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Designing a Neuroscience-Based Curriculum Model: Enhancing Cognitive–Emotional Performance of Aid Workers

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Original Article

Abstract

INTRODUCTION: This study aims to identify and develop the key elements and components of a neuroscience-based curriculum model designed to enhance the cognitive–emotional performance of aid workers. From scholarly perspectives, a curriculum encompasses multiple interrelated elements, including objectives, content, teaching–learning strategies, resources, time, learning environment, and evaluation.

METHODS: This qualitative study was conducted using a grounded theory approach. Data were collected through semi-structured interviews and analyzed using systematic coding procedures. As a result, seven core elements of a neuroscience-based curriculum model were identified: objectives, content, teaching–learning strategies, materials and resources, teaching–learning opportunities, learning environment conditions, and evaluation.

FINDINGS: The findings indicate that these elements provide a coherent and practical framework for curriculum design and implementation. The model contributes to enhancing the cognitive and emotional performance of aid workers in both educational settings and crisis situations. To ensure trustworthiness, continuous validation was carried out throughout the coding process, with iterative reviews of data and coding stages to maintain accuracy and consistency.

CONCLUSION: The results indicate that incorporating the identified elements into a neuroscience-based curriculum model can improve the quality and effectiveness of training programs, better address the needs of aid workers, and strengthen their preparedness for critical situations. By offering a scientifically grounded and practically applicable framework, the model enhances both cognitive and emotional capacities essential for effective performance in high-stress environments.

Keywords: Curriculum; Neuroscience; Cognitive performance; Emotional performance; Aid Workers; Grounded Theory.

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Introduction

Curriculum, as one of the fundamental fields of educational sciences, has evolved with the aim of systematically designing and optimizing teaching–learning processes. Early scholars in this field focused on organizing educational activities according to coherent principles to achieve effective learning outcomes (1). Accordingly, curriculum can be regarded as a structured roadmap that guides learning experiences, within which educational practices are meaningfully interconnected (2). A curriculum model, in this context, refers to an organized framework of content, activities, and instructional strategies that shape learners' experiences and influence learning outcomes (3).

In recent decades, neuroscience has emerged as a critical bridge between understanding brain function and improving educational practice. First introduced in the 1960s (4), neuroscience is now recognized as a major interdisciplinary field examining the structure and function of the nervous system. Within this domain, educational neuroscience explores the dynamic interactions between neural processes, cognitive functions, instructional methods, and learning outcomes. Although initially conceptualized as the intersection of neuroscience and education, its foundations are strongly rooted in psychological theories and methodologies (5,6).

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Advances in neuroimaging technologies, such as functional magnetic resonance imaging (fMRI) and functional near-infrared spectroscopy (fNIRS), have enabled real-time observation of brain activity and provided deeper insights into cognitive processes such as memory, attention, and emotion (7). These developments have significantly enhanced our understanding of how learning experiences are linked to neural and emotional processes by allowing researchers to track moment-to-moment changes in brain activity with high precision. Beyond its medical applications, neuroscience has increasingly influenced non-medical fields, particularly education (8).

A neuroscience-informed approach to education emphasizes that effective learning is not solely cognitive but is also shaped by emotional, social, and motivational factors (9). Evidence suggests that brain plasticity enables continuous changes in cognitive and emotional functioning through targeted educational experiences (10). From an emotional perspective, processes such as emotion regulation and resilience are closely associated with neural activity, highlighting the importance of integrating neuroscience into educational design (11). Cognitively, learning involves adaptive changes in neural networks, and meaningful learning occurs when instructional experiences facilitate the formation of new neural pathways and deeper conceptual processing (12).

Within this framework, three key components—working memory, emotional intelligence, and cognitive resilience—play a central role in enhancing cognitive–emotional performance and should be considered in curriculum design. Working memory refers to the ability to temporarily store and manipulate information, enabling individuals to process ongoing tasks and connect past experiences with present demands (13). It plays a critical role in activities that require integrating information over time, such as reading comprehension or navigating complex environments (14–16).

Emotional intelligence is another essential component, defined as a set of non-cognitive abilities and skills that influence an individual's capacity to cope with environmental demands and pressures (10,17,18). It encompasses dimensions such as self-awareness, self-control, sociability, and emotional regulation (19,20). Core abilities include recognizing emotions in oneself and others, using emotions to facilitate thinking, understanding emotional relationships, and regulating emotions effectively (21,22).

Cognitive resilience refers to the ability to maintain or recover cognitive functioning under stress or adverse conditions (23–28). It enables individuals to overcome the negative effects of challenges, failures, and stress on performance (29). Individuals can develop compensatory strategies to reduce errors and improve performance by reflecting on cognitive failures (30). In this context, resilience is shaped by personal factors (e.g., self-efficacy), environmental supports (e.g., social and organizational support), and their interaction (31).

Considering the critical role of aid workers in the Iranian Red Crescent Society (IRCS) as frontline responders in crisis management, the importance of these neuroscience-based components becomes increasingly evident. Their work involves substantial psychological, physical, and organizational pressures, and evidence indicates frequent experiences of stress, anxiety, and operational challenges (32,33). Operating in complex and unpredictable environments, these responders must make rapid decisions, regulate emotions effectively, and maintain sustained cognitive performance under pressure. Therefore, enhancing cognitive and emotional capacities—particularly resilience and emotional intelligence—plays a crucial role in improving their performance and operational effectiveness (34).

Previous research highlights the importance of emotional intelligence in enhancing professional competencies. Rakhshani et al. demonstrated that emotional intelligence significantly predicts effective leadership skills, encompassing both social dimensions (e.g., empathy and social skills) and individual attributes (e.g., self-awareness) (9). Emotional intelligence is broadly defined as the ability to perceive, understand, and regulate emotions and to use this information to guide thinking and behavior (35,36).

Moreover, studies indicate that integrating cognitive and behavioral skills with technical training improves learning outcomes and strengthens organizational response capacity (37). Brain-based instructional design has also been shown to enhance learning effectiveness (14). Additionally, integrating neuroscience into educational curricula improves both learning quality and emotional interactions (8,38).

Despite this growing body of evidence, there remains a lack of integrated curriculum models specifically designed to enhance the cognitive–emotional performance of aid workers in high-stress environments. Existing approaches are often applied in isolation rather than within a comprehensive neuroscience-informed framework. Accordingly, the main research question of this study is: How can a neuroscience-based curriculum design enhance the cognitive–emotional performance of IRCS aid workers?

Methods

This study employed a grounded theory approach to develop a scientific and practical framework based on real-world data and field experiences. This data-driven methodology was selected to address the scarcity of prior research and to uncover new dimensions of neuroscience-based curriculum design. Data were collected through semi-structured interviews, allowing in-depth exploration and the emergence of concepts during the research process.

A total of 15 experts and academics in the fields of education and curriculum planning, neuroscience, and emergency response participated in the study. All participants possessed relevant expertise in neuroscience and emergency education. Sampling was conducted using a purposeful and theoretical approach, with additional participants identified through snowball sampling.

Interviews were conducted at mutually agreed times and locations. Data collection and analysis were carried out simultaneously, following the principles of theoretical sampling, until theoretical saturation was reached. Data analysis involved three stages: open coding, axial coding, and selective coding, progressing from raw data to abstract categories and ultimately to a coherent theoretical framework.

To ensure validity, continuous comparison between data and emerging categories was conducted throughout the coding process. Through iterative review and refinement, the final framework was structured to closely reflect participants' perspectives and experiential realities.

Table 1. Components of a neuroscience-based curriculum and its elements

Curriculum Elements	Components
Goal	- Enhancement of cognitive and emotional performance of responders based on neuroscience findings - Preparation for effective role fulfillment in rescue and crisis situations - Empowerment for quick and correct decision-making in emergency conditions - Strengthening emotional skills such as empathy, calming, and stress control
Substance	- Integrating theoretical discussions of neuroscience with practical emergency response training - Teaching brain mechanisms related to emotion and cognition - Providing practical exercises for emotion regulation and cognitive focus
Teaching Strategies - Learning	- Use of active methods such as simulation and role-playing in emergency situations - Group-based and collaborative learning to enhance empathy and cooperation - Encouraging reflection and analysis of real-life emergency responder experiences
Materials and Resources (Human and Equipment)	- Utilizing coaches and experts in neuroscience and emergency response - Employing educational software and simulators for crisis practice - Multimodal educational resources to enhance experiential learning
Teaching-Learning Opportunities	- Integrating theoretical neuroscience education with practical experiences to solidify learning and transfer it to real emergency situations. - Creating learning opportunities through scenario-based crisis activities and group exercises.
Learning conditions and environment	- Creating a dynamic and simulated learning environment for emergency response training. - Flexibility in time and location of training to align with aid workers ' conditions.
Appraisal	- Assessment of cognitive and emotional capabilities in simulated situations - Evaluation of aid workers ' performance in practical projects and exercises - Peer assessment and group feedback for enhancing social learning

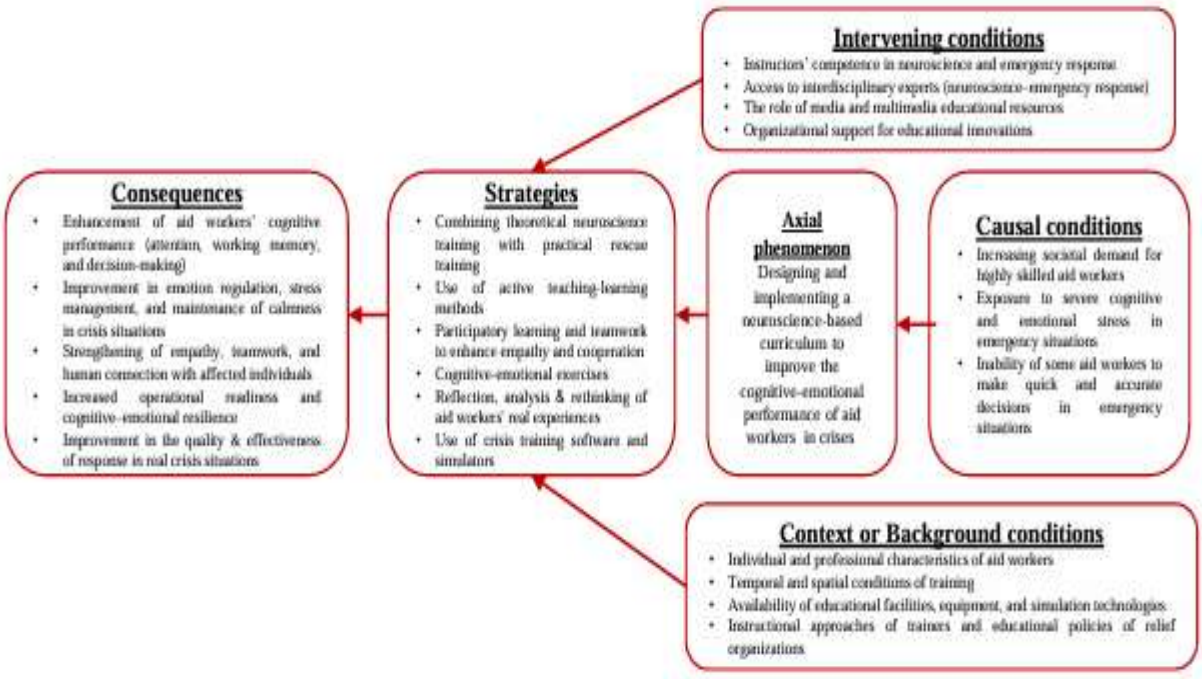

Figure 1. The final model for designing a neuroscience-based curriculum: enhancing cognitive–emotional performance of aid workers

Findings

The aim of this study was to develop the key elements and components of a neuroscience-based curriculum model with a focus on enhancing the cognitive–emotional performance of aid workers (Figure 1). From the perspective of various scholars, a curriculum comprises multiple interrelated elements. For instance, Klein conceptualizes the curriculum as consisting of nine core components: objectives, content, teaching–learning strategies, materials and resources, learning activities, grouping, time, space, and evaluation.

Similarly, Van den Akker conceptualizes the curriculum as comprising ten key elements: rationale, objectives, content, teaching–learning activities, instructional strategies, materials and resources, time, space, grouping, and evaluation.

In the present study, following in-depth interviews and systematic data analysis, seven core elements of a neuroscience-based curriculum aimed at enhancing the cognitive–emotional performance of aid workers were identified. These elements include: objectives, content, teaching–learning strategies, materials and resources, learning opportunities, learning environment conditions, and evaluation.

These elements, as presented in Table 1, provide a structured and practical framework for the design and implementation of a neuroscience-informed curriculum.

Neuroscience-Based Curriculum Framework

The neuroscience-based curriculum is designed to prepare aid workers to perform effectively in both professional settings and high-stress crisis situations. Accordingly, it pursues the following objectives:

1. **Enhancement of Cognitive and Emotional Performance of Aid Workers Based on Neuroscience Findings**

One of the primary goals of this curriculum is to enhance the cognitive and emotional performance of aid workers . This objective seeks to equip aid workers with mental preparedness and emotional stability in crisis situations, enabling them to make sound decisions and deliver effective and humane responses.

Education in this domain extends beyond the mere transmission of theoretical knowledge and necessitates the integration of practical training, including simulations of real-life crisis scenarios.

As one participant noted: “the most important goal of this program is for the aid worker to maintain mental focus and emotional calm in crisis situations. They must be able to regulate their emotions using neuroscience-based insights and make rapid, accurate decisions. These skills develop across diverse environments and crisis

conditions, and their acquisition requires a combination of neuroscience knowledge and practical disaster response experience" (Interviewee Code 9).

a) *Preparation for effective role performance in emergency and crisis situations*

Preparing aid workers to perform effectively in emergency and crisis situations is a fundamental component of this curriculum. This section aims to equip individuals not only with the ability to carry out their professional responsibilities under high-pressure conditions but also to fulfill their human and social roles effectively. Training in this area emphasizes group-based exercises, crisis simulations, and structured practical feedback. These approaches enable learners to develop both cognitive readiness and emotional stability in realistic contexts.

One participant in this study explained: "When a crisis occurs, the responder must be able to fully fulfill their role; that is, they must be mentally prepared to make the right decisions and emotionally capable of maintaining composure while establishing human connections with affected individuals. This level of readiness is achieved through practical exercises and neuroscience-based training. In fact, responders should practice their cognitive and emotional skills in simulated environments before entering real crisis situations, so they can act without confusion under actual conditions. Such training not only enhances professional performance but also conveys a sense of security and support to affected individuals from a human perspective" (Interviewee Code 5).

b) *Empowerment for rapid and accurate decision-making in emergency contexts*

Rapid and accurate decision-making in emergency situations is a critical professional requirement for aid workers. Such conditions demand immediate and precise responses, which depend on well-developed cognitive abilities, including attention, working memory, and cognitive flexibility. Training in this domain emphasizes practical exercises and the analysis of real crisis scenarios to strengthen these capacities.

One participant stated: "In emergency situations, aid workers must be able to make the best possible decision in the shortest time. This requires a high level of focus and the ability to manage emotions effectively. A neuroscience-based curriculum can equip aid workers with the cognitive and emotional strategies needed to perform under such conditions." (Interviewee Code 7)

c) *Enhancement of emotional competencies, including empathy, emotional regulation, and stress management*

Emergency and crisis situations require rapid, precise, and well-regulated responses. Achieving such performance depends not only on cognitive abilities—such as focus, working memory, and mental flexibility—but also on well-developed emotional competencies. To foster this level of readiness, training should emphasize practical exercises, realistic simulations, and the analysis of aid workers' lived experiences. These approaches enable individuals to regulate their emotions, maintain composure, and respond effectively under pressure.

One participant in this study stated: "In emergency situations, an aid worker must be able to make the best decision in the shortest time, as every moment can influence the fate of human lives. This requires both high concentration and strong emotional control. If individuals cannot regulate their emotions or lack sufficient mental focus, they may react impulsively and make incorrect decisions, ultimately reducing the quality of rescue operations. A neuroscience-based curriculum—by teaching cognitive techniques such as strengthening working memory and enhancing selective attention, alongside emotional skills like relaxation and empathy—can empower aid workers to manage such conditions effectively and perform both accurately and humanely in real crisis scenarios" (Interviewee Code 3).

2. Features of a neuroscience-based curriculum content

The interviewees in this study identified various components of the content of a neuroscience-based curriculum, which are discussed below:

a) *Integration of theoretical neuroscience concepts with practical emergency response exercises*

This section emphasizes the integration of theoretical neuroscience concepts—particularly in the domains of attention, memory, and emotion—with practical emergency response exercises. The aim is to enable learners to translate scientific knowledge into effective action in real-life crisis situations. One participant in the study stated: "When theoretical instruction is integrated with practical exercises, aid workers not only acquire scientific knowledge but also develop the ability to

apply it effectively in real crisis situations. This integration enhances their self-confidence and overall performance. Moreover, it transforms training from a purely theoretical process into a tangible and experiential form of learning—one that enables aid workers to remain calm and make more accurate decisions in critical moments" (Interviewee Code 10).

b) *Training of brain mechanisms underlying emotion and cognition*

This component focuses on developing neural functions related to emotion regulation, attention, and memory, enabling aid workers to maintain balanced and effective performance in high-stress situations. One interviewee stated: "Understanding the brain's mechanisms helps us recognize why we experience stress or reduced focus in emergency situations and how these responses can be managed through targeted practices. Knowledge of brain functioning in such moments enables aid workers to better regulate their natural reactions and make decisions with greater composure." (Interviewee Code 1)

c) *Provision of practical exercises for emotion regulation and cognitive focus*

This section emphasizes the use of practical exercises—such as relaxation techniques, deep breathing, and selective attention training—to help aid workers effectively manage stress and enhance cognitive focus in high-pressure situations. These exercises are designed to strengthen both emotional regulation and attentional control, enabling individuals to respond more effectively during crises.

One participant in the research stated: "When we repeatedly practice these exercises, our minds become better prepared for real crisis situations, allowing us to make appropriate decisions without panic. These practices act as a form of mental preparation that gradually becomes an automatic part of our responses. Continuous repetition of calming techniques and cognitive focus exercises reduces confusion in critical moments and enables aid workers to act with greater confidence. These exercises are only effective when performed consistently, as the human mind requires repeated experiences to consolidate learning and develop correct response patterns. Therefore, practical exercises not only enhance cognitive and emotional skills but also create a sustained state of readiness that can be applied in real crisis situations" (Interviewee Code 7).

3. Teaching Strategies: Neuroscience-Based Learning Approaches

Interviewees emphasize the necessity of utilizing neuroscience-based teaching and learning strategies for the cognitive-emotional performance of responders.

a) *Utilization of active learning methods, including simulation and role-playing in emergency contexts*

This strategy emphasizes the direct and active engagement of learners in the educational process. The use of crisis simulations and role-playing in emergency contexts enables aid workers to experience psychological and emotional stress within a controlled and safe environment while practicing appropriate responses to complex situations. One interviewee in this study explained: "When we participate in crisis simulation exercises, our minds become better prepared. This experience reduces confusion in real-life situations and enables us to react more quickly. In fact, simulations give us the opportunity to encounter challenging situations before entering the real field and to learn how to make appropriate decisions. These exercises increase our confidence and create a sense that we have already experienced similar situations during an actual crisis" (Interviewee Code 15).

b) *Group-based and collaborative learning to enhance empathy and cooperation*

Group-based learning plays a key role in developing aid workers' communication and social skills. Through teamwork, individuals learn to act with greater empathy and cooperation in crisis situations, while also benefiting from mutual support and shared responsibility. One participant in the study stated: "Group work teaches us that we are not alone in times of crisis. When we practice together, empathy and collaboration among members increase, and this sense of support reduces individual stress. In group exercises, we learned how important it is to divide tasks and trust one another. When each person knows their role and trusts others, the team performs much better in real crisis situations. These experiences show that collaborative training not only strengthens individual skills but also enhances team cohesion" (Interviewee Code 12).

c) *Encouragement of reflection and analysis of real-life aid workers' experiences*

This strategy emphasizes learning from past experiences. Reflecting on and analyzing real emergency situations helps individuals identify

their strengths and weaknesses and plan for improvement in their performance. One participant in this study stated "When we sit down and analyze our experiences after real operations, we identify our strengths and weaknesses. This reflection enables us to act more prepared in subsequent crises. For instance, in one of the operations, we realized that team coordination was weak; when we examined it, we worked on this weakness in subsequent practices, and our performance improved significantly in the next operation. Analyzing our experiences helps us avoid repeating past mistakes and take a step forward each time (Interviewee Code 13)".

This strategy emphasizes learning from experience through systematic reflection and analysis of real emergency situations. Such reflective practices enable aid workers to identify their strengths and weaknesses and develop targeted strategies to improve future performance.

One participant in this study stated: "When we sit down and analyze our experiences after real operations, we can clearly identify our strengths and weaknesses. This reflection helps us become more prepared for future crises. For example, in one operation, we realized that team coordination was weak. After analyzing the situation, we addressed this issue in subsequent training, and our performance improved significantly in the next operation. Reviewing our experiences helps us avoid repeating past mistakes and continuously improve our performance" (Interviewee Code 13).

4. Materials and Resources in a Neuroscience-Based Curriculum

Interviewees identified the following from the curriculum-based neuroscience program resources and materials:

a) *Utilization of interdisciplinary experts in neuroscience and emergency response*

The involvement of specialized instructors with expertise in both neuroscience and emergency response enables learners to acquire up-to-date scientific knowledge alongside practical field-based experience. This interdisciplinary approach enhances the relevance and applicability of training by bridging theoretical understanding with real-world practice. One interviewee in this study explained: "When an instructor has expertise in both neuroscience and emergency response, the training becomes more realistic and applicable. They can explain brain mechanisms while also demonstrating how to act in real field situations. This combination moves training beyond pure theory and transforms it into a tangible and practical experience" (Interviewee Code 5).

b) *Use of educational software and simulation tools for crisis training*

Educational software and simulation tools create conditions that closely resemble real-life crises, providing learners with opportunities to practice in a safe and controlled environment. These tools facilitate experiential learning by enabling repeated exposure to diverse emergency scenarios, thereby enhancing cognitive readiness and emotional regulation. One participant stated: "When we work with a simulator, we feel as if we are in a real crisis. This experience allows us to practice appropriate responses without risk. Simulators prepare our minds to experience less anxiety in real situations and support faster decision-making." (Interviewee Code 15) Another participant explained: "Working with educational software allows us to repeatedly practice crisis scenarios without real danger. In simulated environments, our minds learn how to respond in moments of distress. These exercises make our decisions faster and more accurate in real situations. Moreover, when the software presents various scenarios, we can prepare for each one, which increases our confidence." (Interviewee Code 14)

c) *Application of multimedia educational resources to enhance experiential learning*

The use of multimedia resources—such as videos, podcasts, images, and interactive scenarios—enhances the depth and engagement of learning. These tools facilitate experiential learning by enabling learners to visualize concepts, interact with content, and connect theoretical knowledge to real-world applications. One of the interviewees stated: "When learning is limited to text, it quickly becomes monotonous. However, the use of videos, images, and multimedia content makes learning more engaging and memorable. These resources enable us to observe and learn from real-life experiences." (Interviewee Code 11)

5. Learning Opportunities in a Neuroscience-Based Curriculum

Interviewees identified the following as learning-teaching opportunities in a neuroscience-based curriculum:

a) *Integration of theoretical neuroscience education with practical experiences to consolidate learning and facilitate transfer to real emergency situations*

This educational opportunity emphasizes the integration of theoretical knowledge with practical experience. Learners are first introduced to the fundamental principles of neuroscience and then apply these concepts in emergency response scenarios. This integration enhances the durability of learning and facilitates its transfer to real-life situations. One participant explained: "This combination makes learning more sustainable. When an aid worker understands neural mechanisms and experiences them through practical exercises, the transfer of learning to real-life situations occurs more rapidly. The brain, supported by both theoretical understanding and practical experience, consolidates neural pathways and activates appropriate responses in real conditions more efficiently and accurately." (Interviewee Code 6)

Another participant stated: "From a scientific perspective, combining theoretical education with practical experience strengthens neural pathways associated with working memory and decision-making, transferring learning from the cognitive level to the behavioral level. This process stabilizes mental and behavioral patterns, enabling individuals to respond more quickly and accurately in real-world conditions." (Interviewee Code 10)

b) *Creating learning opportunities through scenario-based crisis activities and group exercises*

This educational approach emphasizes the design of real or simulated crisis activities that allow aid workers to practice their cognitive and emotional skills in environments that closely resemble real-life situations. Such experiences enhance experiential learning by engaging both individual and collective dimensions of performance. One interviewee in this study stated: "Scenario-based crisis activities and group exercises stimulate brain activity and can trigger the release of hormones such as oxytocin, which strengthen cooperation and trust among participants. This biological process contributes to deeper and more lasting learning. When individuals engage in simulated group situations, their brains not only reinforce cognitive pathways related to decision-making and problem-solving but also activate emotional and social networks. This integration elevates learning from an individual process to a collective experience—one that consolidates cognitive skills while enhancing empathy and collaborative abilities in real crisis situations" (Interviewee Code 2).

6. Learning Environment Conditions for a Neuroscience-Based Curriculum

According to the experts, the following are considered key conditions of the learning environment in a neuroscience-based curriculum:

a) *Creation of learning opportunities through scenario-based crisis activities and group exercises*

This component emphasizes the design of educational environments that recreate real-life crisis scenarios, enabling learners to practice their skills within a safe and controlled setting. Such environments, through interactive simulations, realistic scenarios, and modern technologies, provide opportunities to experience high-risk situations without real consequences. One participant explained: "A dynamic and simulated environment allows learners to engage, make mistakes, and practice again. This cycle of experience and feedback deepens learning and consolidates skills in long-term memory. In such environments, mistakes are viewed not as failures but as integral parts of the learning process, enabling reflection and strategy adjustment. Furthermore, interactive simulations create conditions in which learners can practice cognitive skills such as rapid decision-making, problem-solving, and attention management in near-realistic situations, while also strengthening emotional abilities including anxiety control, emotion regulation, and team collaboration. Immediate feedback and performance analysis help learners identify weaknesses and develop effective compensatory strategies to enhance cognitive and emotional resilience. Thus, dynamic and simulated educational environments not only improve the operational readiness of aid workers but also enhance their psychological and social capacities." (Interviewee Code 8)

b) *Flexibility in the time and location of training to accommodate aid workers' conditions*

This component emphasizes the design of flexible trainings so that responders can participate in programs according to their work and time conditions. One of the interviewees in this research stated "Flexibility in time and place of training allows us to align programs with the actual conditions of aid workers . This approach increases participation and prevents fatigue or additional pressure, as learners can participate in training at times when they are most mentally and physically prepared. As a result, the learning process becomes more natural and sustainable, and performance

quality in real-life situations is also improved". (Interviewee Code 1)

7. Neuroscience-*Based Curriculum Evaluation*

Neuroscience-based evaluation emphasizes assessing cognitive and emotional abilities in simulated situations, evaluating aid workers' performance in practical exercises and real-world projects, and incorporating peer assessment and group feedback to enhance social learning at all stages of instruction:

a) *Assessment of cognitive and emotional capabilities in simulated environments*

This type of evaluation emphasizes the reconstruction of real crisis conditions within educational settings. From a neuroscience perspective, when responders are placed in simulated situations, their brains exhibit responses similar to those experienced in real-life crises. These responses involve the activation of neural networks associated with working memory, selective attention, and emotion regulation.

One of the participants stated: "Assessment in simulated environments shows how effectively a responder can maintain focus and manage intense emotions. This form of evaluation not only reveals current capabilities but also identifies neural pathways that require further strengthening. In such environments, aid workers have the opportunity to practice cognitive skills—such as working memory, rapid decision-making, and problem-solving—under conditions close to reality, while simultaneously developing emotional competencies including anxiety control, emotion regulation, and team collaboration. Immediate feedback enables the correction of strategies and enhances cognitive–emotional resilience. Furthermore, data derived from simulated assessments can provide a scientific basis for designing targeted educational programs that address responders' weaknesses and actual needs, strengthen neural pathways related to cognitive and emotional performance, and ultimately improve operational readiness in real crisis situations." (Interviewee Code 3)

b) *Evaluation of aid workers' performance in practical exercises and real-world projects*

This form of evaluation focuses on assessing the transfer of learning from the theoretical level to observable behavior. In practical exercises, the aid worker's brain must simultaneously manage multiple processes, including the processing of environmental information, motor coordination, and emotional regulation. One of the interviewees explained: "When aid workers participate in practical exercises, we can observe whether neural pathways associated with decision-making and rapid response have been effectively reinforced. Practical evaluation, therefore, reflects underlying brain functions and the individual's level of cognitive–emotional readiness. It demonstrates how effectively the brain integrates theoretical knowledge, practical experience, and emotional regulation to produce appropriate responses in real-life conditions". (Interviewee Code 9)

c) *Peer assessment and group feedback to enhance social learning*

This form of evaluation emphasizes group interaction and mutual feedback. From a neuroscience perspective, social learning is among the most effective mechanisms for consolidating knowledge and skills.

One participant explained: "When aid workers engage in peer assessment within group settings, social networks in the brain are activated. These networks enhance trust, empathy, and motivation through the release of neurochemicals such as oxytocin and dopamine. Group feedback not only facilitates the correction of individual behavior but also strengthens neural pathways related to social interaction and cooperation, thereby deepening learning." (Interviewee Code 4)

Discussion and Conclusion

The present study aimed to develop the components of a neuroscience-based curriculum model to enhance the cognitive–emotional performance of aid workers. The findings identified seven core elements—goals, content, teaching–learning strategies, materials and resources, teaching–learning opportunities, learning environment conditions, and evaluation—which together provide a comprehensive and integrated framework for improving performance in crisis situations. Importantly, this model moves beyond traditional training approaches by systematically linking cognitive and emotional processes to educational design, thereby offering a more scientifically grounded structure for emergency training.

In the goals dimension, the emphasis on working memory, rapid and accurate decision-making, and emotional competencies such as empathy and stress regulation reflects a shift from purely skill-based training toward cognitively and emotionally informed performance development. While these findings are consistent with prior

research on working memory (18), executive functions (15), and emotional intelligence (22), they also extend existing literature by demonstrating how these constructs can be operationalized within a structured curriculum model for aid workers. This suggests that neuroscience-informed goal setting can transform reactive and instinct-driven behaviors into more controlled, adaptive, and evidence-based responses in crisis situations.

Regarding content, the integration of neuroscience concepts with practical emergency training plays a critical role in bridging the gap between theory and practice. Unlike traditional curricula that often separate knowledge from application, the present model emphasizes applied neurocognitive understanding, including brain mechanisms of emotion and cognition, alongside scenario-based exercises. This finding aligns with neuroeducation research (8, 39) and further highlights that learning becomes more transferable when theoretical knowledge is embedded within realistic and context-based experiences.

In terms of teaching–learning strategies, the use of active and experiential methods—such as simulations, role-playing, and collaborative learning—not only enhances knowledge retention but also strengthens confidence and interpersonal skills. While previous studies (11, 37) have emphasized the effectiveness of such approaches, the present findings contribute by situating these strategies within a neuroscience-informed framework, thereby explaining their effectiveness in terms of cognitive and emotional engagement and neural activation.

The findings related to materials and resources underscore the importance of interdisciplinary instruction and technological support. The combination of neuroscience experts, emergency professionals, and advanced tools such as simulators and multimedia resources creates a rich learning environment that supports both cognitive processing and experiential learning. This highlights the critical role of technology-enhanced learning in preparing aid workers for complex and high-risk environments. Furthermore, the teaching–learning opportunities identified in this study demonstrate that the integration of theoretical and practical experiences facilitates the strengthening of neural pathways associated with decision-making and working memory. This suggests that repeated and meaningful engagement in realistic tasks can promote the transition from cognitive understanding to behavioral competence, which is essential in emergency response contexts.

The learning environment conditions also emerged as a key factor. The design of dynamic, flexible, and simulation-based environments provides safe yet realistic contexts in which aid workers can develop and refine their skills. This finding highlights that learning effectiveness is not only dependent on content and methods but also on the contextual conditions under which learning occurs.

In the evaluation dimension, the emphasis on multidimensional assessment—including cognitive, emotional, and performance-based measures—represents a significant advancement over traditional evaluation methods. Consistent with Wagnild and Collins (2009) (27), the findings suggest that such comprehensive assessment approaches not only capture individual competencies but also enhance social learning and teamwork through feedback processes.

Overall, the findings of this study contribute to the field by proposing an integrated and neuroscience-informed curriculum model that addresses both cognitive and emotional dimensions of performance. This model not only responds to the increasing complexity of crisis situations but also fills a gap in existing training approaches, which often overlook the interaction between brain-based processes and practical performance. From a practical perspective, the model provides a structured framework that can be adopted by relief organizations to enhance training effectiveness and improve real-world response outcomes.

Based on the findings, several practical and research recommendations are proposed:

a) *The use of crisis simulations in training aid workers*: It is recommended that simulation-based scenarios be incorporated into the design of training programs, enabling aid workers to practice their cognitive and emotional skills in a safe environment and enhance their preparedness for real-life situations. Crisis simulations provide opportunities for aid workers to encounter psychological and emotional pressures similar to those experienced in actual emergencies within controlled settings, allowing them to evaluate their responses and practice appropriate strategies. This approach, in addition to improving cognitive and emotional readiness, contributes to increased self-confidence and a reduction in potential errors during real operations. Furthermore, the use of gradual and staged simulations can support the development of rapid and accurate decision-

making skills and promote more sustainable learning outcomes.

b) *Integrating neuroscience technologies into educational programs*: The application of advanced tools such as neuroscience-based educational software and brain imaging technologies can contribute to more precise assessment of aid workers' cognitive and emotional performance and help identify neural pathways associated with learning. These technologies enable real-time observation and analysis of brain activity, allowing instructors to identify strengths and weaknesses and tailor training programs to individual needs. In addition, the integration of interactive technologies such as virtual reality and augmented reality can enrich learning experiences and allow for more accurate simulation of crisis conditions. Such an approach not only enhances the quality of training but also increases motivation and promotes the active engagement of aid workers in the learning process.

c) *Emphasizing emotional intelligence training and cognitive resilience:* It is recommended that specialized training programs be designed to enhance emotional intelligence (self-awareness, empathy, and emotion regulation) and cognitive resilience, enabling aid workers to maintain stable and effective performance in crisis situations. Emotional intelligence training can strengthen aid workers' ability to establish human connections with victims, manage stress, and remain calm under high-pressure conditions. On the other hand, cognitive resilience helps aid workers maintain their mental capacities and make sound decisions when facing psychological and organizational pressures. The integration of these two components within training programs can enhance both individual and social competencies, better preparing aid workers to perform effectively in emergency operations.

In conclusion, the proposed neuroscience-based curriculum model offers a novel, integrative, and practical approach to training aid workers. By simultaneously addressing cognitive and emotional dimensions, this model enhances preparedness, improves decision-making, and strengthens resilience in crisis situations, and can serve as a valuable framework for future developments in both emergency training and neuroscience-based education.

Compliance with Ethical Guidelines

All ethical principles were observed in this study and participants were fully informed about the purpose of the research and its implementation procedures, and informed consent was obtained prior to data collection.

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Author's Contributions

This article is based on the original idea of Mahdi Ghoraba, who was responsible for the study design and development of the research methodology. Tayebeh Tajari contributed to data collection, implementation of the study, and data analysis. She also served as the corresponding author and was responsible for editing and finalizing the manuscript submitted to the journal.

Conflict of Interests

The authors declare no conflict of interest.

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