hand, participants in the experimental group exhibited a significant improvement in working memory word accuracy in the post-condition (Positive: M=0.65, SD=.15; Negative: M=.48, SD=.23) compared to the pre-condition (Positive: M=0.59, SD=.21; Negative: M=0.40, SD=.25). The findings of the study indicate that participants in the positive, negative, and non-emotion induction groups showed significant improvements in working memory word accuracy during both the pre and post conditions (see Figure 3).

Effect of Emotions Working Memory Problem Accuracy. The result further revealed that WMPA is significant in group (F = 5.77, P =.001, p2 =) and has an interaction effect between group and pre-post (F = 2.48, P =.001, p2 =) but is non-significant in pre-post (F =.7, P =.401, p2 =). Control group (neutral and non-emotion induction) participants showed no significant improvement in pre (neutral, M =.47, SD =.11; non-emotion, M =.50, D = 0.09) and post (neutral, M =.47, SD =.11; non-emotion, M =.50, SD =.10). Whereas participants in the negative experiment group (M =.52, SD =.16) showed a significantly higher accuracy rate in the post condition as compared to the precondition (M =.44, SD =.14), Conversely, there was a slight low accuracy rate in the positive emotion induction group in post (M =.53, SD =.21) as compared to pre (M =.57, SD =.18). The findings of the study revealed that participants in the negative emotion induction group showed significant improvement in the post-induction phase, whereas participants in the positive emotion induction group showed a slightly lower accuracy rate in the post-induction phase (see Figure 4)**.**

Effect of Emotions on Lexical Decision Reaction Time. The result demonstrates a non-significant LDRT in group (F = 1.11, P =.341, p2 =.) pre-post (F = 1.94, P =.0.164, p2 =.) and their interaction effect (F =.99, P =.394, p2 =.). Results further revealed that participants in the control group showed significantly shorter reaction periods in the post-condition (neutral, M = 1460.5, SD = 362.52; non-emotion, M = 1320.4, SD = 378.2) as compared to the pre-phase (neutral, M = 1889.05, SD = 2379.3; non-emotion, M = 1537.9, SD = 1784.3). Moreover, participants with positive emotion induction showed a significantly shorter reaction time in the post-test (M = 1422.0, SD = 178.5) as compared to the pre-condition (M = 1496.2, SD = 458.6). Conversely, participants in the negative emotion group show higher reaction times in the post-phase (M = 1554.8, SD = 319.3) than in the pre-emotion induction phase (M = 1496.2, SD = 458.6). The findings further demonstrated that participants in the negative emotion induction group had significantly higher reaction times in the post-emotion induction phase as compared to the positive group, where there was a slightly lower reaction time in the post-phase. Moreover, results further showed a significant decline in reaction time in the neutral emotion induction group in the post-phase (see Figure 5)**.**

Emotional Effects on Lexical Decision Accuracy. The analysis demonstrated a significant effect of the group (F = 44.8, p = .000, ηp2 =.0) and a significant interaction between the group and pre-post conditions (F = 14.8, p = .000, ηp2 = .0), while the pre-post condition alone showed marginal non-significance (F = .4, p = .526, ηp2 =.0). Furthermore, the findings indicated that participants in the experimental group exhibited significantly higher mean differences in the post-condition (Positive: M = .84, SD = .08; Negative: M = .61, SD = .08) compared to the pre-condition (Positive: M = .64, SD = .09; Negative: M = .74, SD = .11). Notably, no significant mean difference was observed between the pre and post lexical decision task accuracy for participants in the control group (see Figure 6).

Induction group had a significantly higher lexical decision accuracy rate in the post- emotion induction phase as compared to the negative emotion induction group, where negative emotion induction group had significantly higher reaction times in the post-emotion induction phase as compared to the positive group, where there was a slightly lower reaction time in the post-phase. Moreover, results further showed a significant decline in reaction time in the neutral emotion induction group in the post-phase.

Figure 3. Mean difference of Working Memory Word Accuracy in T1 (pre phase) and T2 (Post phase) between experimental and control group.

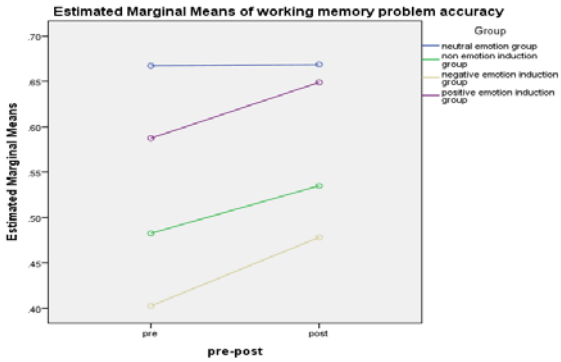


Figure 4. Mean difference of Working memory problem recognition between T1 (pre phase) and T2 (post phase) between experimental and control group.

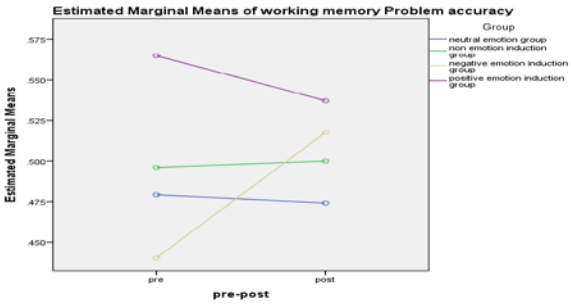


Figure 5. Mean difference of Lexical Decision Reaction time in T1 (pre phase) and T2 (Post phase) between experimental and control group.

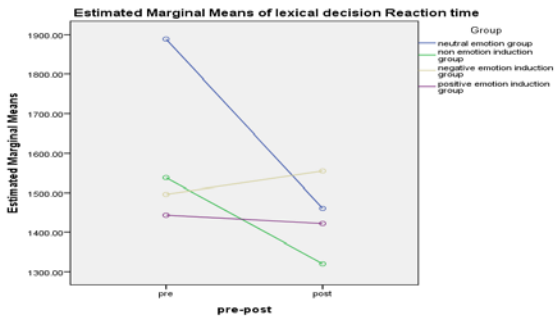
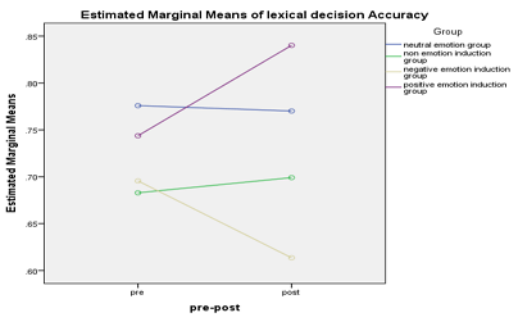


Figure 6. Mean difference of Lexical Decision Accuracy in T1 (pre phase) and T2 (Post phase) between experimental and control group



Discussion

The present study investigated the effects of emotional valance on working memory and lexical decision tasks in schoolchildren. Participants completed online working memory and lexical decision tasks. The results supported the primary hypotheses, showing that children in the experimental group exhibited improved performance in the post-induction phase compared to the control group. The experimental group demonstrated higher accuracy rates in working memory tasks during the post-trial phase compared to the pre-trial phase. Additionally, the findings revealed that the positive emotion induction group had higher working memory task accuracy compared to the negative emotion induction group. Moreover, the positive emotion induction group showed shorter reaction times in the lexical decision task, while the negative emotion induction group displayed longer reaction times.

Emotion's Effect on Working Memory Task Accuracy

The present study's findings are consistent with previous research, indicating that inducing positive or negative moods, as opposed to a neutral mood, can influence cognitive functioning, including attention, concentration, and working memory. Emotionally salient stimuli often receive greater attention during task performance. Similar to the results of Mohammed and Lyusin (2022), this study shows that both negative and positive mood induction can either enhance or impair working memory task accuracy and reaction time. Other studies in the literature have also reported improved working memory task accuracy in the positive emotion induction group and decreased accuracy in the negative emotion induction group. In line with the findings of Hou and Cai (2022), these results suggest that the impact of emotions on working memory can vary depending on factors such as task relevance, emotion type, working memory paradigms, and individual characteristics. Furthermore, the present study's results support the notion that positive emotions can enhance cognitive performance, including cognitive flexibility, memory, problem-solving, and executive functioning (Vanderveren et al., 2020). Additionally, non-clinically sad participants demonstrated better memory for negative emotional events compared to other emotional materials (Lin et al., 2021).

Effect of Emotion on Lexical Decision Task

The positive emotion induction group exhibited slightly shorter reaction times in the lexical decision task, while the negative emotion induction group displayed longer reaction times. However, the control group also showed shorter reaction times in the post-induction trial. Previous studies have suggested that positive emotion states with high or low arousal levels may have unpredictable effects on lexical decision tasks. For instance, participants induced to experience high arousal-positive emotions showed shorter reaction times (Maire et al., 2017). Furthermore, another study compared participants exposed to positive and negative emotion stimuli prior to a lexical decision task, revealing

significant differences in accuracy scores and response times for related and unrelated words (Finesse, 2022). Negative mood conditions have been associated with worse performance compared to neutral and positive mood conditions (Irrmischer et al., 2018).

Notably, the control group's shorter reaction times and higher accuracy align with prior research that suggests practice effects and increased familiarity can lead to faster and more accurate responses. Additionally, positive and negative words are processed more rapidly with higher accuracy rates (Kissler & Bromberek, 2021). Studies have also highlighted the congruent relationship between affect and lexical response, where positive images elicit more positive word responses and neutral images elicit more negative word responses (Out et al., 2020). Children have also shown sensitivity to word valence in lexical processing, with faster responses to negative words and more efficient processing of abstract neutral words (Lund et al., 2019). Negative word trials have been associated with slower response times but higher accuracy (Vitale et al., 2018).

Limitations & suggestions

The current study has several limitations that should be acknowledged. Firstly, limited time and resources constrained the data collection process. Secondly, obtaining approval from schools was challenging due to COVID-19 restrictions, which restricted the generalizability of the results as the data was only collected from schools in Jhelum. Lastly, in some schools, the available settings for data collection were inadequate, with rooms provided by the administration not being properly isolated from distractions and noise, potentially impacting the results.

This study recommends investigating the effects of emotion on other relevant variables, such as spatial working memory, long-term memory, false memory, and lexical decision tasks involving bilingual children. In contrast, Grissmann et al. (2017) found that performance in a visuospatial 2-back task decreased when negative pictures were used as targets. They also observed a decrease in accuracy and slower reaction times compared to positive and neutral pictures. However, no significant effects of picture valence were observed in the 1-back version of the task. Additional cognitive domains and diverse populations would contribute to a more comprehensive understanding of the topic.

Implication

The present study has significant implications for mental healthcare. The association between emotions and executive functioning can promote children's overall well-being and may guide strategies and interventions. Tailoring interventions based on individual differences can help mental healthcare professionals support children's cognitive performance and overall psychological health. Integrating cognitive and emotional interventions can address both aspects simultaneously, promoting emotional resilience and self-regulation.

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Children who require additional support for their cognitive and emotional difficulties can be identified at an early stage. Moreover, the findings will be helpful for designing intervention plans and curriculum development by emphasizing the importance of children's emotional well-being alongside cognitive development.

Conclusion

This study concluded that emotion induction techniques significantly affect lexical decision-making and working memory in schoolchildren. Further, positive emotion induction led to improved performance in both fields, especially enhanced levels of task accuracy and reaction time in schoolchildren, while negative emotion induction had mixed effects. This study's results highlight the complex interplay between cognitive and emotional processes in schoolchildren, proposing the significance of considering emotional conditions when developing educational and clinical interventions. This study is also warranted to interpret the underlying mechanisms of emotional induction and the potential applications of these results in educational and clinical settings in Pakistan.

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Ethical Consideration

The study was approved by Department of Psychology, Government College University, Pakista*n*. Consent Form was taken before taking data and participants were asked to take voluntary participation.

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Availability of data and materials

The data sets used and analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions/Author details

Aqsa Chaman and her colleagues performed this study. She wrote the article under the guidelines of Nature-Nurture Journal of Psychology.

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Ethics declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board (*Department of Psychology, Government College University, Pakistan*). A written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare to have no competing interests.

Additional Information

Not applicable.

References

Abida, H., Chaman, A., & Qureshi, A. B. (2023). Effect of emotion induction on the cognitive functioning of graduate and undergraduate students: A double-blind, parallel-group, randomized controlled trial. Nature-Nurture Journal of Psychology, 3(1), 19–30. https://doi.org/10.53107/nnjp.v3i1.31

Arriagada, M. F., & Ferreira, R. A. (2022). The effect of emotional valence on auditory word recognition memory in English as a foreign language. Journal of Psycholinguistic Research, 51, 309–322. https://doi.org/10.1007/s10936-022-09841-3

Baddeley, A. (2000). The episodic buffer: A new component of working memory? Trends in Cognitive Sciences, 4(11), 417–423. https://doi.org/10.1016/S1364-6613(00)01538-2

Briesemeister, B. B., Kuchinke, L., & Jacobs, A. M. (2011). Discrete emotion effects on lexical decision response times. PLoS One, 6(8), e23743. https://doi.org/10.1371/journal.pone.0023743

Carvalho, S., Leite, J., Galdo-Álvarez, S., & Gonçalves, Ó. F. (2012). The emotional movies database (EMDB): A self-report and psychophysiological study. Applied Psychophysiology and Biofeedback, 37(4), 279–294. https://doi.org/10.1007/s10484-012-9201-6

Chainay, H., Ceresetti, R., Pierre-Charles, C., et al. (2023). Modulation of maintenance and processing in working memory by negative emotions. Memory and Cognition. Advance online publication. https://doi.org/10.3758/s13421-023-01428-0

Czapka, S., Schwieter, J., & Festman, J. (2022). The influence of peripheral emotions on inhibitory control among children. Acta Psychologica, 223, 103507.https://doi.org/10.1016/j.actpsy.2022.103507

Del, R. G., Malaguti, A., & Del, R. S. (2014). Practice effects associated with repeated assessment of a clinical test of reaction time. Journal of Athletic Training, 49(3), 356-359. https://doi.org/10.4085/1062-6059-49.2.04

Devis, K. L., & Montag, C. (2019). Selected Principles of Panksepian Affective Neuroscience. Frontiers in Neuroscience, 12, 1025.https://doi.org/10.3389/fnins.2018.01025

Edwards, M., & Goodhew, S. C. (2023). Emotion-

Induced Blindness Is Impervious to Working Memory Load. Affective Science. https://doi.org/10.1007/s42761-022-00176-9

Fachinello, K., Garcia, R. B., & Galera, C. (2021). The effects of mood induction and emotional stimuli on visuospatial working memory binding: A study on the hedonic detector. [Manuscript submitted for publication]. Department of Psychology, Faculty of Philosophy, Sciences and Letters at Ribeirão Preto.

Fartoukh, M., Chanquoy, L., & Piolat, A. (2014). Mood induction in children: Effect of the affective valence of a text on phonological working memory. Advances in Cognitive Psychology, 10(3), 113-118. https://doi.org/10.5709/acp-0162-z

Finesse, E. (2022). How does positive and negative emotion stimuli affect the lexical decision task?

Hou, T. Y., & Cai, W. P. (2022). What emotion dimensions can affect working memory performance in healthy adults? A review. World Journal of Clinical Cases, 10(2), 401-411. https://doi.org/10.12998/wjcc.v10.i2.401

Irrmischer, M., Van D.W., Natalie, M., & Huibert,

L. H. K. (2018). Negative mood and mind wandering increase long-range temporal correlations in attention fluctuations. PLOS ONE, 13(3), e0196907. https://doi.org/10.1371/journal.pone.0196907

Kissler, J., & Bromberek-Dyzman, K. (2021).

Mood induction differently affects early neural correlates of evaluative word processing in L1 and L2. Frontiers in Psychology, 11, 588902. https://doi.org/10.3389/fpsyg.2020.588902

Kranz, M. B., Baniqued, P. L., Voss, M. W., Lee, H., & Kramer, A. F. (2017). Examining the roles of reasoning and working memory in predicting casual game performance across extended gameplay. *Frontiers in psychology*, *8*, 203.

Lemaire, P. (2021). Emotion and Cognition: An Introduction (1st ed.). Routledge. https://doi.org/10.4324/9781003231028

Lin, W., Lin, J., Cai, X., Deng, J., Gao, Y., & Mo, L. (2021). Effects of two different emotion-inducing methods on the emotional memory of non-clinically depressed individuals. PLOS ONE, 16(5), e0249863. https://doi.org/10.1371/journal.pone.0249863

Lindstrom, B. B. R., & Bohlin, G. (2011). Emotion processing facilitates working memory performance. Cognition and Emotion, 25(1), 37–41.

Liu, Jiaqi. (2022). Effects of Positive and Negative Emotions on Working Memory Renewal. 10.2991/978-2-494069-45-9_21.

Lund, T. C., Sidhu, D. M., & Pexman, P. M. (2019). Sensitivity to emotion information in children's lexical processing. Cognition, 190, 61–71. https://doi.org/10.1016/j.cognition.2019.04.017

Maire, H., Brochard, R., Kop, J. L., Dioux, V., &

Zagar, D. (2017). Effect of emotions in a lexical decision task: A diffusion model analysis. Swiss Journal of Psychology, 76(2), 71-79. https://doi.org/10.1024/1421-0185/a000193.

Maire, H., Brochard, R., Kop, J.-L., Dioux, V., & Zagar, D. (2017). Effect of emotions in a lexical decision task: A diffusion model analysis. Swiss Journal of Psychology, 76(2), 71-79. https://doi.org/10.1024/1421-0185/a000193

Mark, A. R., & Steven R. P. (2011). Emotion/Affect. In Encyclopedia of Creativity (2nd ed., pp. 449-455). Academic Press. https://doi.org/10.1016/B978-0-12-375038-9.00089-3

Mayer, J. D., & Gaschke, Y. N. (1988). The experience and meta-experience of mood. Journal of Personality and Social Psychology, 55(1), 102-111.

Mehta, K. J. (2022). Effect of sleep and mood on academic performance—at the interface of physiology, psychology, and education. Humanity & Social Sciences Communications, 9(1), 16. https://doi.org/10.1057/s41599-021-01031-1

Miyake, A., Friedman, N. P., Rettinger, D. A., Shah, P., & Hegarty, M. (2001). How are visuospatial working memory, executive functioning, and spatial abilities related? A latent-variable analysis. Journal of Experimental Psychology: General, 130(4), 621–640. https://doi.org/10.1037/0096-3445.130.4.621.

Mohammed, A. R., & Lyusin, D. (2022). The effect of an induced negative mood on the updating of affective information. Cognition Process, 23(1), 91–98. https://doi.org/10.1007/s10339-021-01060-3

Mueller, C. J., & Kuchinke, L. (2016). Individual differences in emotion word processing: A diffusion model analysis. Cognition, Affect, & Behavior in Neuroscience, 16, 489–501. https://doi.org/10.3758/s13415-016-0408-5

Murakami, M., Shino, M., Harada, M., Nakahira, K. T., & Kitajima, M. (2023). Effects of emotion-induction words on memory and pupillary reactions while viewing visual stimuli with audio guide. In et al. Computer Vision, Imaging and Computer Graphics Theory and Applications: VISIGRAPP 2021 (Communications in Computer and Information Science, Vol. 1691, pp. 115-129).

Springer. https://doi.org/10.1007/978-3-031-25477-2_4

Out, C., Goudbeek, M., & Krahmer, E. (2020). Gradual positive and negative affect induction: The effect of verbalizing affective content. PLOS ONE, 15(5), e0233592. https://doi.org/10.1371/journal.pone.0233592

Rączy, K., & Orzechowski, J. (2021). When working memory is in a mood: Combined effects of induced affect and processing of emotional words. Current Psychology, 40(10), 2843–2852. https://doi.org/10.1007/s12144-019-00208-Sylvester, T., Liebig, J., & Jacobs, A. M. (2021). Neural correlates of affective contributions to lexical decisions in children and adults. Scientific Reports, 11(1), 945. https://doi.org/10.1038/s41598-020-803591

Valenti, L., Garcia, R. B., & Galera, C. (2021). Neutral and negative mood induction in executive tasks of working memory. Psicology of Reflection, 34(1), 31. https://doi.org/10.1186/s41155-021-00196-7

Vanderveren, E., Bijttebier, P., & Hermans, D. (2020). Autobiographical memory coherence in emotional disorders: The role of rumination, cognitive avoidance, executive functioning, and meaning making. PLOS ONE, 15 (12), e0243669. https://doi.org/10.1371/journal.pone.0243669

Vitale, J., Kosson, D. S., & Resch, Z. (2018). Speed-accuracy tradeoffs on an affective lexical decision task: Implications for the affect regulation theory of psychopathy. Journal of Psychopathology and Behavioral Assessment, 40(3), 412–418. https://doi.org/10.1007/s10862-018-9652-z

Wen, Z., Teng, M. F., Han, L., & Zeng, Y. (2022).Working memory models and measures in language and bilingualism research: Integrating cognitive and affective perspectives. Brain Sciences, 12(6), 729. https://doi.org/10.3390/brainsci1206072

Yüvrük, E., Kapucu, A., & Amado, S. (2020). The effects of emotion on working memory: Valence versus motivation. Acta Psychologica, 202, 102983. https://doi.org/10.1016/j.actpsy.2019.102983

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