



# Design thinking in engineering education

Hariklia Tsalapatas, November 21, 2021



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▶ Find a solution to the problem

«how can premature babies be saved in India, where there is a lack of incubators?»

# User-centered design

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- ▶ Focuses on the needs of the user
  
- ▶ Deploys tools such as interviews or questionnaires



# Innovation and design

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- ▶ **In the future, all problems will be design problems**
  - ▶ Education
  - ▶ Poverty
  - ▶ Health
  - ▶ Energy
  - ▶ Sustainability
  - ▶ Natural resources management



# Design thinking

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- ▶ Designers try to understand the actual problem
- ▶ Try to see the world from the perspective of the user
- ▶ Design solutions for the user
- ▶ Needs and feelings



# Design thinking

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- ▶ Several steps beyond traditional user-centered design



# Design thinking

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- ▶ Understand real, as opposed to perceived, needs
- ▶ Feelings and experiences of the user from exposure to a solution
- ▶ Consider that users may not be able to describe their needs
- ▶ E.g. Ford, first car



# Design thinking

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- ▶ Designers put themselves in the user's shoes
- ▶ Observe, empathize
- ▶ Live in the user's environment, experience challenges first hand
  - ▶ E.g. to design solutions for a small village, we need to live in the village for a few days
- ▶ This helps understand latent needs, that users don't realize they have
- ▶ Understand functional and psychological elements (feelings)



# Design thinking

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- ▶ **Observe uses in their everyday life**
- ▶ **Observe unconscious acts**
  - ▶ E.g. use a book as a doorstep
  - ▶ Label computer cables



# Design thinking

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- ▶ **Observe non-characteristic users**
  - ▶ E.g. when designing kitchen utensils
  - ▶ Children need ease of use
  - ▶ Chefs need easy cleaning

# Design thinking

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- ▶ **Observe other situations**
  - ▶ Car racing and emergency rooms

# Design thinking

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- ▶ Try to understand the real, as opposed to perceived, problem



# Design thinking example

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Find a solution to the problem

«how can we bring electricity to sub-Saharan Africa, where there are no electricity lines and no supply networks?»



# Through design thinking

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- ▶ We can introduce solutions to difficult problems, even if none appears to exist at first glance



# Design thinking example in ICT

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- ▶ How does internet change the world?
- ▶ It is all about communication
- ▶ Half of the world does not use the internet
- ▶ To bring internet to everyone, we need to understand how they will use it
- ▶ This helps introduce effective solutions



# Who uses design thinking?

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- ▶ **Entrepreneurship**

- ▶ For introducing solutions in commercial design

- ▶ **Social entrepreneurship**

- ▶ For introducing solutions to societal challenges







# Design thinking example: AirBnb

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- ▶ In the beginning, AirBnB was failing
- ▶ They used design thinking
- ▶ They understood that the problem was that customers could not understand the interior of apartments from the photos
- ▶ Improved the photos and the descriptions on the portal



# Malnutrition in east Asia

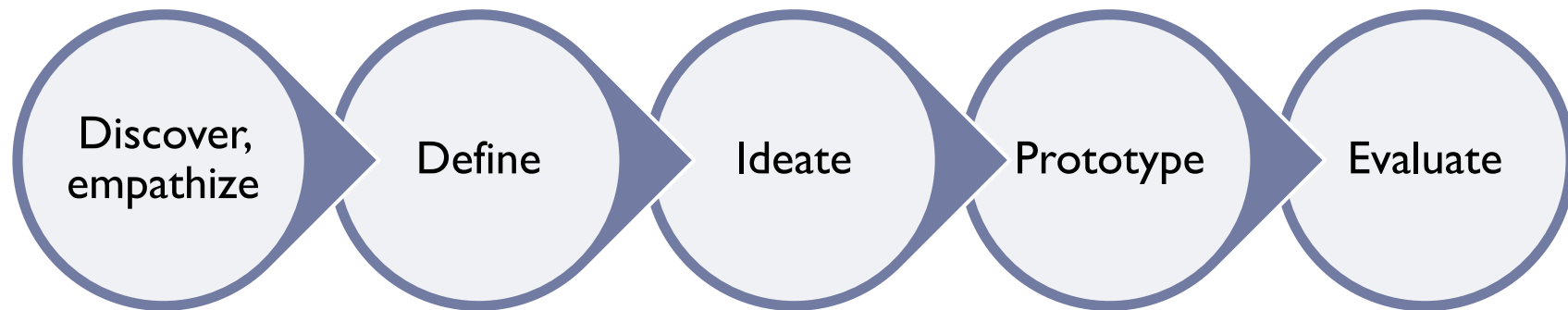
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- ▶ The children of some families were well nourished, even though they were very poor
- ▶ How did they achieve that?
- ▶ They collected small organisms when harvesting rice
  - ▶ E.g. shrimp
- ▶ That provided the needed protein



# Design thinking process

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# How to approach design

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- ▶ We do not know the solution!
- ▶ If we approach the problem thinking we do, we will miss on opportunities
- ▶ Be curious, don't judge, find patterns, listen!



# Understanding the user

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- ▶ The problem is not ours
  
- ▶ To understand the problem
  - ▶ Observe
  - ▶ Engage
  - ▶ Immerse



# Define the problem

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- ▶ **Include**
  - ▶ User insight
  - ▶ Our own understanding
  - ▶ **Point of view**



# Ideate

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- ▶ **Generate as many ideas as possible**
- ▶ **Ideas don't need to be always reasonable**
- ▶ **We categorize ideas**
  - ▶ Reasonable, innovative, out-of-the-box
- ▶ **We select one idea that can lead to a prototype**
  - ▶ Physical, digital, but the users needs to interact with it



# Prototype and evaluate

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- ▶ This is the opportunity to get user feedback
- ▶ We introduce prototypes into the users' lives
- ▶ And observe reactions and experiences, ask questions
  - ▶ What are you thinking?
  - ▶ How do you feel?
- ▶ Prototypes are discardable





# ICT-INOV



# Vision

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«To introduce design thinking in computer engineering education for promoting innovation and entrepreneurial thinking»



# Vision

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**“Modernize and internationalize ICT higher education**

through a combination of **design thinking and gamification**

for promoting **innovation and entrepreneurial thinking”**



# Why ICT-INOV?

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- ▶ ICT is an innovation sector
- ▶ Expected to drive growth in the coming years
- ▶ For every job in innovation sectors, another 5 are created in others
- ▶ Shortage of 900.000 ICT specialists in the EU
- ▶ At the same time youth unemployment is 24%



# Why ICT-INOV?

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- ▶ Technology evolves rapidly
- ▶ Today's technology will be obsolete in 5 years
- ▶ The most important skills developed in higher education are soft skills
- ▶ Such as innovative thinking
- ▶ That help excel in all areas



# Why ICT-INOV?

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- ▶ Someone who enters the university today will retire in 2070
- ▶ We do not know how the world will be then
- ▶ Still, need to prepare youth for this new world
- ▶ Need to build soft skills, such as innovation, critical thinking, learning-to-learn, collaboration, and more



# Why ICT-INOV?

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- ▶ Innovation skills help students turn ideas into action
- ▶ They help them collaborate, brainstorm, evaluate, prototype



# Specific objectives

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- ▶ **Innovative learning** based on **design thinking** and **gamification**
- ▶ Bring higher education in the **digital era**
- ▶ Build the **capacity of educators** to apply design thinking
- ▶ Promote the **internationalization of ICT education** through a community of stakeholders





# Direct and indirect stakeholders

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- ▶ Higher education students
- ▶ Higher education instructors
- ▶ Higher education institutions
- ▶ Industry and society



# What is innovative about ICT-INO V?

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- ▶ **Strategic development innovation**
- ▶ Building skills and competences for innovation in ICT
- ▶ Building the problem solvers of tomorrow
  
- ▶ **Pedagogical innovation**
- ▶ Experiential learning
- ▶ Gamification
- ▶ Design thinking



# Participating organizations

University of Thessaly, GR

Tallinn University, EE

Porto Polytechnic, PT

EUTRack, IT

University of Malaya, MY

UNITEN, MY

Hanoi University, VT

Von Neumann Inst, VT

ISRA University, PK

NUCES, PK

Kathmandu University, NP

Tribhuvan University, NP



# Events and instructor training

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# Events and instructor training

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# Events and instructor training

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# Other related work



# High5 Erasmus+ project

## Integrated design for higher education



**HIGH 5**



University of Thessaly, GR  
University of Lodz, PL  
University of Aveiro, PT  
Tallinn University, EE  
ULSIT, BU

▶ Design thinking, problem-solving, critical thinking

Co-funded by the  
Erasmus+ Programme  
of the European Union





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# HERA: Re-engineering higher education through active learning for growth

