Modules CAS Cognitive Science

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The Certificate of Advanced Studies in Cognitive Science is an interdisciplinary, research-oriented additional qualification for Master's students and doctoral candidates that promotes individual profile formation. The focus of interest is on human cognition, in the conviction that mutual enrichment is possible by building bridges to computational approaches and artificial intelligence.

Our cognitive abilities underpin processes such as remembering and forgetting, attending and constructing meaning, planning and decision making, language production and comprehension, which allow us to respond to complex problems in our environment. The question of how cognition works is fundamental to our self-understanding as human beings as well as to countless areas of our daily lives, be it at school, in social interactions, on the road, daydreaming, in mental institutions, translating or in court - to name but a few. The search for answers requires knowledge from different disciplines, an overview of the variety of methods, and a good deal of creativity.
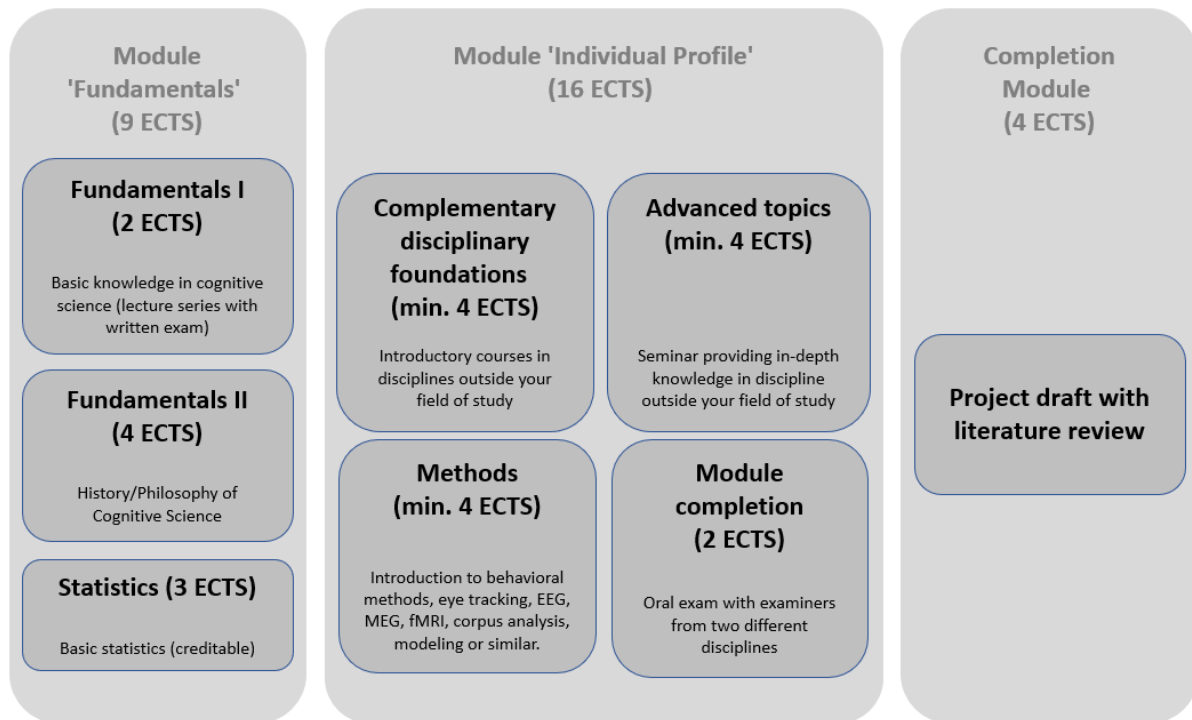
Cognitive science aims at asking appropriate questions about the connection between cognition and observable phenomena. At the same time, it provides the means to develop answers.

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In case of discrepancies between German and English, the German version prevails.

I. Structure

The certificate is divided into three modules, each consisting of several components, with the exception of the final module, which has only one component:

1. The first module provides the basics for the certificate. The lecture series (Fundamentals I) can be attended without prior registration. Participation in the seminar Philosophy/History of Science (Fundamentals II) requires prior registration and admission. Successful passing of the respective examination of both courses (Fundamentals I+II) is a prerequisite for final admission to the certificate program.
2. The second module allows students to develop an individual profile. This involves the acquisition of general knowledge in at least two disciplines outside the student's own field of study as well as in-depth knowledge in one research method. The module is concluded with an oral exam.
3. Finally, the third module offers the opportunity to apply the acquired methods and approaches in an own project design within the framework of a specific research question. The implementation of the project is not part of the certificate, but the proposal can be used as the basis for a thesis, dissertation or research project.

II. Learning objectives

Graduates of the Certificate in Cognitive Science will be able to grasp a broad spectrum of cognitive science topics and terms and present them in a way that is understandable for a multidisciplinary audience. They have acquired the ability to develop questions about human cognition and to evaluate

research literature from different disciplines on these questions. Their general overview of possible methods with in-depth knowledge and ability to apply at least one method enables them to propose an appropriate approach to find answers. In interdisciplinary teams, they can identify different perspectives and thus contribute to mediation.

1. Learning objectives of the module 'Fundamentals'

On completion of the module, certificate students

- will have acquired a basic understanding of the questions, concepts and methods of cognitive science so that they can outline the interplay of disciplinary contributions to the interdisciplinary research dialogue.
- will be able to analyze operationalizations of questions and critically question the process of scientific knowledge and theory generation.
- will have acquired a basic understanding of statistics and the tools to be able to assess statistical analyses in general terms and carry out circumscribed types of analyses themselves.

Components in the module 'Fundamentals'

Fundamentals I

On completion of the component, students

- will be able to outline the subject matter, methods, some important research questions and fundamental concepts of cognitive science.
- understand that cognitive processes can be operationalized differently for investigation and can exemplify this.
- understand the different disciplinary perspectives as complementary. Thus, they can use an example to explain how different disciplinary perspectives can jointly contribute to answering a question.

Fundamentals II

On completion of the component, students

- can contrast different understandings of science and the relationship of theory or model to reality.
- can critically question the validity of empirical observations in relation to a theory.
- can point to ethical issues and recommendations for good scientific practice that play a role in science in general and specifically in cognitive science.
- have acquired the necessary vocabulary to be able to understand papers and discussions in the field.

Statistics

On completion of this component,

- based on their understanding of essential statistical concepts, students will be able to understand and assess in general terms common statistical analyses in publications (e.g., descriptive statistics, common methods of inferential statistics, linear models).

- they will be able to carry out basic statistical analyses (e.g., graphical evaluation, descriptive statistics, individual methods of inferential statistics) for concrete examples with the support of statistical software.

2. Learning objectives of the module 'Individual Profile'

On completion of the module, certificate students will have the following competencies:

- Students will be familiar with key research questions/approaches, concepts and methods in at least two disciplines outside their own field of study, and thus be able to review the scientific literature in these areas.
- They have in-depth knowledge of current approaches in a selected subject area.
- They have in-depth knowledge of at least one method that enables them to plan and carry out an empirical investigation or set up a model using this method.

Components in the module 'Individual Profile'

In this module, individual priorities can be set. The specific competences acquired in the modules depend on the subjects chosen.

Complementary disciplinary foundations

On completion of the component, students …

- will be able to describe some key research questions as well as (theoretical) approaches or empirical methods and findings in at least two disciplines outside their own and to situate them within the cognitive sciences.
- will be able to evaluate scientific literature from these disciplines and to present an appropriate written or oral account of a circumscribed topic.
- will be able to formulate their own initial research questions in the chosen area.

Advanced Topics

On completion of the component, students …

- will have in-depth knowledge of current (research) approaches in a chosen topic area. This means that they are familiar with related research questions and concepts, can compare and critically reflect on different approaches, to assess empirical findings, to identify open questions and to propose possible approaches to solution.
- will be able to present this knowledge orally in a way that is scientifically adequate and understandable to cognitive scientists from other disciplines.

Methods

On completion of the component, students …

- will be able to evaluate the method in terms of its strengths and weaknesses, based on their knowledge of the working principles of the method.
- will be able to describe exemplary research designs/examples of use.
- will be able to design and conduct an experiment/project using this method.

3. Learning objectives of the Completion module

On completion of the module, certificate students demonstrate the following competencies:

- They can independently develop a specific research question based on the existing literature.
- They can evaluate the research literature from different disciplines on this question.
- They can present an appropriate method to investigate the question.

III. Detailed module descriptions

1. Module 'Fundamentals'

a) Component 'Fundamentals I'

Name of component	Fundamentals I
Associated module	Fundamentals
Applicability	Additional qualification in the field of Cognitive Science - open to students from all fields of study from Master's level upwards
CP (ECTS)	2
SWS	2
Recommended semester	1st semester CAS
Cycle	every semester
Prerequisites	Proficient knowledge of English
Course contents	The lecture series provides an overview of the questions that different disciplines, such as psychology, neurosciences, psychiatry, psycholinguistics, computer science, economics, and others, investigate in the cognitive sciences and which methods are used. It provides an exemplary insight into how the different disciplinary perspectives complement each other.
Learning objectives	On completion of the course, students will be able to outline the subject matter, methods, some important research questions and fundamental concepts of cognitive science.

	They understand that cognitive processes can be operationalised differently for investigation and can exemplify this. Furthermore, they understand the different disciplinary perspectives as complementary. Thus, they can use an example to explain how different disciplinary perspectives can jointly contribute to answering a question.
Forms of teaching, learning and assessment	Final exam
Requirements	Self-study, passing the exam

Workload	**Lecture series with final exam**	**2 CP (ECTS)**
	Contact time	1 CP (ECTS)
	Self-study, including preparation for final exam	1 CP (ECTS)

b) Component 'Fundamentals II'

Name of component	Fundamentals II
Associated module	Fundamentals
Applicability	Additional qualification in the field of Cognitive Science - open to students from all fields of study from Master's level upwards
CP (ECTS)	4
SWS	2
Recommended semester	1st semester CAS
Cycle	every semester
Prerequisites	Proficient knowledge of English

Course contents	The course is about reflecting on what we understand by knowledge and how knowledge can be acquired. This question can be put into perspective in different ways. Possible topics can be drawn from the following areas:
	
	− History of cognitive science
	− General science and epistemology
	− Special theory of science and epistemology of cognitive science:
	   − Relationship between model, observation, and reality.
	   − Philosophical questions (relationship between mind and body, the 'nature' of thinking, definition of central concepts, etc.)
	− Ethics in science
	− Good scientific practice

Learning objectives	On completion of the course, students can contrast different understandings of science and the relationship of theory or model to reality. They can critically question the validity of empirical observations in relation to a theory. They can point to ethical issues and recommendations for good scientific practice that play a role in science in general and specifically in cognitive science. Furthermore, they have acquired the necessary vocabulary to be able to understand papers and discussions in the field.
Forms of teaching, learning and assessment	Lecturer presentations with discussion, text reading and presentation by participants.
Requirements	Self-study, active participation, written assignments on a seminar topic. The specific requirements depend on the course.

Workload	**1 seminar**	**4 CP (ECTS)**
	Contact time	1 CP (ECTS)
	Self-study and written assignments	3 CP (ECTS)

c) Component 'Statistics'

Name of component	Statistics
Associated module	Fundamentals
Applicability	Additional qualification in the field of Cognitive Science - open to students from all fields of study from Master's level upwards
CP (ECTS)	3
SWS	2
Recommended semester	1st-2nd semester CAS; existing statistics certificates may be credited after individual assessment.
Cycle	every semester
Prerequisites	Knowledge of basic mathematical operations such as summation signs, powers, roots, exponential function.
Course contents	Basic knowledge of statistics and how to apply it, including the following: - scale levels - location and dispersion measures - frequency distributions - basic assumptions of inferential statistics - first and second type errors - correlation - regression analysis using a simple example - calculation in a software (e.g., R)
Learning objectives	Based on their understanding of essential statistical concepts, on completion of the course, students will be able to understand and assess in general terms common statistical analyses in publications (e.g., descriptive statistics, common methods of inferential statistics, linear models). They will be able to carry out basic statistical analyses (e.g., graphical evaluation, descriptive statistics, individual methods of inferential statistics) for concrete examples with the support of statistical software.
Forms of teaching, learning and assessment	Lecturer presentations in plenum Discussion in plenum Exercises Self-study

Requirements	Self-study, active participation, regular completion of assignments. The specific requirements will depend on the course.	
Workload	**1 seminar / lecture / excercise**	**3 CP (ECTS)**
	Contact time	1 CP (ECTS)
	Self-study	2 CP (ECTS)

2. Module ‚Individual Profile'

a) Component 'Complementary disciplinary foundations'

Name of component	Complementary disciplinary fundamentals
Associated module	Individual Profile
Applicability	Additional qualification in the field of Cognitive Science - open to students from all fields of study from Master's level upwards
CP (ECTS)	min. 4
SWS	min. 4
Recommended semester	1st – 3rd semester CAS
Cycle	every semester
Prerequisites	Proficient knowledge of German and English Willingness to explore outside area of expertise.
Course contents	The module is designed to provide a foundation in two cognitive science disciplines outside the own degree program and typically corresponds to introductory lectures or seminars in an area.
Learning objectives	On completion of the courses, students will be able to describe some key research questions as well as (theoretical) approaches or empirical methods and findings in at least two disciplines outside their own and to situate them within the cognitive sciences. They will be able to evaluate scientific literature from these disciplines and to present an appropriate written or oral account of a circumscribed topic, and they will be able to formulate their own initial research questions in the chosen area.

Forms of teaching, learning and assessment	Courses in this module are taught in a variety of formats (regular seminars offered by the participating departments). Typical forms of teaching and learning include lectures, discussions, readings, possibly exercises, small homework assignments or short presentations as well as self-study, which may vary depending on the course chosen. Regular attendance and active participation are essential to pass the module. The specific requirements will depend on the course and the number of credit points.
Requirements	Courses must be taken in departments other than the student's own major or minor.

Workload	**min. 2 courses**	**min. 4 CP (ECTS)**
	Contact time	min. 2 CP (ECTS)
	Self-study	min. 2 CP (ECTS)
	Other	depending on the chosen seminar and number of CP (ECTS).

b) Component 'Advanced topics'

Name of component	Advanced topics
Associated module	Individual Profile
Applicability	Additional qualification in the field of Cognitive Science - open to students from all fields of study from Master's level upwards
CP (ECTS)	min. 4
SWS	min. 4
Recommended semester	3rd semester CAS
Cycle	every semester
Prerequisites	Proficient knowledge of German and English. Acquisition of basic knowledge in the relevant discipline in the "Complementary Disciplinary Foundations" module.

Course contents	The module is designed to deepen knowledge in a cognitive science discipline outside the regular field of study and typically corresponds to a master's level seminar in a field or, in the case of medicine, in an advanced semester.
Learning objectives	On completion of this component, the students will have in-depth knowledge of current (research) approaches in a chosen topic area. This means that they are familiar with related research questions and concepts, can compare and critically reflect on different approaches, to assess empirical findings, to identify open questions and to propose possible approaches to solution. They can present this knowledge orally in a way that is scientifically adequate and understandable to cognitive scientists from other disciplines.
Forms of teaching, learning and assessment	Courses in this module are taught in a variety of formats (regular seminars offered by the participating departments). Typical forms of teaching and learning include lectures, discussions, readings, possibly exercises, small homework assignments or short presentations as well as self-study, which may vary depending on the course chosen. Regular attendance and active participation are essential to pass the module. The specific requirements will depend on the course and the number of credit points.
Requirements	The course must be taken in one of the disciplines selected in the Complementary Disciplinary Foundations module.

Workload	**min. 1 course**	**min. 4 CP (ECTS)**
	Contact time	min. 1 CP (ECTS)
	Self-study	min. 1 CP (ECTS)
	Other	depending on the chosen seminar and number of CP.

c) Component 'Methods'

Name of component	Methods
Associated module	Individual Profile
Applicability	Additional qualification in the field of Cognitive Science - open to students from all fields of study from Master's level upwards
CP (ECTS)	min. 2
SWS	min. 2
Recommended semester	2nd – 3rd semester CAS
Cycle	every semester
Prerequisites	Proficient knowledge of German and English.
Course contents	The module provides application-oriented technical and/or theoretical basics of the respective method and the resulting strengths and limits of its applicability, which are illustrated by application examples. Practical exercises prepare for independent use of the method. Examples of research methods are eye tracking, MEG, EEG, fNIRS, corpus analysis or language models.
Learning objectives	On completion of the component, students will be able to evaluate the method in terms of its strengths and weaknesses, based on their knowledge of the working principles of the research method. They can describe exemplary research designs and are able to design and conduct an experiment/project using this method.
Forms of teaching, learning and assessment	Courses in this module are taught in a variety of formats (regular seminars offered by the participating departments). Typically, a course in the Methods component should include some hands-on training, it can also be a project seminar. Regular attendance and active participation are essential to pass the module. The specific requirements will depend on the course and the number of credit points.

Workload	**min. 1 course**	**min. 2 CP (ECTS)**
	Contact time	min. 1 CP (ECTS)
	Self-study	min. 1 CP (ECTS)
	Other	depending on the chosen seminar and number of CP (ECTS).

d) Module exam

Name of component	Module exam	
Associated module	Individual Profile	
Applicability	Additional qualification in the field of Cognitive Science - open to students from all fields of study from Master's level upwards	
CP (ECTS)	2	
SWS	--	
Recommended semester	3rd – 4th semester CAS	
Cycle	every semester	
Prerequisites	Successful participation in the three modules in the Individual Profile Formation module.	
Qualification goals	Upon completion of the module, certificate students demonstrate the following competencies: They are familiar with key research questions/approaches, concepts and methods in at least two disciplines outside their own field of study, and thus be able to review the scientific literature in these areas. They have in-depth knowledge of current approaches in a selected subject area. They have in-depth knowledge of at least one method that enables them to plan and carry out an empirical investigation or set up a model using this method.	
Forms of teaching, learning and assessment	Oral exam	
Workload	Self-study	2 CP (ECTS)

3. Completion Module

Component 'Project draft with literature review'

Name of component	Project draft with literature review	
Associated module	Completion Module	
Applicability	Additional qualification in the field of Cognitive Science - open to students from all fields of study from Master's level upwards	
CP (ECTS)	4	
SWS	--	
Recommended semester	4th semester CAS	
Cycle	every semester	
Prerequisites	Successful participation in the modules Fundamentals and Individual Profile	
Qualification goals	On successful completion of the module, students will have demonstrated that they can independently develop a specific research question based on the existing literature, evaluate the research literature from different disciplines on that question, and present an appropriate method to investigate the question.	
Forms of teaching, learning and assessment	Written thesis	
Workload	Self-study	4 CP (ECTS)