國立清華大學課程大綱

科號 Course Number		學分 Credit	3	人數限制 Class Size	
中文名稱 Course Title	教育神經科學與科技				
英文名稱 Course English Title	Educational Neuroscience and Technology				
任課教師 Instructor	姚在府 (Zai-Fu Yao)				
上課時間 Time		上課教室 Room			

課程簡述(必填) (最多 500 個中文字) 本欄位資料會上傳教育部課程網
Brief Course Description (required) (50-200 words if possible, up to 1000 letters

本課程是一個跨領域學科，著重在於中樞神經系統在學習的歷程中的角色及運作方式，本課程旨在藉由掌握學習神經機制的研究及發現，探討改進教育現場的教學方式和增進學生學業表現方法。

This course offers an in-depth exploration of Educational Neuroscience and Technology, which focuses on how the brain works during the learning process. It is an interdisciplinary field that utilizes research on the neural mechanisms of learning to improve educational methods and outcomes. By examining the latest findings in educational neuroscience, we can provide recommendations for classroom practices that are backed by evidence. This course also explores how psychology and teaching expertise can be combined with knowledge of brain function to transform student outcomes. As technology continues to evolve, this field integrates emerging technologies like learning analytics, artificial intelligence, serious games, and micro-credentialing to create more advanced and personalized learning experiences. We will also look at the latest advancements in learning technologies and consider important aspects like security, privacy, diversity, equity, and inclusion. By completing this course, educators, students, and professionals can effectively utilize educational technology while meeting the practical needs and requirements of educational organizations.

請輸入課程內容「中文暨英文關鍵字」至少 5 個, 每個關鍵字至多 20 個中文, 以

半形逗點分隔 (必填)

Please fill in at least 5 course keywords (up to 40 letters for each keyword) and use commas to separate them. (required)

中文關鍵字: 教育神經科學、科技、教學實踐、個人化學習、多樣性

Keywords: Educational neuroscience, technology, classroom practices, personalized learning, diversity

課程大綱 Detailed Course Syllabus

Ethical Statement in NTHU course syllabi: This course follows the Guidelines for Collaboration, Co-learning, and Cultivation of Artificial Intelligence Competencies in University Education, which require conditional openness. In compliance with this policy, students in this course are not subject to it and are free to use generative AI, like ChatGPT, without any required disclosure.

● 課程說明(Course Description)

This course steps through the brain’ s priorities: processing senses and moving our bodies, emotional processing, and the difficult job of dealing with other people. It unpacks the tricky tasks of thinking and learning, considering how memory works and the many systems involved in learning. It draws this all together to offer guidance for effective classroom practice, current and future.

- **Introduces the** nature of individual differences at different stages in development, from early years into adulthood
- **Acquires** the latest knowledge on the development of educational neuroscience from a life-span perspective
- Discusses cognitive enhancement, summarizing research that has investigated activities that might give general benefits to cognition
- **Explores** neuropsychological perspectives on socioeconomic disparities in educational achievement, reading difficulties, phonological skills, executive function, and emotional development
- Provides a comprehensive overview of educational technology using widely emerging competency approach to learning and assessment
- Demonstrates multi-disciplinary approach, and aims to prepare students for becoming competent and innovative educational technology professionals
- Addresses the knowledge and skills to understand the organizational needs and requirements with practical uses of educational technology

● **指定用書(Text Books)**

N/A

● **參考書籍(References)**

1.[書名 Title: Educational Neuroscience-The Basics (1st Edition); 作者 Author: Cathy Rogers, Michael S. C. Thomas; 出版社 Publisher: Routledge; Published Date: November 15, 2022]

2.*[書名 Title: Educational Neuroscience-Development Across the Life Span (1st Edition); 作者 Author: Michael S. C. Thomas, Denis Mareschal, Iroise Dumontheil; 出版社 Publisher: Routledge; Published Date: April 20 2020]

3.*[書名 Title: Foundations of Educational Technology-Integrative Approaches and Interdisciplinary Perspectives (3rd Edition); 作者 Author: Gwendolyn M. Morel, J. Michael Spector; 出版社 Publisher: Routledge; Published Date: October 18, 2022]

● **教學方式(Teaching Method)**

In this course, the instructors will provide knowledge to the students through lectures and direct instructions. They will measure the results through testing and assessment. The instructors will offer a practical introduction to quantitative methods. The students will study a scholarly paper on a designated topic every few weeks through reading assignments. They will evaluate their understanding of the content through reading reflection or short answer questions.

● **教學進度(Syllabus)**

週次 (Week)	課程大綱(Syllabus)	週次 (Week)	課程大綱(Syllabus)
1	Why is neuroscience relevant to education?	9	Sleep and its relation to educational outcomes
2	An introduction to brain and cognitive development	10	Physical exercise for improving educational outcomes
3	The origins of individual differences in educational abilities and achievements	11	The cognitive benefits and disadvantages of bilingualism across the lifespan and implications

			for education
4	Socioeconomic disparities	12	Educational neuroscience: so what does it mean in the classroom?
5	Reading difficulties & variability in mathematical development	13	Defining Educational Technology
6	Executive functions in childhood and adolescence	14	Innovative Technology Use and Managing Change in the Digital Age
7	Esports games to potential educational applications	15	Integrating Technologies into Activities and Tasks under a Variety of Contexts
8	Mindfulness: Implications for learning and early childhood education	16	Key challenges in advancing educational neuroscience and emerging technologies

● **成績考核(Evaluation)**

1.. 課堂表現(attendance and performance)25%: 學生課堂出席及互動、邏輯思辯能力。不定期課堂週間進行指定閱讀反思作業(或簡答題)線上繳交。Interaction during class and constructive criticism in the way of logic. Reading reflections (short answer questions) are submitted online during each class and after completing a reading assignment.

2. 口頭報告(oral presentation)/小組討論(group discussion)30%: 學生就相關文獻掌握程度、報告流暢度、結構嚴謹度及組織性進行綜合評量。A PowerPoint presentation will include all of the critical components of the paper (e.g., background, question, hypothesis, methods, design, statistical analysis, results, and discussion) to explain to the class their research question, review of literature, and a design on how to address the questions. For 小組討論(group discussion), 學生經由自身研讀對討論主題有透徹的了解, 具批判性和創造性思維, 傾聽且尊重他人的意見, 學生利用他人的資訊加以討論（不只是說出自己的觀點和知識）。The student displays a thorough knowledge of the topic gained through research; Critical and creative thinking is evident; The student is respectful of others and listens in turn; the student makes use of the information given by others in the discussion (does not simply speak their own opinion and knowledge). The evaluation criteria would be based on the structure, organization, fluency, and coherence of the presentation. For detail on how to structure an oral presentation, please refer to the following paper: Bourne P. E. (2007). Ten simple rules for making good oral presentations. PLoS computational biology, 3(4), e77. https://doi.org/10.1371/journal.pcbi.0030077

3. 期末評論報告(opinion essay)40%: 繳交一篇針對神經影像領域的最新研究（三年內發表）進行評論。一篇評論觀點文章主要三個評分重點：對所評論的研究中所涉及的主題和問題的簡短概

述; 對主要發現的描述; 並簡要解釋統計分析邏輯。報告簡潔扼要 1500 字以內。Submit an essay to provide a scholarly review of recent studies in the educational neuroscience and technology field (publication within three years). An opinion essay should have three components: a short overview of the topic and questions addressed in the reviewed paper; a description of the key findings; and a brief explanation of why the statistical analysis is adequate. I encourage critical reviews, but comments must be accurate, well-reasoned, and diplomatic. Moreover, the focus on what was learned, and what might have been done differently is also encouraged. Submissions must be concise and should be limited to 1,500 words. The deadline for fulfilling this requirement is the last day of the semester, Friday, June 21, 2024.

* All assignments will be evaluated on the basis of content (completeness, correctness, depth, substance, relevance, logical conclusions, creativity, etc.) and format (in accordance with the assignment guidelines, including grammar, punctuation, and spelling).

4. 研究參與體驗 (Research participation for final grade) 5%: 學生可選擇實際參與實驗行為研究，體驗人類行為的奧秘，或書面報告作為期末總成績 5%的成績 Students earn 5 percentage of their final grade either by participating in research studies or by studying for and writing an exam in lieu of participation. Students in this course are strongly encouraged to participate in 3 hours of research as part of their final grade. Option 1: Students will receive course credit, not money, for participating in the studies included in this participant pool. Option 2: Research opt-out exam: Students who choose not to participate in research can write an exam (please contact the instructor for more detail) as an alternative to participating in research. The deadline to fulfill this requirement is the last day of classes, Friday, June 21, 2024.

● 可連結之網頁位址 相關網頁(Personal Website): N/A