MSc Human Development: Genetics, Neuroscience and Psychology

Course / Practice Descriptions

Interdisciplinary Study of Development

The course has two main objectives: (1) to provide a systematic introduction to developmental psychology; (2) to present examples of recent interdisciplinary research in developmental psychology stressing the importance of using multi-methods approaches when studying cognitive development. Conceptual, historical, theoretical and ethical issues will also be discussed.

This course aims to introduce students to some of the foundational theories within developmental and cognitive psychology. Students will be introduced to classic research studies that will help them to evaluate theories proposed to explain various aspects of cognition, such as attention and our ability to think in symbols. This module also aims to provide students with some of the qualities and transferrable skills necessary for conducting interdisciplinary research in developmental psychology. These include discussion, summation and evaluation skills, research methods in developmental psychology and other scientific disciplines and skills of evaluating ethical issues in interdisciplinary research.

Individual Differences

This course will provide a systematic introduction to the study of individual differences. Conceptual, historical, theoretical and ethical issues will be discussed alongside developments in specific fields. Critical evaluation of the existing research, including major misunderstandings surrounding the distinction between individual and average differences, will be a major focus of the course. The study of individual differences will be addressed in the context of cross-cultural differences. An important component of the course will be the study of causative mechanisms, particularly, in the context of recent understanding of the immense complexity of such processes. A major focus of the course will be studying educational, family and other social environments. Intervention studies will also be introduced.

This module is key for the entire MSc programme and is embedded in the ICRHD research programme. Students will get involved in cutting-edge research under supervision of members of the ICRHD TSU, and will be able to utilise the resources, provisions, and collaborations of the Centre.

Research Methods

Research methods module is designed to introduce students to a wide variety of research methods that can be applied to the study of development. During this module students will develop knowledge and skills that are necessary for planning and designing studies that can test specific hypothesis about development and provide knew knowledge in this field. Students will develop their analytic skills as well as learning to use a range of specific equipment. The following themes will be covered during the course: research methods used for studying human activity within diverse contexts; research methods classification; hardware and software for

experiments; measurement, observation, interview, testing; qualitative and quantitative research; experiment and quasi-experiment; reconstruction and modelling; machine learning and image recognition; longitudinal model-fitting, twin method, molecular genetic methods.

Data Analysis

The course aims to introduce basic concepts in statistics in social sciences as well as lead the students into higher-order analyses. Students will be introduced to a variety of statistical and mathematical methods. In the course of three semesters, students will build knowledge and skills that will provide solid foundation for their understanding of published research and for analyzing data collected as part of their own research. Students will acquire the following knowledge and skills: using statistics to describe the data and understand levels of measurement; understanding distributions of individual scores and sampling distributions; describing power in relation to significance; evaluating power and effect sizes; conducting statistical analyses including T-test, regressions, ANOVAs, MANOVAs and MANCOVAs, multiple regressions, Factor Analysis (FA) and Principal Component Analysis (PCA) and other techniques.

Neuroscience and Cognitive Science

This course is intended to introduce the basic concepts in neuroscience. The role of neuroscience in the interdisciplinary field of cognitive science will be discussed. The students will be introduced to several levels of analysis, from anatomical to the whole functioning brain. Students will develop the ability to identify common trends in neuroscience; evaluate neuroscientific methods and approaches in the field of cognitive science; evaluate contribution of neuroscientific advances to psychological and cognitive science. The course covers the following topics: brain anatomy and physiology; behavioral experiments and eye-tracking; invasive and non-invasive neuroimaging; EEG and MEG; modeling of the brain. Students will be introduced to research findings in different aspects of cognition and other traits including object recognition, attention, memory, language, emotions, sleep and consciousness. Students on the programme will have opportunities to apply the knowledge and skills acquired during the course in research projects supervised by the researchers of the ICRHD TSU.

Academic Writing, Publishing and Presenting

The main aim of this course it to provide students with the necessary skills and knowledge to: (1) disseminate science through quality writing and through publishing in high impact journals; (2) co-author with researchers internationally; and (3) effectively advocate and present research projects and findings to scientific and non-scientific audiences. This course focuses on: key aspects of academic writing - structure, content and style; main aspects of the process for publication on international journals, including preparation of manuscripts and letters to editors, responding to reviewers, revising and resubmitting manuscripts; practical skills of working jointly with multiple co-authors and co-applicants on research manuscripts and grant applications; key skills for effective public speaking to different audiences; and knowledge and skills needed for effective presentation at conferences.

Experimental Psychology

The course covers main concepts in experimental psychology, links between theory and experiment and specific uses of experiments in different areas of psychology. The key course outcome is acquisition of a system of theoretical knowledge and practical skills of experimental studies in psychology, cognitive science and brain science. The module will cover key

experiments, study designs and approaches to data collection (measurement), equipment and data analysis approaches. The course will introduce studies involving humans and non-human animals. The following skills will be developed during the course: planning and performing psychological experiments, evaluating reliability of psychological experiments, evaluating results of experimental studies, controlling experimental settings and other.

Ethical, Legal and Societal Issues in Research

The main aim of this course is to facilitate knowledge necessary for: (1) legal and ethical use of human data, at international level, for the benefit of societies; and (2) the protection and promotion of scientific development by handling legal and ethical concerns of research at early stages to strengthen public confidence in science.

The course is designed to provide a strong foundation of ethical, legal and societal aspects of research and of their interrelation. The course will focus on research conducted on human data and particularly genetic research. Main ethical and legal issues related to scientific research will be covered in this course. These include data handling/protection, genetic discrimination (employment, insurance, race, mental health etc.), human genetic data and privacy, genomics medicine and commercialization, including patents, genomics and liability, gene editing and intelligence. The course will also cover international practices, guidelines and regulations in the field, as well as historical developments.

Behavioral Genetics

This course will provide a systematic introduction to behavioural genetics, including methods of quantitative and molecular genetics. Conceptual, historical, theoretical and ethical issues will be discussed alongside developments in specific areas of application (e.g. behavioural genetics and psychopathology; behavioural genetics and education). The course will promote an understanding of the current issues in behavioural genetics, including the concept of "missing heritability", epigenetics and paths from genome to phenome. Basic principles as well as recent developments will be explored in relation to a broad range of phenotypes. Historical and ethical issues will be discussed.

Child Development Programmes

This course will provide a foundation for understanding the role of childhood in development across the lifespan; contribution of early development programmes (intervention programmes) to promoting positive life outcomes; policy implications and significance of knowledge mobilization in child development. The course content provides an overview of developmental theories, developmental milestones, risk and protective factors in child development within diverse contexts. The course will also focus on: ethical aspects and research methods in studies involving children; design and assessment of child development programmes targeting various developmental outcomes. Finally, policy implications of evidence-based research in early childhood development and findings will be discussed to demonstrate relevance of child development knowledge mobilization initiatives.

Cognitive Technologies

This course will provide an overview of cognitive science and its application in real world. Conceptual and theoretical issues will be discussed as well as historical and modern studies in the field. The following topics will be covered:

general and specific cognitive abilities; perception and object recognition; working and short-term memory; long-term memory; spatial ability – genes and environment; spatial ability – cross cultural studies; problem solving; planning abilities and executive functions; cognition and emotion. Cross-cultural and genetically informative approaches will be covered in the course. Additionally the course will introduce cognitive ergonomics; usability and user experience; cognitive games and brain enhancement; cognitive technologies and artificial intelligence; cognitive technologies in clinical practice.

Bioinformatics

Key aims of the course are (1) to provide an understanding of core biology concepts that relate to bioinformatics and molecular data including genomes, DNA, protein structure and function; (2) provide an introduction to growing areas in bioinformatics research, including systems biology, regulatory and functional networks and Next-Generation Sequencing; (3) introduce common tools for the analysis of high throughput genetic, expression, sequencing and methylation data.

The course will cover a broad range of topics spanning from the analysis of genetic data, through gene expression and next generation sequencing, methylation and regulatory network analysis. The course will highlight the convergence between systems biology and bioinformatics. Common tools for data analysis including several bioinformatics packages for the analysis of expression data, and PLINK for the analysis and manipulation of genetic data will be introduced. R fundamentals will be covered.

Language and the Brain

The main aims of the course are: (1) to introduce students to the major approaches to science about language processing (psycholinguistics), with particular emphasis on recent developments in the area; (2) to stimulate students' interest in psychology and cognitive science particularly in the issues of language-related psychological processes; (3) to encourage students to acquire research experience in the field of psycholinguistics. Upon completion of the course students should be able to: understand and discuss the main themes and concepts in a number of areas of current psycholinguistic theory; demonstrate knowledge about different aspects of functioning of the language system; formulate hypotheses about different structures and functions of language and design studies to test these hypotheses.

Aetiology of Developmental Problems

The course provides an introduction to theories of human development and to the problems occurring in social, emotional, perceptual and cognitive development during the lifespan. The course covers major theories of human developmental disorders, including biological and social factors influencing atypical development. The course will cover learning problems such as poor reading, poor mathematics and their comorbidity, intellectual disability, memory and attentional problems. Another part of the course covers psychopathologies including a range of mood, social and neurodegenerative disorders such as depression, anxiety, autism, ADHD, conduct disorders, schizophrenia and dementia. The course also introduces the effects of parental conflict on stress and cortisol levels as well as on cognitive development and problem behaviour.

Linguistics in the System of Natural Sciences

The course aims to introduce the methods of interaction between linguistics and natural sciences in solving theoretical and applied problems. The course content is structured to answer the following questions: What practical social needs stimulate linguistic theory development? What is the actual linguistic knowledge? What aspects of language are studied by linguistics? What is the basic set of linguistic methods? What models of language are the result of the usage of linguistic modeling? How can these results be used and are used in related sciences? How are linguistic theories and methods used in other sciences, e.g. neuroscience, genetics, and cognitive sciences? When and in what cases are linguistic data used to solve practical and theoretical problems?

Pedagogical Practice

Pedagogical Practice aims to provide introduction into pedagogical knowledge and facilitate development of teaching related competencies contributing to efficient organization of the learning process. Pedagogical practice takes place in the 3rd semester. Intended practice outcomes: knowledge of current trends in education: theory, practice and research; understanding the key foundations of professional competence and teaching effectiveness; knowledge of key factors contributing to academic achievement; knowledge of teaching and assessment strategies; acquisition of teaching experience and its critical evaluation.

Research Practice

Research Practice aims to develop a wide range of research competencies contributing to successful implementation of individual as well as large-scale interdisciplinary projects. Research practice is embedded in all four semesters during the MSc study. Students are encouraged to gain experience in ongoing projects at the International Centre for Research in Human Development TSU as well as develop their own projects.

Pre-diploma Practice

Pre-diploma practice is focused on writing up the MSc thesis and includes the following individual and group work: 1) writing up the MSc thesis following a set of requirements; 2) systematizing research materials; 3) preparing a presentation of the MSc research; 4) presenting MSc research project to scientific and non-scientific audience; 5) receiving and analyzing feedback on the thesis and presentations; 6) finalizing the MSc thesis.

Final MSc Programme Assessment – MSc thesis defense