

# Identifying neurophysiological needs for tourism education curriculum

Worldwide  
Hospitality and  
Tourism Themes

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## Abstract

**Purpose** – The purpose of this article is to identify neurophysiological learning needs in tourism education by examining the subjective perspectives of educators and scholars. The study aims to contribute to discussions on how neuroscience-informed approaches can support curriculum development in a practice-oriented discipline without undermining its experiential and contextual foundations.

**Design/methodology/approach** – The study adopts Q methodology to systematically explore academic subjectivities. Based on an interdisciplinary concourse, 40 Q statements addressing pedagogical, cognitive, affective and technological dimensions were developed. A forced quasi-normal Q sort was conducted with academics from tourism-related disciplines, and the data were analyzed using principal component analysis with varimax rotation.

**Findings** – The findings reveal strong agreement that conventional lecture-based and sedentary teaching methods are inadequate for tourism education, while experiential, field-based and simulation-supported learning approaches are widely endorsed. At the same time, participants express caution toward the direct pedagogical application of certain neuroscientific claims. Four distinct and internally consistent epistemic perspectives were identified through factor analysis.

**Research limitations/implications** – The study is limited by its relatively small and discipline-specific sample, which restricts the generalizability of the findings. Nevertheless, it provides important theoretical implications by framing neuroscience-related debates in tourism education as epistemological and by demonstrating the usefulness of Q methodology in interdisciplinary educational research.

**Practical implications** – The findings suggest that tourism curricula should prioritize experiential and practice-oriented learning environments while adopting neuroscience-informed insights cautiously and contextually. Rather than promoting prescriptive brain-based techniques, educators and curriculum designers are encouraged to use neuroscientific knowledge as a reflective support tool that complements experiential learning, emotional engagement and disciplinary practice.

**Social implications** – By fostering more effective, reflective and learner-centered educational practices, the study contributes to the development of tourism education that is responsive to contemporary cognitive and experiential learning needs. A context-sensitive integration of neuroscience has the potential to enhance student engagement, professional competence and long-term learning outcomes, thereby supporting the social relevance and sustainability of tourism education.

**Originality/value** – This article offers original value by systematically mapping plural academic perspectives on neurophysiological learning needs in tourism education. It advances the literature by showing how neuroscience-informed insights can be integrated into curriculum design in a reflective, context-sensitive and evidence-based manner.

**Keywords** Tourism education, Neurophysiological learning needs, Brain-based learning, Neuroscience-informed curriculum, Experiential learning, Q methodology

**Paper type** Research article

## Introduction

Tourism education has undergone sustained and multidimensional transformation as the tourism sector itself has been reshaped by economic restructuring, technological acceleration,



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socio-environmental pressures and shifting societal expectations. Early approaches to tourism curricula were frequently fragmented and weakly aligned with the systemic complexity of tourism, resulting in educational designs that inadequately reflected industry realities, stakeholder demands or broader social responsibilities (Fidgeon, 2010). Although tourism has since become firmly institutionalized within higher education worldwide, longstanding debates persist concerning curriculum philosophy, coherence and purpose, particularly regarding how vocational preparation should be balanced with critical reflection, ethical responsibility and societal engagement (Airey and Tribe, 2006; Oktadiana and Chon, 2016; Fidgeon, 2010). These debates are not merely technical but epistemological, as tourism curricula are increasingly recognized as sites where economic imperatives, educational values and power relations intersect (Tribe, 2001; Oktadiana and Chon, 2016).

A dominant strand of scholarship highlights persistent misalignment between tourism education and labor-market needs, cautioning against both outdated curricula and narrowly instrumental, market-driven models. Empirical evidence across diverse contexts demonstrates recurring gaps between curricular content and employer expectations, with graduates often underprepared in applied skills, soft skills and adaptive capacities required in contemporary tourism workplaces (Koh, 1995; Al-Romeedy and Elbaz, 2020; Kasa *et al.*, 2020). National and regional studies from Egypt, Bangladesh, Sarawak, Europe and the Middle East consistently identify shortcomings such as limited standardization, weak outcome orientation, insufficient field-based learning and inadequate responsiveness to industry change (Al-Romeedy and Elbaz, 2020; Alam, 2025; Kasa *et al.*, 2020; Maráková *et al.*, 2025; Petrovič *et al.*, 2025). In response, several authors advocate structured, stakeholder-informed curriculum frameworks that integrate employer input, student expectations, alumni feedback and policy priorities to define core competencies, learning outcomes and national or sectoral benchmarks (Koh, 1995; Alam, 2025; Hyasat, 2025; Fernández-Villarán *et al.*, 2024).

Beyond employability, tourism education research increasingly foregrounds entrepreneurship, innovation and future-oriented capabilities as essential graduate attributes. Entrepreneurship-focused curricula, particularly those grounded in project-based and design-thinking pedagogies, have been shown to enhance students' perceptions of relevance, foster noncognitive skills and support both employment and self-employment pathways (Daniel *et al.*, 2017). Horizon-scanning analyses further argue that future tourism programs must integrate entrepreneurship, crisis management, data analytics, communication and humanities perspectives, delivered through flexible, blended and technology-enhanced learning environments that include flipped classrooms, co-creation pedagogies and immersive technologies such as augmented and virtual reality (Hsu, 2017). These pedagogical shifts align with broader calls for tourism education to cultivate adaptive, reflective and interdisciplinary thinkers capable of navigating uncertainty and complexity (Wattanacharoensil, 2013).

Sustainability and citizenship have emerged as central pillars in contemporary tourism curriculum debates. In response, scholars argue that tourism education should move beyond narrow vocationalism. They emphasize the need for reflective, action-oriented and values-based educational models that prepare graduates to contribute to sustainable tourism development and to act as responsible global citizens. Farsari (2021) and Fernández-Villarán *et al.* (2024) empirical work demonstrates both progress and persistent constraints in embedding sustainability, with motivated lecturers playing a crucial role while institutional barriers – such as limited resources, weak managerial support and incentive systems prioritizing research over teaching innovation – continue to impede curricular transformation (Moreno Luna *et al.*, 2021). Parallel studies reveal substantial gaps in sustainability literacy, particularly regarding strong sustainability, Net-Zero transitions and emissions monitoring, suggesting that many tourism degrees still inadequately prepare students for sustainability-driven systemic change (Mínguez *et al.*, 2021; Conefrey *et al.*, 2025).

At the same time, critical and decolonial perspectives have drawn attention to the philosophical foundations and cultural positioning of tourism curricula. Research indicates that curriculum decisions are often pragmatic and path-dependent rather than explicitly

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grounded in educational theory, reinforcing tensions between industry-driven objectives and broader educational aims (Oktadiana and Chon, 2016; Kirlar *et al.*, 2021). Decolonial scholarship from South Africa highlights the need to center local knowledges, contextualized case material, multilingual practices and sustainability-oriented worldviews, challenging the reproduction of Eurocentric models in tourism education (Bouwer, 2024). These perspectives underscore that tourism curricula are neither neutral nor universal but embedded within specific epistemologies, cultural contexts and power structures.

Technological change and digitalization further complicate curriculum design, functioning as cross-cutting drivers across regions and sectors. Studies emphasize the growing need to integrate digital marketing, big data analytics, AR/VR applications and AI-supported systems into tourism curricula, alongside investments in lecturers' digital literacy and technology-rich learning environments (Hsu, 2017; Sumardani *et al.*, 2025). Evidence from competency-based and neural-network-supported training models suggests that iterative feedback, active engagement and adaptive learning environments can enhance professional competencies, aligning with broader neurophysiological and brain-based learning principles (Sun and Zhao, 2024; Harden and Jones, 2022). Brain-based learning research further emphasizes the importance of activating whole-brain functions, fostering emotionally supportive environments, and encouraging active participation to enhance motivation, retention and deep learning (Oh *et al.*, 2014; Dwiputra *et al.*, 2023). Complementary pedagogies such as problem-based learning have demonstrated robust effects on critical thinking and practical application, reinforcing their relevance for tourism education seeking deeper cognitive engagement and skill transfer (Bligh, 1995; Tavakol *et al.*, 2009; Ge *et al.*, 2025).

Identifying neurophysiological needs in education involves understanding how brain function and neural development influence learning processes, behavior, and cognitive growth. Research in this field underscores that educational strategies should be aligned with neurophysiological characteristics to promote effective learning, especially among students with developmental or intellectual disabilities. Druzhinina *et al.* (2020) emphasized that specific neural patterns – such as variations in alpha rhythm activity – can serve as important indicators of cognitive and adaptive development in children with health-related disabilities. Similarly, Ribtsun and Pinchuk (2025) highlighted the importance of considering neurophysiological features when designing inclusive preschool education programs to foster social adaptability and equitable participation. These findings suggest that educators and curriculum designers must take into account how differences in brain activity shape learning readiness and social development.

At the higher education and professional training levels, the identification of neurophysiological needs extends to improving how neuroscience concepts are taught. Studies have revealed significant gaps in neurophysiology education within medical and health science programs. Daniello and Weber (2018) reported that many neurology residents fail to achieve sufficient competence in electroencephalography (EEG) and electromyography (EMG), largely due to time constraints and limited exposure. Similarly, Bocci *et al.* (2021) found that Italian neurology specialization programs displayed inconsistencies in neurophysiology training, with insufficient standardization and variability in skill development. These findings underscore the importance of developing structured and competency-based neurophysiology education to meet the growing demands of healthcare and research sectors.

Incorporating neurophysiological understanding into education also benefits learners' conceptual and emotional engagement. Colleary *et al.* (2017) demonstrated that teaching pain neurophysiology significantly improved physiotherapy students' knowledge and attitudes toward chronic pain management. Likewise, King *et al.* (2018) found that neurophysiological education enabled patients with chronic low back pain to reconceptualize their understanding of pain, leading to better coping mechanisms and self-management. These studies show that neurophysiological education, when made personally relevant and contextually grounded, enhances both comprehension and behavioral outcomes – a principle that can be applied across educational contexts.

Finally, effective needs assessment is essential in identifying gaps in both neurophysiological and pedagogical knowledge. Igarashi *et al.* (2013) noted that perceived learning needs often differ from actual knowledge-based deficiencies, indicating that educators must use multiple assessment methods to capture true educational needs. Minaiyan *et al.* (2020) further supported this by showing that motivation and practical relevance are key drivers of engagement in continuing education programs. Together, these studies reinforce that understanding neurophysiological needs in education requires a multidimensional approach that integrates neuroscience, psychology and pedagogy to support learners' cognitive and emotional development across all levels of education.

Identifying neurophysiological needs in education requires integrating insights from neuroscience, psychology and pedagogy to optimize learning for diverse learners. Research shows that neurophysiological characteristics such as variations in alpha rhythm activity play a critical role in cognitive and adaptive development among children with disabilities, highlighting the importance of tailoring educational methods to neurobiological differences (Druzhinina *et al.*, 2020; Ribtsun and Pinchuk, 2025). In higher education, significant gaps exist in neurophysiology training, with neurology residents often lacking adequate competence in EEG and EMG interpretation due to limited exposure, suggesting a need for standardized and competency-based curricula (Daniello and Weber, 2018; Bocci *et al.*, 2021). Studies in applied neurophysiology education further demonstrate that targeted instruction, such as pain neurophysiology education, not only enhances students' conceptual understanding but also shifts attitudes and behaviors toward a biopsychosocial perspective on health and learning (Colleary *et al.*, 2017; King *et al.*, 2018). Moreover, effective needs assessment is essential to uncover hidden gaps between perceived and actual educational deficiencies, emphasizing the role of motivation, self-awareness and applied learning relevance in fostering engagement and knowledge retention (Igarashi *et al.*, 2013; Minaiyan *et al.*, 2020). Collectively, these findings underscore that understanding and addressing neurophysiological needs across educational levels is foundational to creating inclusive, effective and evidence-based learning environments that align with how the brain learns and adapts.

Within this evolving pedagogical landscape, neurophysiological and brain-based perspectives have gained increasing attention as potential frameworks for enhancing experiential, emotional and cognitive dimensions of tourism learning. Tourism education scholars have linked experiential learning, workplace learning and action-oriented pedagogy to embodied cognition, contextual memory formation and affective engagement, all of which are particularly salient in a practice-intensive field such as tourism (Naicker, 2017; Farsari, 2021). Variation theory and sustainability-focused pedagogy further highlight the role of cognitive flexibility and deep conceptual understanding in preparing students to navigate complex sustainability challenges (Cotterell *et al.*, 2015). At the same time, concerns remain regarding cognitive overload, technological determinism and the readiness of faculty to adopt facilitative rather than directive teaching roles (Hsu, 2017; Korkmaz, 2024).

Against this background, Q methodology has emerged as a particularly suitable approach for exploring contested and pluralistic perspectives in tourism education. By systematically capturing subjectivity through a combination of qualitative interpretation and quantitative structure, Q methodology enables researchers to identify shared viewpoints, areas of consensus and deep-seated epistemic tensions among stakeholders (Stergiou and Airey, 2011). Its application in tourism research has revealed divergent perspectives on sustainability, policy and curriculum priorities, demonstrating its capacity to illuminate how values and beliefs shape educational design (Nikraftar and Jafarpour, 2020). Within education more broadly, Q methodology has been used to assess affective competencies and evaluate curriculum innovations, further supporting its relevance for curriculum-focused inquiry (Gaebler-Uhing, 2003; Hensel, 2017).

The present study is situated within this extensive and multifaceted literature and responds directly to calls for empirically grounded, philosophically informed and pedagogically

reflective curriculum design in tourism education. By employing Q methodology to examine academics' subjective perspectives on neurophysiological learning needs, the study seeks to map the epistemic positions that shape how neuroscience-informed ideas are interpreted, accepted or resisted within tourism education. In doing so, it contributes to ongoing debates on curriculum relevance, sustainability, digitalization and pedagogical innovation, while offering a pluralistic and evidence-based foundation for context-responsive curriculum reform in contemporary tourism education.

### **Methodology**

This study employed Q methodology to systematically examine academics' subjective perspectives on the neurophysiological foundations of tourism education. Q methodology is particularly suitable for exploring contested and pluralistic viewpoints, as it combines qualitative interpretation with quantitative factor-analytic techniques to reveal shared patterns of subjectivity.

### **Development of the Q-set**

The Q-set was developed through an extensive review of interdisciplinary literature spanning four main domains: (1) neuroeducation and brain-based learning, (2) experiential and embodied learning theories, (3) tourism education and curriculum studies and (4) educational technologies and digitalization in higher education. Key sources included foundational and contemporary studies on tourism pedagogy, sustainability-oriented education, neuroscience-informed learning approaches and experiential curriculum design. From this literature, an initial concourse of statements was generated to capture a broad spectrum of pedagogical, cognitive, affective and technological positions relevant to tourism education.

The initial pool of statements was refined through iterative screening to eliminate redundancy, overly technical formulations and conceptually overlapping items. Selection criteria focused on clarity, relevance to tourism education and the capacity of each statement to provoke meaningful subjective differentiation. This process resulted in a final set of 40 Q statements, designed to represent both supportive and critical positions toward neuroscience-informed approaches, as well as traditional and emerging pedagogical orientations within tourism education.

### **Participants and sampling strategy**

The study sample consisted of 14 academics purposively selected from tourism-related disciplines, in line with the logic of Q methodology, which prioritizes depth and diversity of perspectives over statistical representativeness. Participants were recruited from departments of Tourism Management, Gastronomy and Culinary Arts, and Tourism Guidance, ensuring the inclusion of both managerial and practice-oriented educational viewpoints.

In terms of academic background, the sample included scholars holding different academic ranks (assistant professor, associate professor and lecturer) and representing diverse institutional and geographical contexts within higher education. The participants comprised 8 males (57.1%) and 6 females (42.9%), providing a balanced gender distribution for an exploratory Q-methodological study. While age ranges were heterogeneous, all participants were actively engaged in teaching and curriculum-related activities in tourism education. Some participants had prior familiarity with neuroscience-related concepts through pedagogical research or technology-enhanced learning practices, whereas others approached the topic primarily from experiential or curriculum design perspectives. This diversity was considered an analytical strength, enabling the identification of contrasting epistemic positions.

### Data collection procedure

Participants were contacted directly via institutional email and invited to take part in the study on a voluntary basis. Upon consent, they were provided with detailed instructions explaining the purpose of the research, the Q-sorting procedure and the meaning of the response scale. The Q-sorting task was administered individually.

Each participant was asked to rank the 40 statements using a forced quasi-normal distribution ranging from  $-4$  (strongly disagree) to  $+4$  (strongly agree). This forced-choice structure encouraged participants to make relative judgments among statements, thereby revealing their underlying subjective priorities rather than isolated evaluations. Participants completed the sorting process independently, and clarification was provided when necessary to ensure procedural consistency.

### Data analysis

The completed Q sorts were analyzed using principal component analysis (PCA), followed by varimax rotation, to identify shared patterns of subjectivity among participants. Factor extraction was guided by eigenvalues, explained variance and the interpretability of factor structures. Factor arrays were constructed using z-scores to represent the idealized Q sort for each factor.

To support interpretation, mean scores and standard deviations were calculated to identify consensus and dissensus statements across the entire sample. Visual analytical tools, including a PCA plot and a heatmap, were used to illustrate relationships among participants, statements and factors. This multi-layered analytical process enabled the identification and interpretation of four distinct and theoretically meaningful epistemic perspectives on neurophysiological learning needs in tourism education.

### Findings

The agreement statements in [Table 1](#) note a common center of varied opinions on tourism education that is focused on reform to active, applied learning and limiting neurophysiological interventions. There is a strong and consistent agreement among participants that the teaching based on pure lectures and sitting is not sufficient as dispersion is low with a positive mean. They strongly support field-based activities and experiential learning as crucial, which is congruent with the practice-intensive nature of tourism, where practical experience and

**Table 1.** Agreement (consensus) statements

Statement	Statement text	Mean	SD	Z
18	A lecture-based, sedentary teaching model is insufficient for tourism education	2.07	1.00	1.48
7	The emotional learning processes of tourism students are not sufficiently taken into account in education	0.31	1.32	0.22
20	Field-based practices positively influence the cognitive development of tourism students	2.86	1.41	2.05
34	Experiential learning is fully aligned with the nature of the tourism sector	1.29	1.44	0.92
39	Learning based on brain plasticity makes a significant contribution to tourism education	-2.27	1.44	-1.63
21	Simulation-based education should be frequently used in tourism programs	1.43	1.45	1.02
36	Students can learn to cope with customer complaints more effectively through neurophysiological training models	-1.85	1.46	-1.33
37	Sensory memory exercises should be incorporated into the curriculum	-0.79	1.48	-0.57

resolving issues are critical. Simulation-based education is also widely accepted as a useful tool, but with a much wider dispersion in its perceived centrality in the curriculum. Conversely, it is characterized by mutual doubt of some neurophysiological approaches. The participants disregard the suggestions of brain plasticity-based learning as an important part of the tourism education, neurophysiological training of customer complaints and sensory memory exercises as something immature or unproven. Moderate accord indicates that there is a recognized gap of dealing with the emotional learning processes and this indicates an area that can develop without the strong prescription. On the whole, teachers come together in supporting change to an experiential and practice-based approach, but are wary of wholesale implementation of particular neuroscience ideas. The disputes are not whether reform is necessary or not, but whether neuroscience-based interventions are legitimate and valuable or not. Although all 40 Q statements were included in the Q-sorting and factor-analytic procedures, the tables and factor interpretations highlight only those statements with the highest positive or negative z-scores, as these were the most salient in differentiating the identified perspectives.

Table 2 also shows dissensus statements that indicate significant areas of disagreement between the participants, although the overall means are neutral because of high dispersion, which shows polarization. The most significant divergence is related to the pedagogical role of storytelling in learning destination knowledge: although the mean score is weakly positive, the outward extremes represent the opinions of storytelling as an effective experience tool and informal or not rigorous enough in higher learning. This brings out epistemic conflicts between narrative and analytical methods. The same polarization is around the concept of multisensory learning (smell, taste, touch), in which it is debated whether it is possible, whether it can be scaled, and whether it can be regarded as an academic discipline. Cognitive processes-working memory support, long-term memory strategies and processing speed statements also have high variability about near-zero means, displaying different opinions about explicitly discussing cognitive processes in curriculum design. Simultaneous development of cognitive and emotional abilities attracts significant dissensus, indicating contradictions between the traditional academic models and holistic and competence-based frameworks, even though emotional labor in tourism is acknowledged. New interventions such as AI-assisted technology and mindfulness-based training create controversy, which some view as potential yet invalidated or unsuitable. In general, the fundamental issues in tourism education debates are not whether it should change, but how, with the neurocognitive, affective, and technological methods taking priority and the neuroscience-guided tourism

**Table 2.** Disagreement (dissensus) analysis

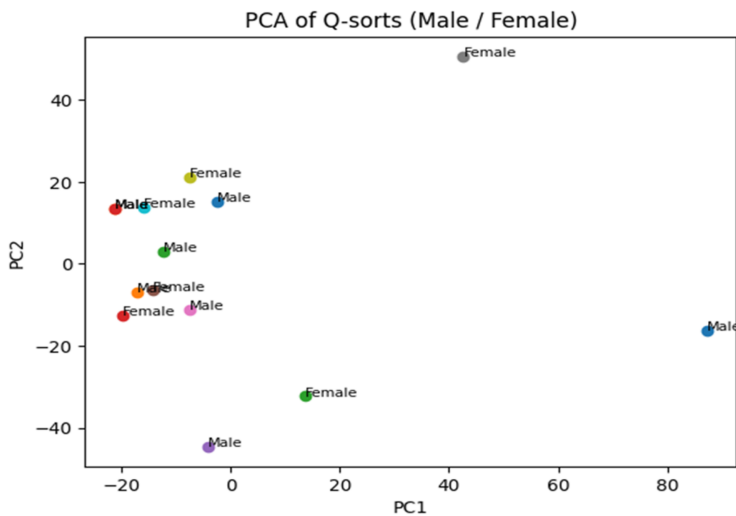
Statement	Statement text	Mean	SD	Z
15	The storytelling method is highly effective in learning destination knowledge in tourism	0.50	2.93	0.38
6	Tourism students learn more meaningfully when they use their senses of smell, taste, and touch in educational settings	1.57	2.59	1.12
16	Teaching methods that support working memory are largely neglected in tourism programs	-0.64	2.56	-0.48
3	The integration of long-term memory strategies into tourism courses is insufficient	0.14	2.51	0.11
40	Tourism education should simultaneously develop students' cognitive and emotional capacities	-0.29	2.40	-0.21
33	Tourism students' information processing speed should be considered in educational planning	0.07	2.31	0.05
25	Artificial intelligence-supported systems can accelerate tourism students' learning processes	0.93	2.28	0.69
12	Mindfulness-based training can improve tourism students' performance under stress	0.21	2.22	0.16

education being a source of persistent tension in terms of innovation, evidence and academic legitimacy. These products are very crucial in distinguishing the emerging aspects.

The principal component analysis (PCA) of the Q sorts is presented in [Figure 1](#). (participants are identified as male/female). The initial two factors account for 51.8% of variance (PC1: 31.8; PC2: 19.9) and indicate an undisputed low-dimensional organization of the opinions of the participants. The gender-based clustering is not revealed in the plot: there are males and females, and they are mixed in both dimensions, playing the central and extreme roles. PC1 first of all measures a continuum between firm support of experiential, simulation-based and reform-oriented methods to more conservative positions regarding neurocognitive and technological innovations-distinctions depending upon pedagogical and epistemic orientations rather than gender. PC2 introduces the cross-cutting differentiation regarding the focus on affective, emotional, and neurophysiological (e.g. stress management, emotional regulation, mindfulness), which is again not patterned according to gender. In general, the PCA illustrates an organized heterogeneity of perspectives, which is motivated by pedagogical ideologies and epistemic assets but not gender. It proves at least two latent dimensions and is a useful complement to the following Q factor analysis, as an exploratory tool.

The factor analysis yielded four distinct viewpoints ([Figure 2](#)) concerning the neurophysiological foundations of tourism education. These factors do not merely reflect preferences for specific teaching techniques; rather, they represent coherent epistemic positions regarding how learning, cognition, emotion, technology and practice should be integrated into tourism curricula.

The first factor of [Table 3](#) represents an opinion that neurophysiological measurement, consumer cognition and neuroscientific assessment is of precedence to embodied or experience-oriented learning. Respondents identifying with this aspect are strong proponents of neuromarketing, brain-based measurement methods (e.g. brainwave analyses), neurophysiological paradigms to control customer complaints and behavior response. They, however, also undermine experiential learning, field practices, kinesthetic movement and stress management training, which is educational. In this sense, tourism education is theorized as having a primarily cognitive and analytically manageable process with consumer behavior being the core of the matter in terms of understanding and manipulation using neuroscientific



**Figure 1.** The principal component analysis

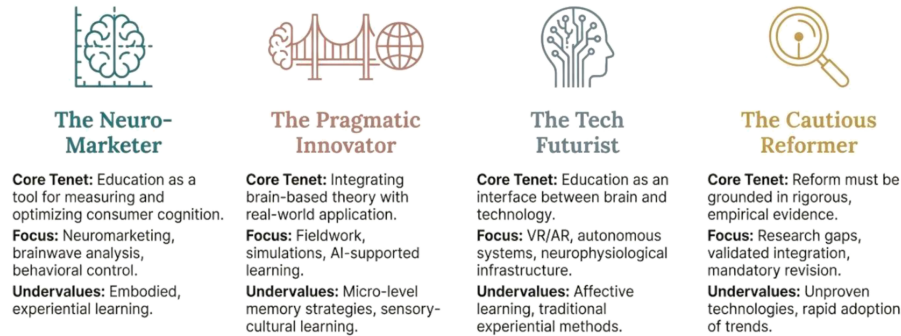


Figure 2. A comparative summary of the four competing g philosophies

Table 3. Factor 1 – neuro-marketing and measurement-oriented neuroeducation

Statement	Statement text (abbreviated)	Z (Factor 1)	Mean	SD
22	Neuromarketing is essential in tourism education	+2.10	0.79	1.84
27	Brainwave analyses can be used in educational assessment	+1.98	0.64	1.89
39	Learning based on brain plasticity contributes significantly	+1.85	-2.27	1.44
36	Neurophysiological models improve handling customer complaints	+1.72	-1.85	1.46
23	Brain imaging should be used in tourism marketing research	+1.61	0.64	1.69

means. Learning is not considered as something that involves the body or emotions but rather as a field of accuracy, forecasting and economically.

Table 4 articulates the second factor that represents a pragmatic and integrative approach based on brain-based learning as the key organizing principle of tourism education. This perspective is firmly in favor of the application of neuroscience-informed concepts and at the same time, it underlines applied elements like fieldwork, simulations and experiential learning that are in tandem with the reality of the sector. This position, in contrast to Factor 1, appreciates in-world experience and technological support, such as AI-based learning systems. It however puts relatively low emphasis on sensory-cultural learning (e.g. smell, taste, art, gastronomy) and micro-level memory strategies like storytelling, or working-memory-oriented instruction. This aspect therefore is a form of utilitarian neuroeducational where neuroscience informs the curriculum design but efficacy is determined mostly by application and operability.

The third factor in Table 5 is prevailed with a high focus on the sophisticated technologies and neurophysiological resources. The representatives of this perspective purchase VR/AR

Table 4. Factor 2 – brain-based core learning with pragmatic application

Statement	Statement text (abbreviated)	Z (Factor 2)	Mean	SD
1	Brain-based learning should be central in tourism programs	+1.30	0.93	1.87
20	Field practices enhance cognitive development	+1.22	2.86	1.41
21	Simulation-based education should be frequently used	+1.18	1.43	1.45
34	Experiential learning fits the nature of tourism	+1.05	1.29	1.44
25	AI-supported systems accelerate student learning	+0.97	0.93	2.28

**Table 5.** Factor 3 – technology-centric neurophysiological infrastructure

Statement	Statement text (abbreviated)	Z (Factor 3)	Mean	SD
26	VR and AR are core components of future tourism education	+2.04	1.14	1.91
28	Autonomous hotel technologies must be included	+1.88	0.57	1.97
27	Brainwave analyses can be used in evaluation	+1.73	0.64	1.89
16	Working-memory-supporting methods are neglected	+1.61	-0.64	2.56
29	Neuroscience-based curriculum revision is mandatory	+1.54	1.07	1.76

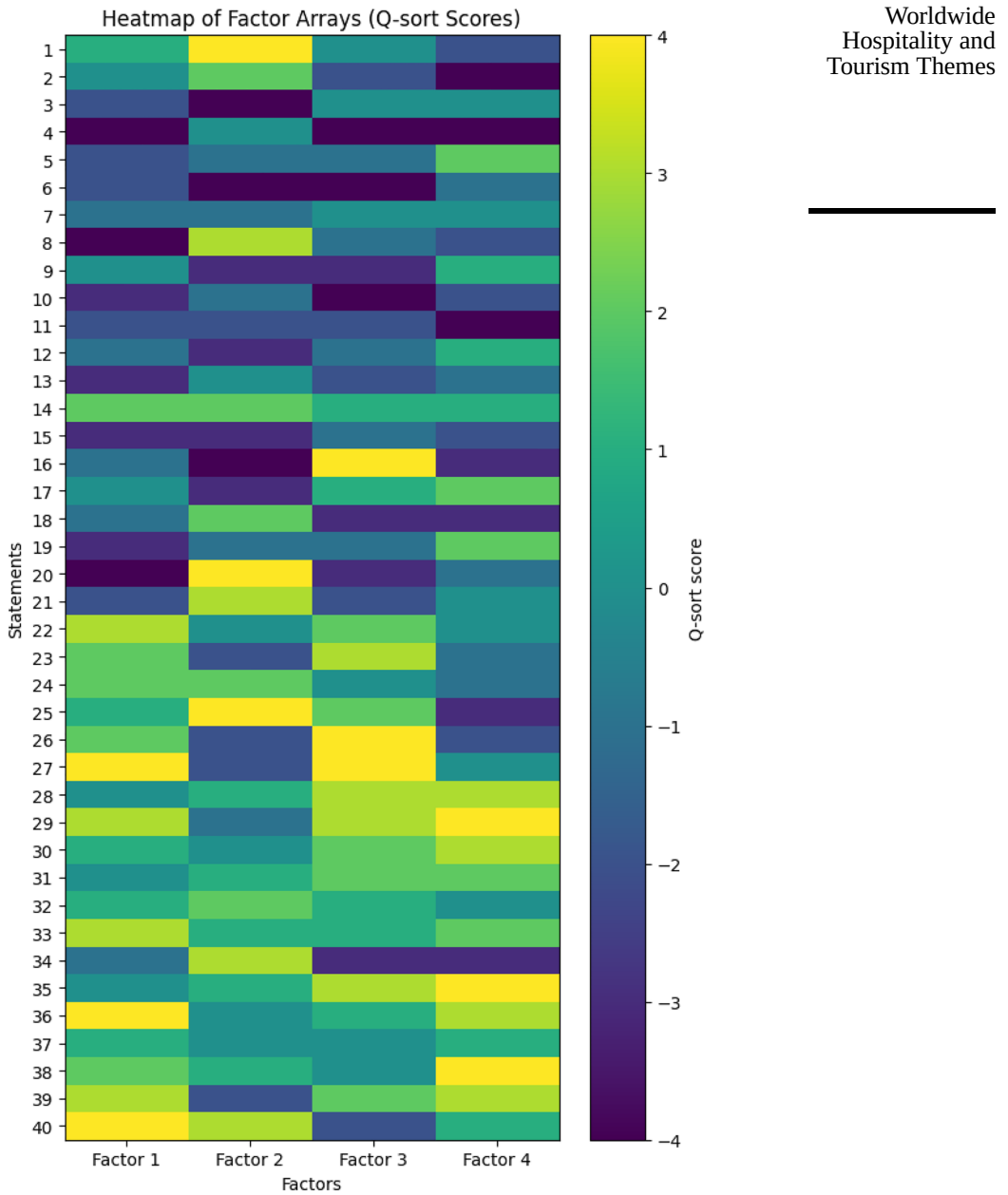
applications, autonomous hotel technologies, brain imaging techniques and neurophysiological assessment tools as the main elements of future tourism education. The experiential learning, sensory involvement, stress management and affective regulation, on the other hand, receive comparatively low priority. This aspect theorizes neurophysiological requirements mostly through technological capacity, data-driven appraisal and cognitive architecture as an outlook of educational reform that is both futuristic and technocentric. The process of learning is viewed as a brain-intelligent system interaction and not as a comprehensive embodied one.

The fourth factor in Table 6 represents a reflective and critical stance toward neuroscience-informed tourism education. Participants strongly emphasize the need for a neuroscience-based revision of tourism programs while simultaneously expressing skepticism toward claims that are perceived as insufficiently researched, particularly regarding artificial intelligence and experiential learning effectiveness. This viewpoint highlights gaps between neuroscientific research and educational practice and stresses the necessity of evidence-based integration rather than rapid adoption of popular innovations. Neuroplasticity, cognitive-emotional development and program-level reform are central, yet endorsement is conditional upon empirical validation. This factor thus embodies an epistemically cautious reform orientation that foregrounds methodological rigor and theoretical grounding.

Figure 3 provides a thick and integrative visualization of the factor arrays, which provides a closer analysis of how subjectivities relating to neurophysiological approaches to tourism education are internally organized and opposed to each other. Instead of just showing the differences among factors, the heatmap shows the rationality behind each of the perspectives of how the pedagogical priorities, epistemic commitments and boundaries of legitimacy are arranged. On the structural level, the heatmap reveals that every factor displays a coherent inner structure, where there are clusters of high-positive and high-negative scores and not isolated or irregular dispersion. This internal consistency signifies that the perceptions are not constructed by solitary inclinations to specific utterances, but rather orderly concurring evaluations in conceptually connected areas like experiential learning, neuro-physiological activities, affective control and technological intervention. The fact of such patterned clustering supports the view of the factors as consistent configurations of meaning and not arbitrary aggregations of views. On further examination, the strongest contrasts are found to be

**Table 6.** Factor 4 – critical and evidence-sensitive neuroeducational reformism

Statement	Statement text (abbreviated)	Z (Factor 4)	Mean	SD
38	AI effects on tourism education are insufficiently researched	+2.06	0.64	1.79
35	Neuroscientific findings are underused in tourism education	+1.91	0.50	1.86
29	Neuroscience-based revision of programs is mandatory	+1.76	1.07	1.76
39	Brain plasticity-based learning is highly beneficial	+1.58	-2.27	1.44
36	Neurophysiological models aid complaint management	+1.44	-1.85	1.46



**Figure 3.** Heatmap of the Q statements

around the statements associated with the manner in which the learning is embodied and mediated. Field-based, simulated and experiential statements demonstrate a positive clustering pattern when it comes to certain factors, and seem to be in very negative positions in others. This implies that there is an underlying disparity between perspectives that

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constitute learning as embodied, situational and practice-based and those that constitute learning as a cognitive architecture, or measurement, or technological mediation. Notably, this gap is not total; the heatmap displays shades of endorsement, which means that the factors vary in degree and warranting but not blatant acceptance or denial.

The other salient pattern is that of treatment of the neurophysiological concepts themselves. Theoretical or infrastructural neuroscience statements (e.g. neuroplasticity, brain-based curriculum revision, neurophysiological assessment tools) are likely to be positively clustering around some factors and mutually rejected on others. The heatmap hence reveals a difference between the instrumental and cautious interactions with neuroscience. There are some perspectives that provisionally take neuroscientific concepts as philosophically validating structures or technologies of pedagogy, and others that rebel against their actual translation into pedagogy, indicating anxieties about the level of evidence, practicability or applicability to standard teaching practice. The status of affective and emotional learning is also made clear as a result of the visualization. Statements involving stress management, emotional balance and affective performance are not consistently supported or unsupported among factors, but seem to hold intermediate or polarized positions in relation to factors. This trend suggests that the emotional aspects of learning play the role of the conceptual pivot in the discourse: they are broadly acknowledged to be applicable to the field of tourism education, but they are disputed with respect to their explicitness and systematicity of the implementation in the curricula. Lastly, the heatmap brings out the stratified nature of consensus and dissensus. In even those contexts, there are consensus statements; their order in relation to other statements varies on factors that make it possible that shared agreement does not imply shared reasoning. That is, it can be true that the factors can coincide on similar rankings and differ in epistemic narratives to support the rankings. This fact highlights one of the key contributions of the study: the controversies in neurophysiology-based tourism education are not about whether or not a change is necessary but about what conceptual paths the change should take.

Overall, the heatmap is an analysis prism with the help of which the reader is able to see the multidimensional structure of the opinions, the internal consistency of each of the factors, and the underlying epistemological contradictions that determine the industry. It therefore gives a critically important interface between the quantitative results of the Q analysis and theoretical clarification of neurophysiological needs in modern tourism education.

### Discussion

The findings of this study reinforce the view that current debates on tourism education reform are not limited to methodological preferences but are deeply rooted in epistemological questions concerning what counts as legitimate knowledge, evidence and pedagogy within the field. The strong consensus against lecture-based, sedentary teaching confirms earlier critiques that traditional curricular models fail to reflect the systemic, experiential and practice-oriented nature of tourism as both an academic and professional domain (Fidgeon, 2010; Airey and Tribe, 2006; Oktadiana and Chon, 2016). Participants' shared endorsement of experiential and field-based learning resonates with a substantial body of tourism education research emphasizing learning through situated practice, workplace exposure, and action-oriented pedagogy as essential for developing adaptive and industry-relevant competencies (Koh, 1995; Daniel *et al.*, 2017; Wattanacharoensil, 2013). From this perspective, neurophysiological needs are not interpreted as a call for highly specialized neuroscientific techniques, but rather as a reinforcement of long-standing arguments for embodied, emotionally engaged and contextually grounded learning.

At the same time, the results reveal a clear and consistent caution toward the direct pedagogical implementation of neuroscientific claims, particularly those perceived as insufficiently validated or poorly contextualized for tourism education. The rejection of statements related to brain plasticity-based learning, sensory memory exercises and neurophysiological training for customer complaint management reflects broader concerns

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raised in the literature about the risk of instrumentalizing neuroscience in educational contexts without adequate theoretical grounding or empirical support (Hsu, 2017; Korkmaz, 2024). This skepticism aligns with evidence from other educational domains, where gaps between neuroscientific research and instructional practice have been documented, and where uncritical adoption of neuroscience-informed interventions has been questioned (Daniello and Weber, 2018; Bocci *et al.*, 2021). In tourism education, these concerns are amplified by the field's reliance on experiential authenticity, emotional labor and socio-cultural interaction, which are not easily reducible to neurocognitive mechanisms.

The dissensus patterns identified in the study further illuminate persistent tensions within tourism education regarding narrative versus analytical modes of knowledge, holistic versus modular views of learning and human-centered versus technology-driven pedagogies. Polarization around storytelling and multisensory learning mirrors earlier debates on curriculum philosophy, where tourism education has struggled to balance vocational relevance with academic rigor and theoretical coherence (Tribe, 2001; Oktadiana and Chon, 2016). While narrative and sensory approaches are closely aligned with destination interpretation, gastronomy and cultural experience, their contested status suggests ongoing uncertainty about how such methods can be systematized and assessed within higher education frameworks. Similar tensions emerge around mindfulness-based training and affective regulation, which, despite the acknowledged importance of emotional processes in tourism work, remain unevenly integrated into curricula (Farsari, 2021; Moreno Luna *et al.*, 2021).

The four epistemic perspectives identified through factor analysis offer a nuanced understanding of how neurophysiological needs are conceptualized within tourism education. The neuromarketing and measurement-oriented perspective reflects a managerial and market-driven tradition that prioritizes consumer cognition, prediction and behavioral control, echoing long-standing emphases on employability and market alignment in tourism curricula (Koh, 1995; Al-Romeedy and Elbaz, 2020). In contrast, the pragmatic brain-based learning perspective aligns neuroscience-informed ideas with applied and experiential pedagogies, reflecting calls for curriculum frameworks that integrate theory with practice while remaining responsive to industry realities (Alam, 2025; Hyasat, 2025). This position treats neuroscience less as a source of prescriptive techniques and more as a justificatory framework for active learning.

The technology-centric neurophysiological infrastructure perspective resonates with contemporary discourses on digitalization, smart tourism, and AI-supported education, which emphasize immersive technologies, data analytics, and intelligent systems as drivers of curricular innovation (Hsu, 2017; Sumardani *et al.*, 2025). However, the relative de-emphasis of affective and embodied learning within this perspective reflects concerns raised in the literature about technological determinism and the potential marginalization of humanistic and relational dimensions of tourism education (Farsari, 2021; Bouwer, 2024). By contrast, the evidence-sensitive reformist perspective closely aligns with recent calls for methodologically rigorous, sustainability-oriented and context-responsive curriculum reform, emphasizing the need to bridge the gap between neuroscientific research and educational practice without succumbing to uncritical innovation (Fernández-Villarán *et al.*, 2024; Mínguez *et al.*, 2021).

Collectively, these findings suggest that neurophysiological needs in tourism education function as a contested but productive conceptual space rather than as a unified agenda for reform. The heatmap analysis demonstrates that shared agreement on certain pedagogical outcomes often masks divergent epistemic rationales, confirming earlier arguments that curriculum decisions in tourism are shaped as much by values and beliefs as by empirical evidence (Stergiou and Airey, 2011; Nikraftar and Jafarpour, 2020). In this sense, the study supports the view that effective curriculum development must accommodate pluralistic perspectives while maintaining transparency about epistemic assumptions and evidentiary standards.

Overall, the discussion positions neurophysiological needs not as a prescriptive set of techniques to be inserted into tourism curricula, but as a reflective lens through which

experiential learning, emotional engagement and technological innovation can be critically examined. Consistent with broader trends in tourism education research, the findings advocate a cautious, evidence-informed and philosophically grounded approach to curriculum reform – one that leverages insights from neuroscience where appropriate, yet remains anchored in the experiential, ethical and contextual foundations of the discipline (Airey and Tribe, 2006; Farsari, 2021; Fernández-Villarán *et al.*, 2024).

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### Conclusion

This study examined neurophysiological learning needs in tourism education by analyzing academics' subjective perspectives through Q methodology. Rather than treating neuroscience-informed education as a unified or prescriptive reform agenda, the findings reveal a structured plurality of epistemic positions that reflect deeper assumptions about learning, evidence, embodiment and the role of technology in tourism curricula.

From a strategic perspective, tourism education can be understood as a downstream enabler of neuroscience-informed tourism practice. The ways in which learning, cognition, emotion and experience are conceptualized and taught within tourism curricula shape how future professionals interpret, apply or critically evaluate neuroscience-informed approaches in areas such as service design, marketing, customer experience and workforce management. In this sense, curriculum design functions as a mediating layer between advances in learning sciences and their practical translation into tourism and hospitality practice.

Across the four perspectives identified, a clear point of convergence emerges around the perceived inadequacy of traditional, lecture-based and sedentary teaching models. Regardless of their epistemic orientation, participants broadly agree that tourism education must engage learners more actively and contextually, reflecting the experiential, relational and practice-intensive nature of the tourism sector. This shared position suggests that neurophysiological considerations are not interpreted as a replacement for established pedagogical principles, but rather as a lens through which long-standing calls for experiential and applied learning are rearticulated.

At the same time, the perspectives diverge markedly in how neuroscience is understood, valued and legitimized within curriculum design. One group approaches neurophysiological knowledge primarily through measurement, neuromarketing and cognitive control, emphasizing predictive and instrumental applications aligned with market-oriented logics. In contrast, another perspective integrates neuroscience more pragmatically, treating brain-based concepts as a supportive framework that legitimizes experiential learning, simulations and applied pedagogies without displacing disciplinary or contextual considerations. These two positions differ not in their commitment to reform, but in whether neuroscience is positioned as a core epistemic authority or as an enabling rationale for existing educational practices.

A further point of divergence concerns the role of technology and infrastructure in addressing neurophysiological learning needs. The technology-centric perspective foregrounds digital systems, immersive environments and data-driven assessment as the primary vehicles of educational innovation, framing learning as an interaction between cognitive architecture and technological mediation. By contrast, the evidence-sensitive reformist perspective adopts a more cautious stance, emphasizing the need for empirical validation, theoretical coherence and pedagogical alignment before neuroscience-informed tools and technologies are widely adopted. This contrast highlights a central tension in contemporary tourism education: whether innovation should be driven primarily by technological possibility or by evidence-based pedagogical integration.

The comparative analysis also reveals that affective and emotional dimensions of learning function as a critical boundary object across perspectives. While emotional regulation, stress management and embodied engagement are widely acknowledged as relevant to tourism education, their curricular status remains contested. Some perspectives treat affective learning as implicit within experiential practice, whereas others call for its explicit and systematic integration, subject to empirical justification. This ambivalence underscores the difficulty of

translating neurophysiological insights into curriculum structures without oversimplifying the complex emotional labor inherent in tourism work.

Theoretically, these findings suggest that neurophysiological learning needs in tourism education should be understood not as a fixed set of instructional techniques, but as a contested conceptual space in which pedagogical values, epistemic commitments and institutional priorities intersect. Q methodology proves particularly valuable in this context by revealing how shared educational goals can coexist with fundamentally different rationales and reform pathways. The study thus contributes to tourism education literature by shifting the debate from whether neuroscience should inform curricula to how, under what conditions and with what epistemic safeguards such integration should occur.

From a practical perspective, the results imply that curriculum reform in tourism education is unlikely to succeed through uniform or technology-driven solutions. Instead, effective reform requires dialogic and incremental approaches that acknowledge competing epistemic positions while fostering shared commitments to experiential engagement, reflective learning and evidence-informed innovation. Tourism education can thus be positioned as a downstream enabler of neuroscience-informed tourism practice, provided that curricular change remains sensitive to disciplinary identity, contextual variability and pedagogical legitimacy.

In conclusion, this study offers a comparative and integrative framework for understanding neurophysiological learning needs in tourism education. By articulating both convergence and divergence among academic perspectives, it provides a reflective foundation for curriculum development that balances innovation with evidence, and experimentation with epistemic responsibility.

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