TUM School of Education

Courses

Master Research on Teaching and Learning

Study Plan Master Research on Teaching and Learning

Sem.	Modules						ECTS per Sem.
1. (WS)	**COMPULSORY MODULES**				**ELECTIVE MODULES A**		
	Module 1 (P: exam) **"Introduction to methods in teaching and learning science"**	**Module 3** (SL: presentation) **"Writing and presentation skills"**	**Module 4** (P: presentation) **"Institutions in the international context of educational systems**	**Module 5.1** **"Models and theoretical conceptions of teaching and learning research 1""**	**Module 2** (SL: portfolio) **"Reading and administration of literature**	**Module 18** (SL: project report) **"Active Learning"**	
	Lecture "Introduction to quantitative methods"	Seminar "Basic scientific writing"	Seminar "Organization and Management in educational systems"	Seminar "Models and theoretical conceptions of teaching and learning research"	Seminar "Active reading strategy"	Seminar "Active Learning"	
	Exercise course "Introduction to quantitative methods"	Seminar "Presentation skills"	Seminar "Educational systems and achievement"	Seminar "Qualitative and quantitative research methods of classroom research"	Seminar "Literature administration and knowledge organization"	**Module 19** (SL: exam) **"Advanced statistical methods"**	
			Seminar "Researching educational systems/project seminar"			Seminars **(winter semester 2021/22)**	
	5	5	10		5		**25**
2. (SS)	**COMPULSORY MODULES**						
	Modul 6 (P: exam) **Advanced methods in teaching and learning science**	**Modul 7** (P: essay) **"Educational institutions and their quality development"**	**Modul 8** (P: presentation) **"Teaching and learning processes in classrooms and instructional design"**	**Modul 5.2** (P: project report) **"Models and theoretical conceptions of teaching and learning research 1"**			
	Lecture "Test theory and advanced methods in teaching and learning science"	Seminar "Basics of quality development and quality assurance"	Seminar "Introduction to teaching and learning processes in classrooms and instructional design"	Seminar "Planning and implementation of research works in classroom research I"			
	Exercise course "Test theory and advanced methods in teaching and learning science"	Seminar "Quality development by professionalization"	Seminar "Planning and evaluating educational research"				
		Seminar "Quality assurance by evaluation"	Seminar "Planning and implementation of research works in classroom research II"				
	5	10	10	10			**35**

<table>
<tr><td rowspan="5">3. (WS)</td><td colspan="2">COMPULSORY MODULES</td><td colspan="2">ELECTIVE MODULES INTERNSHIP</td><td colspan="2">ELECTIVE MODULES B</td><td></td></tr>
<tr><td>Module 9
(P: presentation)
“Educational processes and outcomes"</td><td>Module 13
(P: presentation)
"Research on teaching and learning: specialization"</td><td>Module 14
(SL: report)
"Research internship"</td><td>Module 15
(SL: report)
"Internship in educational Institutions"</td><td>Modul 10
(SL: portfolio)
"Analysis of variance"</td><td>Modul 11
(SL: portfolio)
“Video analysis"</td><td></td></tr>
<tr><td rowspan="2">Seminar
"Development of research instruments”</td><td rowspan="3">Seminar
„Selected Isssues in Educational Research”</td><td rowspan="2">internship
(3 weeks, 5 ECTS)</td><td rowspan="2">internship
(3 weeks, 5 ECTS)</td><td>Seminar
“Scientific writing”</td><td>Seminar
"Scientific writing"</td><td rowspan="2"></td></tr>
<tr><td>Seminar
"Analysis of variance procedures”</td><td>Seminar
"Video analysis"</td></tr>
<tr><td>Exercise course
“Conducting assessments in different modalities”</td><td>Module 16
(SL: report)
"Extended research internship"</td><td>Modul 17
(SL: report)
"Extended internship in educational Institutions"</td><td colspan="2">Modul 12
(SL: portfolio)
"Analysis of interview data, learning journals and portfolios"</td><td></td></tr>
<tr><td>internship
(6 weeks, 10 ECTS)</td><td>internship
(6 weeks, 10 ECTS)</td><td colspan="2">Seminar
"Scientific writing"
Seminar
"Analysis of interview data, learning journals and portfolios"</td><td></td></tr>
<tr><td></td><td>10</td><td>5</td><td>10</td><td></td><td>5</td><td></td><td>30</td></tr>
<tr><td>4. (SS)</td><td colspan="6">Master’s Thesis</td><td></td></tr>
<tr><td></td><td colspan="7"></td><td>30</td></tr>
<tr><td></td><td colspan="7"></td><td>120</td></tr>
</table>

Note*

1. P: graded module; SL: pass/fail credit requirement;
2. Students need 10 ECTS of elective modules (two modules). One from elective group A, one from elective group B;
3. Students need 10 ECTS of internships. It could be Module 14+15, Module 16, or Module 17.

Courses – winter and summer term

Required Modules

<table>
<tr><th colspan="3">ED0223: Introduction to Methods in Teaching and Learning Science</th></tr>
<tr><td>Study program:
Master Research on Teaching and Learning</td><td>Language:
English</td><td>Frequency:
every winter</td></tr>
<tr><td>Credits:
5</td><td>Learning setting:
150 hours
Lecture/exercise course: 56 hours
self-study 94 hours</td><td>Requirements:
For participation in this module, the admission to the master's program is expected.</td></tr>
<tr><td colspan="3">Description of evaluation procedure:
To test both theoretical knowledge and the advanced use of the research methods the written examination consists of a test with respect to the contents of the lecture "Introduction to quantitative methods" and the exercise course "Introduction to quantitative methods" (graded credit requirement).</td></tr>
<tr><td>Contents:</td><td colspan="2">The module "Introduction to methods in Teaching and Learning Science" aims at facilitating students'
understanding of basic quantitative methods in the field of empirical research methods. Basic knowledge about
(a) the quantitative research process and its foundation in the philosophy of science,
(b) typical research designs (i.e., (quasi-)experiments, cross-sectional and longitudinal surveys),
(c) descriptive and inferential statistics, and
(d) applied statistical methods (regression, group comparisons) is provided in the lecture "Introduction to quantitativemethods".
Further, the acquired knowledge is applied and advanced through the attached exercise course which is
adapted to the students' individual state of knowledge.</td></tr>
<tr><td>Objectives and learning outcomes:</td><td colspan="2">The students can explain and understand concepts and procedures of quantitative research methods:
(a) the quantitative research process and its foundation in the philosophy of science,
(b) typical research designs (i.e., (quasi-)experiments, cross-sectional and longitudinal surveys),
(c) descriptive (central tendency, dispersion, correlation) and inferential statistics (estimation, confidence intervals, hypothesis testing), and
(d) applied statistical methods (regression, group comparisons by t-test and ANOVA).
Students are able to apply these concepts and procedures to different problem situations in educational context to analyze and evaluate these problem situations.
Students are able to recognize and interpret covered concepts correctly when reading empirical literature. Further, students can implement the statistical analyses in statistical software and they can interpret and illustrate empirical findings of statistical analyses.</td></tr>
</table>

Teaching and learning methods:	The lecture is largely based on presentations by the lecturer. Understanding of the empirical study designs is fostered by examples of applications from real research. Statistical concepts are illustrated and explored by examples using various software (SPSS, MS Excel and R). Problems and short phases of partner or group discussions are used to engage students in elaboration of the presented material. The exercise course is largely based on short reviews by the lecturer followed by practical exercises which include group work, discussions and presentations to deepen the acquired knowledge. The students implement the statistical analyses in statistical software (SPSS) to apply their theoretical knowledge.

ED0232: Writing and Presentation Skills		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every winter
Credits: 5	**Learning setting:** 150 hours Lecture/exercise course: 56 hours self-study 94 hours	**Requirements:** For participation in this module, the admission to the master's program is expected.

Description of evaluation procedure:
The pass/fail credit requirement comprises two courses of the domain representation of information: "Basic writing skills" and "Presentation skills". As the acquisition of soft skills builds up on several activities, required achievements in all courses of the module encompass active class participation (including an individual
presentation of each participant), completing assignments, reading scientific literature, oral presentations and learning outcomes in form of an essay on reflection outcomes (Portfolio).

Contents:	The aim of this module is that students learn to make information accessible to other researchers. In this connection different soft skills (oral presentation skills such as prosody, body language, gestures/postures) but also writing skills (e.g., expression, verbalism, writing style, use of academic language) are needed which should be acquired in this module. The students obtain basics for scientific working within the scope of representation of information (writing an abstract and how to structure argumentation in a paper and citations; not writing a whole paper). The students attend the following two courses: - Presentation skills (in Presentation skills techniques and competencies such as the use of PowerPoint, presenting a poster, leading a discussion, ask guiding questions, chairing a session; giving feedback will be gained). - Basic scientific writing (in Basic scientific writing techniques to structure scientific papers, to use scientific style guidelines as well as competencies to use scientific arguments will be gained).
Objectives and learning outcomes:	In basic scientific writing students will learn to structure own texts on a high academic leve, apply knowledge about academic writing style (APA) to own work, and show first competencies in using academic argumentation in their own texts. In presentations skills they learn soft skills in how to present own academic work in front of an audience (in paper sessions, posters etc.), and how to deal with questions and lead a discussion.
Teaching and learning methods:	Variation of different teaching and learning methods, which are facilitated to the students through a facilitator's toolbox (hands-on tasks, small-group discussions, role plays, video-based feedback, theoretical input)

ED0224: Institutions in the International Context of Educational Systems		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every winter
Credits: 10	**Learning setting:** 300 hours Lecture/exercise course: 98 hours self-study 202 hours	**Requirements:** For participation in this module, the admission to the master's program is expected.

Description of evaluation procedure:
Required achievements in all courses of the module encompass completing (non-graded as well as graded) assignments. The project seminar "Researching educational systems" encompasses a written graded credit requirement, that consists of a project report. Deadline for submission is the end of the semester break. The project report assesses the ability of the students to transfer theoretical concepts and models into an empiricial research design that allows to clarify important research questions in the field of educational systems management.

Contents:	The module comprises one introductory seminar, one seminar of a required electives and a project seminar. The introductory seminar and the seminar of a required electives focus on theoretical underpinnings of organization and management in educational systems as well as achievements of educational systems. In the project seminar the students develop their own research questions regarding a topic area of the introductory seminar. The students run an inquiry into the state of theory and research and learn to find information within data sets of the OECD and other free available data sets which are necessary to answer the research question. They deal with the topic area in depth from an economical view of education. They conduct an interview with respect to the topic area with a representative from the educational administration or educational research. Module 3 offers methodological instruction and training regarding three central extracts of scientific working: professional search of the state of theory and research regarding an own freely chosen topic, stringent deduction of an empirically provable question (hypotheses) on the basis of the state of theory and research, as well as search of exposable data sources and the draft of a research design. To test the acquired competencies one project report has to be written whereby the students have to demonstrate their skills regarding the three central extracts of scientific working. The following processes of the methodological implementation, the data analysis and the project report are accomplished in the further modules. The interview serves for a first contacting with actors in the professional action fields.
Objectives and learning outcomes:	The module aims at familiarizing students with the institutional action field, in which the empirical educational research takes place. This involves structures, processes and decisions on the level of the educational system. The first part deals with educational systems in general and compared on international level as well as with the German educational system in particular. Students acquire structural knowledge through reading and discussing studies within the field of empirical educational research. They are able to assess the state of the art in research on educational systems and identify research

	questions of educational organization and educational management, as well as the economics of education. In the second part the students acquire knowledge about quality characteristics of educational institutions about current forms and methods of quality assurance. They understand basics of evaluation and collect first experiences in the collective realization of an evaluation. The students are able to develop their own research design with research questions and hypotheses.
Teaching and learning methods:	Learning through active class participation is promoted throughout all three courses. Lectures by course lecturers as well as invited experts are combined with own oral presentations by the students. Knowledge is deepened through the reading and joint discussion of scientific literature. Special assignments are used to trigger further reflection. Practical tasks and hands-on excercises give students the opportunity to apply (emerging) knowledge and develop their understanding of the field and topics in question.

ED0225: Models and Theoretical Conceptions of Teaching and Learning Research		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every winter
Credits: 10	**Learning setting:** 300 hours Lecture/exercise course: 98 hours self-study: 202 hours	**Requirements:** For participation in this module, the admission to the master's program is expected.
Description of evaluation procedure: The written examination consists of a project report in the project seminar "Planning and implementation of research works in classroom research" (graded credit requirement).		
Contents:	The module "Models and theoretical conceptions of Teaching and Learning Research" aims at giving the students an overview about models and theoretical conceptions of teaching and learning research from a general and a subject-related didactical view. The complex models integrate (subject-)didactic aspects of instructional design with knowledge about the effectiveness on the part of the learners, but as well with knowledge about preconditions/required competencies on the part of the teachers. Basic knowledge is provided in the seminar "Theoretical principles about teacher acting and classroom". Further qualitative and quantitative methodical standards for the investigation of teaching and learning processes are acquired in the seminar "Qualitative and quantitative research methods of classroom research". An integration of the courses and a test of all contents and competencies takes place in the form of a project work "Planning and implementation of research works in classroom research" within a team. Within the team composition the students work together interdisciplinarily (educational science, psychology, subject didactics).	
Objectives and learning outcomes:	The students acquire detailed and differentiated knowledge about classroom models together with their specifications for mathematics and science didactics, especially about the central influences on learning in classroom and teacher acting. Furthermore they know relevant research designs of classroom research and their theoretical foundation. On the basis of this knowledge they are able to develope and produce a classroom model in an own project work, to identify a research question and to deduce an appropriate research design with work schedule for the investigation of a selceted research question. The final project report is intended as a form of documentation for these learning outcomes, as well as the basis for feedback and discussion during the learning process. Furthermore, it is a first practice piece for the students' future scientific writing.	
Teaching and learning methods:	Students will be exposed to expert presentations by the lecturer in order to lay the theoretical foundations of the module. Furthermore, they will be responsible for the design of multiple sessions in which they will function as the experts on the topic under discussion in order to tutor their class mates. For these additional independent study on top of the reading requirements is necessary. In class,	

	both whole group and small group discussions will be employed to further students' understanding. In the project seminar students will pursue the full cycle of scientific enquiry in small groups, guided by the instructor. They will work both in the full group, as well as the small group and present their work in regular intervals in order to afford them the opportunity of feedback and monitor their progress. Teams of students work together on this report. Deadline for submission is the end of the semester break. In order to prepare the report successfully, students have to participate in on-site classes (compared to phases of self-regulated work), complete part-time assignments for the report by due date, read scientific literature, present research findings, and prepare the final project work.

ED0226: Test theory and advanced methods in teaching and learning science		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every summer
Credits: 5	**Learning setting:** 150 hours Lecture/exercise course: 60 hours self-study: 90 hours	**Requirements:** Students must have a basic understanding of introductory statistics (descriptive statistics, correlation) from their Bachelor's studies and from Module 1.

Description of evaluation procedure:
The students have to acquire the basics of pychometric theory they need to know to develop tests to assess educational processes and outcomes. These basics comprise Concepts in Measurement, Reliability, Validity, Test Construction, Factor Analysis and Item Response Theory. Additionally, the students must develop practical skills to use statistical software (SPSS, R, etc.) to conduct analyses to assess the quality of a test and answer research questions by using the data collected with the test. To show that they have reached the goals, students will be assessed on their performance in an exam at the end of the semester (graded credit requirement). In the exam students get the task to assess examples of educational tests at different stages (test items, reliability issues, test bias, dimensionality) by reviewing the tests themselves and interpreting parameters they read in the output of statistical calculations.

Contents:	The module Test theory and advanced methods in teaching and learning science covers theories and techniques for defining and testing educational processes and outcomes. The lecture provides conceptual knowledge about (a) the construction of tests and test items to assess educational processes and outcomes and (b) the meaning of quality criteria of tests such as objectivity, reliability, validity, and dimensionality. The exercise provides practical knowledge about (a) do's and dont's when constructing tests and test items (b) the condustion of statistical analysis to evaluate reliability, validity and dimensionality of tests and how to interpret the results, and (c) the conduction of advanced statistical analyses to answer research questions with the data collected by the tests on educational processes and outcomes.
Objectives and learning outcomes:	At the end of the module, students are able to construct and apply tests for educational measurement purposes in a theory based manner. Moreover, students are able to verify the quality of existing test instruments: They can name and explain the relevant psychometric quality criteria; they can apply techniques to evaluate these criteria for a given test and they can interpret the outcomes. Furthermore, they can analyze the data collected by the test using advanced statistic procedures, such as multiple regressions, ANCOVAs, MANOVAs, etc.
Teaching and learning methods:	At the end of the module, students are able to construct and apply tests for educational measurement purposes in a theory based manner. Moreover, students are able to verify the quality of existing test instruments: They can name and explain the relevant psychometric quality criteria; they can apply techniques to evaluate these criteria for a given test and they can interpret the outcomes. Furthermore, they can analyze the data collected by the test using

	advanced statistic procedures, such as multiple regressions, ANCOVAs, MANOVAs, etc.

ED0227: Educational Institutions and Their Quality Development		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every summer
Credits: 10	**Learning setting:** 300 hours Lecture/exercise course: 105 hours self-study: 195 hours	**Requirements:** For participation in this module, the admission to the master's program is expected.

Description of evaluation procedure:
The module is assessed through a written report. In the report, students have to demonstrate their knowledge and understanding of quality standards and quality development in educational contexts by showing their ability to apply concepts, standards, guidelines and strategies of evaluation to a given rough outline of a fictitious teacher professionalization development training (TPD). The report should demonstrate the students' ability to design a fictitious evaluation study which allows an assessment of criteria of educational quality in the context of the given teacher professionalization training. The report comprises a description of all steps of conducting a fictitious evaluation study (development of evaluations questions for assessing theory-based quality criteria of the TPD, study design, sample, selection of suitable assessment instruments, implementation of the data collection, statistical analyses and interpretation of the assumed results).
The written report is to comprise 2000-2500 words (exclusive of bibliography and tables)

Contents:	The module "Educational institutions and quality development" aims at introducing students to central topics of quality development such as teacher professionalization development and quality assurance by evaluation in schools and other educational institutions. Thereby, basic theoretical models and approaches of evaluation are linked with practical examples and methods at schools and other educational institutions (e.g. university, informal learning settings). The seminar "*Basics of quality development and quality assurance*" provide basic theoretical knowledge in psychology and pedagogy that is relevant for the discussion of quality in educational contexts as well as current measures for quality development and quality assurance. The seminar deals with areas such as of quality development and quality assurance in education and their application in different types of educational institutions. In the seminar "*Quality development by professionalization*", theoretical concepts and practical approaches of quality development using the example of teacher professionalization build the content of the seminar. Furthermore, specific programs of teacher professionalization as well as methods and corresponding research results to evaluate these programs are in the focus of the seminar. The seminar "*Quality assurance by evaluation*" links and completes the topics of the seminars by providing some basics in social scientific evaluation. The seminar presents central topics of evaluation and their application in various types of educational institutions, e.g. basic standards of evaluation, basic theoretical knowledge as well as practical information on how to conduct an evaluation study as well as different concepts and approaches of evaluation.
Objectives and	Through the three course within the module " Educational Institutions and Their Quality Development", students develop their ability to

learning outcomes:	➢ Explain and critically assess the concepts of quality, evaluation and assessment in education ➢ Explain different approaches and frameworks, current perspectives and challenges of quality development in education ➢ Understand and critically assess the application of quality development in different educational institutions ➢ Explain and critically assess the concept of standards in professional development and the means to advance its quality assurance ➢ Describe teacher professional development concepts from an international perspective with emphasis on effective features of teacher professional development programs ➢ Describe and explain effective assessment tools for teacher professional development programs ➢ Explain standards of evaluation and apply them to reports on evaluation studies ➢ Describe, explain and reflect the process of an evaluation study and current perspectives and challenges in evaluation approaches and frameworks ➢ Understand, critically assess and apply the ideas of Theory-Based Evaluation in the context of educational evaluation
Teaching and learning methods:	In the seminars the students read study related scientific literature, do coursework, class presentations and discussions. They present and discuss relevant literature and communicate theories, models and latest trends in quality assurance and evaluation. Furthermore, they work on assignments like for example, reading scientific literature, oral presentations and project work. Expert talks and related discussions as well as excursions complement the lectures of the instructors.

ED0228: Teaching and Learning Processes in Classrooms and Instructional Design		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every summer
Credits: 10	**Learning setting:** 300 hours Lecture/exercise course: 105 hours self-study: 195 hours	**Requirements:** Students should have completed the Module "Models and theoretical conceptions of Teaching and Learning Research".

Description of evaluation procedure:
Students will present the contents (i.e., theories and research findings, as well as methods of educational research) and their research project (research questions, hypotheses, used methods and instruments, data collection and analysis). Thereby their competence to be able to elaborate the contents in a way to be able to present them and to answer questions to the contents is assessed. The presentation is done in a group and should take about 10-15 minutes.
The theory, methods, and results, and discussion of the research project are further described in a short written report. In this report each person of a group should contribute ca. 5 pages.

Contents:

The module "Teaching and Learning Processes in Classrooms and Instructional Design" aims at facilitating knowledge about important topics and methods of educational research as well as applying this knowledge. Thereby, the main focus is on how instruction can be supported by digital media so that it is most effective for student learning. The seminars in this module are related to certain domains of educational research, such as educational or instructional media, and related fields (e.g., psychology). This module consists of three seminars. In the seminar “Introduction to Teaching and Learning Processes in Classrooms and Instructional Design” basic knowledge about the following contents of educational research is provided:

- Cognition and Metacognition
- Self-regulated learning
- Motivation
- Emotion
- Learning with Mulitmedia
- Computer Supported Collaborative Learning
- Virtual Learning Environments and Pedagogical Agents
- Game Based Learning, Serious Learning
- Massive Open Online Courses
- Mobile Learning

Knowledge of the following methodological principles and practical aspects of educational research is provided in the seminar "Planning and Evaluating Educational Research":

- How to conduct a study
- Study design, methods, sample selection
- constructs, variables, scales, objectivity, relaibiliy, validity
- Experimental reseach, causal-comparative research, survey research, correlational research, quantitative data collection
- Descriptive and inferetial statistics
- Reporting and Evaluating Research

	In the seminar "Implementation of Research Works in Classroom Research II", practical knowledge about how to conduct a research project is provided: - Finding Research Questions and Hypotheses - Setting Up a Research Design - Developing Instruments - Prepare Data Collection - Collecting Data - Analyze Data - Data Evaluation
Objectives and learning outcomes:	The students acquire detailed and differentiated knowledge about central studies about interventions in classroom and their effects on student learning. They know psychological models and research findings that should be considered in order to use digital media effectively. Furthermore, they know relevant research designs and their theoretical foundation. This enables them to set up their own research project about educational media. On the basis of this knowledge they are able to enhance their own project work by planning, conducting and analyzing an educational study about the effects of educational media.
Teaching and learning methods:	Variation of different teaching and learning methods. To acquire detailed knowledge about central studies and their effects on student learning, the students prepare relevant articles, and actively engage in group discussions. Group discussions and hands-on activities are used to make students familiar with the theoretical and practical aspects of conducting a research study. Project work is used to enable students to work on their own research study. This module consists of three seminars: In the seminar “Introduction to Teaching and Learning Processes in Classrooms and Instructional Design” selected research articles are critically discussed. In the seminar "Planning and Evaluating Educational Research" students read literature and do hands-on activities. In the project seminar "Planning and Implementation of Research Works in Classroom Research II", the students work in groups on their own research project in the context of educational media under the supervision of the instructor. Accordingly, the students make use of their basic theoretical and methodological knowledge and apply it by working on their own research projects.

ED0229: Educational Processes and Outcomes		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every winter
Credits: 10	**Learning setting:** 300 hours Lecture/exercise course: 105 hours self-study: 195 hours	**Requirements:** Students must have a basic understanding of introductory statistics (descriptive statistics, correlation) from their Bachelor's studies and from Module 1.

Description of evaluation procedure:
After this modul the students have developed and evaluated their own questionnaire based on statistical knowledge taught in the course. To show that they have reached this goal, they give a presenation (20-30 minutes) and add a report describing the questionnaire development and evaluation process and its results (in the research seminar "Development of Research Instruments" (graded credit requirement).)Students work on this presentation individually or together in teams, as agreed upon in the beginning of the course. In the report, the final version of the questionnaire as the outcome of the seminar is documented.

Contents:	The module Educational Processes and Outcomes covers theories and techniques for defining educational processes and outcomes as developing and evaluating questionnaire instruments for their measurement. In this context, students acquire competencies on (a) the development of questionnaire instruments (b) the evaluation of questionnaire instruments in terms of objectivity, reliability, and validity.
Objectives and learning outcomes:	At the end of the module, students are able to construct and apply questionnaires for specific educational measurement purposes in a theory based manner and to communicate the process and its results in a precise and structured way. Moreover, students are able to verify the quality of existing questionnaire instruments: They can name and explain the relevant psychometric quality criteria; they can systematically plan and execute studies aiming at testing these criteria for a given questionnaire; they can interpret the outcomes of such studies, draw conclusions on what are problematic aspects of the instrument and, based on these, figure out ways to overcome these problems.
Teaching and learning methods:	The module consists of a research seminar and two exercise course. The research seminar introduces theoretical and technical concepts of educational measurement. Moreover, the students engage in the process of defining a relevant educational construct and developing an instrument for its measurement. The lecturer will introduce key concepts and guide the project work of the students. The seminar introduces basic concepts of test theory. The exercise course offers opportunities to acquire specific theoretical knowledge and practical skills that students will need for the work on their projects. General teaching and learning activities in the courses of the module involve project work, literature search and scientific reading, constructive criticism of own work and the work of others, presentations, and exercises. Teaching and Learning methods in all courses of the module encompass completing assignments, reading scientific literature, oral presentations, and project work.

ED0230: Research on Teaching and Learning: Specialization		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every winter
Credits: 5	**Learning setting:** 150 hours Lecture/exercise course: 60 hours self-study: 90 hours	**Requirements:** Students should have completed the Module 1 "Introduction to Research Skills in Educational Research"

Description of evaluation procedure:
The achievement will be measured by a presentation of their designed learning envionment. Furthermore, students reflect on the learning experiences during creating a learning environment and how this influences their understanding of conducting own research on teaching and learning by writing a short report.

Contents:	The module "Research in Teaching and Learning Science: Specialization" aims at increasing and deepening the students' knowledge in how to use educational media in learning environments. Students learn about different types of educational media (e.g., mobile devices, VR-Glasses, MOOCs, or Pedagogical agents) and how to use these technologies. Based on theories and research evidence about educational media (e.g., cognitive load theory, instructional design-theories), students learn how to design a learning environment that aims at improving learning with educational media..
Objectives and learning outcomes:	The students can critically analyze and evaluate current research questions of empirical teaching and learning research. They can apply their acquired knowledge to design evidence-based innovative learning environments (e.g., using pedagogical agents, MOOCs, mobile devices, or VR-Glasses).
Teaching and learning methods:	Teaching and learning methods encompass active class participation, completing assignments, reading scientific literature, short theoretical inputs, hands-on tasks, discussions, and reflections. In the seminar students work collaboratively, and discuss research findings. Furthermore, students build study groups on topics of their interest and meet with their advisors separately to create a learning environment.

Elective Modules

ED0231: Reading and Administration of Literature		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every winter
Credits: 5	**Learning setting:** 150 hours Lecture/exercise course: 56 hours self-study: 94 hours	**Requirements:**
Description of evaluation procedure: The pass/fail credit requirement comprises the course "Active reading strategy" and four courses offered by the TUM library (Target Group: Students) ("Literature administration and knowledge organization"). The portfolio includes assignments, l presentations and learning outcomes in form of an essay on reflection outcomes (Portfolio).		
Contents:	The aim of this module is that students learn to acquire information. The students attend the following two courses: 1. Literature administration and knowledge organization. To pass ¿Literature administration and knowledge organization¿ the students attend four courses offered by the TUM library (Target Group: Students). Content of the courses are literature search as well as literature administration by different software such as Citavi or Endnote. The students should acquire soft skills in: literature search - literature selection base on appropriate criteria - organization of certain scientific papers by using literature administration programs. 2. Active reading strategy. The students attend one course providing techniques in effective academic reading. Inthe course the students should acquire soft skills in reading strategies: highlighting - summarizing -questioning - critical thinking.	
Objectives and learning outcomes:	The students demonstrate basic competencies in the domain of acquisition of information and are able to adapt them to their own studies. They are able to conduct comprehensive literature research in library, internet and databases. They should be able to understand the main idea of academic texts in an elaborated way, to select all relevant information and to summarize academic information in own words. Learning outcomes are: to use the technique of critical judgment about literature; to reflect about sources of information; to know how to select important information; to understand how to make connections between different sources of information; to develop techniques to summarize relevant information.	
Teaching and learning methods:	With the aim to acquire techniques for gathering information practical knowledge is required. A variation of different teaching and learning methods, which are facilitated to the students through a facilitator's toolbox, provide opportunities to acquire this kind of knowledge. This includes: hand on tasks (exercise for practical knowledge), discussions (critical thinking), reflections (critical thinking), short oral inputs from the facilitator for building up a common	

	knowledge base, role-play, active class participation (including an individual presentation of each participant).

ED0233: Analysis of Variance		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every winter
Credits: 5	**Learning setting:** 150 hours Lecture/exercise course: 56 hours self-study: 94 hours	**Requirements:** Students should have completed the Module 1 "Introduction to Methods in Teaching and Learning Science"

Description of evaluation procedure:
The pass/fail credit requirement comprises the two courses "Scientific writing" and "Analysis of variance procedures". The portfolio includes assignments with a written summary, presentations and learning outcomes in form of an essay on reflection outcomes

Contents:	The module "Analysis of variance" aims at increasing and deepening the students' skills regarding the research process. For an effective data analysis within the research process writing skills are needed. Therefore, students attend the course "Scientific writing" whereby they can deepen their competencies regarding their writing skills. Furthermore, the students attend the seminar "Analysis of variance procedures" where they deepen their knowledge regarding research methods. The aim is to transfer the learned theoretical knowledge about analysis of variance in the handon application via different statistical programs (for example SPSS). Different research designs with according statistical methods will be learned. In addition, students learn how to structure a scientific paper, wrap their studies in a convincing story and present procedures as well as methods and results in a professional way.
Objectives and learning outcomes:	The students can use the knowledge within the fields of writing which they have acquired in the courses, for their own study purposes. The students acquire in-depth knowledge about research methods of empirical educational research and are able to apply this knowledge for different topics in teaching and learning science: they know which statistical method with regard to analysis of variance are appropriate for certain research questions, they understand how to perform the statistical procedures by using SPSS, they are able to use techniques to analyse data using statistical software by their own. In "scientific writing", students are supposed to learn how to read scientific papers in order to evaluate the quality of published scientific work. Furthermore, they are provided with elements of scientific writing that enable them to build up research papers according to guidelines of the scientific community (e. g. APA).
Teaching and learning methods:	Variation of different teaching and learning methods, which are facilitated to the students through a facilitator's toolbox. This includes: • short theoretical inputs; • hand on tasks, guided practical exercises; • demonstrations; • writing exercises;

	• active class participation (including an individual presentation of task solution of each participant); • completing hand on tasks assignments with a written summary; reading scientific literature; • oral presentations and • learning outcomes in form of an essay on reflection outcomes

ED0234: Video Analysis		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every winter
Credits: 5	**Learning setting:** 150 hours Lecture/exercise course: 56 hours self-study: 94 hours	**Requirements:** Students should have completed the Module 1 "Introduction to Methods in Teaching and Learning Science"
Description of evaluation procedure: The portfolio comprises: presentation of an interaction situation, developed category system, written reflection about advantages and disadvantages of video studies, writing exercises, short written papers		
Contents:	The module "Video analysis" aims at increasing and deepening the students' skills regarding the research process. For an effective data analysis within the research process writing skills are needed. Therefore, students attend the course ""Scientific writing"" whereby they can deepen their competencies regarding their writing skills. Furthermore, the students attend the seminar "Video analysis" where they deepen their knowledge regarding research methods. In this course the students will learn basics of video studies including examples and an overview of the research process of video studies. Besides theoretical input the students will also learn practically with exercises how to collect, code and analyze video data. In addition, students learn how to structure a scientific paper, wrap their studies in a convincing story and present procedures as well as methods and results in a professional way.	
Objectives and learning outcomes:	The students can use the knowledge within the fields of writing which they have acquired in the courses, for their own study purposes. In the course "Video analysis" the students acquire in-depth knowledge about video analysis. Students know and can name and describe video studies in educational research. They know advantages and disadvantages of video research, can handle camera equipment, know standardized guidelines of videotaping and can collect videotapes. They know how to develop coding schemes, can code video data, know the software ¿Videograph¿, can use the software ¿Videograph¿ for coding video data, can export video data from ¿Videograph¿ to SPSS, can present descriptive results of video codings and can answer specific research questions using analysis of video data. In "scientific writing", students are supposed to learn how to read scientific papers in order to evaluate the quality of published scientific work. Furthermore, they are provided with elements of scientific writing that enable them to build up research papers according to guidelines of the scientific community (e. g. APA).	
Teaching and learning methods:	The seminars offer opportunities to acquire specific skills that students need for the research process within the educational context. Teaching and learning activities in the courses "Scientific writing"	

	and "Video analysis" involve theoretical inputs, group work, reflections, brainstorming, discussions, presentations, practical exercises, and literature search. Teaching and Learning methods in all courses of the module encompass active class participation, completing assignments, reading scientific literature, and oral presentations

ED0235: Analysis of Interview Data, Learning Journals and Portfolios		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every winter
Credits: 5	**Learning setting:** 150 hours Lecture/exercise course: 56 hours self-study: 94 hours	**Requirements:**

Description of evaluation procedure:
The portfolio comprises: contributions of every session (about one page written). The students get assignments to reflect the content and to foster independent proposals on qualitative data analysis. The portfolio includes several elements that are taught during the class, hands-on writing exercises and short written papers.

Contents:	The module "Analysis of interview data, learning journals and portfolios" aims at increasing and deepening the students' skills regarding the research process. For an effective data analysis within the research process writing skills are needed. Therefore, students attend the course "Scientific writing" where they can deepen their competencies regarding their writing skills. Furthermore, the students attend the seminar "Analysis of interview data, learning journals and portfolios" where they deepen their knowledge regarding research methods. The students get an introduction into qualitative research and the presentation of studies and results. They learn about the demands of qualitative research, central features of qualitative research, the position of qualititive research, etc. Furthermore they get to know different instruments of qualitative research, e.g. various forms of qualitative interviews like expert interviews, ethnographic interviews, and more. The seminar focusses on different analysis methods to analyse interviews or written documents. The students study methods like the qualitative content analysis by Mayring, the Grounded Theory, etc. In this context students will also get an introduction into the computer-based anlysis of interviews. In addition, students learn how to structure a scientific paper, wrap their studies in a convincing story and present procedures as well as methods and results in a professional way.
Objectives and learning outcomes:	The students can use the knowledge within the fields of writing which they have acquired in the courses, for their own study purposes. The students acquire in-depth knowledge about research methods of empirical educational research and are able to apply this knowledge for different topics in teaching and learning science. The module aims to enable studentsto plan and conduct qualitative research projects on their own as well as to present their proceedings in written form. They will be able to estimate the advantage and disadvantage of different qualitative methods. For example they know which interview form fits to their research questions and they can also decide which analysis method makes sense for their project. They are able to reflect on strengths and weaknesses of their studies and learn to communicate their findings.

Teaching and learning methods:	Variation of different teaching and learning methods, which are facilitated to the students through a facilitator's toolbox. In more detail in the course "Analysis of interview data, learning journals and portfolios" following teaching and learning methods are used: presentations by students, groupwork, peerwork, individual work, discussion, classroom-discourse, writing exercises, active class participation, completing assignments, reading scientific literature, oral presentations

ED0384: Active Learning		
Study program: Master Research on Teaching and Learning	**Language:** English	**Frequency:** every second winter
Credits: 5	**Learning setting:** 30 hours Seminar self-study: 45 hours	**Requirements:** Students must have a basic understanding of introductory statistics (descriptive statistics, correlation) from their Bachelor's studies and from Module 1 "Introduction to Methods in Teaching and Learning Science"

Description of evaluation procedure:
The group has to write a short 5-pages project report (pass/fail assessment) on a research question of their choice including a summary of the background theory considered, discussion of one or more hypotheseses, the design of a simple study testing the hypotheses under consideration and an analysis and interpretation of the results. The project will be developed as a group activity, but the individual contribution have to be accounted for grading. The progress and the final results will be presented by the group during the seminar.
If students decide to get a grade for their participation in the seminar, they will be additionally required to write a more detailed 15-20 pages paper about the research project.

Contents:	How do young children learn so much about the world, so quickly? A rich body of research has demonstrated that that active engagement with the world is a crucial component of learning: As soon as they can sit or walk, infants spontaneously grab and manipulate objects and approach or avoid people. As language develops, young children ask about the meaning of words, request the labels of objects, and inquire about the many new and puzzling phenomena they encounter. Active learning has been a topic of interest for philosophers, psychologists, cognitive and computer scientists. What is active learning? Are children efficient active learners? Is there a developmental trajectory for active learning? Is active learning better than more passive forms of instruction? This seminar examines these questions across domains such as visual attention, hysical reasoning, causal learning, and problem solving; readings will also address issues in explanation, exploration, and other related topics. The seminar involves a mix of lectures, group readings and discussions, as well as an active learning workshop designed to offer students a hands-on experience on how questions related to active learning are investigated experimentally, from identifying the research questions and hypotheses to interpreting and presenting the results obtained.
Objectives and learning outcomes:	At the end of the module, students will be familiar with the theoretical background and the computational bases of information search and active learning theories and models, tackled from a developmental perspective, and will have developed an understanding of how the results from active learning research can impact education.

Teaching and learning methods:	This course is an active experience, and requires students' full engagement. Participation includes active involvement in class discussions and activities: asking questions about the topics and subject matter and expressing themselves through comments and opinions. Lectures. The seminar comprises four lectures, corresponding to the four seminar days. For all lectures we will suggest a few readings. Students are supposed to read suggested papers prior to the class for which they are listed. Lectures will not go over the specific content of the readings, but rather build upon the content of the readings. In other words, lectures will never merely repeat information in the readings. Therefore, students are responsible for understanding what they read, asking questions about what they do not understand, and being prepared to go beyond the readings in class. All suggested readings will be available on Moodle. Research Article Commentaries, Discussions and Presentation. Throughout the seminar, students will be asked to read eight research articles (two per day) and to prepare at least two written questions and/or critical comments per paper, demonstrating that they have horoughly read, understood, and thought about each article. Discussion will take place in class, and will be followed by a group activity, in which students will be asked to either prepare a short presentation or to write a blog post about one of the research articles discussed. All research articles will be available on Moodle. Active Learning workshop. This group workshop is designed to offer students a hands-on experience on how questions related to active learning are investigated experimentally. It is divided in four blocks (one per seminar day), each roughly corresponding to an experimental research phase: 1. Identify an interesting research topic; narrow it down to a research question; do some background research to get familiar with what has been done on the topic, and to make sure the question is original; evelop one or few competing hypotheses; 2. Design a simple study aimed at answer the research question and test the hypotheses; prepare the materials and the instructions; 3. Test (test modalities will depend on the design the group has developed); 4. Analyze, interpret and present the results. At the end of each seminar day, each group will present its progress to the rest of the class.