NEUROPHOBIA AS AN EDUCATIONALLY MEDIATED PHENOMENON: A CRITICAL REVIEW

NEUROFOBIA COMO UM FENÔMENO MEDIADO EDUCACIONALMENTE: UMA REVISÃO CRÍTICA

LA NEUROFOBIA COMO UN FENÓMENO MEDIADO EDUCATIVAMENTE: UNA REVISIÓN CRÍTICA

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ABSTRACT

Background: Neurophobia, commonly defined as the fear of neurology among medical students and non-specialist physicians, is a persistent and internationally reported problem in medical education. It is often attributed to the intrinsic complexity of neurology, including neuroanatomy, lesion localisation and diagnostic reasoning. However, educational factors such as lack of integration between basic and clinical sciences, fragmented curricula and passive teaching methods have also been consistently identified. This suggests that neurophobia may not be explained by content complexity alone, but also by how neurology is taught and learned.

Methods: This study was designed as a critical review. Literature on neurophobia, neurology education and educational theory was purposefully sampled and reviewed. The aim of the review was not only to summarise the literature but to reinterpret neurophobia through the lens of educational theory and to develop a conceptual framework to explain its emergence and potential mitigation.

Results: The literature suggests that neurophobia is associated with difficulties in knowledge integration, low perceived relevance of neuroscience teaching, passive learning environments, fragmented curricula, high cognitive load and difficulty constructing mental models of neurological function. Educational theories, including meaningful learning theory, adult learning theory, critical pedagogy, curriculum theory, cognitive load theory and analogical learning, provide explanatory frameworks for these difficulties and suggest corresponding educational strategies.

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Discussion: This synthesis suggests that neurophobia is primarily an educationally mediated phenomenon resulting from a misalignment between the cognitive demands of neurology and the educational design through which it is taught. Educational theory provides a framework not only to explain neurophobia but also to guide curriculum design and teaching strategies aimed at improving knowledge integration, motivation, clinical reasoning development and student confidence.

Keywords: Neurology. Education, Medical. Learning. Curriculum. Cognition. Workload. Comprehension. Clinical Reasoning. Review Literature as Topic. Models. Educational.

RESUMO

Introdução: A neurofobia, comumente definida como o medo da neurologia entre estudantes de medicina e médicos não especialistas, é um problema persistente e relatado internacionalmente na educação médica. Frequentemente, é atribuída à complexidade intrínseca da neurologia, incluindo a neuroanatomia, a localização de lesões e o raciocínio diagnóstico. No entanto, fatores educacionais, como a falta de integração entre as ciências básicas e clínicas, currículos fragmentados e métodos de ensino passivos, também têm sido consistentemente identificados. Isso sugere que a neurofobia pode não ser explicada apenas pela complexidade do conteúdo, mas também pela forma como a neurologia é ensinada e aprendida.

Métodos: Este estudo foi concebido como uma revisão crítica. A literatura sobre neurofobia, educação em neurologia e teoria educacional foi selecionada intencionalmente e revisada. O objetivo da revisão não foi apenas resumir a literatura, mas reinterpretar a neurofobia à luz da teoria educacional e desenvolver um arcabouço conceitual para explicar sua emergência e possível mitigação.

Resultados: A literatura sugere que a neurofobia está associada a dificuldades na integração do conhecimento, baixa percepção de relevância do ensino de neurociência, ambientes de aprendizagem passivos, currículos fragmentados, alta carga cognitiva e dificuldade na construção de modelos mentais do funcionamento neurológico. Teorias educacionais, incluindo a teoria da aprendizagem significativa, teoria da aprendizagem de adultos, pedagogia crítica, teoria curricular, teoria da carga cognitiva e aprendizagem analógica, fornecem estruturas explicativas para essas dificuldades e sugerem estratégias educacionais correspondentes.

Discussão: Esta síntese sugere que a neurofobia é principalmente um fenômeno mediado educacionalmente, resultante de um desalinhamento entre as demandas cognitivas da neurologia e o desenho educacional por meio do qual ela é ensinada. A teoria educacional fornece uma estrutura não apenas para explicar a neurofobia, mas também para orientar o desenho curricular e estratégias de ensino voltadas para melhorar a integração do conhecimento, a motivação, o desenvolvimento do raciocínio clínico e a confiança dos estudantes.

Palavras-chave: Neurologia. Educação Médica. Aprendizagem. Currículo. Cognição. Carga de Trabalho. Compreensão. Raciocínio Clínico. Revisão de Literatura Como Assunto. Modelos Educacionais.

RESUMEN

Introducción: La neurofobia, comúnmente definida como el miedo a la neurología entre estudiantes de medicina y médicos no especialistas, es un problema persistente y reportado internacionalmente en la educación médica. A menudo se atribuye a la complejidad intrínseca de la neurología, incluyendo la neuroanatomía, la localización de lesiones y el

razonamiento diagnóstico. Sin embargo, factores educativos como la falta de integración entre las ciencias básicas y clínicas, los currículos fragmentados y los métodos de enseñanza pasivos también han sido identificados de manera consistente. Esto sugiere que la neurofobia puede no explicarse únicamente por la complejidad del contenido, sino también por la forma en que la neurología es enseñada y aprendida.

Métodos: Este estudio fue diseñado como una revisión crítica. La literatura sobre neurofobia, educación en neurología y teoría educativa fue seleccionada intencionalmente y revisada. El objetivo de la revisión no fue solo resumir la literatura, sino reinterpretar la neurofobia desde la perspectiva de la teoría educativa y desarrollar un marco conceptual para explicar su aparición y posible mitigación.

Resultados: La literatura sugiere que la neurofobia está asociada con dificultades en la integración del conocimiento, baja percepción de la relevancia de la enseñanza de la neurociencia, entornos de aprendizaje pasivos, currículos fragmentados, alta carga cognitiva y dificultad para construir modelos mentales del funcionamiento neurológico. Las teorías educativas, incluyendo la teoría del aprendizaje significativo, la teoría del aprendizaje de adultos, la pedagogía crítica, la teoría curricular, la teoría de la carga cognitiva y el aprendizaje analógico, proporcionan marcos explicativos para estas dificultades y sugieren estrategias educativas correspondientes.

Discusión: Esta síntesis sugiere que la neurofobia es principalmente un fenómeno mediado educativamente, resultante de una desalineación entre las demandas cognitivas de la neurología y el diseño educativo mediante el cual se enseña. La teoría educativa proporciona un marco no solo para explicar la neurofobia, sino también para orientar el diseño curricular y las estrategias de enseñanza dirigidas a mejorar la integración del conocimiento, la motivación, el desarrollo del razonamiento clínico y la confianza de los estudiantes.

Palabras clave: Neurología. Educación Médica. Aprendizaje. Currículo. Cognición. Carga de Trabajo. Comprensión. Razonamiento Clínico. Revisión de la Literatura Como Tema. Modelos Educativos.

1 INTRODUCTION

Neurophobia, a term first introduced by Jozefowicz (1), describes the fear of neurology among medical students and physicians and is commonly associated with low confidence in neurological examination, difficulty applying basic neuroscience knowledge to clinical practice and avoidance of the discipline. Since its original description, neurophobia has been reported in multiple countries and educational contexts, suggesting that it represents a persistent and widespread problem in medical education (2, 3).

The causes of neurophobia described in the literature are multifactorial. Students frequently report difficulties related to the complexity of neuroanatomy, challenges in lesion localisation and low confidence in neurological examination. However, many studies also highlight educational factors, including lack of integration between basic neurosciences and clinical neurology, inadequate curriculum structure, ineffective teaching methods and limited opportunities for active learning (4). These findings suggest that neurophobia may not be explained by content complexity alone, but also by how neurology is taught and learned.

Despite the growing literature on neurophobia, most studies focus on describing the phenomenon and identifying associated factors, while fewer studies attempt to interpret neurophobia through an educational theory framework. As a result, neurophobia is often treated as a problem inherent to neurology rather than as a phenomenon that may emerge from the interaction between the cognitive demands of neurology and the educational design through which it is taught.

This distinction is important because neurology is not the only complex domain in medicine. Many areas of medical practice require the integration of basic science knowledge, the construction of mental models of invisible physiological processes and the development of clinical reasoning under conditions of uncertainty. Yet neurology consistently appears as one of the disciplines most frequently associated with anxiety and avoidance among students. This suggests that neurophobia may represent not only a neurology problem but also a broader educational problem related to how complex knowledge is taught in medicine.

Educational theory offers a framework for understanding how students learn complex material, how knowledge is integrated, how motivation influences learning and how curriculum structure shapes learning experiences. However, the extent to which educational theory can explain neurophobia and inform strategies to mitigate it remains insufficiently explored.

This paper therefore does not aim merely to review the literature on neurophobia, but to critically reinterpret neurophobia through the lens of educational theory and to propose a conceptual framework that may help explain why neurophobia emerges and how it may be

mitigated. We argue that neurophobia may be better understood as the result of a misalignment between the cognitive demands of neurology and the educational design through which neurology is taught.

2 METHODS

This study was designed as a critical review with the aim of developing a conceptual framework to explain neurophobia and explore how educational theory may inform strategies to mitigate it. Critical reviews involve a narrative synthesis that brings an interpretative lens to the literature, combining the reviewer's theoretical premise with existing models to allow for the synthesis and interpretation of diverse studies (5). This method is particularly useful when the objective is to generate new theoretical insights and shift conversations in the field rather than merely aggregating data (6).

A purposeful literature search was conducted in major databases (PubMed/MEDLINE, ERIC, Scopus, Web of Science) to identify dominant themes and highly relevant publications addressing neurophobia, neurology education, and educational theories. Search terms included combinations of “neurophobia”, “neurology education”, “learning theory”, “curriculum”, “cognitive load”, and “meaningful learning”. Rather than attempting an exhaustive systematic search, our sampling strategy prioritised works that offered the most influential evidence or theoretical arguments necessary to shape our conceptual understanding of the phenomenon.

Reflexivity Statement

Because critical reviewers must exercise interpretative judgement throughout the process, reflexivity is essential to ensure rigour and transparency (7). Our research team comprises [inserir: ex: a clinical neurologist, a medical education researcher, and a cognitive psychologist]. Recognising that our diverse backgrounds inherently shape our analytical lens, we engaged in regular discussions to challenge our own assumptions. This collaborative reflexivity deliberately moved our focus away from viewing neurophobia purely as a clinical deficit of the learner, guiding us to filter the literature through a pedagogical and systemic lens to identify underlying educational misalignments.

Data analysis was conducted using a thematic and conceptual synthesis approach. First, we identified causes of neurophobia described in the literature and grouped them into thematic categories. Second, we mapped these themes to major educational theories. Third, we conducted a conceptual synthesis to develop a theory-informed framework describing neurophobia as an educationally mediated phenomenon.

3 RESULTS

Neurophobia in the literature

The literature consistently describes neurophobia as a phenomenon characterised by fear of neurology, low confidence in neurological examination, difficulty applying basic neuroscience knowledge to clinical practice and a tendency to avoid the discipline. One of the most frequently cited causes of neurophobia is the difficulty students experience in integrating basic neuroscience knowledge with clinical neurology. This difficulty often manifests as problems with lesion localisation, clinical reasoning and understanding how neurological systems function as integrated networks rather than isolated structures (8).

Other commonly reported causes include the perceived complexity of neuroanatomy, insufficient exposure to neurological patients, lack of confidence in neurological examination and the perception that neurology is abstract and difficult. However, several studies also highlight educational factors, including lack of integration between basic and clinical sciences, fragmented curricula, predominantly lecture-based teaching methods and limited opportunities for active learning.

Taken together, these findings suggest that neurophobia may be associated not only with the intrinsic complexity of neurology but also with how neurological knowledge is structured and taught within medical curricula.

Educational theories relevant to neurophobia

Several educational theories provide frameworks that help explain the learning difficulties described in the neurophobia literature.

Meaningful learning theory suggests that new knowledge is learned more effectively when it is integrated with prior knowledge in a structured and meaningful way. Adult learning theory emphasises that learners are more motivated when they perceive the relevance of what they are learning to real-life problems. Critical pedagogy suggests that passive learning environments may reduce engagement and limit deep understanding. Curriculum theory emphasises the importance of integration and progressive learning. Cognitive load theory suggests that learning may be impaired when the amount of information exceeds the learner's cognitive processing capacity. Analogical learning theory suggests that analogies and conceptual models may help learners understand complex and abstract systems.

Mapping neurophobia through educational theory

We mapped the causes of neurophobia described in the literature to mechanisms described in educational theory. Difficulties in knowledge integration can be interpreted through meaningful learning theory; low motivation through adult learning theory; passive learning environments through critical pedagogy; fragmented curricula through curriculum

theory; excessive information load through cognitive load theory; and difficulty understanding abstract systems through analogical learning theory. This relationship supports the interpretation of neurophobia as a phenomenon influenced by curriculum design, teaching strategies and learning environment rather than by content complexity alone.

Table 1

Mapping causes of neurophobia, educational theories and educational strategies

Cause of neurophobia	Educational theory	Educational strategy
Fragmented knowledge	Meaningful learning	Integration of basic and clinical sciences
Low motivation	Adult learning	Problem-based learning and clinical relevance
Passive learning	Critical pedagogy	Active learning
Fragmented curriculum	Curriculum theory	Spiral curriculum
Cognitive overload	Cognitive load theory	Instructional design
Abstract concepts	Analogical learning	Analogies and conceptual models

4 DISCUSSION

Primary findings and Theoretical implications

This review identified recurring themes in the neurophobia literature, including difficulties in knowledge integration, low perceived relevance of neuroscience teaching, passive learning environments, fragmented curricula, high cognitive load and difficulty constructing mental models. We argue that neurophobia emerges from a misalignment between the cognitive demands of neurology and the educational design through which neurology is taught. Neurology requires integration of knowledge, construction of mental models and development of clinical reasoning under uncertainty (9). When educational design does not support these processes, students may experience cognitive overload, fragmented knowledge, low confidence and reduced motivation.

We therefore propose a theory-informed framework in which neurophobia is understood as the result of misalignment between cognitive demands and educational design.

Equity, Diversity and Inclusion (EDI) Implications

Reconceptualising neurophobia as an educationally mediated phenomenon also raises important questions regarding equity and social justice in medical training, aligning with the growing recognition of how systemic structures impact learners. Rigid, fragmented curricula and passive learning environments do not affect all students equally. High cognitive load and the lack of contextualised learning may disproportionately disadvantage students from non-traditional or marginalised backgrounds, who might already expend cognitive resources navigating exclusionary aspects of the hidden curriculum. By improving

educational architecture to provide better cognitive scaffolding and active engagement, educators can foster a more inclusive learning environment that supports diverse cognitive needs and mitigates systemic alienation.

Practical implications for medical education

This framework has implications beyond neurology. If neurophobia is related to how complex knowledge is taught, then similar phenomena may occur in other areas of medical education involving complex systems and high cognitive load. Educational strategies such as integration between basic and clinical sciences, early clinical exposure, structured approaches to clinical reasoning, and instructional design that manages cognitive load may help reduce neurophobia (10). This perspective also reframes the role of the medical teacher from a mere transmitter of knowledge to an active designer of learning experiences.

Methodological considerations

This review has some limitations inherent to its design. As a critical review, our purposeful sampling strategy was not intended to be an exhaustive or highly reproducible mathematical search of the literature, but rather a representative selection necessary to build a robust theoretical framework. Our selection of educational theories was interpretative and influenced by the specific academic lenses of the research team. Exploring alternative frameworks, such as those strictly focused on organisational psychology or institutional hierarchies, might yield different, yet complementary, interpretations of neurophobia. The main contribution of this review, therefore, lies in its theory-informed synthesis rather than quantitative evidence of specific interventions.

Future directions

This framework generates a testable hypothesis: educational interventions explicitly designed based on educational theory may reduce neurophobia by improving knowledge integration, motivation, clinical reasoning development and student confidence. Future research should investigate theory-informed educational interventions in neurology education and their impact on student learning and attitudes towards neurology.

5 CONCLUSION

Neurophobia has traditionally been interpreted as a consequence of the intrinsic complexity of neurology. This review reconceptualises neurophobia as an educationally mediated phenomenon resulting from misalignment between the cognitive demands of neurology and the educational design of neurology teaching. Educational theory provides a framework not only to explain neurophobia but also to guide the development of educational strategies to mitigate it. Understanding neurophobia through educational theory shifts the

focus from simplifying neurology content to improving the educational architecture through which complex knowledge is taught and learned in medical education.

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