Course proposal

Digital Transformation and Educational Practice

Teacher(s)
Chronis Kynigos *(homepage optional)*

Course Website (optional)

Course description (min 150, max 300 words)

Despite the abundance of examples of digital transformation in our society, there is still a lack of cohesive understanding of what digital transformation entails. One major challenge is to envision what innovations digital technologies bring to society and, particularly, to education in the future. In this course, we will present some new perspectives trying to make sense of education in an era of intense, unpredictable, complex, ill-defined societal and digital transformation, focusing on mathematics education. We will start with a review of the main ideas in digital transformation and educational practices and then move to an in-depth analysis of relevant publications in the field, seeking to suggest possible answers to at least some of the following research questions: How can digital technologies become an integral tool in the ways rationality and mathematical thinking are cultivated in schools transforming from an academic to a citizenship paradigm? How can we use digital media to instil rationality and mathematical understanding in individual and collective citizenship? What is the value of mathematics in the so-called 21st-century skills movement in education focusing on trans-disciplinarity and grappling with socio-scientific issues? What can STEM and STEAM bring to mathematics education in this context? How can programming, computational thinking and modelling bring added educational value to the teaching and learning of Mathematics? What kind of educational practices and uses of digital media can we expect to value in the digital transformation era?

Course period
January 2024

SSD
MAT/04

Course References (optional)

Credits and Hours
2 credits of lectures (8 hours), for a total of 16 hours

Exam Modality
Paper presentation. Students present the content of 2 papers suggested by the teacher. No groups are allowed.
(Teacher(s) may choose other modalities)

Teacher(s) CV
Attached or link a max 3 pages CV for each teacher proposing the course.

Teacher(s) Main Publications
List 10 main publications in the last 15 years for each teacher.

1. Kynigos, C. & Karavakou, M. (2022) Coding dancing figural animations: a flow of transitions for creative mathematical actions, *Digital Experiences in Mathematics* Education, Springer https://doi.org/10.1007/s40751-022-00118-x
2. Kynigos, C., Diamantidis, D. (2021) Creativity in Engineering Mathematical Models Through Programming, Mathematical Creativity – State-of-the-art of Empirical Research, Roza Leikin Bharath Srirama (Eds) *The International Journal of Mathematics Education, ZDM*, Springer Verlag. https://doi.org/10.1007/s11858-021-01314-6
3. Kynigos, C., Essonnier, N., Trgalova, Y. (2020) Social creativity in the education sector: The case of collaborative design of resources in mathematics, *Creativity Research Journal*, Volume 32, 2020 - Issue 1: Creativity, learning and technology, Vlad P. Glaveanu, Ingunn Johanne Ness & Constance de Saint Laurent (Eds), Routledge, 17-29
4. Kynigos, C., Grizioti, M (2020) Modifying games with ChoiCo: integrated affordances and engineered bugs for Computational Thinking, *British Journal of Educational Technology*, 51 (6), 2252-2267, Wiley, UK, https://doi.org/10.1111/bjet.12898
5. Kynigos, C., Grizioti, M. (2018) Programming Approaches to Computational Thinking: Integrating Turtle Geometry, Dynamic Manipulation and 3D Space, *Informatics in Education*, 17.2, 321-340 Vilnius University
6. Kynigos, C., Yiannoutsou, N. (2018) Children Challenging the Design of Half-baked Games: Expressing Values through the process of Game Modding, *International Journal of Child- Computer Interaction*, Volume 17, September 2018, Elsevier, Pubs., 16-27.
7. Kynigos, C. (2015) Constructionism: Theory of Learning or Theory of Design? In *Selected Regular Lectures from the 12th International Congress on Mathematical Education* 417- 438, Sung Je Cho (Ed), Springer, DOI 10.1007/978-3-319-17187-6
8. Kynigos, C., Lagrange, B. (2014) Cross-analysis as a tool to forge connections amongst theoretical frames in using digital technologies in mathematical learning. Special Issue in Digital representations in mathematics education: conceptualizing the role of context and networking theories, *Educational Studies in Mathematics*, 85 (3), 321-327.
9. Dragon, T., McLaren, B., Mavrikis, M., Harrer, A., Kynigos, C., Wegerif, R., Yang, Y. (2013) Metafora: A Web-Based Platform for Learning to Learn Together in Science and Mathematics, *IEEE Transactions on Learning Technologies*, vol. 6, no. 3, 197-207.
10. Kynigos, C. (2007) Half-baked Microworlds in use in Challenging Teacher Educators' Knowing, *International Journal of Computers for Mathematical Learning*. Kluwer Academic Publishers, 12 (2), 87-111.

CV - Chronis Kynigos

Chronis Kynigos is Professor of mathematics and technology education since 2008 and director of the Educational Technology Lab (ETL), at the School of Philosophy, National and Kapodistrian University of Athens, NKUA, https://en.uoa.gr/, which ranks 26th in the Webometris - Google Scholar Citations list worldwide. NKUA comprises of 8 Schools, 33 Faculties, 183 Masters' programs and maintains 224 Research Labs. It employs 1605 Academic members of Staff, serves over 40000 undergraduate students, over 14000 Masters' students and close to 9000 PhD students. ETL was legally established 20 years go and has employed 6 members of staff and numerous post- doc and PhD student researchers, usually maintaining 10-15 active researchers in the field. Chronis has also been the Director of a Masters course in Educational Technology and a member of the steering committee of two others, one of them in Mathematics Education. He was a member of the core group of the EU Kaleidoscope Network of Excellence and director of three highly successful large European Projects in Digital Technology and Mathematics Education (worth around 3M each), also a partner in a number of others. He is member of two steering committees at the Greek Ministry of Education a) for a large-scale longitudinal project for in-service teacher education having reached 30% of teachers in the country (https://e-pimorfosi.cti.gr/en/) and b) for the development and maintenance of the 'Photodendro' portal, responsible therein for the design and development of 1800 original micro-experiments connected to the curriculum books for mathematics year 3-11 (http://dschool.edu.gr/). Hs research however, has been inspired by a transformative agenda for education. Since 1993, he has engaged in design research involving the infusion of constructionist pedagogy based on digital media in and out of mainstream schooling. His research has proposed alternative curicular structures with the aim to create dense meaning- making discursive environments for learners. He has designed several constructionist digital media, most recently a programmable dynamic 3D Turtle Geometry modeller (http://etl.ppp.uoa.gr/malt2) and a game designer for socio-scientific issues (http://etl.ppp.uoa.gr/ChoiCo). He served in the editorial boards of the IJCML, BJET and DEME Journals. He has organised and co-organised national and international conferences such as the 'GARME' and the 'Constructionism' conference and structured events within conferences such as two TSGs at ICME conferences and a TWG at CERME. He was a founding member of the Greek Association of Mathematics Education (GARME). He has been invited to give plenary lectures at several conferences in techology and education and to give a regular lecture at the ICME conference in 2012. He has played a significant role in bidding for and running a number of multi-organisational projects attracting a total funding of around 100M Euros by the European Community, the Greek Ministry of Education and the Ministry of Development. He initiated the first School of Philosophy spin-off company, 'Polymechanon', bringing emerging technologies to playful learning. He has published over 70 papers in peer reviewed journals and academic books and has a broad international readership (h-index 23).

Short summary for mathematics education

Chronis Kynigos is Prof. at the National and Kapodistrian University of Athens, director of the Educational Technology Lab therein and visiting professor at Linnaeus University in Sweeden. For 30 years he has been engaged in design research on constructionist pedagogy in primary and secondary schools and in informal settings adopting a transformative approach to mathematics education. The interventions he designed and implemented include original constructionist media now used widely in Greece and beyond, pedagogical scenarios and tasks for student individual and discursive constructionist meaning-making and TPD in pre and in-service settings. He is known for the didactical engineering notion of 'half-baked (faulty) artifacts' aiming to infuse a fallible mathematical approach to learning, thinking through and doing mathematics. He has been responsible for mathematics in the Greek Ministry of Education's wide-scale TPD and digital infrastructure initiatives for over 15 years. He is the national representative for ICMI and one of the founders of the Greek Association of Researchers in Mathematics Education (GARME).

Short summary for educational technology

Professor at NKUA with 30 years of design research studying transformative innovative interventions in education based on the use of expressive constructionist digital media and the adoption of an epistemology of fallibility in scientific reasoning. Leads a lab where he and his researchers have designed and developed widely used digital authoring systems in this wake providing modelling and serious game modding experiences to educational practitioners and learners. Over 250 publications, amongst the latest of which,

one about half-baked constructionism in MIT press and one about agency in mathematical creativity in the ZDM Journal, Springer. Chronis is Professor at the National and Kapodistrian University of Athens and Director of the Educational Technology Lab at the School of Philosophy, Dept. of Educational Studies. In the past 30 years he has contributed to our knowledge on educational practices made posssible with the use of digital technologies in a changing society. He has led the design of freely avilable and widely used original digital media for learning though expression, creative construction, argumentation and meaning making. Through design research, he has shown the potential of such new pedagogy to transform education to support digital citizenship, 21st century skills and competences and at the same time to enhance meaning-making in the traditional scientific domains. He sits at the scientific boards of the Ministry of Education's professional development initiative in the use of digital media having reached 35% of teachers in the country and the popular digital infrastructures including interactive curriculum books, the Photodendro portal and the educational social media system called 'e-me'.

Personal details

Name, Chronis Kynigos
Date of birth 23 February 1960. Place of birth: Athens, Greece.

Degrees

- Ph. D. in Mathematics Education with the use of Computers, Institute of Education University of London.
- M. Sc. in Mathematical, Statistical and Computing Education, Institute of Education University of London,
- Dip. Ed. in Educational Psychology, Institute of Education University of London,
- Mathematics Graduate, University of Athens, Dept. of Mathematics.

Employment history

- 2018-2022 Visiting Professor, CeLeKT, Linnaeus University, Sweeden
- 2017-2018 Visiting Professor, SLATE, University of Bergen, Norway
- 2008, Professor, Department of Pedagogy, Faculty of Philosophy, Pedagogy and Psychology (P.P.P.), School of Philosophy, National Kapodistrian University of Athens (N.K.U.A.).
- 2003, Associate Professor, Department of Pedagogy, Faculty of Philosophy, Pedagogy and Psychology (P.P.P.), School of Philosophy, National Kapodistrian University of Athens (N.K.U.A.).
- 2000, Director, the 'Educational Technology Lab', Department of Pedagogy, P.P.P. Faculty, School of Philosophy, N.K.U.A..
- 1998, Assistant Professor, Department of Pedagogy, P.P.P. Faculty, School of Philosophy, N.K.U.A..
- 1993, Principal Investigator at the Research Academic Computer Technology Institute, Ministry of Education.
- 1993, Lecturer, Department of Pedagogy, P.P.P. Faculty, School of Philosophy, N.K.U.A..
- 1990-1992, Teaching and Research Associate, Dept. of Informatics, University of Athens
- 1986, Consultancy/supervision of applied educational technology programs in selected private schools (Psychico College Athens, Hill School Athens, Karavanas School Larissa).

Selection of paper

1. Kynigos, C. & Karavakou, M. (2022) Coding dancing figural animations: a flow of transitions for creative mathematical actions, Digital Experiences in Mathematics Education, Springer https://doi.org/10.1007/s40751-022-00118-x
2. Kynigos, C., Diamantidis, D. (2021) Creativity in Engineering Mathematical Models Through Programming, Mathematical Creativity – State-of-the-art of Empirical Research, Roza Leikin Bharath Srirama (Eds) *The International Journal of Mathematics Education, ZDM*, Springer Verlag. https://doi.org/10.1007/s11858-021-01314-6
3. Kynigos, C. (2020) Half - baked Constructionism: The Challenge of Infusing Constructionism in Education in Greece *Designing Constructionist Futures: The Art, Theory, and Practice of Learning Designs*, Nathan Holbert, Matthew Berland, and Yasmin Kafai (Eds), 61-72, MIT Press, Cambridge Massachussetts.

4. Kynigos, C., Essonnier, N., Trgalova, Y. (2020) Social creativity in the education sector: The case of collaborative design of resources in mathematics, *Creativity Research Journal*, Volume 32, 2020 - Issue 1: Creativity, learning and technology, Vlad P. Glaveanu, Ingunn Johanne Ness & Constance de Saint Laurent (Eds), Routledge, 17-29
5. Kynigos, C., Grizioti, M (2020) Modifying games with ChoiCo: integrated affordances and engineered bugs for Computational Thinking, *British Journal of Educational Technology*, 51 (6), 2252-2267, Wiley, UK, https://doi.org/10.1111/bjet.12898
6. Kynigos, C., Grizioti, M. (2018) Programming Approaches to Computational Thinking: Integrating Turtle Geometry, Dynamic Manipulation and 3D Space, *Informatics in Education*, 17.2, 321-340 Vilnius University
7. Kynigos, C., Yiannoutsou, N. (2018) Children Challenging the Design of Half-baked Games: Expressing Values through the process of Game Modding, *International Journal of Child- Computer Interaction*, Volume 17, September 2018, Elsevier, Pubs., 16-27.
8. Kynigos, C. (2015) Constructionism: Theory of Learning or Theory of Design? In *Selected Regular Lectures from the 12th International Congress on Mathematical Education* 417- 438, Sung Je Cho (Ed), Springer, DOI 10.1007/978-3-319-17187-6
9. Kynigos, C., Lagrange, B. (2014) Cross-analysis as a tool to forge connections amongst theoretical frames in using digital technologies in mathematical learning., *Educational Studies in Mathematics*, 85 (3), 321-327.
10. Dragon, T., McLaren, B., Mavrikis, M., Harrer, A., Kynigos, C., Wegerif, R., Yang, Y. (2013) Metafora: A Web-Based Platform for Learning to Learn Together in Science and Mathematics, IEEE *Transactions on Learning Technologies*, vol. 6, no. 3, 197-207.
11. Kynigos, C. (2007) Half-Baked Logo Microworlds as Boundary Objects in Integrated Design, *Informatics in Education*, 2007, Vol. 6, No. 2, 1–24, Institute of Mathematics and Informatics, Vilnius.
12. Kynigos, C. (2007) Half-baked Microworlds in use in Challenging Teacher Educators' Knowing, *International Journal of Computers for Mathematical Learning*. Kluwer Academic Publishers, 12 (2), 87-111.
13. Laborde, C., Kynigos, C., Hollebrands, K. and Strasser, R. (2006) Teaching and Learning Geometry with Technology, *Handbook of Research on the Psychology of Mathematics Education: Past, Present and Future*, A. Gutiérrez, P. Boero (eds.), 275–304, Sense Publishers. 162
14. Kynigos, C. (2004). A Black and White Box Approach to User Empowerment with Component Computing, *Interactive Learning Environments*, Carfax Pubs, Taylor and Francis Group, Vol. 12, Nos. 1–2, 27–71.
15. Kynigos C. (2002). Generating Cultures for Mathematical Microworld Development in a Multi-Organisational Context. *Journal of Educational Computing Research*, Baywood Publishing Co. Inc. (1 and 2), 183-209.

On-going European projects

1. 2023-2025: TransEET Transforming Education with Emerging Technologies, HORIZON Coordination and Support Actions, HORIZON-WIDERA-2021-ACCESS-03-01 – Twinning. Project: 101078875 (Συντονιστής Φορέας ΕΕΤ, ΠαιτΔΕ, Φ.Σ., ΕΚΠΑ)
2. 2022-2025: Exten.D.T.2 Extending Design Thinking with Emerging Digital HORIZON-RIA Proposal number:101060231, Technologies, Activity:HORIZON CL2-2021- TRANSFORMATIONS-01-05 (Συνεργαζόμενος Φορέας ΕΕΤ, ΠαιτΔΕ, Φ.Σ., ΕΚΠΑ)
3. 2020–2022: GAMMA' Game-Based learning in Mathematics, (2020-2022) Erasmus+ Programme, KA2 - Cooperation for innovation and the exchange of good practices, KA201 - Strategic Partnerships for school education, Project No: 2020-1-HR01-KA201-077794, (Συνεργαζόμενος Φορέας ΕΕΤ, ΠαιτΔΕ, Φ.Σ., ΕΚΠΑ)
4. 2020–2022: : 'STEAMTeach' ' STEAM Education for Teaching Professionalism, (2020-2023) Erasmus+ Programme, KA2 - Cooperation for innovation and the exchange of good practices, KA201 - Strategic Partnerships for school education, KA201-96C773E0, (Συνεργαζόμενος Φορέας ΕΕΤ, ΠαιτΔΕ, Φ.Σ., ΕΚΠΑ)