

Master of Science (Science of Learning)

Course Code	Course Title	Course Synopses	AU
MSL901	Foundations in Science of Learning	<p>The Science of Learning (SoL) frontier draws upon a science-based understanding of the effectiveness of education methods as well as develop new teaching and learning strategies that can lead to actionable and scalable interventions for enhanced learning outcomes. Rapid developments in neural and physiological imaging technologies afford opportunities for a science-based understanding of the effectiveness of education methods as well as develop innovative pedagogies and classroom practices to realise better learning outcomes of learners.</p> <p>With an evolving education landscape,there exists a need to contribute to the understanding of the principles and practices that optimally support teaching and learning across the lfe-long learning trajectory- from infant to adulthood, witha focus on enhancing learning across diverse learner profiles e.g. (at-risk,mainstream) in Singapore's classroom learning environment.</p> <p>This proposed course aims to address a keygap that exists in the translation of scientific research evidence into pedagogical practice. Specifically, the course will provide participants with the necessary foundational, broad-based understanding in philosophies and theories of the science of learning that draws upon educational neuroscience work. Strong grounding of the theoretical basis for science of learning will facilitate translation pathways of scientific research findings towards innovative learning designs and technological tools that are relevant and useful in current learning contexts.</p>	4

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MSL902	Science of Learning: Research Methods	<p>As the name implies, the “Science of Learning” is reliant on the scientific method in studying how humans learn. In turn, the scientific method is the manifestation of modern science as we know it from Karl Popper, Thomas Kuhn and Paul Feuerabend. As a consequence, if one intends to practise the Science of Learning, one has to know how modern science is conceptualised in the form of research methods and operationalised by means of data-analytical techniques.</p> <p>In addition, since the Science of Learning is frequently associated with the application of neuroscientific methods, it seems appropriate to incorporate some educational neuroimaging techniques, such as functional near-infrared spectroscopy, in the standard repertoire of research methods.</p> <p>Finally, it is not sufficient to be only proficient in the application of research methods and statistical data analyses, but one should also be able to effectively communicate the procedures involved and the results obtained. Thus, academic report-writing is a vital skill every educational researcher should master.</p>	4
MSL903	Learning Analytics for Science of Learning	<p>Learning analytics is an emerging field of study that has been gathering broad interests in educational research and practices; recent research has harnessed the power of learning analytics to enhance understanding of learning processes.</p> <p>Learning analytics can be a game-changer that creates more effective learning environments by providing useful insights that help us to understand, visualize and predict learners' performance, provide learners with personalized learning, and increase retention and success rates.</p> <p>As a relatively new field of study, there is no such course offered in NIE. Learning analytics can bolster the scientific bases of learning through making visible empirical evidences of learning. Hence it is timely to introduce this course as a new and relevant specialized elective for the MSc (Science of Learning) programme.</p>	4

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MSL904	Educational Neuroscience: Principles, Perspectives, Practices	<p>Advances in imaging techniques, behavioural and psychological research enable the integration of disciplines that investigate human learning, opening up possibilities for the enhancement, update and eventually the reform of educational theories and practices. The field of educational neuroscience and its potential contributions to educational research is now more pronounced than before. Apart from shedding light on brain mechanisms that underpin cognitive and social learning development, research on brain science is also contributing towards neurobiological evidence-based interventions that are addressing educational concerns. These include issues such as i) early learning struggles and early intervention, ii) challenges that individual differences pose, iii) effectiveness of educational and treatment approaches to cognitive struggles and deficits, iv) widening possibilities that brain plasticity brings to normal (e.g. life-long learning) and more. Such a neuroscience and education convergence not only carry multiple implications for educational policy but at the same time, foregrounds the mutual benefits of the interaction between neurobiology and education, as education may also conceivably offer a naturalistic framework for research on the brain.</p> <p>This course is designed to follow the 'Foundations in Science of Learning' course, and although it is not necessary to have taken this course previously, students will be expected to undertake some specified pre-reading.</p>	4

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MSL905	Rethinking Assessment from, and for, the Science of Learning	<p>The Science of Learning (SoL) frontier draws upon a science- based understanding of the effectiveness of education methods as well as develop new teaching and learning strategies that can lead to actionable and scalable interventions for enhanced learning outcomes.</p> <p>But what constitutes a learning outcome, and what purposes the learning is fit for are contested and complex questions that depend on how and why such learning is assessed in the first place. Furthermore, SoL discourse assumes a paradigm and theory of learning that may be in tension with scientific notions of assessment theory. Hence, it cannot be assumed that the requisite learning outcomes from a SoL approach is compatible, let alone synergistic, with assessment practices and paradigms. It is therefore imperative to understand how assessment theories and practice posit the epistemology of learning outcomes, and how assessment theories may help or hinder the SoL agenda. In turn, advances in SoL research is an invaluable opportunity for the scientific perspectives of assessment theories to be revisited.</p>	4
MSL906	Education at the Intersection of Artificial Intelligence and Neuroscience	<p>The human brain is the best example of intelligence known, with unsurpassed ability for complex, real-time interaction with a dynamic world. At the same time, developments in AI are yielding benefits for neuroscientific research. Patterns identified from neural networks can illuminate computations enacted by the biological brain, functioning both as a model for developing and testing ideas about how the brain performs computations. Conversely, brain-activity recordings can be fed to an artificial neural network and tasked with learning how to reproduce the data, functioning as a tool for processing complex data sets that the Science of Learning research field is generating. This course will explore cycles of mutual reinforcement between neuroscientific data and artificial neural networks to obtain further insights into how computation works in the brain, and how machines that can take on more human-like intelligence to advance understanding for how a learner develops. Specifically, the course will focus on unexplored spaces at the intersections of neural AI, symbolic AI, brain science and cognitive science. Takeaways include implications for education and how cutting edge teaching and learning methodologies harnessed from AI and SoL fields may be developed.</p>	4

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MSL907	Translating Educational Neuroscience	Efficacious translation from science of learning research to the education practice and policy making continues to have challenges. Educational professionals need to have up to date knowledge of the ethics, feasibility, and challenges of translation to make informed decisions for their students.	4
MSL908	Brain, Behaviour, Cognition	Rapid changes in the milieu of 21st century learning culture and environments foregrounds the criticality to be cognizant of the multidimensional aspects of human cognition. This course entails an indepth understanding of the nature of human learning focusing on neurobiological tenets. Having a grasp of the interfacing dimensions between brain, behavior and cognition can provide insights and a deep understanding of how learning occurs, particularly in the current milieu. This course will provide the biological foundation for students pursuing the Science of Learning program with its niche focus on neuroscientific bases of learning.	4
MSL909	Integrative Project	This research-based course consolidates students' overall learning from the programme. It requires students to identify a Science of Learning education related issue, which forms the focus of inquiry, locate and read the most relevant literature to generate suggested potential solution to address the problem. The solution should show evidence that they are able to take the available information and restructure it in an appropriate way to deal with the issue.	2