Cognitive Strategies in Study
WISDOM ACADEMIC ISSN: 3080-7336 | E-ISSN: 3080-7344 Volume 1 , Issue 3

Article

The influence of stress and emotional arousal on the misleading effect of memory and its application in educational design

Shuyu Liu[1,*]

[1]University of Queensland, Brisbane 4072, Australia.

[*]**Corresponding author:** Shuyu Liu, 446019020@qq.com.

CITATION

Liu SY. The influence of stress and emotional arousal on the misleading effect of memory and its application in educational design. Cognitive Strategies in Study. 2025; 1(3): 252.

https://doi.org/10.63808/css.v1i3.252

ARTICLE INFO

Received: 30 October 2025
Accepted: 7 November 2025
Available online: 21 November 2025

Abstract: This study explores how stress and emotional arousal influence the misinformation effect and examines its implications for educational design. The misinformation effect refers to the distortion of memory accuracy when individuals are exposed to misleading post-event information. This paper synthesizes evidence on the interaction between stress, emotion, and memory distortion. The findings indicate that moderate stress and emotional arousal can enhance attention and memory for central details, while excessive stress or intense negative emotions impair memory accuracy and increase susceptibility to misinformation. Neuroimaging evidence suggests that stress hormones and amygdala–hippocampal interactions play key roles in memory reconsolidation and false memory formation. Integrating these insights into educational contexts, the paper proposes strategies for reducing learning-related memory biases, including stress management during examinations, emotional regulation training, and fostering metacognitive awareness. It concludes by emphasizing that stress and emotion act as a "double-edged sword" in learning: while moderate levels may strengthen knowledge retention, excessive levels undermine memory fidelity. Future research should further investigate neural mechanisms, individual differences, and classroom interventions to promote accurate learning and memory resilience.

Keywords: misinformation effect; stress; emotional arousal; false memory; emotion regulation; educational design; instructional strategies; metacognition

1. Introduction

The misinformation effect is defined as a phenomenon in which individuals, after experiencing an event, are subsequently exposed to misleading information, are subsequently exposed to misleading information that distorts or compromises the accuracy of their original memory. This phenomenon was first proposed by Loftus et al. in the 1970s and is widely present in judicial investigations, news dissemination, and even daily teaching scenarios. When people are in a high-stress or highly emotionally aroused state, their memory system may be more vulnerable and thus being more susceptible to the influence of misleading information. However, current evidence regarding how stress and emotional arousal affect the misinformation effect remains inconclusive. Some studies have shown that intense stress can impair memory accuracy and increase individuals' susceptibility to incorrect information. Conversely, other evidence suggests that moderate emotional arousal may strengthen core event memory and thus potentially mitigate susceptibility to misinformation under certain conditions. This complexity underscores the need for a comprehensive review of theoretical frameworks and empirical findings to clarify how stress and emotional factors contribute to the misinformation effect (Morgan III et al., 2013).

This paper aims to examine the mechanisms by which stress and emotional arousal influence the misinformation effect on memory, with particular attention to classic experimental studies by Morgan et al. (2013) and Porter et al. (2010). It further integrates recent advances (2022–2025), including insights into the neural mechanisms of emotion–memory processing, the role of stress regulation strategies on memory bias, and the relationship between cognitive bias and the integration of misleading information. Finally, the article discusses implications for educational practice, including how to reduce students' memory bias in teaching design, and propose feasible research directions for the future (Sharma, Wade, & Jobson, 2023).

2. Theoretical Foundations of Memory Distortion and the Misinformation Effect

2.1. Section Headings

The reconstructive nature and misleading effect mechanism of memory: Memory is not a passive repository of objective experiences but rather a dynamic, reconstructive process vulnerable to subsequent information and pre-existing cognition. Within the misinformation paradigm, individuals initially view event materials, subsequently encounter misleading information containing erroneous details, and ultimately, they tend to incorporate these inaccuracies into their recollections during memory testing (Morgan III et al., 2013). This effect reflects the failure of source monitoring during retrieval, wherein individuals struggle to differentiate details derived from the original experience from those introduced by later information. From a cognitive psychology perspective, memory retrieval relies on semantic and contextual cues to reconstruct past events. When misleading information has similar semantic or situational features to the original memory traces, it more likely to be erroneously integrated into the reconstructed memory. Emotional and stress factors can further modulate this reconstruction process: intense emotional arousal influences attention allocation and physiological responses (such as stress hormone levels), thereby affecting the encoding, consolidation and retrieval fidelity of memories (Lentoor, 2023). Therefore, examining the mechanisms of emotional memory processing is essential to understand how stress and emotions regulate susceptibility to misinformation.

Neurological Mechanisms of Emotion and Memory Processing: Neuroscientific research demonstrates that emotional arousal can both enhance and impair memory through interactions between the limbic system and cortical regions. Highly arousing emotional events typically activate the amygdala-hypothalamus pathway; under the influence of stress hormones (such as norepinephrine and cortisol), the amygdala modulates memory encoding within the hippocampus (Zhang et al., 2024). Specifically, the amygdala becomes highly active when processing emotional salience, which facilitates the hippocampus in encoding and consolidating emotional information, thereby strengthening memory for the central aspects of the event. This explains why people often retain stronger and more enduring memories of traumatic or highly emotional events. However, this enhancement primarily benefits the “central details” related to the emotion, whereas memory for background or peripheral details may decline rather than improve — a phenomenon often referred to as the “tunnel vision” effect. The functional imaging study by Madan et al. revealed that high

emotional arousal disrupts associative memory. Excessive amygdala involvement weakens the hippocampus's capacity to encode connections among different elements of an event. In other words, under high emotional arousal, people focus more on the most salient elements and overlook other details, leading to incomplete or distorted memory of the event. This creates an opportunity for the misinformation effect: when encoding of certain details in the original memory is weak, later misleading information is more likely to fill in these "gaps".

Recent neuroimaging evidence has further elucidated how misleading information is integrated within the brain. A 2023 neuroimaging study demonstrated that the similarity of hippocampus activation patterns between the event encoding stage and the misleading information stage can predict the occurrence of false memories (Shao et al., 2023). In particular, individuals whose hippocampal activation patterns after exposure to misleading information more closely matched those from the original event were more likely to experience memory distortion on the final test. This suggests that the brain may reactivate or modify the original memory traces after the event, integrating incorrect information into them. Additionally, the study found that when traces of the original information are primarily stored in the lateral cortical regions (such as the visual association cortex) and the hippocampus contains more traces of post-event information, false memories are more likely to occur (Shao et al., 2023). These findings support the reconsolidation theory of memory: during recall or re-exposure, original memory traces may become unstable, allowing new information -including incorrect details- to enter and alter the memory representation. Under emotional or stressful conditions, this reconsolidation process may be amplified, as stress hormones promote the remodeling of memory traces. This neural-level insight provides important clues for understanding how stress and emotions influence the misinformation effect.

Differences in the Impact of Stress Levels and Emotional Types: The effects of varying stress intensities and emotional valence(positive/negative) on the misleading effect remain inconsistent. A series of research reviews (Sharma et al., 2023) suggest that moderate stress (such as short-term moderate tension) exert a protective effect on memory by enhancing vigilance and the encoding of events details, thereby temporarily reducing susceptibility to misinformation. Conversely, extremely high stress levels and traumatic circumstances often degrade overall memory accuracy, prompting individuals to depend more on peripheral cues or pre-existing knowledge

to fill gaps during recall and thereby increasing vulnerability to misinformation. For instance, Morgan et al. (2013) investigated more than 800 soldiers and provided compelling evidence: in a high-stress simulated prisoner-of-war camp, even well-trained military personnel exhibited substantial vulnerability to memory distortion induced by misinformation (Morgan III et al., 2013). In addition, emotional valence (positive or negative) also plays a critical role. Experimental work by Porter et al demonstrates that negative emotions heighten sensitivity to misleading details: witnesses in a negative emotional state are more likely to misremember significant but non-existent details, whereas such false memories occur less frequently under positive emotional states (Porter et al., 2003). This tendency of negative emotions to increase the suggestibility of memory can be explained as follows: Negative emotions may prompt individuals to focus on threatening information or adopt a more pessimistic interpretation, thereby making them more likely to accept erroneous information consistent with their emotional state (Porter et al., 2003). Additionally, highly arousing negative emotions such as anger have been linked to greater susceptibility to misleading information (Sharma et al., 2023); anger may elevate self-confidence and impulsive decision-making, thereby reducing careful evaluation of information sources and authenticity. In contrast, if overall physiological arousal does not persist during information retrieval, it may exert little influence on susceptibility to misinformation (Sharma et al., 2023). Overall, the influence of stress and emotion on the misinformation effect appears to follow an inverted U-shaped or complex interaction pattern: Moderate stress and emotion can sharpen attention, strengthen core memory, and temporarily resist some misleading information; whereas excessive stress and extreme emotions destabilize the memory network, allowing incorrect information to intrude (Sharma et al., 2023).

Integration of Cognitive Bias and Misleading Information: Beyond the immediate effects of emotions and stress, individual's enduring cognitive biases also shape their susceptibility to misleading information. A prominent example is confirmation bias: individuals tend to accept information that aligns with their pre-existing beliefs while disregarding or challenging conflicting evidence. This bias manifests in memory misleading distortion as follows: when misleading information conforms to an individual's existing views or expectations, it is more readily integrated into memory. Collin and Klincewicz (2025) found that individuals with stronger negative dispositions were more likely to retain corrected information

consistent with their previous beliefs, whereas corrections misaligned with those beliefs were often forgotten or disregarded. This suggests that the effectiveness of memory correction is constrained by personal beliefs: when corrective content contradicts entrenched attitudes, individuals may implicitly resist acceptance, thereby continuing to retain the original erroneous memory or belief (Collin & Klincewicz, 2025). Similarly, in the absence of correction, misleading information that aligns with an individual's cognitive framework (such as stereotypes, conspiracy theories, personal preferences) is more likely to become embedded in memory. This has been demonstrated across multiple domains, including politics and scientific knowledge: individuals are more likely to form and retain false memories consistent with their political stance or worldview (Martínez et al., 2024).

Furthermore, individual differences in susceptibility to deception are closely linked to memory biases. Empirical evidence indicates that individuals prone to generating false memories are more likely to endorse believe pseudoscience claims and misinformation (Martínez et al., 2024). García-Arch et al. (2024) found that participants who frequently reported false memories in experimental paradigms were also more inclined to accept scientifically unsubstantiated beliefs (such as pseudo medicine therapies) in daily life. This pattern suggests a bidirectional relationship: On the one hand, individuals with high memory susceptibility may misattribute encountered misinformation to personal experience owing to weaker source-monitoring ability; on the other hand, those who strongly endorse pseudoscience may actively or inadvertently fabricate memories to support their beliefs, thereby reinforcing those beliefs through false recollections. Cognitive styles and biases -such as reduced engagement in analytical thinking and a tendency toward rapid conclusions -have also been shown to increase the risk of false memory formation. In conclusion, emotions and stress together with cognitive biases jointly shape memory's vulnerability to misleading information: the former exert short-term effects on neural processing, while the latter influence long-term patterns of information selection and interpretation. Both domains warrant sustained empirical investigation.

3. Empirical research analysis

3.1. The high-pressure situation study conducted by Morgan et al.

(2013)

Morgan et al. (2013) conducted an experiment to investigate the effects of misleading information on memory within a highly realistic, stress-inducing environment. The study employed a simulated prisoner-of-war camp scenario derived from the U.S. military survival training (Survival School). During this training, participants experienced high-stress events such as capture, isolated, and interrogation, closely approximating the psychological pressure faced by actual prisoners. The experiment involved more than 800 military personnel. Following rigorous interrogation, participants were presented with misleading information; their accuracy in recalling the interrogator's identity and situational details was subsequently assessed (Morgan III et al., 2013). A key strength of this design its exceptionally high ecological validity: participants experienced authentic fear and stress, far exceeding what is typically achievable in conventional laboratory settings. This scenario also enabled a clear comparison between the control and experimental groups: all participants underwent high-stress events, but only some were exposed to misleading information (such as an incorrect photograph of the interrogator), allowing the researchers to isolate and measure the effects of information.

The findings of Morgan et al. are striking: even well-trained and experienced military personnel remained highly susceptible to memory distortion under high-pressure conditions when exposed to misleading information. Specifically, under certain conditions, more than half of the soldiers exposed to misleading photographs later misidentified unrelated individuals as interrogators and failed to recall the actual interrogators. Regarding the details of the event (such as whether the interrogator wore glasses or carried a weapons), numerous memory errors also occurred among participants who received misleading information. These findings clearly indicate that extreme stress does not render individuals "immune to all threats", but instead increases the fragility of memory. Morgan et al. specifically noted that all participants had been trained to resist interrogation and maintain memory accuracy. It might have been assumed that such training would protect against misinformation; however, the findings demonstrated the opposite.

From an experimental design perspective, Morgan's study featured a large sample size ($n > 800$) that included both male and female military personnel, providing robust statistical power and representing a range of individual differences. However, it is important to critically note that the sample primarily comprised young

military personnel, who may possess distinct cognitive and physical characteristics. Whether ordinary students or the general public would show a comparable degree of susceptibility to misinformation under similar stress remains to be empirically verified. Additionally, the control condition involved testing memory without misleading information, and the results indicated that soldiers who were not misled could still recall the main details with reasonable accuracy. However, high stress might still diminish overall memory accuracy, although this effect was less pronounced in the absence of misleading information. Morgan's study employed realistic scenarios and a randomized controlled design but lacked precise measurement of stress levels (such as physiological indicators), making it difficult to determine how individual subjective stress intensity affects memory performance. Future studies could address this limitation by incorporating physiological measures such as heart rate and cortisol levels. Moreover, the study focused on short-term memory assessment (identification shortly after interrogation) and did not examine the relationship between stress and misinformation effects over longer retention intervals. Given that the impact of stress on memory might differ across consolidation and retrieval stages, this limitation highlights an important avenue for future research.

3.2. The emotion-arousing experimental study conducted by Porter et al. (2010)

Porter et al. (2010) investigated the influence of emotional arousal and emotional valence on the misinformation effect. They employed a controlled laboratory paradigm in which participants viewed visually distinct emotional scenes (such as highly positive pleasant scenes, neutral scenes, and highly negative traumatic scenes). Each participant was exposed to only one emotional category, thereby creating groups with differing levels of emotional arousal. After viewing, some participants received misleading questions about the scene content that contained a critical erroneous detail, whereas the remaining participants served as a non-misled control group. Following a delay of several hours, all participants completed memory assessments, including free recall and questions targeting key scene details. Porter et al. employed a 3 (emotion valence: positive, negative, neutral) × 2 (misinformation: present or absent) factorial design to examine whether emotional states modulate the impact of misinformation on memory.

The experimental results clearly demonstrate that individuals in a negative emotional state are more susceptible to the influence of misleading information. In the misinformation group, among participants who viewed negative scenes, up to 80% falsely recalled non-existent "central details" (such as a large animal appearing in the scene), whereas in the misinformation groups who viewed neutral or positive scenes, this proportion was only about 40%. Meanwhile, in the control group that did not receive misinformation, no participants—regardless of the emotional state—reported remembering non-existent details, confirming that the formation of false memories is indeed triggered by misleading misinformation rather than arising spontaneously from emotional state alone. Additionally, Porter et al. found that even for questions containing accurate details, the memory accuracy of the negative emotion group was slightly lower than that of the positive neutral groups, suggesting that negative emotions may generally weaken memory retrieval and thereby create greater vulnerability to the misinformation effect.

The design of Porter's experiment was notably rigorous in its manipulation of emotional states and control of misleading information. By using pre-screened images from the International Affective Picture System to induce emotions and by matching scenes complexity across emotional conditions, the researchers aimed to confine the independent variable primarily to emotional valence and arousal, thereby reducing interference from extraneous factors. Additionally, the introduction of a salient yet implausible detail (such as an imaginary large animal) was carefully designed: this detail had a certain rationality with the scene background (for example, in a negative car accident scene, the presence of a large animal was not entirely implausible), sufficient to mislead individuals experiencing high arousal and narrowed attention under negative emotions; however, for those in calm or positive states, it appeared abrupt and more readily detectable. The selection of misleading materials effectively differentiated participants susceptibility to misinformation across emotional states. A key limitation of the experiment was its relatively small sample size (approximately 90 participants), primarily composed of college students. For broader generalizability, further research is needed to determine whether individuals of different ages and cultural backgrounds exhibit the same patterns when exposed to emotional stimuli and misinformation. Moreover, Porter et al. focused on emotional influence during the encoding stage, inducing participants' emotions while they viewed the events. However, emotions may also influence memory during the retrieval stage. Subsequent

research by Porter et al. (2014) expanded on this point, showing that when emotions are re-induced during retrieval (for example, requiring reinterpretation of the event from a positive or negative perspective), distinct patterns emerge: the negative emotions during retrieval can reduce the incidence of false memories (Porter et al., 2014). These findings suggest that the mechanisms by which emotions influence the misinformation effect are highly complex: high emotional arousal during encoding may weaken memory for peripheral details, thereby increasing susceptibility to misleading information; whereas emotional state during retrieval may affect an individual's monitoring and evaluation of memory (such as greater caution and skepticism under negative mood, reducing unwarranted acceptance of misinformation). Collectively, these findings emphasize the temporal dynamics of emotional influence, highlighting the need to distinguish between effects occurring at the time of encoding and during subsequent recall.

3.3. Other related empirical advancements

In addition to the two foundational studies discussed above, numerous empirical investigations have emerged since 2022, further expanding and refining this research area. For instance, Sharma et al. (2023) conducted a systematic review of existing research and found notable differences in how emotional states influence susceptibility to misinformation. Specifically, under certain conditions, short-term aversive emotions and moderate levels of stress can reduce its impact, whereas anger and heightened cortisol responses significantly increase vulnerability. These findings support aspects of the conclusions drawn by Morgan and Porter et al.'s research and help explain certain contradictory experimental results - inconsistencies across studies may stem from variations in the types and intensities of the induced emotions and stress. Another example is a study by Nie et al. (2022), which examined aversive emotional responses in traumatic contexts. They found that the intensity of post-traumatic distress was positively correlated with the incorporation of misleading information, indicating that individuals experiencing greater emotional trauma were more likely to confuse false details with true memories after the event. This further supports the view that severe emotional shocks render the memory system more vulnerable to distortion.

With respect to individual differences, recent studies have yielded significant findings. For instance, Greene et al. (2021) demonstrated that when misleading false

news aligns with an individual's political stance, the likelihood of forming corresponding false memories increases; moreover, individuals prone to false memories often exhibit distinctive patterns in moral orientation and value expression. Zhu et al. further found that individuals with low novelty-seeking personality traits are more likely to form false memories when exposed to misleading information. These findings collectively suggest that educators should consider student's diverse cognitive and affective traits when evaluating memory errors. Some students may be naturally detail-oriented and toward in-depth exploration, making them being less susceptible to misleading information; whereas others may have weaker memory-monitoring abilities or a greater tendency to rely on affective impressions, rendering them more vulnerable to errors driven by emotions and preconceptions.

In summary, various empirical studies have revealed, from different perspectives, the patterns by which stress and emotions influence the misleading effect on memory. High-intensity stress and negatively valanced, high-arousal emotions often increase the likelihood of accepting misleading information, whereas moderate arousal or timely emotional regulation can, to some extent, protect memory from distortion. However, experimental outcomes also vary with contextual factors, emotional types, and individual differences. These observations call for caution when interpreting and applying such findings, emphasizing the need to consider the limitations of the experimental design and the sampling, and through continuous empirical verification to deepen the understanding of the underlying mechanism.

4. Empirical Studies on the Misinformation Effect Under Stress and Emotional Arousal

Building on the foregoing theoretical and empirical evidence, the influence of stress and emotional arousal on the misinformation effect in memory is a multifactorial and complex process. At the mechanism level, stress and emotions influence the memory system through multiple pathways: neurophysiologically, via amygdala-hippocampus interactions, the release of stress hormones (such as cortisol), and regulation of memory monitoring (Madan et al., 2017). Together, these mechanisms determine the fidelity of memory encoding and the reliability of retrieval. Under high stress, elevated cortisol transiently weakens hippocampus function and

disrupts prefrontal processes that support source monitoring and inhibitory control (Marr et al., 2023), making it harder to differentiate information sources and increasing the likelihood of misattributing misinformation as true memories. This pattern aligns with the findings of Morgan et al.: even after professional training, discriminatory capacity under high stress remains impaired. Conversely, under low to moderate arousal, prefrontal and other higher-order cortical regions function more effectively, supporting stricter recall and source monitoring. Accordingly, participants exposed only to mild stress or emotions tended to adopt a more conservative response to misinformation and showed greater memory accuracy (Sharma et al., 2023).

Secondly, regarding experimental methods and ecological validity, discrepancies in certain research conclusions may result from mismatches between controlled experimental contexts and real-world conditions. Many early experiments sought to control variables by inducing "stress" with brief, mild stimuli and then testing memory performance immediately within the same session. This design differs markedly from real-world situations in which witnesses experience highly stressful events and provide testimony days or even weeks later. As Marr et al. (2023) observed, the effects of stress on memory may differ between the encoding and retrieval stages: stress during encoding can strengthen retention of core information, whereas stress during retrieval may disrupt recall. Therefore, experiments conducted before the long-term effects of stress have fully emerged may underestimate its adverse impact on memory. This highlights the need to consider both the temporal dimension and the ecological authenticity of the stress when evaluating different studies. Morgan et al.'s research provides a valuable example of contextual authenticity; however, its time span remains limited and does not encompass memory changes after longer delays. Future research should employ more realistic temporal frameworks to investigate the dynamic effects of stress and emotion during memory consolidation.

Again, regarding emotional categories, it is essential to differentiate the distinct effects of highly arousing positive and negative emotions. For highly arousing emotions such as anger and fear, the elicited threat-alert response may prompt individuals to overemphasize specific threatening details while neglecting other information. Consequently, when misleading information is embedded within the overlooked aspects, individuals may find it difficult to discriminate between true and false details (Porter et al., 2003). On the other hand, highly arousing positive emotions (such as excitement and joy) may induce a state of cognitive relaxation, whereby

individuals are less inclined to scrutinize the authenticity of details when experiencing happiness and relaxation. This may further heighten susceptibility to misleading information. However, Porter et al. reported that the misleading effect did not increase substantially under positive emotional states and was, in fact, lower than under negative emotional states (Porter et al., 2003). One plausible explanation lies in content salience: Negative scenarios frequently entail threat and harm, predisposing the brain toward "erroneous detection" (falsely perceiving non-existent threats as real), due to evolutionary sensitivity to danger; whereas in positive scenarios, individuals are prone to "erroneously reject" (overlooking incongruent elements that could disrupt the pleasant scene). Therefore, when the misleading information is negative in valence (such as fictional disaster cues), individuals experiencing negative emotions are more likely to accept it, whereas those experiencing positive emotions tend to reject it. This highlights the need for nuanced analysis of the emotional valence of misleading information and its congruence with the surrounding content when investigating the impact of emotions on susceptibility to misinformation.

From the perspectives of individual differences and cognitive biases, it is important to acknowledge that stress and emotions do not influence all individuals uniformly. Individuals with ample cognitive resources and well-developed logical reasoning skills may actively verify information sources even under pressure, thereby resisting certain forms of misinformation. However, those who highly rely heavily on intuition or habitually follow external cues may lower their cognitive vigilance in response to minor emotional fluctuations, thereby permitting misleading information to integrate into memory. In particular, confirmation bias predisposes individuals to readily accept inaccurate congruent with their worldview, while resisting corrective information (Collin & Klincewicz, 2025). This indicates that in practical educational and communication contexts, simply reducing stress or supplying objective information may be insufficient to rectify false memories. Targeted guidance is also required to address underlying cognitive biases. For example, students who firmly hold a particular misconception may not respond effectively to mere factual correction, as their memory and conceptual framework tend to filter out information that contradicts their expectations. It is therefore necessary to employ heuristic dialogue or facilitate personal verification to attenuate the impact of cognitive biases on memory.

Overall, current research has established a partial consensus regarding the influence of stress and emotions on memory distortion: stress and emotions on

memory distortion: elevated stress levels and highly arousing emotions appear to increase the risk of distorted recollection. However, buffering factors such as moderate arousal, timely emotional regulation, and strong cognitive monitoring can reduce distortion. Nevertheless, many questions remain, including the role of long-term chronic versus acute stress, how complex emotions (such as guilt, shame) affect memory, and whether group emotions (such as classroom collective emotions) amplify distortion. Furthermore, the outcome indicators used in different studies vary. Some assess detailed recall accuracy, others error recognition rates. These differences can produce findings that are not directly comparable. When synthesizing literature, it is essential to consider these methodological differences and to promote greater paradigm standardization and improved cross-study comparability in future research.

5. Implications for Educational Practice

The research on the effects of stress and emotions on memory provides valuable insights for education practice and theory. Various stressful situations (such as examinations, classroom questioning) and emotional experiences (such as interest or anxiety toward learning content) frequently arise during classroom instruction and student learning. These factors may unconsciously influence the quality of students' knowledge retention and contribute to the formation of misconceptions. Drawing on these research findings, the following strategic recommendations can be proposed to enhance educational design and instructional practices:

Managing exam-related stress to minimize memory errors is essential, as examination settings frequently impose substantial psychological pressure on students. Reports from students indicate that exam anxiety may induce mental blankness or incorrect recall of learned material. This aligns with research demonstrating that elevated stress impairs memory retrieval processes. Accordingly, interventions should be implemented to reduce excessive stress experienced by students in assessment contexts. Specific strategies include incorporating mock tests or quizzes into the curriculum to familiarize students with the exam format and reduce novelty-induced anxiety. In addition, relaxation training techniques (such as breathing regulation, mindfulness meditation) can be provided for practice before and after examinations to lower physiological arousal level. Clear, reassuring instructions should also be delivered at the outset of the exam to emphasize its role in monitoring learning

progress rather than imposing punitive consequences, thereby fostering a calmer mindset. These methods aim to maintain control students' stress within a "moderate" range - adequate to promote concentration without impairing memory retrieval. According to a meta-analysis by Shields et al., in the absence of long-term delay, moderate stress can enhance memory performance; therefore, reducing exam anxiety to a medium level may enable students to better demonstrate their actual memory abilities and avoid serious errors caused by extreme tension. In addition, under high pressure, errors may reflect temporary stress-induced memory disruption rather than a lack of knowledge. Accordingly, post-examination review and error correction sessions should be conducted to help students clarify tension-induced mistakes and promptly revise inaccurate memories, preventing their consolidation.

Integrating emotion regulation into the teaching process is crucial, as the classroom activities inevitably include moments that elicit strong emotions in students, such as viewing a shocking historical event or engaging in an intense classroom debate. Although such emotionally arousing activities can increase classroom participation, they may also introduce the risk of memory bias: students may focus on their emotional reactions or the most striking segments while neglecting the key instructional contented, in some cases, forming misconceptions driven by emotion. For example, a minor incident during an experimental demonstration may provoke panic, causing students to misremember the experimental results or the instructor's subsequent remarks. When designing such instructional activities, it is essential to balance emotional stimulation with rational consolidation. On one hand, the memory-enhancing effect of emotions can be leveraged by using appropriate emotional elements to strengthen impressions when teaching certain important concepts. On the other hand, a cooling-off period should be incorporated after emotionally charged event. For instance, after presenting a distressing documentary segment, allow students a few minutes for quiet reflection and note-taking before guiding them to summarize and clarify the key facts. The "emotional digestion" process facilitates a neural shift from the amygdala-driven to the prefrontal cortex-led mode, enabling more rational integration of observed and experienced material and reducing the influence of emotional aftershocks on memory distortion.

Emotional regulation strategies can also be explicitly taught to students as part of their learning skills. Cognitive reappraisal represents an effective approach to emotion regulation. It involves guiding individuals to interpret emotion-eliciting events from

alternative perspectives, thereby modifying their emotional response. Research indicates that adopting a third-person perspective for cognitive reappraisal during the encoding of negative events can reduce the prominence of negative emotional memories and diminish the tendency to over-discriminate negative information (Hayes et al., 2023). In other words, if students learn to approach failures or setbacks (such as poor exam results) with an objective and composed attitude, they can prevent these negative experiences from becoming excessively vivid and distressing in memory, thereby avoiding long-lasting fear-based memory bias. Accordingly, instructional practice incorporates guidance for students to apply cognitive reappraisal or psychological distancing strategies when appropriate. For instance, before examinations, encouraging students to view the assessment as a measure of learning progress rather than an evaluation of self-worth can help alleviate anxiety. When encountering misinformation (such as inaccurate learning tips circulated among classmates), students should be guided to re-evaluate such content from a factual perspective rather than accept it uncritically on an emotional basis. A study conducted at the University of Hong Kong indicates that cognitive reappraisal and distraction strategies effectively alleviate emotional distress induced by negative social feedback and facilitate the forgetting of such adverse content (Xie et al., 2023). This finding suggests, within educational settings, appropriate application of emotion regulation can not only improve students' emotional well-being but also selectively attenuate the retention of harmful information. For example, in response to negative incidents or campus rumors, guidance can be provided for students to use distraction techniques (redirecting attention from negative events to constructive activities) or reappraisal strategies (objectively interpreting events without equating them with self-evaluation) to reduce the prolonged impact of these negative memories.

Helping students recognize memory biases and misleading effects by cultivating metacognitive awareness and critical thinking constitutes a long-term strategy preventing erroneous memories. Instructional design should incorporate the principle that memory is not a flawless recording. For example, in science or social studies classes, a brief experiment can be designed: present students with a complex video, subsequently supply a mixed of accurate and inaccurate details for questioning, and finally disclose the inaccuracies in their recollections along with the techniques that produced them. This approach parallels the illusion-based demonstrations used in police training, enabling students to intuitively grasp the potency of misleading effects.

Through this approach, students can recognize that even personal experiences may contain memory inaccuracies and that maintaining a questioning and verification mindset is essential. Such awareness can encourage students to actively verify retained knowledge during daily study, thereby reducing the likelihood of memory biases formed through incomplete understanding or hearsay.

Learning errors stemming from pre-existing (preconceptions)can be addressed through a guided error-correction instructional approach. For instance, prior to introducing a scientific concept, common misconceptions can be collected, presented, and systematically corrected during instruction. During this process, the instructional approach is crucial. Research indicates that simply stating "X is wrong" may backfire, leading students to confuse incorrect concepts with accurate ones and encode them incorrectly. A more effective approach is to contextualize error correction, guiding students to understand why initial concepts are incorrect and how accurate explanations account for the phenomenon. Repeated practice should then be incorporated to strengthen retention. At the same time, remind students should also be reminded to remain vigilant against emotional interference in learning, as strong affective tendencies toward particular topics (such as preference or aversion to a theory) can increase susceptibility to memory bias. Instruction should guide students to apply scientific methods to evaluate claims rather than accept information as true simply because it aligns with immediate preferences. For example, an experimental study found that individuals inclined to believe in conspiracy theories may fabricate supporting details consistent with such narratives in news reports (Martínez et al., 2024). In this situation, educational programs can therefore be designed to teach students strategies for evaluating information authenticity, including consulting authoritative sources and conducting cross-channel comparisons. Such interventions help limit emotionally or cognitively biased acceptance of information and ultimately decrease the likelihood of misleading content being stored in long-term memory.

Enhancing classroom interaction and evaluation methods is essential, as teacher's questions and students' responses constitute a micro-level process of memory reconstruction. If the questioning style is inappropriate, it may inadvertently embed inaccurate information into students' memories. For example, a suggestive question such as "Do you also think the main idea of this poem is somewhat pessimistic?" might create an impression of pessimism in students' minds that was not originally present. To mitigate this risk, open-ended and neutral questioning should be

employed to encourage students to retrieve information from memory rather than infer the teacher's intentions. When a student's response deviates, timely and constructive correction should be provided to prevent reinforcement of the error. In practice, if a student recalls the year of a historical event incorrectly, the correct information should be provided immediately, accompanied by an emphasis on the importance of investigation and verification, rather than addressing it superficially. This aligns with findings from research on the misinformation effect, which indicate that timely warnings can reduce the impact of misleading information (Karanian et al., 2024). In the classroom, timely feedback and clarification serve as cognitive warnings, signaling which aspects of memory may be inaccurate and require correction.

Furthermore, adopting a multi-dimensional and process-oriented evaluation approach can help mitigate memory distortion associated with high-pressure, one-off examinations. Some institutions have implemented practices such as open-note examinations, multiple low-stakes quizzes, and project-based assessments replacing single high-stakes exams, all of which help minimize the drawbacks of rote learning and memory distortion under extreme pressure. These strategies align with previously discussed stress reduction principles: when assessment becomes more continuous and supportive, the overall pressure experienced by students is reduced and prevented from peaking at any single point in the learning process.

Examining the memory performance of students with psychological vulnerabilities, teachers should pay particular attention to those experiencing psychological conditions such as anxiety and depression. These students often exhibit a negative memory bias, characterized by a tendency to recall negative information more clearly while overlooking positive experiences (Hayes et al., 2023). They may be extremely sensitive to criticism and errors in class, often ruminating on them for extended periods, thereby forming a persistent negative memory cycle. This not only undermines their mental well-being but also contributes to distortions in learning-related memory (such as exaggerating a single failure or developing the false belief that "I always perform poorly in examinations"). For these students, educators should implement targeted interventions; beyond providing school-based psychological counseling, teachers can offer consistent positive feedback during instruction to counterbalance negative memory patterns, thereby helping students recognize their progress and accuracy and reducing the cognitive dominance of "failure". At the same time, teachers can train students in the aforementioned emotion

regulation strategies and guide them to cognitively reframe academic setbacks as opportunities for growth. Empirical evidence indicates that individuals exhibiting higher depressive symptoms can more effectively attenuate negative emotional memories through distraction strategies than through cognitive reappraisal (Xie et al., 2023). Therefore, in counseling practices, teachers should recommend strategies tailored to individual needs: some students may benefit from reflective journaling as a form of cognitive reappraisal, whereas others may benefit more from engaging in physical exercise or leisure activities that facilitate distraction. The overarching objective of these interventions is to prevent students from becoming trapped in negative emotional memories, thereby enhancing both the accuracy and confidence associated with their overall learning-related memory performance.

6. Future research direction

Although substantial progress has been made in elucidating the misleading effects of stress and emotions on memory, numerous frontier questions remain that merit deeper investigation. Drawing upon existing literature and aligning with the practical imperatives of educational contexts, subsequent investigations may concentrate on several promising directions.

Refinement of neural mechanisms: Through the application of advanced neuroimaging and physiological monitoring techniques, forthcoming studies can more precisely delineate the neural pathways through which stress and emotional arousal modulate memory reconstruction. One potential approach involves designing longitudinal fMRI paradigms in which participants experience experimentally induced high-stress events, followed by memory assessments and neuroimaging sessions at multiple post-event intervals (such as immediately, 24 hours later, and one week later). Such designs would enable systematic observation of temporal dynamics in hippocampal-prefrontal interactions and the network-level mechanisms underlying the integration information. Recent research employing cross-stage neural pattern similarity analysis has demonstrated that the hippocampus plays a central role in representing misleading information and mediating the construction of false memories (Shao et al., 2023). Subsequent studies could incorporate intervention strategies (such as pharmacological blockade of stress hormones or modulation of prefrontal cortex activity through transcranial electrical stimulation) to examine whether such

manipulations attenuate hippocampal re-encoding of misleading information and, in turn, lower the incidence of false memories. Such investigations would help elucidate causal mechanisms and establish a theoretical foundation for developing neural modulation approaches aimed at enhancing memory accuracy.

Multifactor Interaction Paradigm: Real-world stress-emotion-memory processes typically entail the interplay of multiple interacting factors. Future investigations should employ ecologically valid and multidimensional experimental designs to better approximate real-life conditions. One feasible design could adopt a 2×2×2 factorial structure, manipulating stress level during encoding (low or high), emotional valence during encoding (positive or negative), and emotional state during retrieval (neutral or negative re-activation), followed by assessing variations in the magnitude of misleading effects across conditions. Such experimental frameworks would allow researchers to address questions including whether negative memory distortions induced by high pressure can be mitigated through subsequent emotional regulation, and how incongruence between encoding and retrieval emotions influences the direction of memory bias. Similarly, the interaction between stressor type (social stress versus physiological stress) and the magnitude of the misleading effect warrants systematic examination. Distinct forms of stress may engage divergent neural and cognitive pathways. For example, social evaluation stress (such as public speaking) tends to activate processes associated with self-awareness and evaluative cognition, whereas physiological fear stress (such as sudden loud noise) primarily elicits instinctive panic response. Employing diverse stress induction paradigms and systematically comparing their effects on susceptibility to misleading information would substantially advance the theoretical understanding of the stress-memory interaction framework.

Field Research in Educational Settings: To facilitate the translation of research findings into pedagogical practice, it is essential to examine the influence of stress and emotions on learning and memory within authentic classroom environments. One potential design involves conducting a classroom-based quasi-experiment in which students are randomly assigned to either a high-stress condition (such as completing tasks under strict time constraints or responding to questions publicly) or a low-stress condition where the same content is learned in a more relaxed atmosphere. Subsequently, misleading materials related to the course content can be introduced—either through intentional textbook inaccuracies or the verbal

dissemination of false information among peers—and the memory accuracy of each group can then be assessed through a unit test. Such research would directly illuminate how classroom-induced stress affects students' mastery of accurate knowledge and their capacity to detect misinformation. If findings indicate that students in the high-stress condition are more prone to errors or to accepting misinformation, this would underscore the necessity of minimizing extraneous stressors in instructional design. Conversely, if moderate challenges are found to facilitate learning, instructional frameworks should explore ways to design forms of "benign stress" that enhance memory retention. Previous evidence indicates that short-term moderate stress may enhance memory for core information (Sharma et al., 2023), and that social evaluation stress can strengthen memory for central details (Stanek et al., 2024). These findings suggest that introducing mild tension, such as through low-stakes competitions or reward-based mechanisms, may help direct students' attention to key knowledge points, facilitating immediate review and the consolidation of deeply encoded memories formed under stress.

Intervention Study on Stress and Emotion Regulation Training: Considering the potential of emotion regulation techniques in mitigating memory biases, future intervention studies should be designed to assess the effectiveness of these strategies. For instance, one group of students could undergo emotion regulation training (such as cognitive reappraisal and self-relaxation techniques), while a control group receives no such intervention. Subsequently, both groups would undergo high-pressure learning tasks and tests involving misleading information, with memory accuracy rates compared between the groups. If the training group demonstrates a significantly lower error rate, this intervention could be promoted as a viable educational support strategy. A study on individuals with depression has shown that employing the psychological distancing reappraisal strategy during learning can mitigate the bias toward excessive negative memory encoding (Hayes et al., 2023). In the general student population, brief mindfulness meditation or exam mindset adjustments may significantly reduce anxiety-induced memory distortions, such as misremembering textbook content. Similar intervention studies could also be implemented at the group level: for instance, introducing a semester-long "stress management and memory discrimination" course and comparing changes in overall test scores and knowledge biases between the intervention group and a control group. If significant effects are observed, this would suggest that integrating mental health

education with cognitive training can enhance students' collective resilience to misleading information.

Individual Differences and Precision Education: Future research should investigate which students are particularly vulnerable to stress-induced emotions and memory biases, to facilitate the implementation of targeted preventive interventions. This requires the development of reliable measurement tools, such as the susceptibility to misleading effect scale and the emotion-memory cognitive style assessment. Based on existing finding, potential predictors can be verified, such as whether working memory capacity correlates with resistance to misleading information (individuals with strong working memory may be better at retaining both original information and critical thoughts, thereby resisting influence), and whether certain personality traits (such as neuroticism, high experientialism) are significantly associated with the susceptibility to misinformation. Previous findings suggest that individuals with low novelty-seeking tendencies are more susceptible to being misled (Martínez et al., 2024). In the future, more dimensions can be examined. By assessing these traits in a large sample of students and tracking their performance under high-pressure learning conditions with exposure to misleading information, a predictive model can be developed. Based on this model, educators can identify "high-risk" student groups susceptible to misinformation and provide them with targeted support. For example, when introducing new content, educators could provide these students with additional verification materials, encourage them to ask clarifying questions, or provide more corrective exercises during the review phase. Such targeted interventions can improve educational effectiveness, reduce reliance on "one-size-fits-all" approaches, and optimize resource allocation.

Digital Technology and Situational Simulation: With advancements in Virtual Reality (VR) and Augmented Reality (AR), these technologies can be leveraged to realistically simulate stressful emotional scenarios, providing an opportunity to investigate their impact on learning and memory in controlled environments. One possible application of VR is creating a virtual classroom where "emergency situations" unfold, or where AI-driven instructors apply varying levels of pressure, with physiological responses and learning outcomes recorded for analysis. This immersive approach addresses ethical and safety concern in real-world research (such as the inability to introduce actual danger in a classroom, which can be safely simulated in VR), while preserving experimental control. By 2025, technologies will

be capable of monitoring learners' emotions and stress indicators in real time (such as through heart rate and skin conductance data obtained via smartwatches), allowing future research to integrate this data with learning platforms for simultaneous learning and assessment. This approach not only facilitates the collection of large-scale of data to analyze the dynamic relationship between emotional stress and learning memory, but also supports the development of adaptive learning systems. When such systems detect excessive anxiety or emotional interference affecting student attention, they can adjust the teaching pace and provide relaxation cues to mitigate the negative memory effects of high stress during learning.

Long-term Effects and Longitudinal Studies: Much of the existing research on memory distortion has concentrated on short-term time frames following an event. However, in the context of education, the focus is on the long-term retention of knowledge and the evolution of concepts over time. Future research should involve longitudinal studies to track the enduring effects of stress and emotions on knowledge retention. Throughout the semester, student's stress levels (measured through self-reported questionnaires and objective measurements), emotional state, and changes in their understanding of learned material should be continuously monitored. The focus should be on whether students are more prone to developing misconceptions at high-stress intervals (such as midterms and final exams), and whether these misconceptions can be corrected through relearning once the stress has subsided. It is also important to examined whether memory distortions are consolidated over the long term: if a student develops an incorrect memory during an emotionally charged class, and it remains uncorrected, will it persist several months later? Alternatively, will the memory naturally adjust as the emotional influence diminishes? Such studies could inform the design of more effective academic schedules, such as conducting corrective teaching sessions following major exams, when students' emotions have stabilized, to realign their knowledge framework.

Cross-cultural and Contextual Studies: Educational systems across cultures vary in their approach to stress and emotions, which may influence students' memory processes. In East Asian cultures, exam pressure is typically high but students have become accustomed to it over time. In contrast, classrooms in some Western countries emphasize a more relaxed and open learning environment. By comparing the performance of students from diverse cultural backgrounds in similar misleading experiments, cultural moderating factors can be identified. Furthermore, the extent to

which emotional factors interfere varies across academic disciplines (such as literature vs. mathematics), and the nature of misleading effects also differ. In literature, emotional attitudes may lead to deviations in interpreting text meanings, whereas in mathematics, anxiety may cause errors in calculation steps due to interference with working memory. Future research should investigate the effects of stress and emotions across different academic disciplines to propose contextualized teaching strategies. For humanities, creating a positive and empathetic classroom atmosphere is recommended to mitigate the cumulative effect of negative emotion discussions. In contrast, in science and engineering, providing ample practice on challenging concepts can help alleviate anxiety during problem-solving.

In conclusion, future research should adopt a balanced approach that integrates scientific rigor with educational applicability. By integrating laboratory-based mechanism exploration with real-world application studies, researchers can further advance the understanding of the effects of stress, emotions, and memory misdirection. This will provide a robust foundation for developing more comprehensive educational strategies and fostering students' cognitive qualities.

7. Conclusion

The influence of stress and emotional arousal on memory distortion is a complex and significant topic. Its significance lies not only in advancing theoretical understanding of the human memory system but also in providing guidance for fields such as education and judicial evidence collection. This paper reviews key studies in this area, including Morgan et al. (2013), whose high-stress experiment demonstrated that even well-trained individuals are susceptible to memory distortion under extreme pressure. Porter et al. (2010) conducted an emotion manipulation experiment demonstrated that negative emotions significantly amplify memory distortion. Combining recent literature suggests that the influence of stress and emotion is multiple dimensional, with intensity, nature, duration, and timing each playing distinct roles. The research on the neural mechanisms of emotion and memory indicates that interactions between the amygdala, hippocampus, and prefrontal cortex influence the formation of emotional and false memory. The potential of stress regulation strategies (such as cognitive reappraisal) suggests that enhancing students' emotional regulation ability through educational reduce the interference of negative emotions on memory

retention. Additionally, individual cognitive biases and beliefs can affect the assimilation of misleading information, emphasizing the importance of cultivating critical thinking skills (Collin & Klincewicz, 2025).

In teaching practice, strategies such as managing exam-related stress, integrating emotional regulation education, and enhancing students' awareness of memory monitoring are recommended. These strategies aim to establish a learning environment that is balanced-neither overly stressful nor devoid of emotional engagement-allowing students' memory systems to encode and retrieve knowledge effectively, thereby enhancing memory retention and reducing errors. Future research should continue to bridge the gap between experimental studies and classrooms applications through interdisciplinary and cross-contextual approaches, with the aim of refining theoretical models and translating research results into practical teaching strategies. For example, developing intelligent teaching systems capable of detecting and regulating students' emotional stress in real time, or designing course activities specifically aimed at training students' abilities to assess information authenticity and regulate their emotions.

In conclusion, stress and emotions can be both facilitators and disruptors of memory. Moderate levels of stress and emotions can enhance learning by strengthening knowledge retention, but excessive levels may undermine memory and lead to misleading effects. Educators and researchers must collaborate to effectively manage this "double-edged sword", maximizing its positive effects while minimizing its negative consequences. Through continuous research and educational innovation, the goal is to cultivate learners who are both passionate and rational, acquiring authentic knowledge through rich emotional experiences, while avoiding the pitfalls of memory distortion.

Conflict of interest: The author declares no conflict of interest.

Funding: This research received no external funding.

References

[1] Collin, S. H. P., & Klincewicz, M. (2025). The effects of beliefs on correcting misinformation in memory. *Journal of Cognitive Psychology, 37*(2), 150-165.

[2] Greene, C. M., McCarthy, T., O'Connell, K., & Murphy, G. (2021). Partisan bias and individual predictors of false memories for fake news stories. *Memory, 29*(5), 587–604.

[3] Hayes, B. K., Harikumar, A., Ferguson, L. A., Dicker, E. E., Denny, B. T., & Leal, S. L. (2023). Emotion regulation during encoding reduces negative and enhances neutral mnemonic discrimination in individuals with depressive symptoms. *Neurobiology of Learning and Memory, 205*, 107824. https://doi.org/10.1016/j.nlm.2023.107824

[4] Joshi, G., Rathore, T., & Verma, K. (2025). Emotion-induced memory distortions: Insights from DRM and misinformation paradigms—a comprehensive review. *Health Sciences Review, 14*, 100216. https://doi.org/10.1016/j.hsr.2025.100216

[5] Karanian, J. M., Thomas, A. K., & Race, E. (2024). Warning before misinformation exposure modulates memory encoding. *Cognition and Emotion, 38*(3), 440–452.

[6] Lentoor, A. G. (2023). Cognitive and neural mechanisms underlying false memories: Misinformation, distortion or erroneous configuration? *AIMS Neuroscience, 10*(3), 255–268.

[7] Madan, C. R., Fujiwara, E., Caplan, J. B., & Sommer, T. (2017). Emotional arousal impairs association-memory: Roles of amygdala and hippocampus. *NeuroImage, 156*, 14–28. https://doi.org/10.1016/j.neuroimage.2017.04.065

[8] Marr, C., Otgaar, H., Howe, M. L., & Patihis, L. (2023). Correcting myths about stress and memory: A commentary on Pezdek and Reisberg (2022). *Frontiers in Psychology, 14*, 1078021. https://doi.org/10.3389/fpsyg.2023.1078021

[9] Martínez, N., Barberia, I., & Rodríguez-Ferreiro, J. (2024). Proneness to false memory generation predicts pseudoscientific belief endorsement. *Cognitive Research: Principles and Implications, 9*(1), 39.

[10] Morgan, C. A., III, Southwick, S., Steffian, G., Hazlett, G. A., & Loftus, E. F. (2013). Misinformation can influence memory for recently experienced, highly stressful events. *International Journal of Law and Psychiatry, 36*(1), 11–17. https://doi.org/10.1016/j.ijlp.2012.11.002

[11] Pando, V., Martínez, N., & Barberia, I. (2024). The role of cognitive biases in pseudoscientific beliefs: A replication and extension. *Cognitive Research: Principles and Implications, 9*(1), 13.

[12] Porter, S., Spencer, L., & Birt, A. (2003). Blinded by emotion? Effect of the emotionality of a scene on susceptibility to false memories. *Canadian Journal of Behavioural Science, 35*(3), 165–175.

[13] Porter, S., ten Brinke, L., Riley, S. N., & Baker, A. (2014). Prime time news: The influence of primed positive and negative emotion on susceptibility to false memories. *Cognition and Emotion, 28*(8), 1422–1434.

[14] Shao, X., Li, A., Chen, C., Loftus, E. F., & Zhu, B. (2023). Cross-stage neural pattern similarity in the hippocampus predicts false memory derived from post-event inaccurate information. *Nature Communications, 14*(1), 2299.

[15] Sharma, P. R., Wade, K. A., & Jobson, L. (2023). A systematic review of the relationship between emotion and susceptibility to misinformation. *Memory, 31*(1), 1–21.

[16] Stanek, M. L., Boaz, K. M., Cordes, C. N., Niese, T. D., Long, K. E., Risner, M. S., Otto, T. M., & Zoladz, P. R. (2024). Social evaluative stress enhances central detail memory, reduces false memory, and results in intrusive memories that last for days. *Neurobiology of Learning and Memory, 209*, 107906. https://doi.org/10.1016/j.nlm.2024.107906

[17] Xie, H., Lin, X., Hu, W., & Hu, X. (2023). Emotion regulation promotes forgetting of negative social feedback: Behavioral and EEG evidence. *Acta Psychologica Sinica, 55*(6), 905–919. https://doi.org/10.3724/SP.J.1041.2023.00905

[18] Zhang, H., Skelin, I., Ma, S., Paff, M., Mnatsakanyan, L., Yassa, M. A., Tseng, C., & Lin, J. J. (2024). Awake ripples enhance emotional memory encoding in the human brain. *Nature Communications, 15*(1), 215.

[19] Zhu, B., Chen, C., Loftus, E. F., Lin, C., & Dong, Q. (2010). The relationship between personality and susceptibility to false memories. *Memory & Cognition, 38*(4), 471–480. https://doi.org/10.3758/MC.38.4.471