POSTGRADUATE PROGRAM

«Didactics of Mathematics, Science, and ICT in Education: Interdisciplinary Approach»

M02.04 Courses Outlines

December 2023

Courses Index

X1 Didactics of Mathematics and Science: An Interdisciplinary Approach

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Preschool Education Sciences and Educational Design- Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd Cycle of Studies (Level 7)
COURSE CODE	X1 **SEMESTER** A
COURSE TITLE	Didactics of Mathematics and Science: An interdisciplinary approach

INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	CREDITS
	3	7.5

COURSE TYPE	Special background in functional understanding of Didactics of Mathematics and Science and to highlight the interdisciplinary essence and the sociocultural breadth of its concepts and methods. Skills development in critical evaluation and reflective design of interdisciplinary teaching-learning activities and situations.
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes
The students will be able: • to identify the psychological conditions, the mental representations/constructions and the expression difficulties with which the scientific knowledge and its didactics are linked. • to discern the role of the reflective process and cooperative learning in the formalisation and documentation of the scientific process. • to design learning activities within which are utilised the stages of experience, questioning and theory to promote an inclusive, active participation in the scientific process. • to incorporate within the didactical situations interdisciplinary referenced activities, which allows for the critical, inquiry-based thinking, the intellectual value, the epistemological necessity and the usefulness of the scientific knowledge in the social development to be evident.
General Competences
• *Search for, analysis and synthesis of data and information, with the use of the necessary technology*

• *Adapting to new situations*	
• *Decision-making*	
• *Working independently*	
• *Teamwork*	
• *Working in an interdisciplinary environment*	
• *Respect for difference and multiculturalism*	
• *Showing social, professional and ethical responsibility and sensitivity to gender issues*	
• *Criticism and self-criticism*	
• *Production of free, creative and inductive thinking*	

(3) SYLLABUS

The course focuses on and inter-relates methodological tools and theories of the Didactics od Mathematics and Sciences and in particular:

- Didactical Engineering and the understanding-interpretation of the difficulties and the erroneous approaches linked with the didactical context, the learning experiences, the mental stages and the epistemological obstacles of the scientific development.
- Systemic approaches of the complexity of the teaching-learning phenomena. They include the multiplicity of the factors (scientific, psychological, family and social related) and of the metacognitive and the meta-didactical attitudes (conceptions and practices), which interact in the individual/collective constitution and use of scientific thinking, as well as in the cultivation of an interdisciplinary conception of each school and social context.
- Topics and historical references about the birth, formation and development of scientific questions, of the methods of observation, measurement and calculation, of the empirical or mental investigation, proof, documentation or critical acceptance of conjectures and empirical evidence.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	• Face-to-face (one module of meetings) and distant learning (the remaining modules of meetings) • Educational Material and Notes delivered through the moodle platform of the University of the Aegean
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	• Presentation software • Analysis/Synthesis of the literature software • Educational software • Communication with the students through the moodle platform of the University of the Aegean

TEACHING METHODS	Activity	Semester workload
	Attending lectures	39 hours
	Study of bibliography and educational material	61 hours
	Collaboration in teams for interdisciplinary reports	60 hours
	Group/individual ppt editing and presentation	25 hours
	Writing group assignments and individual reflection	40 hours
	Course total	**225 hours**

STUDENT PERFORMANCE EVALUATION	Language: Greek
	• Combination of summative and conclusive evaluation
	• Oral presentations / Individual essays 30%
	• Collective essay, oral presentation 20%
	• Written essay-report 30%
	• Summative and conclusive evaluation of collective and individual reflective synthesis 20%

(5) ATTACHED BIBLIOGRAPHY

Suggested Bibligraphy:

- *Gaston Bachelard, «Το νέο επιστημονικό πνεύμα», Μτφ. Γιώργος Φαράκλας Πανεπιστημιακές Εκδόσεις Κρήτης, 2000.*
- *Moshé Flato «Η ισχύς των Μαθηματικών», Μτφ. Τάσος Κυπριανίδης, Εκδόσεις Κάτοπτρο, 1993.*
- *Thomas S. Kuhn «Η δομή των επιστημονικών επαναστάσεων», Μτφ. Γ. Γεωργακόπουλος, Β. Κάλφας, Εκδόσεις Σύγχρονα Θέματα, 1997.*
- *Seymour Papert «Νοητικές θύελλες», Μτφ. Αίγλη Σταματίου, Εκδόσεις Οδυσσέας, 1991.*
- *Henri Poincaré «Η αξία της επιστήμης», Μτφ. Στέλιος Τσεκούρας, Εκδόσεις Κάτοπτρο, 1997.*
- *Ilya Prigogyne «Το τέλος της βεβαιότητας», Μτφ. Σταύρος Μαρουλάκος, Εκδόσεις Κάτοπτρο, 1997.*
- *Καλαβάσης Φραγκίσκος, Μούτσιος - Ρέντζος Ανδρέας (2015) Ανάμεσα στο μέρος και στο όλο : Αναστοχαστική οικοδόμηση μαθηματικών εννοιών. Εκδόσεις Gutenberg.*
- *Καλαβάσης Φ., Μεϊμάρης Μ. (επ.) (2000) Διεπιστημονική προσέγγιση των Μαθηματικών και της Διδασκαλίας τους- Θέματα Διδακτικής Μαθηματικών V, Εκδόσεις Gutenberg.*
- *Καφούση Σόνια, Σκουμπουρδή Χρυσάνθη (2008). Τα μαθηματικά των παιδιών 4-6 ετών. Αριθμοί και χώρος. Εκδόσεις Πατάκη.*
- *Καφούση Σόνια, Χαβιάρης Πέτρος (2013). Σχολική τάξη, οικογένεια, κοινωνία και μαθηματική εκπαίδευση. Εκδόσεις Πατάκη. Αθήνα.*
- *Κοντάκος Αναστάσιος, Καλαβάσης Φραγκίσκος (επ) Θέματα Εκπαιδευτικού Σχεδιασμού, Τόμος 7, Εκόσεις Διάδραση.*
- *Φ. Καλαβάσης, Μ. Μεϊμάρης (επ.) «Διεπιστημονική προσέγγιση των Μαθηματικών και της Διδασκαλίας τους», Θέματα Διδακτικής Μαθηματικών V, Εκδόσεις Gutenberg, 2000.*
- *Πρακτικά Συνεδρίων Μαθηματικής Εκπαίδευσης Ε.Μ.Ε. – Ελληνική Μαθηματική Εταιρείας (www.hms.gr)*
- *Πρακτικά Συνεδρίων Ε.Ε.Φ. – Ένωσης Ελλήνων Φυσικών (www.eef.gr)*
- *Πρακτικά Συνεδρίων Εν.Ε.Δι.Μ – Ένωση Ερευνητών Διδακτικής Μαθηματικών (http://www.enedim.gr/)*
- *Πρακτικά Συνεδρίων ΕΝΕΦΕΤ – Ένωση για την Εκπαίδευση στις Φυσικές Επιστήμες & την Τεχνολογία (www.enephet.gr)*
- *Πρακτικά συνεδρίων της CIEAEM – The International Commission for the Study and Improvement of Mathematics Teaching (http://www.cieaem.org/)*
- *Πρακτικά συνεδρίων της IGPME – The International Group of the Psychology of Mathematics Education (http://igpme.org/)*
- *Πρακτικά συνεδρίων της ERME – European Society for Research in Mathematics Education (http://www.mathematik.uni-dortmund.de/~erme/)*
- *Πρακτικά Συνεδρίων ESERA – European Science Education Research association (www.esera.org)*
- *Πρακτικά Συνεδρίων GIREP – Groupe International de Recherche sur l'Enseignement de la*

Physique (International Research Group on Physics Teaching) (www.girep.org)
- *Πρακτικά Συνεδρίων NARST – National Association for Research in Science Teaching (www.narst.org)*
- *Πρακτικά συνεδρίων της EARLI – European Association for Research in Learning and Instruction (www.earli.org)*
- *Πρακτικά Συνεδρίων The Learner (www.thelearner.com)*
- *Σκουμπουρδή, Χρυσάνθη (2012). Σχεδιασμός ένταξης υλικών και μέσων στη μαθηματική εκπαίδευση των μικρών παιδιών. Εκδόσεις Πατάκη, Αθήνα.*
- *Σταμάτης Παναγιώτης. (2013). Επικοινωνία στην εκπαίδευση. Αθήνα: Διάδραση.*
- *Χατζηγεωργίου Ιωάννης, (2005). Ήχος, φως, νερό και αέρας - Ξεκίνημα στις φυσικές επιστήμες, εκδόσεις Γρηγόρης.*

Related academic journals:
- *Έρευνα στη Διδακτική των Μαθηματικών*
- *Φυσικές Επιστήμες στην Εκπαίδευση*
- *Ευκλείδης γ΄*
- *Φυσικός Κόσμος*
- *HMS – International Journal for Mathematics in Education*
- *Educational Studies in Mathematics*
- *Journal for Research in Mathematics Education*
- *For the Learning of Mathematics*
- *International Journal of Science Education*
- *International Journal of Science and Mathematics Education*
- *Journal of Research in Science Teaching*

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Prechool Education Sciences and Educational Design Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	Postgraduate / 2nd Cycle of Studies (Level 7)
COURSE CODE	X2 **SEMESTER** A
COURSE TITLE	Modern Theories for Learning and Organization of Educational Structures

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and workshops	3	7,5

COURSE TYPE	Specialised general knowledge, and specialised general knowledge
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek and occasionally English and/or German
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes
As the team involves postgraduate students from different scientific backgrounds and therefore lacking pedagogical training, first it is necessary some fundamental concepts to be approached for easier understanding of the this subject matter. At the same time, there is an opportunity for originality in the development and/or application of ideas in the context of research activity, especially for postgraduate students who are holders to degrees of the first cycle of studies. The course aims to familiarize students with concepts that contribute to the development of specialized and comprehensible knowledge in order they be able to solve problems in a new or unfamiliar environment within an interdisciplinary context related to their cognitive field. In this context, students will acquire the ability to combine knowledge and handle or resolve complex environmental issues responsibly and to make judgments, even with limited information, by applying knowledge at their own discretion. The course also seeks to make the students competent to communicate clearly and purposely their conclusions as well as the knowledge and reasoning on which they are based and reasonable assumptions on which they are based, both to specialized and non-specialized audiences and to acquire the necessary learning skills that will allow them to continue their studies in a self-sufficient way. The general aim of the course is the deepening in issues of learning, organization and development of educational structures, providing emphasis on theories of complexity and difference as well as on their pedagogical implementation in different organizational and functioning levels of the Greek

educational system.

Within this framework the above mentioned learning outcomes stems from the following aims of the course:

- Conceptual clarification of key terms of systems theory.
- Observation, description and understanding of systemic parameters of the organization of "School".
- Development of interconnection capacity of Systemic and Pedagogical theories and models of School Improvement.
- Approach of the phenomenon of learning at different organizational levels and at different levels of complexity.
- Awareness for development of observation and discrimination criteria as well as description of learning styles.
- Ability of discrimination, organization and observation of an intermediate learning environment.
- Development of a new perception and "re-understanding" of the phenomenon of knowledge as the ability of schools in order to use elements of complex systems environments.
- Identify historical and epistemological context of Pedagogical Science and Sciences of Education and accessed quotes basic terms and concepts of these fields.
- Approximate the basics of classical conditioning and operant learning theories, theory of motivation and learning psychoanalytic theory.
- Access to social and cognitive theories of learning and to develop the concept and effects of constructivism in modern educational process, with emphasis on discovered, experiential learning and group cooperation.
- Approximate the gestalt learning theory and field theory with emphasis on personality theories and their influence on the idea of personalized learning and distance learning. Also, to access the new learning environments, conditions that shaping them and means which contributing to consolidation and their efficiency.

In the context of establishing a "learning counseling" will be discussed the modern effective learning strategies in Educational and Administrative process of school unit, the characteristics of learning process that appear in it, in education, teaching and administrative level, emphasizing to the dynamics developed by the peculiarities of the members of the school community and the wider work environment; and the factors that contribute to hindering the learning process.

General Competences

The course aims to create in those students who attend it, the abilities of inquiring, analyzing and composition of data and information with the use of the appropriate research tools and technologies, in order they could be successfully adjusted in new instructional situations, making the most appropriate decisions whenever they must to. Furthermore, through this course is attempting the development of students ability for autonomous teaching in school units in regards to environmental education programs. Moreover, the spirit and practices of group working within national and international scientific environment are provided in the framework of school opening to the local society and the entire world. Within this framework, through the modules and lectures of this course and through the developed co-operations emphasis is given on the meaning of respect in diversity, in multiculturalism and in pedagogical dimension of school space (build environment) and even more in issues of social, professional and moral responsibility and sensitivity in gender issues, through the promotion of communicative procedures for the development of free, creative and open mindedness and critical thinking and via free academic dialogue. Finally, students who attend this course may cultivate the well- meaning criticism with pedagogical criteria and educational terms and also, the meaning of self criticism in the framework of responsible and cooperative behavior development during their future educational and social work and specifically during their activity as responsible, sensitive, and active citizens in environmental issues.

(3) SYLLABUS

This course is divided into two parts. The first part of the course focuses on the systemic approach of the phenomena, structures and processes of learning and knowledge. Furthermore, the following

specific objectives are discussed:
- Delimitation and interfaces of learning sector of school development.
- The conceptualization of basic systemic terms of learning and organization in different fields of complexity (system, organization, structure, communication, memory, knowledge, intelligence).
- The organization, management and reproduction of educational structures, processes and learning environments.
- The development of individual and organizational learning models in complex educational environments.
- The development of an anthropological, social and cultural well-founded perception of learning processes and structures.
- The development of technology, the association of roles, structures and learning environments.

The high demands for a modern education, leading to a radically different view of development and improving of structures and learning procedures.
In the framework of the second part of this course which is consisted by five modules are approaching the learning theories and their impact on modern-school education system which are developed as parts of their influences in modern educational system and specifically to the fields of teaching, staff development, school leadership/management school and school climate. Consequently, the purpose of these modules is the understanding of the learning processes in all levels of a school unit. Generally, under these themes, the course is seeking to be approached:
- The conceptual clarification of basic pedagogical terms
- An overview of the learning process
- The approach of the main theories and models of learning
- Understanding the effects of learning theories in modern education
- The proposals for the development of strategies for improvement of modern learning process

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	One module of teaching is done face-to-face while the remaining modules take place remotely with modern video conferencing systems. In addition, there is the use of an Online Learning Management System (Moodle) based on the blended learning model for communication, sharing educational materials, collaboration, task assignment and course management. In the meetings for the teaching of the course, a variety of teaching methods are used such as: lecture, work in groups, workshops, discussions, group investigations, etc.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Yes, always. Usage of lap top and video projector is taken place during teaching of every single module. More specifically, every lecture is being supported with modern audio-visual equipment. The 3 hour lecture is following, starting always at the appropriate time according to schedule and finishing at the provided time. Special attention is given in the organization of the course. Students know the exact plan of each lesson before it starts, in order they be able to attend the lecture and actively participate in teaching procedure. At the end of each lesson students are been informed for the content of next module. During the lesson students are encouraged to ask questions to the instructor, to express their opinions, views or experiences they may have. Also, they are motivated in developing a discussion

	among them based on information provided during lecture. Communication with students via e-mail and course website. More specifically, except the time of lecture, students have the ability to communicate with instructor in a daily basis by distance either using telephone or e-mail. Also, they may communicate with him live by meeting him in his office or other university places (library, laboratories etc.). Useful and further details related to the course are provided accompanied with extra supportive material (articles, notes etc.) in https://aegeanmoodle.aegean.gr/course/view.php?id=4922

TEACHING METHODS	Activity	Semester workload
	Lectures	30
	Laboratory practice	20
	Tutorials	30
	study and analysis of bibliography	50
	Educational visits	20
	Essay planning and writing (project)	65
	design presentation of essay	10
	Course total	**225 hours**

STUDENT PERFORMANCE EVALUATION	The evaluation of students is taken place with written essay. The writing of an essay conducted under surveillance of the lesson instructor and its public presentation to him and classroom consist basic criteria of evaluation. These procedure is notified to the students at the beginning of the semester, during the first lesson. The language of evaluation is Greek language. The demonstration of continuing and constant interest and the active participation in teaching procedures of each lesson during semester are taken into account as extra criteria for positive evaluation of student performance.

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:
- Argyris, C. (1999). On Organizational Learning. (2nd Ed.). Oxford: Blackwell Publishing.
- Argyris, C., & Schön, D. (1978) Organizational learning: A theory of action perspective. Reading, Mass: Addison Wesley
- Hedberg, B. (1981). How organizations learn and unlearn. In Nystrom, P., & Starbuck, W. (1981). (Eds).
- Handbook of Organizational Design. Oxford: Oxford University Press.
- Imants, J. (2003). Two basic mechanisms for organizational learning in schools. European Journal of Teacher Education. 26 (3). 293–311.
- Kim, D.H. (1993). The Link between Individual and Organizational Learning. Sloan Management Review. 35 (1). 37-50.
- Klinzing, H.G., Πολεμικός, Ν.Ε., Κοντάκος, Α.Θ. & Σταμάτης, Π.Ι. (2014, επ. επιμ.). Μη λεκτική επικοινωνία στην εκπαίδευση: Θεωρία και πράξη. Αθήνα: Διάδραση.
- Morin, Edg. (1971). Complexity, in: International Social Science Journal 26, 1974, 555-582
- Senge, P. (1990). The fifth discipline: the art and practise of the learning organization. New York: Doubleday.
- Senge, P. M. (1996). Leading learning organizations: The bold, the powerful, and the invisible. Ανακτήθηκε από http://www2.potsdam.edu/betrusak/648/Leading%20Learning

%20Organizations_Senge.pdf von Foerster, H. (2003). Understanding Understanding: Essays on Cybernetics and Cognition, NY. Willke, H. (1996). Εισαγωγή στη Συστημική Θεωρία. Μτφ. Λίβος Νίκος. Αθήνα: Κριτική

- Αναγνωστόπουλος, Κ.Π. (1996). Μάθηση και Οργανώσεις ως συστήματα μάθησης. Διοικητική Ενημέρωση. 6 (Σεπτέμβριος). (σελ.73, 78, 80). Αθήνα: Ειδική Εκδοτική Α.Ε.Ε.Β.Ε..
- Βρεττός, Ι. Ε. (2005). Θεωρίες της αγωγής. Αθήνα: Αυτοέκδοση.
- Γκίβαλος, Μ. (2005). Επιστήμη, Γνώση και Μέθοδος. Αθήνα: νήσος.
- Δανασσής-Αφεντάκης, Α. Κ. (1991). Μάθηση και ανάπτυξη. Αθήνα: Αυτοέκδοση. Καμαρινός, Δ. (2000). Βιωματική μάθηση στο σχολείο. Αθήνα: Αυτοέκδοση.
- Κολιάδης, Ε. Α. (1991, 1994, 1997). Θεωρίες μάθησης και εκπαιδευτική πράξη. τ. Α΄, τ. Β΄ και τ. Γ΄. Αθήνα: Αυτοέκδοση.
- Κοντάκος, Α. (2013). Τα κοινωνικά δίκτυα: ένα επικοινωνιακό παραπροϊόν της σύγχρονης κοινωνίας; Μια προσέγγιση από τη σκοπιά της Θεωρίας των Κοινωνικών Συστημάτων του Νίκλας Λούμαν, σελ. 148- 162. Πρακτικά Συνεδρίου: ΘΕΜΑΤΑ ΕΚΠΑΙΔΕΥΤΙΚΟΥ ΣΧΕΔΙΑΣΜΟΥ, ΚΟΙΝΩΝΙΚΑ ΔΙΚΤΥΑ ΚΑΙ
- ΣΧΟΛΙΚΗ ΜΟΝΑΔΑ: ΓΕΦΥΡΕΣ ΚΑΙ ΝΟΗΜΑΤΑ, επιμ. Αναστάσιος Κοντάκος, Φραγκίσκος Καλαβάσης Κοντάκος, Α. (2014). Το σύστημα επικοινωνίας της κοινωνίας και ο ρόλος του σώματος: Απόπειρα μιας
- ιστορικής, συστημικής προσέγγισης της επικοινωνίας. Στο H. G. Klinzing, Ν. Πολεμικός, Α. Κοντάκος & Π. Ι. Σταμάτης (Επιστ. Επιμ.), Μη Λεκτική Επικοινωνία στην Εκπαίδευση: Θεωρία και Πράξη, τ. 1, σ. 41- 86. Αθήνα: Διάδραση. ISBN: 978-618-5059-35-4
- Μπασέτας, Κ. (2002). Ψυχολογία της μάθησης. Αθήνα: Ατραπός.
- Πόρποδας, Κ. Δ. (1996). Γνωστική ψυχολογία, τ. 1 Η διαδικασία της μάθησης. Αθήνα: Αυτοέκδοση. Πόρποδας, Κ. Δ. (2003). Η μάθηση και η δυσκολίες της. Γνωστική προσέγγιση. Αθήνα: Αυτοέκδοση. Σταμάτης, Π.Ι. (2013). Επικοινωνία στην εκπαίδευση. Αθήνα: Διάδραση.
- Σταμάτης, Π.Ι. (2015). Προσχολική και πρωτοσχολική παιδαγωγική. Επικοινωνιακές διαστάσεις της εκπαιδευτικής διαδικασίας. Αθήνα: Διάδραση.
- Ψυχογιός, Α., & Μιχαλόπουλος, Ν. (2002). Η διοίκηση της γνώσης στην ελληνική δημόσια διοίκηση.
- Οικονομικός Ταχυδρόμος (29 Ιουνίου 2002). (σελ. 73-75). 26. Αθήνα.
- Luhmann, N. (1995). Θεωρία Κοινωνικών Συστημάτων. Αθήνα: Σάκκουλα Maturana, H.R., Varela, F. (1992). Το δένδρο της γνώσης (ελλην. μτφ). Αθήνα.

Related academic journals:
- Θέματα Εκπαιδευτικού Σχεδιασμού / Topics in Educational Design

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Sciences of Preschool Education and Educational Design Postgraduate Studies Program, Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	Postgraduate Studies (Level 7)

COURSE CODE	X3	**SEMESTER**	B

COURSE TITLE	Design of Mathematics and Science Curriculum Programs

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
	3	7,5

COURSE TYPE	Special background
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes
Objectives of the course are: • the analysis of criteria for the design of Mathematics and Science Curricula • the presentation of ways of analyzing the structure and tasks of the school textbooks for Mathematics and Science After the successful completion of the course, students will be able to: • Recognize the influence of historical, social, political and cultural variables on the development of Mathematics and Science curricula • To compare the key design features of different Mathematics and Science curricula • To know axes of analysis of the tasks of school textbooks for Mathematics and Science • To design tasks for Mathematics and Science textbooks
General Competences
• Search for, analysis and synthesis of data and information, with the use of the necessary technology • Adapting to new situations • Production of free, creative and inductive thinking • Respect for difference and multiculturalism • Showing social, professional and ethical responsibility and sensitivity to gender issues • Working independently • Team work • Working in an interdisciplinary environment

| | Criticism and self-criticism |

(3) SYLLABUS

- Historical references on the development of Mathematics and Science curricula
- Basic principles of curriculum design according to the modern approaches of Didactics of Mathematics and Science
- Socio-cultural and socio-political issues of planning curricula for Mathematics and Science
- Examples of illustrative curricula for Mathematics and Science
- Methods of analyzing school textbooks for Mathematics and Science

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face (one module of meetings)
	Distance learning (the remaining modules of meetings)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching, communication with students, in laboratory practice of texts' analysis

TEACHING METHODS	Activity	Semester workload
	Lectures (18 hours)	45 hours
	PPT's production and presentation of analysis of bibliography (12 hours)	72 hours
	Laboratory practice (9 hours)	27 hours
	Preparation and writing of individual and group work (final report)	81 hours
	Course total	**225**

STUDENT PERFORMANCE EVALUATION	- Greek language - Formative evaluation - Individual written work - Public presentation of group work (two presentations) - Final report

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Boaler, J. (1999). Participation, knowledge and beliefs: a community perspective on mathematics learning. *Educational Studies in Mathematics*, *40,* 259-281.
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Related academic journals:

- Euclid c (in greek)
- Research in Didactics of Mathematics (in greek)
- Educational Studies in Mathematics (ESM)
- For the learning of mathematics (FLM)
- International Electronic Journal of Mathematics Education (IEJME)
- International Journal for Mathematics in Education (HMS i JME)
- Journal of Mathematics Teacher Education (JMTE)
- Journal for Research in Mathematics Education (JRME)
- Journal of Research in Mathematics Education (REDIMAT)
- Journal of Research in Science Teaching
- Journal of Technology and Science Education
- Science and Education
- Science Education International
- Research in Science Education
- ZDM Mathematics Education (ZDM)

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Prechool Education Sciences and Educational Design- Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd Cycle of Studies (Level 7)
COURSE CODE	X4 **SEMESTER** A
COURSE TITLE	Design, Development and Assessment of Information and Communication Technologies applications for teaching and learning

INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	CREDITS
Lectures and workshops	3	7,5

COURSE TYPE	Specialised general knowledge, and skills development
PREREQUISITE COURSES	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes
Specifically, the students of the course: • will explore the relationship and interaction of ICT educational applications with the evolution of learning theories • will be able to understand the different types of ICT educational applications • will be able to apply consciously design decisions for the development of educational ICT programs and applications • will approach the concept of computational thinking • will examine the epistemological application of ICT in the disciplines of science and technology (Engineering) • will study the ideas of interdisciplinary and cross-thematic approach of science through the educational robotics and Artificial Intelligence. • Will study the possibilities that give the disciplines of learning analytics and data mining in the design and development of integrated adaptive e-learning environments on a large scale through the Internet. • will be able to pursue comprehensive and theoretically vested learning design systems exploiting ICT
General Competences
• Search for, analysis and synthesis of data and information, with the use of the necessary technology • Adapting to new situations • Decision-making

- Working independently
- Teamwork
- Working in an international environment
- Working in an interdisciplinary environment
- Production of new research ideas
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

The course "Design, development and assessment of ICT applications for teaching and learning" aims to the development of the capability to enhance teaching and learning of Science, Technology, Engineering and Mathematics (STEM) by integrating of ICT in the educational practice, applying approaches grounded on research and modern learning theories. Students who complete the course successfully will be able to design ICT learning scripts and interventions for K12 STEM courses, to orchestrate and implement integrated cross-curricular/interdisciplinary learning experiences with ICT, to develop and enrich curricula using ICT, and to evaluate curricula and ICT applications for teaching and learning. Generally, they will be able to develop theoretical and practical capacities in learning design with ICT under the view of interdisciplinary and cross-curricular approach. Furthermore, the students will develop research skills for issues of STEM Education and ICT taking an interdisciplinary point of view.

The content of the course is organized in the following thematic sections:

- Introduction, learning theories, teaching, multidisciplinary-interdisciplinary approach science and ICT
- Computational modeling and simulation in the teaching of science
- Systems thinking, complex systems, ICT and educational applications.
- Learning design and ICT
- STEM & educational robotics
- Computational thinking, Artificial Intelligence and Teaching ICT
- Specific topics (Learning Analysis, communities of practice, mobile learning).

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	One module of teaching is done face-to-face while the remaining modules take place remotely with modern video conferencing systems. In addition there is the use of an Online Learning Management System (Moodle) based on the blended learning model for communication, sharing educational materials, collaboration, task assignment and course management. In the meetings for the teaching of the course, a variety of teaching methods are used such as: lecture, work in groups, workshops, discussions, group investigations, etc.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching and communication with students. ICT are used as a presentation and productivity tool in the course. In addition, ICT as the content of the course leads to the use of various modern technologies (e.g. Automation and Educational robotics sets, programming languages, mobile devices)

TEACHING METHODS	Activity	Semester workload
	Teaching	39 hours
	Examination-presentation of final projects	3 hours
	Study and analysis of	93 hours

	bibliography	
	Study and implementation of the final project of the course (e.g. learning software development, learning script, theoretical essay)	90 hours
	Course total	**225 hours**
STUDENT PERFORMANCE EVALUATION	The assessment for the course accounts the following components of the students' achievements portfolio: • Individual reflections (writing text on key concepts) (20%), • Collaborative application development projects (50%) • Presentation of the collaborative projects (20%) • Thorough and active participation (10%) The assessment language is Greek. The assessment procedure may adapt year by year.	

(5) ATTACHED BIBLIOGRAPHY

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Related academic journals:
- ACM SIGCSE Bulletin
  http://dl.acm.org/citation.cfm?id=J688
- Computer Science Education , http://www.tandfonline.com/loi/ncse20#.VZbD60arFCs
- The Journal of Educational Computing Research (JECR) http://journals.sagepub.com/home/jec
- Journal of Information Technology Education: Research (JITE:Research), http://www.informingscience.org/Journals/JITEResearch/Overview
- ACM Transactions on Computing Education (TOCE) http://toce.acm.org/
- International Journal of Computer Science Education in Schools http://www.ijcses.org/index.php/ijcses
- Journal of computational science education http://jocse.org/Informatics in Education https://www.mii.lt/informatics_in_education/
- Computers & Education, http://www.sciencedirect.com/science/journal/03601315
- Journal of Computer Assisted Learning, http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291365-2729
- Journal of Educational Technology & Society, http://www.ifets.info/
- International Journal of Computer-Supported Collaborative Learning, http://ijcscl.org/
- Learning and Instruction, http://www.sciencedirect.com/science/journal/10967516
- The Journal of Mathematical Behavior, http://www.sciencedirect.com/science/journal/07323123
- The International Journal for Technology in Mathematics Education http://www.researchinformation.co.uk/time.php
- International Journal of Science and Mathematics Education, http://link.springer.com/journal/10763
- Themes in Science and Technology Education, http://earthlab.uoi.gr/theste/index.php/theste
- International Journal of Emerging Technologies in Learning (iJET), http://online-journals.org/index.php/i-jet
- International Journal of Interactive Mobile Technologies (iJIM), http://online-journals.org/index.php/i-jim
- Journal of Computers in Mathematics and Science Teaching (JCMST) https://www.aace.org/pubs/jcmst/

E1 Educational Policies and Integration Models of Information and Communication Technologies (ICTS) In Education

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Preschool Education Sciences and Educational Design- Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd Cycle of Studies (Level 7)
COURSE CODE	E1 **SEMESTER** B
COURSE TITLE	Educational Policies and Integration Models of Information and Communication Technologies (ICTs) in Education

INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	CREDITS
Lectures and workshops	3	7,5

COURSE TYPE	Specialised General Knowledge & skills development
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning Outcomes
It is expected that students will be able to: • Identify the main historical periods of the educational technology evolution • Present profound knowledge of the interdisciplinary identity of ICTs in Education field, and • based on this, to be able to evaluate the quality of ICTs applications as well as the quality of ICTs usages in every day educational practice • Identify the main dimensions of ICTs in Education Research • Recognise from the related literature the dominant research questions in the various periods of the ICTs in Education evolution • Identify the relations of ICTs categories features with specific learning theories • Know recent trends in digital and technological artifacts' design • Know how to design enriched learning environments through combinations of digital, technological and natural-tangible educational materials • Know the main dimensions of educational policies related to ICTs in Education • Identify and study the sub-dimensions of ICTs practices in macro-meso-micro level of an Educational system • Compare different models of ICTs integration in Educational systems (in countries of Europe, USA, Asia, South America etc.)

- Evaluate the sufficiency and appropriateness of the national plans and measures of ICTs in education policies
- Identify critical parameters of inconsistencies between the announced and the applied ICTs in Education policies
- Be familiar with Educational Leadership and Educational Administration through the study of the needs and the usages of ICTs in Educational Management
- Be familiar with the Learning Analytics sub-field, its approaches, scopes and limits in macro-meso-micro level of educational system
- Analyse and evaluate as well as design best practices of ICTs in learning and teaching, using data analysis as well as Artificial Intelligence approaches
- Study in a profound way, the needed coherence relationships between theoretical framework, educational scenarios, research questions, data collection and analysis
- Know main categories of assistive technology for special needs education
- Know recent approaches for special needs education support via learning technologies adapted to students needs

General Competences

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Production of new research ideas
- Showing social, professional and ethical responsibility and sensitivity to personal data protection issues
- Criticism and self-criticism
- Production of free, creative and inductive thinking
- Working independently
- Team work

(3) SYLLABUS

The content of the course is organized in the following thematic sections:

(I) Foun dat ion s of "I CTs in Edu cati on" s cie ntif ic fi eld
- i) The interdisciplinary nature/identity of the ICTs in Education field
    - Definition and objective of the interdisciplinary field
    - ICTs in Education from a technological, cognitive and pedagogical point of view
- ii) The historical evolution of ICTs in Education
    - The main periods of ICTs in Education evolution
    - Dominant research questions during the ICTs in Education historical evolution
- iii) Main categories of educational applications of ICTs
    - Main categories and kinds of learning technologies
    - Incorporation of technological applications for general usage
    - Internet based applications, social media and collaborative learning environments
    - Interconnections between learning technologies and learning theories

- Educational policies and Integration Models of ICTs in Education
    - Definition of the main implicated concepts (Educational Policies, Integration Models, Support measures' dimensions)
    - Related Educational policies of European Countries
    - Contemporary Integration Models of ICTs in Education systems in characteristic countries in various continents (Asia, North and South America, Africa)
    - Applied Educational Policies in the Hellenic educational system (historical dimension)

(III) Levels of ICTs in Education Integration Models (Theoretical and applied approaches)
• ICTs in Education integration in the various levels of a national system (macro-meso-micro level: from the level of central administration system of education to the level of a school class) • ICTs integration models in the level of a school unit • Cases studies of Special Needs School Units • Categories of digital applications and technological artifacts for special needs students • ICTs in education in the support of school management • The continuous education of school teachers in ICTs in Education • The applications of Learning Analytics in Educational Systems (approaches, applications and ethical issues, in the macro-meso-micro level of education) • Cases studies for Research Design

(4) TEACHING and LEARNING METHODS EVALUATION

DELIVERY	Face-to-face (one module of meetings) and distant learning (the remaining rounds of meetings). Furthermore, blended e-learning is achieved through the use of Moodle LMS for communication, collaboration, educational material sharing and project assignments.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching and communication with students. ICT are used as tools of presentation, expression, publication, projects production, collaborative projects elaboration, and projects submission.
TEACHING METHODS	*(see table below)*

Activity	Semester workload
Lectures	15 hours
Seminars	15 hours
Laboratories	9 hours
Literature and educational material study and analysis	60 hours
Laboratory exercises	40 hours
Elaboration of study	65 hours
PPT production and reports presentation	21 hours
Course total	**225)**

STUDENT PERFORMANCE EVALUATION	The assessment for the course accounts the following components of the students' achievements portfolio: • Laboratory exercises (30%), • Essay production (60%) • Essay Presentation (10%) The assessment language is Greek. The assessment procedure may adapt year by year.

(5) BIBLIOGRAPHY

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Related Scientific Journals:

- Advances in Mobile Learning Educational Research (AMLER) (ISSN: 2737-5676)
- Journal of Information Technology Education: Research (JITE:Research)
- Computers & Education Journal
- Computers-in-human-behavior Journal
- Journal of Computer Assisted Learning,
- Journal of Educational Technology & Society
- International Journal of Computer-Supported Collaborative Learning
- Learning and Instruction Journal
- Learning, Media and Technology Journal
- Themes in Science and Technology Education,
- International Journal of Interactive Mobile Technologies
- Journal of Computers in Mathematics and Science Teaching (JCMST)
- International Journal of Science and Mathematics Education,
- International Journal of Emerging Technologies in Learning
- Journal of Learning Analytics
- Journal of Special Education Technology (JSET)

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Prechool Education Sciences and Educational Design Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd Cycle of Studies (Level 7)

COURSE CODE	E2	SEMESTER	A

COURSE TITLE	Design and Assessment of Educational Material in the Didactics of Mathematics and Science

INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	CREDITS
Lectures	3	7,5

COURSE TYPE	Specialised general knowledge and skills development
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes
The students are expected to: • know mathematics and science materials and means for teaching and learning • develop the ability to select mathematics and science educational materials for teaching and learning • develop the ability to evaluate mathematics and science educational materials for teaching and learning • develop the ability to integrate mathematics and science educational materials in teaching • develop capacity to access and utilize educational research • design and develop mathematics and science educational materials for teaching and learning • report the new perspectives in mathematics and science education • analyse the meaning of inquiry-based learning in mathematics and science and identify its essential features • discuss about mathematics and science education and interdisciplinary approaches
General Competences
• Search for, analysis and synthesis of data and information, with the use of the necessary technology • Adapting to new situations • Decision-making • Working independently

- Team work
- Working in an interdisciplinary environment
- Production of new research ideas
- Project planning and management
- Respect for difference and multiculturalism
- Respect for the natural environment
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Production of free, creative and inductive thinking

(3) SYLLABUS

The following topics will be covered in this course:

- mathematics and science educational materials literacy
- design strategies for mathematics and science educational materials
- selection strategies for mathematics and science educational materials
- evaluation strategies mathematics and science educational materials
- design mathematics and science educational materials
- develop mathematics and science educational materials
- evaluate mathematics and science educational materials
- integrate mathematics and science educational materials in teaching
- mathematics and science education and interdisciplinary approaches
- inquiry-based learning in mathematics and science

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face (one module of meetings)
	Distance learning (the remaining modules of meetings)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching and communication with students
TEACHING METHODS	

Activity	Semester workload
Lectures	39 hours
Literature study and analysis	90 hours
Elaboration and presentation of a theoretical manuscript	42 hours
Elaboration and presentation of a research manuscript	54 hours
Course total	225 hours

STUDENT PERFORMANCE EVALUATION	The language of evaluation is Greek.
	The assessment for the course accounts the following:
	• Individual reflection assignments (edit of reflection texts for basic concepts) (20%),
	• Collaborative learning project (50%)
	• Presentation of the collaborative project (20%)
	• Thorough and active participation (10%)
	The assessment procedure may adapt year by year.

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

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Related academic journals:

- *Educational Studies in Mathematics*
- *Electronic Journal of Science Education*
- *Eurasia Journal of Mathematics, Science & Technology Education*
- *International Journal of Environmental and Science Education*
- *International Journal of Science and mathematics Education*
- *Journal of Research in Science Teaching*
- *Journal of Technology and Science Education*
- *Science and Education*
- *Science Education International*
- *Research in Science Education*
- *ZDM*

E3 Research Methodology of Science Didactics and Information and Communication Technologies Enhanced Learning

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Preschool Education Sciences and Educational Design Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologiesin Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd Cycle of Studies (Level 7)

COURSE CODE	E3	**SEMESTER**	B

COURSE TITLE	Research Methodology of Science Didactics and Information and Communication Technologies enhanced learning

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures and workshops	3	7.5

COURSE TYPE	General background, and skills development
PREREQUISITE COURSES	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes
Students are expected: • to be able to obtain research findings concerning ICT in education, and children life in general • to be able to exploit research findings in their professional decision making and learning design • to have the ability to assess the importance and validity of published research results • to be able to implement a research of their own or to participate in larger research groups/units • to get familiarized with main research methodologies and questions for the specific field of ICT in education • to be able to construct research articles and references as well as to present the research findings • to apply qualitative and quantitative research methods and supporting software for educational problems
General Competences
• Search for, analysis and synthesis of data and information, with the use of the necessary technology • Adapting to new situations • Decision-making • Working independently • Team work

- Working in an international environment
- Working in an interdisciplinary environment
- Production of new research ideas
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

The course aims to link research and learning activity within technological environments where Mathematics and Science are taught. Students are expected to gain basic skills to design individually and/or collaboratively research-action projects and technological environments for the development of teaching models that include the investigation of learning situations in multiple fields [group, class/department, school unit, education center, center for creative activities, etc.].

With emphasis on the epistemological peculiarities of Mathematics and Science, students should be totally able to understand the psychological, cultural, social, political and economic aspects and implications within the learning process, teaching and design within a variety of educational settings, contexts and various conditions of everyday life in general. A historical approach of general trends and examples in research methodology will be conducted (categorization of research questions, methodologies and correlations with Learning Theories and Philosophical examples. Modern research problematics and methodology trends).

With emphasis on the use of ICT, observation and micro-lessons, a critical analysis of the adequacy of interdisciplinary analysis on the factors involved in the research-practice and on eco-systemic parameters in complex and multifactorial conditions proximity real life, of diverse learning environments.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Teaching is done face-to-face (one module of meetings) and remotely via synchronous videoconferencing systems (the remaining modules of meetings). In addition, there is the use of an Online Learning Management System (Moodle) based on the blended learning model for communication, sharing educational materials, collaboration, task assignment and course management. In the meetings for the teaching of the course, a variety of teaching methods are used such as: lecture, work in groups, workshops, discussions, group investigations, etc.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Apart from the use of ICT as a presentation and productivity tool by teachers and students in the context of the course special educational research software is used for the analysis of quantitative and qualitative research data.

TEACHING METHODS	Activity	Semester workload
	Teaching	39 hours
	Examination-presentation of final projects	3 hours
	Study and analysis of bibliography	63 hours
	Training on research data analysis software	30 hours
	Study and implementation of the final project of the course (e.g. essay and	90 hours

	training workshop on a research method)	
	Course total	**225 hours**
STUDENT PERFORMANCE EVALUATION	The assessment for the course accounts the following components of the students' achievements portfolio: • Individual reflection assignments (edit of reflection texts for basic concepts) (20%), • Collaborative learning project (50%) • Presentation of the collaborative project (20%) • Thorough and active participation (10%) The assessment language is Greek. The assessment procedure may adapt year by year.	

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Bryman, A. (2015*). Social research methods.* Oxford university press.
- Mertens, M. D. (2009). *Έρευνα και αξιολόγηση στην εκπαίδευση και την ψυχολογία* / Donna M. Mertens · μετάφραση Σταύρος Κυρανάκης, Παναγιώτα Μπιθαρά, Ματίνα Μαυράκη · επιμέλεια Ελένη Γιαννακοπούλου · επιμέλεια σειράς Βάσω Βασιλού - Παπαγεωργίου. - 1η έκδ. - Αθήνα : Μεταίχμιο.
- Babbie, E. R., Zapheiropoulos, K., & Vogiatzēs, G. (2011). Eisagōgē stēn koinōnikē ereuna. Athēna: Kritikē.
- Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education* (5th ed). London ; New York: RoutledgeFalmer.
- Creswell, John W. (2011). *Εκπαιδευτική έρευνα : Σχεδιασμός, διεξαγωγή και αξιολόγηση της ποσοτικής και ποιοτικής έρευνας* / John W. Creswell · μετάφραση Νάνσυ Κουβαράκου · επιμέλεια Χαράλαμπος Τσορμπατζούδης. - 1η έκδ. - Αθήνα : Έλλην.
- Gay, L. R., Mills, G. E., & Airasian, P. W. (2009). *Educational research: competencies for analysis and applications (*9th ed). Upper Saddle River, N.J: Merrill/Pearson.
- Robson, C., Michalopoulou, K., Kalyva, P., Dalakou, V., & Vasilikou, K. (2007*). Ē ereuna tou pragmatikou kosmou: ena meson gia koinōnikous epistēmones kai epaggelmaties ereunētes*. Athēna: Gutenberg
- Silver, C., Lewins, A. (2018). *Ποιοτική Έρευνα Υποστηριζόμενη από Λογισμικά: Ένας Οδηγός Βήμα προς Βήμα*, Εκδόσεις: Liberal Books, σελ. 426, Πρώτη έκδοση: Sage Publishing 2014, Επιμέλεια Γ. Φεσάκης, Α. Μούτσιος-Ρέντζος, Μετάφραση: Σταυρούλα Πραντσούδη, ISBN:978-618-5012-38-0, Κωδικός Βιβλίου στον Εύδοξο: 77119845

Related academic journals:

- Review of Research in Education
- Journal for Research in Mathematics Education
- The Journal of the Learning Sciences
- The Journal of Educational Research
- ACM SIGCSE Bulletin
http://dl.acm.org/citation.cfm?id=J688
- Computer Science Education , http://www.tandfonline.com/loi/ncse20#.VZbD60arFCs
- The Journal of Educational Computing Research (JECR) http://journals.sagepub.com/home/jec
- Journal of Information Technology Education: Research (JITE:Research),
http://www.informingscience.org/Journals/JITEResearch/Overview
- ACM Transactions on Computing Education (TOCE)
http://toce.acm.org/
- International Journal Of Computer Science Education In Schools

http://www.ijcses.org/index.php/ijcses

- Journal of computational science education
  http://jocse.org/
- Informatics in Education
  https://www.mii.lt/informatics_in_education/
- Computers & Education, http://www.sciencedirect.com/science/journal/03601315
- Journal of Computer Assisted Learning,
  http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291365-2729
- Journal of Educational Technology & Society, http://www.ifets.info/
- International Journal of Computer-Supported Collaborative Learning, http://ijcscl.org/
- Learning and Instruction, http://www.sciencedirect.com/science/journal/10967516
- The Journal of Mathematical Behavior,
  http://www.sciencedirect.com/science/journal/07323123
- The International Journal for Technology in Mathematics Education
  http://www.researchinformation.co.uk/time.php
- International Journal of Science and Mathematics Education,
  http://link.springer.com/journal/10763
- Themes in Science and Technology Education, http://earthlab.uoi.gr/theste/index.php/theste
- International Journal of Emerging Technologies in Learning (iJET),
  http://online-journals.org/index.php/i-jet
- International Journal of Interactive Mobile Technologies (iJIM),
  http://online-journals.org/index.php/i-jim
- Journal of Computers in Mathematics and Science Teaching (JCMST)
- https://www.aace.org/pubs/jcmst

E4 Contemporary Directions and Applications of Research In Didactics of Mathematics and Science

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Preschool Education Sciences and Educational Design Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd Cycle of Studies (Level 7)

COURSE CODE	E4	**SEMESTER**	B

COURSE TITLE	Contemporary directions and applications of Research in Didactics of Mathematics and Science

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
	3	7.5

COURSE TYPE	Special background in contemporary research methodologies in Didactics of Mathematics and Science. Skills development in research design in the framework of Didactics of Mathematics and Science.
PREREQUISITE COURSES:	Didactic of Sciences: Interdisciplinary approach (X1)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes

Students should be able to:
• recognize and characterize aspects, roles, actions, and interactions that characterize the learning and construction of scientific knowledge of mathematics and sciences in an inclusive digital environment.
• develop skills in designing and conducting qualitative and quantitative research on interdisciplinary connections in teaching-learning difficulties such as:
   ○ bibliography search, identification of valid internet sources and categorization
   ○ collection-analysis and digital processing of real data and matching with teaching objectives;
   ○ techniques of observation, interviewing, design and statistical processing of questionnaires
   ○ interdisciplinary framing in specific educational conditions and teaching methods.
• build diagnostic-evaluation tools and use them in the context of Teaching Engineering
• synthesize a set of results, present this synthesis orally and write it in the form of a scientific communication in accordance with the international standards and specifications of the scientific community.

General Competences

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Working independently
- Team work
- Working in an interdisciplinary environment
- Respect for difference and multiculturalism
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

The content of the course aims at the multifaceted development of methodological skills, including:
- Tools of epistemological and psychological diagnosis-evaluation of alternative/wrong paths, expressions and uses of scientific knowledge.
- Technical searches, collection, processing and synthetic utilization of data for the design of experimental teaching situations of Sciences with an Interdisciplinary approach, using appropriate Educational Material and utilization of Information and Communication Technologies.
- Technical searches, collection, processing and synthetic utilization of data for the design of Educational programs, environments and applications of Information and Communication Technologies in the positive sciences with the aim of the interdisciplinary construction of scientific knowledge

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face (one module of meetings) and distant learning (the remaining modules of meetings) Notes through the moodle platform of the University of the Aegean	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Presentation software Educational software (simulation, modelling, etc) Communication with the students through the moodle platform of the University of the Aegean	
TEACHING METHODS	*Activity*	*Semester workload*
	Lectures, seminars and laboratory activities	39 hours
	Study of bibliography and research material	61 hours
	Collaboration in teams for interdisciplinary reports	40 hours
	Group/individual ppt elaboration	25 hours
	editing and presentation of individual/group reposrts	60 hours
		30 hours
	Course total	**225 hours**

STUDENT PERFORMANCE EVALUATION	Language: Greek Oral presentations / Individual essays (30%) Collective essay, oral presentation (20%) Written essay-report (30%) Summative and conclusive evaluation of collective and individual reflective synthesis (20%)

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:
- Gaston Bachelard, «Το νέο επιστημονικό πνεύμα», Μτφ. Γιώργος Φαράκλας Πανεπιστημιακές Εκδόσεις Κρήτης, 2000.
- Moshé Flato «Η ισχύς των Μαθηματικών», Μτφ. Τάσος Κυπριανίδης, Εκδόσεις Κάτοπτρο, 1993.
- Thomas S. Kuhn «Η δομή των επιστημονικών επαναστάσεων», Μτφ. Γ. Γεωργακόπουλος, Β. Κάλφας, Εκδόσεις Σύγχρονα Θέματα, 1997.
- Seymour Papert «Νοητικές θύελλες», Μτφ. Αίγλη Σταματίου, Εκδόσεις Οδυσσέας, 1991.
- Henri Poincaré «Η αξία της επιστήμης», Μτφ. Στέλιος Τσεκούρας, Εκδόσεις Κάτοπτρο, 1997.
- Ilya Prigogyne «Το τέλος της βεβαιότητας», Μτφ. Σταύρος Μαρουλάκος, Εκδόσεις Κάτοπτρο, 1997.
- Καλαβάσης Φραγκίσκος, Μούτσιος - Ρέντζος Ανδρέας (2015) Ανάμεσα στο μέρος και στο όλο: Αναστοχαστική οικοδόμηση μαθηματικών εννοιών. Εκδόσεις Gutenberg.
- Καλαβάσης Φ., Μεϊμάρης Μ. (επ.) (2000) Διεπιστημονική προσέγγιση των Μαθηματικών και της Διδασκαλίας τους- Θέματα Διδακτικής Μαθηματικών V, Εκδόσεις Gutenberg.
- Καφούση Σόνια, Σκουμπουρδή Χρυσάνθη (2008). Τα μαθηματικά των παιδιών 4-6 ετών. Αριθμοί και χώρος. Εκδόσεις Πατάκη.
- Καφούση Σόνια, Χαβιάρης Πέτρος (2013). Σχολική τάξη, οικογένεια, κοινωνία και μαθηματική εκπαίδευση. Εκδόσεις Πατάκη. Αθήνα.
- Κοντάκος Αναστάσιος, Καλαβάσης Φραγκίσκος (επ) Θέματα Εκπαιδευτικού Σχεδιασμού, Τόμος 7, Εκόσεις Διάδραση.
- Φ. Καλαβάσης, Μ. Μεϊμάρης (επ.) «Διεπιστημονική προσέγγιση των Μαθηματικών και της Διδασκαλίας τους», Θέματα Διδακτικής Μαθηματικών V, Εκδόσεις Gutenberg, 2000.
- Σκουμπουρδή, Χρυσάνθη (2012). Σχεδιασμός ένταξης υλικών και μέσων στη μαθηματική εκπαίδευση των μικρών παιδιών. Εκδόσεις Πατάκη, Αθήνα.
- Σταμάτης Παναγιώτης. (2013). Επικοινωνία στην εκπαίδευση. Αθήνα: Διάδραση.
- Χατζηγεωργίου Ιωάννης, (2005). Ήχος, φως, νερό και αέρας - Ξεκίνημα στις φυσικές επιστήμες, εκδόσεις Γρηγόρη.

Conferences Proceedings:
- Μαθηματική Εκπαίδευση Ε.Μ.Ε. – Ελληνική Μαθηματική Εταιρείας (www.hms.gr)
- Ε.Ε.Φ. – Ένωσης Ελλήνων Φυσικών (www.eef.gr)
- Εν.Ε.Δι.Μ – Ένωση Ερευνητών Διδακτικής Μαθηματικών (http://www.enedim.gr/)
- ΕΝΕΦΕΤ – Ένωση για την Εκπαίδευση στις Φυσικές Επιστήμες & την Τεχνολογία (www.enephet.gr)
- CIEAEM – The International Commission for the Study and Improvement of Mathematics Teaching (http://www.cieaem.org/)
- IGPME – The International Group of the Psychology of Mathematics Education

(http://igpme.org/)
- ERME – European Society for Research in Mathematics Education (http://www.mathematik.uni-dortmund.de/~erme/)
- ESERA – European Science Education Research association (www.esera.org)
- GIREP – Groupe International de Recherche sur l'Enseignement de la Physique (International Research Group on Physics Teaching) (www.girep.org)
- NARST – National Association for Research in Science Teaching (www.narst.org)
- EARLI – European Association for Research in Learning and Instruction (www.earli.org)
- The Learner (www.thelearner.com)

Related Academic Journals:
- Έρευνα στη Διδακτική των Μαθηματικών
- EKT. https://ejournals.epublishing.ekt.gr/index.php/enedim
- Έρευνα για την Εκπαίδευση στις Φυσικές Επιστήμες και την Τεχνολογία
- EKT. https://ejournals.epublishing.ekt.gr/index.php/RiSTE/index
- Ευκλείδης γ΄
- EME. http://www.hms.gr
- HMS – International Journal for Mathematics in Education
- EKT. https://ejournals.epublishing.ekt.gr/index.php/ijme
- Educational Studies in Mathematics
- Springer. https://www.springer.com/journal/10649
- Journal for Research in Mathematics Education
- NCTM. https://pubs.nctm.org/view/journals/jrme/jrme-overview.xml
- For the Learning of Mathematics
- https://flm-journal.org/
- International Journal of Science Education.
- Taylor & Francis. https://www.tandfonline.com/journals/tsed20
- International Journal of Science and Mathematics Education
- Springer. https://www.springer.com/journal/10763
- Journal of Science Education and Technology
- Springer. https://www.springer.com/journal/10956
- Journal of Research in Science Teaching
- Willey. https://onlinelibrary.wiley.com/journal/10982736
- Science Education
- Willey. https://onlinelibrary.wiley.com/journal/1098237x

ΠΡΑ1 Observation and Interdisciplinary Design Methods for Practicum

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Preschool Education Sciences and Educational Design Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd cycle Postgraduate Studies (Level 7)
COURSE CODE	ΠΡΑ1 **SEMESTER** C
COURSE TITLE	Methodology of Observation – Interdisciplinary Design for the Practical Exercise

INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	CREDITS
Lectures and laboratory sessions	3	3

COURSE TYPE	Special background and development of scientific observation and design skills
PREREQUISITE COURSES:	To attend the course, the student must have successfully completed all compulsory courses of the 1st and 2nd semesters
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes
Upon completion of the course, students will be skilled in the engineering of designing interdisciplinary interventions in real educational settings. Specifically, they will be able to: • To recognize the relationship between the organizational characteristics and the culture of the Educational Unit with the possibilities of developing Interdisciplinary Approaches. • Identify and observe the operation of specific dimensions of the scientific content and pedagogical practices of teaching, linked to the interdisciplinary approach. • Observe, manage, and link digital and printed resources to develop interdisciplinary teaching practice and reflection. • Design protocols and integrate the observation process into the interdisciplinary educational design within real conditions.
General Competences
• Search for, locate, observe, collect and process educational data in real conditions • Collection and connection of results of the observation on the basis of hypotheses and with the use of the necessary technologies • Adaptation to new situations • Decision making • Autonomous work • Teamwork • Work in an interdisciplinary environment • Respect for diversity and multiculturalism • Demonstrating social, professional, and ethical responsibility and sensitivity to gender issues • Exercise criticism and self-criticism

	Applying Computational Systems Thinking to design research on teaching and learning

(3) SYLLABUS

The purpose of this seminar and laboratory course of the Practical Exercise, which can be carried out with parallel teaching in groups of small classes, is the presentation of the principles and the development of abilities:

- Construction of a protocol for scientific observation of a teaching activity with reference to Science under an Interdisciplinary and Systemic perspective at the level of an Educational Unit.
- Formation of educational material adapted to the observation protocol of the conditions of the Educational Unit of reference and the phenomenology of teaching-learning with an interdisciplinary perspective.
- - Functional connection of the data of the observation protocol and the effects of the observer on the intentionality of the protagonists in terms of interdisciplinarity, with the processing and implementation of the interdisciplinary teaching intervention, as well as the reflection that certifies the pedagogical and teaching professional training of the students of the postgraduate program.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVER.	Distant learning via a video conferencing system and use of an Online Learning Management System (Moodle) based on the blended learning model for communication, sharing of educational material, collaboration, correction of assignments and course management. In the meetings for the teaching of the course, a variety of teaching methods are used such as: lecture, individual work and collaboration in groups, workshops, discussions, group investigations, etc. The course is held in small groups of students with related subjects of diploma thesis.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching, educational communication, the administration of an educational unit, the development or synthesis of learning-educational material and tools, as well as for the observation and recording of real educational data, as a productivity tool.

TEACHING METHODS	Activity	Semester workload
	Lectures, Seminars, Laboratory activity	39 hours
	Elaboration of Observation Protocol and Design of adapted educational material for the teaching intervention	31 hours
	Processing results, writing a report	30 hours
	Course total	**100 hours**

STUDENT PERFORMANCE EVALUATION	The evaluation of the course takes into account the following portfolio assessment: • Documenting interdisciplinary hypotheses for observation. (20%)

	• Observation Grid editing and adaptation to real conditions and interdisciplinary hypotheses (50%) • Participation in the laboratory activities and presentation of the assignment (20%) • Report writing (10%) The language of the evaluation is Greek, while the method of evaluating the course can be adjusted from year to year.

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:
- Chevallard, Y. (1991 [1985]), *La transposition didactique : du savoir savant au savoir enseigné,* Grenoble : La Pensée sauvage.
- Coulibaly Anne, Deman Claudie. Observation des situations didactiques. In: *Revue française de pédagogie*, volume 45, 1978. Didactique des Sciences et Psychologie – Paris, 4-5-6-7 mai 1977. Table Ronde organisée avec le soutien du Centre National de la Recherche Scientifique et de la Maison des Sciences de l'Homme. pp. 149-154. (https://www.persee.fr/doc/rfp_0556-7807_1978_num_45_1_1673)
- Amade-Escot Chantal. Observation des situations didactiques et pratique réflexive en formation initiale. In: *Recherche & Formation*, N°25, 1997. L'identité enseignante : entre formation et activité professionnelle, sous la direction de Annette Gonnin-Bolo et G. Baillat. pp. 47-56. (https://www.persee.fr/doc/refor_0988-1824_1997_num_25_1_1425)
- Sarremajane, P. (2001), « La fabrication des savoirs scolaires », *Penser l'éducation*, 10, pp. 117-141.
- Thierry Geoffre, « De la didactique des sciences à la didactique de l'orthographe », *Corela* [En ligne], HS-17 | 2015, mis en ligne le 30 mai 2015, consulté le 10 novembre 2023. URL : http://journals.openedition.org/corela/3731 ; DOI : https://doi.org/10.4000/corela.3731
- Clément Pierre. La biologie et sa didactique, dix ans de recherche. In: *Aster, recherches en didactique des sciences expérimentales*, n°27, 1998. Thèmes, thèses, tendances. pp. 57-93.
- Kranzfelder P, Bankers-Fulbright JL, García-Ojeda ME, Melloy M, Mohammed S, Warfa A-RM (2019) The Classroom Discourse Observation Protocol (CDOP): A quantitative method for characterizing teacher discourse moves in undergraduate STEM learning environments. PLoS ONE 14(7): e0219019. https://doi.org/10.1371/journal.pone.0219019

Related academic journals and conference proceedings:

(I) Greek conference proceedings and journals
- Enedim.gr [Association of Mathematics Teaching Researchers]
- Enephet.gr [Association for Science and Technology Education]
- Etpe.gr [Hellenic Scientific Association for Information and Communication Technologies in Education]

(II) International journals
- International Journal for Mathematics in Education (HMSiJME) (https://ejournals.epublishing.ekt.gr/index.php/ijme)
- International Journal of Mathematical Education in Science and Technology (https://www.tandfonline.com/toc/tmes20/current)
- Mediterranean journal for research in mathematics education: an international journal of the Cyprus Mathematical Society (https://www.cymsjournal.com/)
- Journal of the Learning Sciences (https://www.tandfonline.com/toc/hlns20/.VCsyjGeSwrU)
- Journal of Science Education and Technology

(https://www.springer.com/journal/10956/)
- International Journal of Science Education (https://www.tandfonline.com/loi/tsed20)
- Science Education Journal (https://onlinelibrary.wiley.com/journal/1098237x)
- Computers & Education Journal (https://www.sciencedirect.com/journal/computers-and-education)
- Journal of Educational Technology & Society (https://www.j-ets.net/)
- Computers in Human Behavior (https://www.sciencedirect.com/journal/computers-in-human-behavior) International Journal of Computer-Supported Collaborative Learning

ΠΡΑ2 Practicum: Educational – Empirical Application

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Preschool Education Sciences and Educational Design Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd cycle Postgraduate Studies (Level 7)
COURSE CODE	ΠΡΑ2 **SEMESTER** C
COURSE TITLE	Practical Exercise: Educational – Experimental Application

INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	CREDITS
Meetings with advisory committee, scientific observation in real conditions & report writing	3	7

COURSE TYPE	General knowledge specialization, skills development
PREREQUISITE COURSES:	In order to join the course, the student must have successfully completed all the compulsory courses of the first and second semesters and at the same time attend ΠΡΑ1
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes
- After completing the course work, students will be able to: • recognize the importance of the observation stage in the educational design of interdisciplinary approaches in Science and ICT in education.   • recognize the difficulties in managing the connections between interdisciplinarity, collaboration, and inclusiveness,   • identify a priori, to recognize in situ the cognitive flexibility and the representational variety, related to the degree of pedagogical autonomy of the education structures, to the quality of organizational intelligence and reflection, in order to systematically include them in the interdisciplinary design.
General Competences
- Search for, locate, observe, collect and process educational data in real conditions   - Collection and connection of results of the observation on the basis of hypotheses and with the use of the necessary technologies   - Adaptation to new situations   - Decision making   - Autonomous work   - Teamwork

• Work in an interdisciplinary environment	
• Respect for diversity and multiculturalism	
• Demonstrating social, professional, and ethical responsibility and sensitivity to gender issues	
• Exercise criticism and self-criticism	

(3) SYLLABUS

The Practical Exercise aims to the design and modeling of the experimental application in scientifically described conditions of a didactic scenario of an interdisciplinary approach of Science and ICT in a real learning environment, teaching, or educational material production.

The content of the work prepared in the ΠΡΑ-2 course under the supervision of a faculty member is connected to and complements the content of the ΠΡΑ-1 course, completing the training of students in modeling the engineering of educational design in real conditions.

The processing and production of an adapted protocol that connects the formulation of a priori teaching hypotheses with the targeted and systematic in situ observation, both at the level of an educational unit, and at the level of a school class/department or educational material production unit, and the reflective integration of this process into the interdisciplinary design, constitutes the first stage in the systemic model of professional apprenticeship of the stage type in the field of Educational Design.

In the second stage, the recording of the data of the protocol, the observation techniques, the interactions of the observer with the phenomenon, and the intentionality of the protagonists, are activated as a functional condition for the processing and implementation of the interdisciplinary teaching intervention, as well as the systemic reflection that completes the professional pedagogic and teaching training of the students of the postgraduate program.

The content of ΠΡΑ-2 should be functionally linked to the content of the Diploma Thesis.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Regular cooperation, guidance, and counselling meetings are held with the supervisor and/or the other members of the advisory committee in person or online		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of ICT in teaching, educational communication, the administration of an educational unit, the development or synthesis of learning-educational material and tools, as well as for the observation and recording of real educational data, as a productivity tool.		
TEACHING METHODS	**Activity**	**Semester workload**	
	Meetings with supervisor and/or advisory committee	39 hours	
	Theoretical search and formulation of observation hypotheses and formulation of a targeted, systematic observation protocol adapted to the real field	31 hours	
	Observation - recording	50 hours	
	Design and implementation of an adapted interdisciplinary intervention in the real field	50 hours	
	Processing results, formulating a systemic reflection, writing a report	30 hours	

	Course total	200 hours
STUDENT PERFORMANCE EVALUATION	The evaluation of the ΠΡΑ-2 Practical Exercise is done by the three-member advisory committee in accordance with the regulation. The committee studies the protocol and the completeness of the report submitted after the approval of the supervisor and may invite the student to a presentation of the work and an oral examination. Among the criteria evaluated are the quality of the hypotheses, the systematicity of the observation, the ability to connect the data and integrate the observation process into the adapted design of the interdisciplinary teaching intervention, as well as the reflection of the synthetic report.	

(5) ATTACHED BIBLIOGRAPHY

Related academic journals:

- International Journal for Mathematics in Education (HMSiJME) (https://ejournals.epublishing.ekt.gr/index.php/ijme)
- Journal for Research in Mathematics Education (JRME) (https://pubs.nctm.org/view/journals/jrme/jrme-overview.xml)
- International Journal of Mathematical Education in Science and Technology (https://www.tandfonline.com/toc/tmes20/current)
- Mediterranean journal for research in mathematics education: an international journal of the Cyprus Mathematical Society (https://www.cymsjournal.com/)
- Journal of the Learning Sciences (https://www.tandfonline.com/toc/hlns20/.VCsyjGeSwrU)
- Journal of Science Education and Technology (https://www.springer.com/journal/10956/)
- International Journal of Science Education (https://www.tandfonline.com/loi/tsed20)
- Science Education Journal (https://onlinelibrary.wiley.com/journal/1098237x)
- International Journal of STEM Education (https://stemeducationjournal.springeropen.com/)
- International Journal of Engineering Pedagogy (iJEP) (https://online-journals.org/index.php/i-jep)

Δ.Ε.1. Methods Oriented to Dissertation Thematic Areas

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Preschool Education Sciences and Educational Design- Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd Cycle of Studies (Level 7)
COURSE CODE	ΔΕ1 **SEMESTER** C
COURSE TITLE	Research methods oriented to dissertation thematic areas

INDEPENDENT TEACHING ACTIVITIES	WEEKLY TEACHING HOURS	CREDITS
Lectures and workshops	3	5

COURSE TYPE	Special background, and design skills development
PREREQUISITE COURSES:	To attend the course, the student must have successfully completed all compulsory courses of the 1st and 2nd semesters
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	It is announced every year to the students

(2) LEARNING OUTCOMES

Learning outcomes
Students are expected to : • recognize the value of scientific research. • get to know ways and means of searching and finding focused research publications • manage and use digital and print resources. • multidimensionally and critically analyze a sufficient variety of published research • conduct extensive bibliographic research with modern techniques and methods. • relate research questions to appropriate research methodologies • know the sources of research data collection, ethical rules and research data collection procedures • Synthesize and organize primary and secondary data. • Use scientific paper writing skills. • design individual and/or collaborative research projects to investigate issues of the interdisciplinary approach and the didactics of the sciences specifically for the topic of their thesis
General Competences
• Search for, analysis and synthesis of data and information, with the use of the necessary technology • Adapting to new situations

- Decision-making
- Working independently
- Team work
- Working in an international environment
- Working in an interdisciplinary environment
- Production of new research ideas
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Criticism and self-criticism
- Production of free, creative and inductive thinking
- Promotion of free, creative and inductive thinking
- Applying Computational Systems Thinking to design research on teaching and learning

(3) SYLLABUS

The purpose of this seminar and laboratory course, which can be carried out with parallel teaching in groups of small departments, is the development of the principles and tools of scientific validity and ethics in research, documentation and the formulation of results in the field of the Interdisciplinary Educational Approach of the Positive Sciences in the modern Pedagogical Conditions.

It aims at developing skills to document the importance of the topic of the thesis, to select and adapt the research methodology to the specific field, as well as the ability to develop research tools, the understanding of the principles of writing a scientific report in connection with the interdisciplinary context and each work case. In this course, students document the problematic of their thesis with the guidance of the teachers and the supervision committee and develop a detailed plan for its preparation and writing.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Teaching takes place remotely via a modern video conferencing system. In addition there is the use of an Online Learning Management System (Moodle) based on the blended learning model for communication, sharing educational materials, collaboration, task assignment and course management. In the meetings for the teaching of the course, a variety of teaching methods are used such as: lecture, work in groups, workshops, discussions, group investigations, etc. The course is held in small groups of students with related dissertation's topics.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Apart from the use of ICT as a presentation and productivity tool by teachers and students in the context of the course special educational research software is used for the analysis of quantitative and qualitative research data.
TEACHING METHODS	

Activity	Semester workload
Teaching	39 hours
Examination-presentation of final projects	3 hours
Study and analysis of bibliography	58 hours
Compilation of an Elaboration plan	50 hours
Course total	**150 hours**

STUDENT PERFORMANCE	The assessment for the course accounts the following

EVALUATION	components of the students' achievements portfolio:

- Elaboration of bibliographic research to document the topic of dissertation (20%)
- Elaboration of a work plan (project) (50%)
- Presentation of the work (20%)
- Diligent and active participation in the course (10%)

The assessment language is Greek. The assessment procedure may adapt year by year.

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:
- Bryman, A. (2015*). Social research methods.* Oxford university press.
- Mertens, M. D. (2009). *Έρευνα και αξιολόγηση στην εκπαίδευση και την ψυχολογία* / Donna M. Mertens · μετάφραση Σταύρος Κυρανάκης, Παναγιώτα Μπιθαρά, Ματίνα Μαυράκη επιμέλεια Ελένη Γιαννακοπούλου · επιμέλεια σειράς Βάσω Βασιλού - Παπαγεωργίου. - 1η έκδ. - Αθήνα : Μεταίχμιο.
- Babbie, E. R., Zapheiropoulos, K., & Vogiatzēs, G. (2011). Eisagōgē stēn koinōnikē ereuna. Athēna: Kritikē.
- Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education* (5th ed). London ; New York: RoutledgeFalmer.
- Creswell, John W. (2011). *Εκπαιδευτική έρευνα : Σχεδιασμός, διεξαγωγή και αξιολόγηση της ποσοτικής και ποιοτικής έρευνας* / John W. Creswell · μετάφραση Νάνσυ Κουβαράκου · επιμέλεια Χαράλαμπος Τσορμπατζούδης. - 1η έκδ. - Αθήνα : Έλλην.
- Gay, L. R., Mills, G. E., & Airasian, P. W. (2009). *Educational research: competencies for analysis and applications (*9th ed). Upper Saddle River, N.J: Merrill/Pearson.
- Robson, C., Michalopoulou, K., Kalyva, P., Dalakou, V., & Vasilikou, K. (2007*). Ē ereuna tou pragmatikou kosmou: ena meson gia koinōnikous epistēmones kai epaggelmaties ereunētes*. Athēna: Gutenberg
- Silver, C., Lewins, A. (2018). *Ποιοτική Έρευνα Υποστηριζόμενη από Λογισμικά: Ένας Οδηγός Βήμα προς Βήμα*, Εκδόσεις: Liberal Books, σελ. 426, Πρώτη έκδοση: Sage Publishing 2014, Επιμέλεια Γ. Φεσάκης, Α. Μούτσιος-Ρέντζος, Μετάφραση: Σταυρούλα Πραντσούδη, ISBN:978-618-5012-38-0, Κωδικός Βιβλίου στον Εύδοξο: 77119845
- Ανδρεαδάκης Ν. &Βάμβουκας Μ. (2005). Οδηγός για την εκπόνηση και τη σύνταξη γραπτής ερευνητικής εργασίας. Αθήνα: Ατραπός, 2005.
- Bell, J. (2007). Πώς να συντάξετε μία επιστημονική εργασία. Αθήνα: Μεταίχμιο.
- Howard, K. & Sharp, J. A. (1994) Η Επιστημονική Μελέτη. Οδηγός Σχεδιασμού και Διαχείρισης Πανεπιστημιακών Ερευνητικών Εργασιών. Αθήνα: Gutenberg.

Related academic journals:

- Review of Research in Education
- Journal for Research in Mathematics Education
- The Journal of the Learning Sciences
- The Journal of Educational Research
- ACM SIGCSE Bulletin
  http://dl.acm.org/citation.cfm?id=J688
- Computer Science Education, http://www.tandfonline.com/loi/ncse20#.VZbD60arFCs
- The Journal of Educational Computing Research (JECR) http://journals.sagepub.com/home/jec
- Journal of Information Technology Education: Research (JITE:Research),
  http://www.informingscience.org/Journals/JITEResearch/Overview
- ACM Transactions on Computing Education (TOCE) http://toce.acm.org/
- International Journal Of Computer Science Education In Schools
  http://www.ijcses.org/index.php/ijcses

- Journal of computational science education http://jocse.org/
- Informatics in Education https://www.mii.lt/informatics_in_education/
- Computers & Education, http://www.sciencedirect.com/science/journal/03601315
- Journal of Computer Assisted Learning, http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291365-2729
- Journal of Educational Technology & Society, http://www.ifets.info/
- International Journal of Computer-Supported Collaborative Learning, http://ijcscl.org/
- Learning and Instruction, http://www.sciencedirect.com/science/journal/10967516
- The Journal of Mathematical Behavior, http://www.sciencedirect.com/science/journal/07323123
- The International Journal for Technology in Mathematics Education http://www.researchinformation.co.uk/time.php
- International Journal of Science and Mathematics Education, http://link.springer.com/journal/10763
- Themes in Science and Technology Education, http://earthlab.uoi.gr/theste/index.php/theste
- International Journal of Emerging Technologies in Learning (iJET), http://online-journals.org/index.php/i-jet
- International Journal of Interactive Mobile Technologies (iJIM), http://online-journals.org/index.php/i-jim
- Journal of Computers in Mathematics and Science Teaching (JCMST)
- https://www.aace.org/pubs/jcmst/

Δ.Ε.2. Dissertation: Writing and Assessing the Dissertation

COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Humanities
ACADEMIC UNIT	Department of Preschool Education Sciences and Educational Design- Postgraduate Studies Programme in Didactics of Mathematics, Science and Information and Communication Technologies in Education: Interdisciplinary Approach
LEVEL OF STUDIES	2nd Cycle of Studies (Level 7)

COURSE CODE	ΔE2	**SEMESTER**	C

COURSE TITLE	Dissertation: writing and assessing the dissertation

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Advisory committee meetings, implentation & writing		15

COURSE TYPE	Specialised general knowledge,
PREREQUISITE COURSES:	To attend the course, the student must have successfully completed all compulsory courses of the 1st and 2nd semesters
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	--

(2) LEARNING OUTCOMES

Learning outcomes
Students are expected to : • recognize the value of scientific research. • conduct extensive bibliographic research with modern techniques and methods. • Synthesize and organize primary and secondary data. • Plan and manage projects • Promote their free, creative and inductive thinking • Apply research paper writing skills • Implement research projects to investigate issues of the interdisciplinary approach and the didactics of the sciences specifically for the subject of their diploma

General Competences
- Search for, analysis and synthesis of data and information, with the use of the necessary technology   - Adapting to new situations   - Decision-making   - Working independently   - Team work   - Working in an international environment   - Working in an interdisciplinary environment   - Production of new research ideas   - Showing social, professional and ethical responsibility and sensitivity to gender issues   - Criticism and self-criticism   - Promotion of free, creative and inductive thinking   - Applying Computational Systems Thinking to design research on teaching and learning

(3) SYLLABUS

The Diploma Thesis constitutes an independent scientific analysis of an issue or approach to a problem, is based on the existing literature and utilizes the knowledge and skills acquired during the studies. The purpose of the Diploma Thesis is for the students to delve deeper into a topic related to the interdisciplinary approach to education and the teaching of science using digital technology and computational thinking. The dissertation can include, in addition to bibliography, design and/or empirical research with the aim of obtaining specialized academic and professional qualifications.

The bibliographic thesis is a systematic and critical discussion of the existing knowledge around a topic. The empirical research dissertation aims to advance existing knowledge by conducting small-scale research, qualitative or mixed-methods, in relation to specific research questions. The design thesis concerns the development of educational tools, interventions, curricula, learning environments, educational materials, etc. which can also be evaluated empirically.

In its final form, the thesis aims to present in a structured and systematic way to the reader-researcher the organized approach of the subject under investigation. The structure of the thesis includes the theoretical framework with the presentation of the topic, the analysis of the literature and the problematic, while the experimental one describes the research questions, the methodology, the implementation of the research, the findings and the results are summarized and compared with those of the literature. Finally, new possible research questions are formulated, and the consequences and applications of the research results are assessed.

The final version of the thesis is posted on the online repositories of the University of the Aegean.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Collaboration, guidance and counseling meetings are held with the supervisor and/or the other members of the advisory committee in person or online
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Apart from the use of ICT as a presentation and productivity tool by teachers and students in the context of the course special

		educational research software is used for the analysis of quantitative and qualitative research data.	
TEACHING METHODS		**Activity**	**Semester workload**
		Meetings with supervisor and/or advisory board	19 hours
		Examination-presentation of final thesis	1 hour
		Study, designs & and analysis of literature & research.	130 hours
		Elaboration of research	100 hours
		Editing-authoring	200 hours
		Course total	**450 hours**
STUDENT PERFORMANCE EVALUATION		The evaluation of the thesis is done by the three-member advisory committee in accordance with the thesis preparation regulation. The committee studies the text of the diploma submitted for evaluation after the approval of the supervisor and may invite the student to a presentation of the work and an oral examination. Among the criteria evaluated are the quality of the work, potential originality, methodological consistency, accuracy of reasoning, elaboration of the schedule and plan, and contribution to science and society.	

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Bryman, A. (2015*). Social research methods.* Oxford university press.
- Mertens, M. D. (2009). *Έρευνα και αξιολόγηση στην εκπαίδευση και την ψυχολογία* / Donna M. Mertens · μετάφραση Σταύρος Κυρανάκης, Παναγιώτα Μπιθαρά, Ματίνα Μαυράκη · επιμέλεια Ελένη Γιαννακοπούλου · επιμέλεια σειράς Βάσω Βασιλού - Παπαγεωργίου. - 1η έκδ. - Αθήνα : Μεταίχμιο.
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- Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education* (5th ed). London ; New York: RoutledgeFalmer.
- Creswell, John W. (2011). *Εκπαιδευτική έρευνα : Σχεδιασμός, διεξαγωγή και αξιολόγηση της ποσοτικής και ποιοτικής έρευνας* / John W. Creswell · μετάφραση Νάνσυ Κουβαράκου · επιμέλεια Χαράλαμπος Τσορμπατζούδης. - 1η έκδ. - Αθήνα : Έλλην.
- Gay, L. R., Mills, G. E., & Airasian, P. W. (2009). *Educational research: competencies for analysis and applications (*9th ed). Upper Saddle River, N.J: Merrill/Pearson.
- Robson, C., Michalopoulou, K., Kalyva, P., Dalakou, V., & Vasilikou, K. (2007*). Ē ereuna tou pragmatikou kosmou: ena meson gia koinōnikous epistēmones kai epaggelmaties ereunētes*. Athēna: Gutenberg
- Silver, C., Lewins, A. (2018). *Ποιοτική Έρευνα Υποστηριζόμενη από Λογισμικά: Ένας Οδηγός Βήμα προς Βήμα*, Εκδόσεις: Liberal Books, σελ. 426, Πρώτη έκδοση: Sage Publishing 2014, Επιμέλεια Γ. Φεσάκης, Α. Μούτσιος-Ρέντζος, Μετάφραση: Σταυρούλα Πραντσούδη, ISBN:978-618-5012-38-0, Κωδικός Βιβλίου στον Εύδοξο: 77119845
- Ανδρεαδάκης Ν. &Βάμβουκας Μ. (2005). Οδηγός για την εκπόνηση και τη σύνταξη γραπτής ερευνητικής εργασίας. Αθήνα: Ατραπός, 2005.
- Bell, J. (2007). Πώς να συντάξετε μία επιστημονική εργασία. Αθήνα: Μεταίχμιο.
- Howard, K. & Sharp, J. A. (1994) Η Επιστημονική Μελέτη. Οδηγός Σχεδιασμού και Διαχείρισης Πανεπιστημιακών Ερευνητικών Εργασιών. Αθήνα: Gutenberg.

Related academic journals:

- Review of Research in Education
- Journal for Research in Mathematics Education
- The Journal of the Learning Sciences
- The Journal of Educational Research
- ACM SIGCSE Bulletin http://dl.acm.org/citation.cfm?id=J688
- Computer Science Education , http://www.tandfonline.com/loi/ncse20#.VZbD60arFCs
- The Journal of Educational Computing Research (JECR) http://journals.sagepub.com/home/jec
- Journal of Information Technology Education: Research (JITE:Research),
  http://www.informingscience.org/Journals/JITEResearch/Overview
- ACM Transactions on Computing Education (TOCE)
  http://toce.acm.org/
- International Journal Of Computer Science Education In Schools
  http://www.ijcses.org/index.php/ijcses
- Journal of computational science education
- http://jocse.org/
- Informatics in Education
- https://www.mii.lt/informatics_in_education/
- Computers & Education, http://www.sciencedirect.com/science/journal/03601315
- Journal of Computer Assisted Learning,
  http://onlinelibrary.wiley.com/journal/10.1111/%28ISSN%291365-2729
- Journal of Educational Technology & Society, http://www.ifets.info/
- International Journal of Computer-Supported Collaborative Learning, http://ijcscl.org/
- Learning and Instruction, http://www.sciencedirect.com/science/journal/10967516
- The Journal of Mathematical Behavior,
  http://www.sciencedirect.com/science/journal/07323123
- The International Journal for Technology in Mathematics Education
  http://www.researchinformation.co.uk/time.php
- International Journal of Science and Mathematics Education,
  http://link.springer.com/journal/10763
- Themes in Science and Technology Education, http://earthlab.uoi.gr/theste/index.php/theste
- International Journal of Emerging Technologies in Learning (iJET),
  http://online-journals.org/index.php/i-jet
- International Journal of Interactive Mobile Technologies (iJIM),
  http://online-journals.org/index.php/i-jim
- Journal of Computers in Mathematics and Science Teaching (JCMST)
- https://www.aace.org/pubs/jcmst/