Are students ready for ICT jobs of tomorrow?

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Content

- Motivation
- Introduction
- Survey
- How can universities keep up with the challenges of the future?
- Comments, conclusion, discussion

Motivation

- Common situation
- Universities are educating ICT experts for the professions of the future
- The field of ICT is dynamic and continuously evolving, and universities play a crucial role in preparing professionals for emerging careers
- Students often do not feel ready/qualified for job market
- Survey for students, after finishing their study (UNIRI)

Motivation

I believe that I am qualified for the job market	
UNIRI (N=2405)	3,89
UG (N=27)	3,44
MASTER (N=18)	4,12

I believe that my study has qualified me to work in the profession	
UNIRI (N=2408)	3,61
UG (N=27)	3,89
MASTER (N=18)	3,71

1 - not at all, 5 - completely

Student satisfaction survey, 2021./2022.

Motivation

- But paradoxically, many students work while they study
  - Then they are ready…
- If they don't feel ready now, what about the future?

- Discussion – please, share:
  - your thoughts and experiences from your faculties
  - the way you solve the problems you face

Introduction

- In some professions - doctors, teachers - this should not be so
- But in ICT it is different, self-study and education outside faculties are possible, and many students (even the best) drop out to work and earn high salaries
- There are too many new things for faculties to cover everything, and ICT is changing too fast, you have to choose and anticipate future needs and interests
- Traditionally, faculties are slow to introduce changes, it takes several years for students to complete a new programme or course, and it takes time to get a new programme approved
- Ungrateful situation
- What can we do?

Survey

- As teachers, one of our jobs is to ensure our students have the right range of skills to succeed in their careers
- It is difficult to predict future needs, future jobs, importance of ICT fields for the future
- What do students think?
- Survey
- Two groups:
  - university students
  - university graduates who are already working

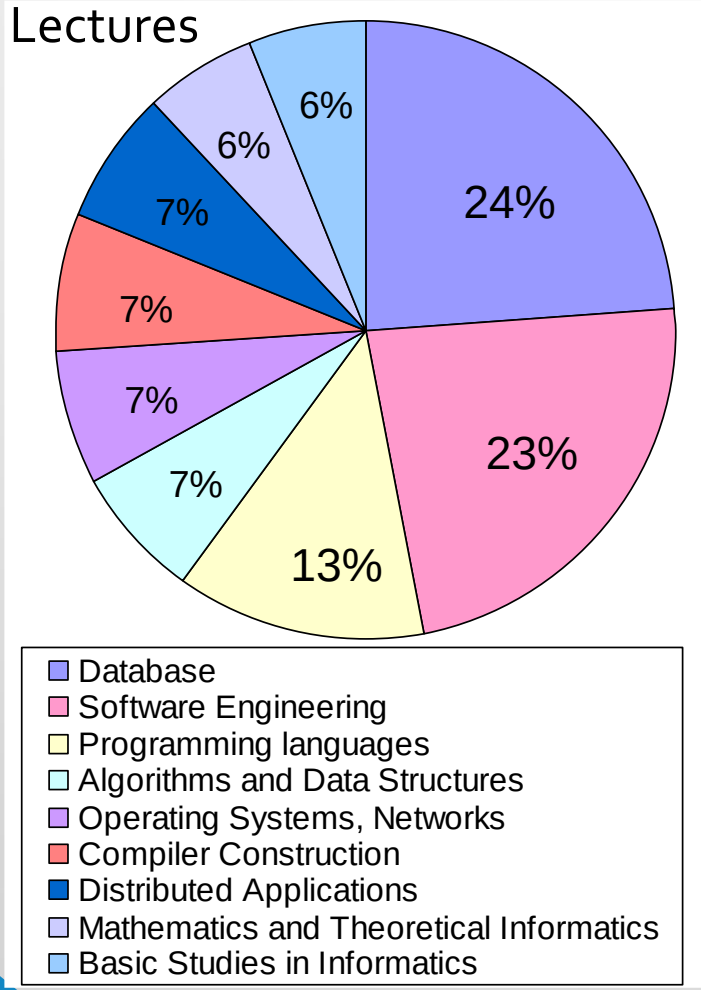
Survey from JCSE (2008.)

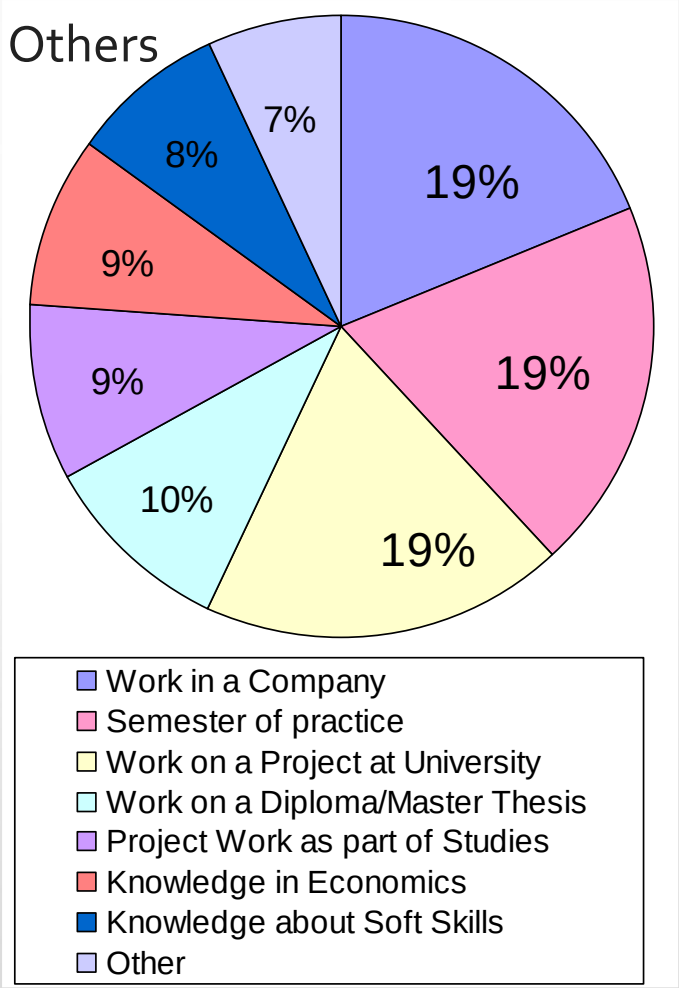
Questioning of young computer scientists working in practice at the German software company Capgemini sd&m (2008)

- Question 1: Looking back, the following lectures / exercises / seminars / side work during my informatics study contributed mostly to my professional work (3 answers possible)
- Question 2: Which technical and personal knowledge would you recommend to your university to be better represented in the informatics study (3 answers possible)

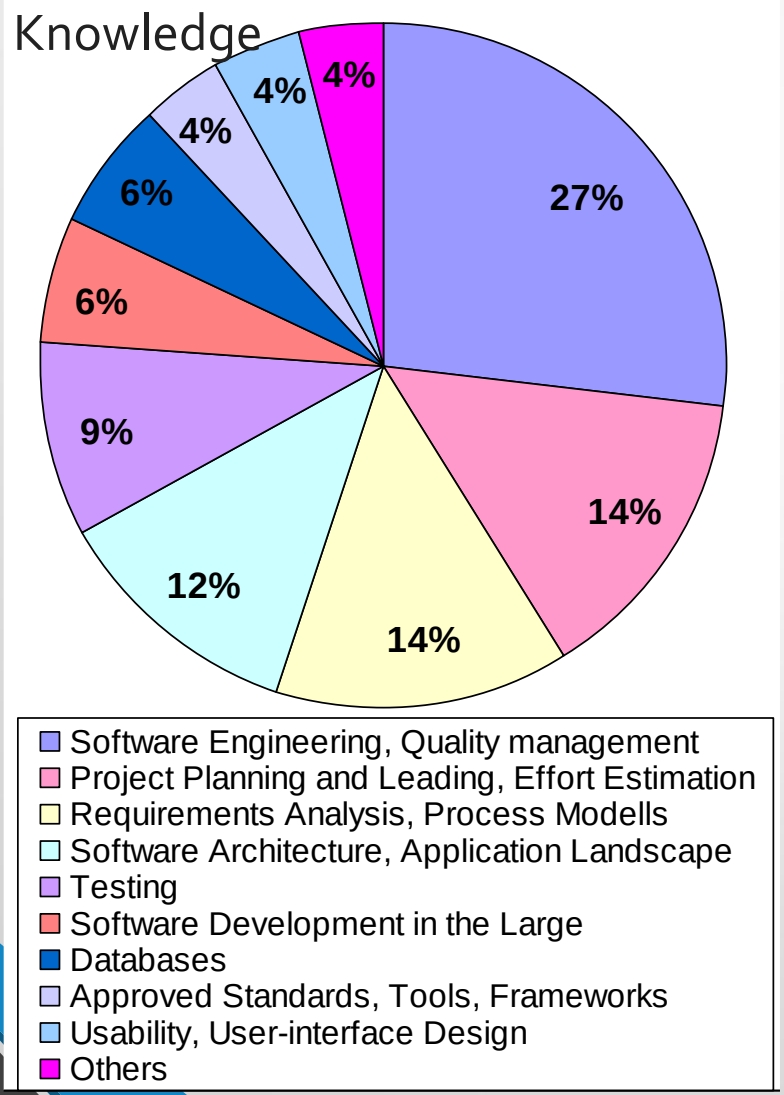
Source: Stephan Frohnhoff: Requirements of Industry to an informatics curriculum (GI conference, Oct. 2008)

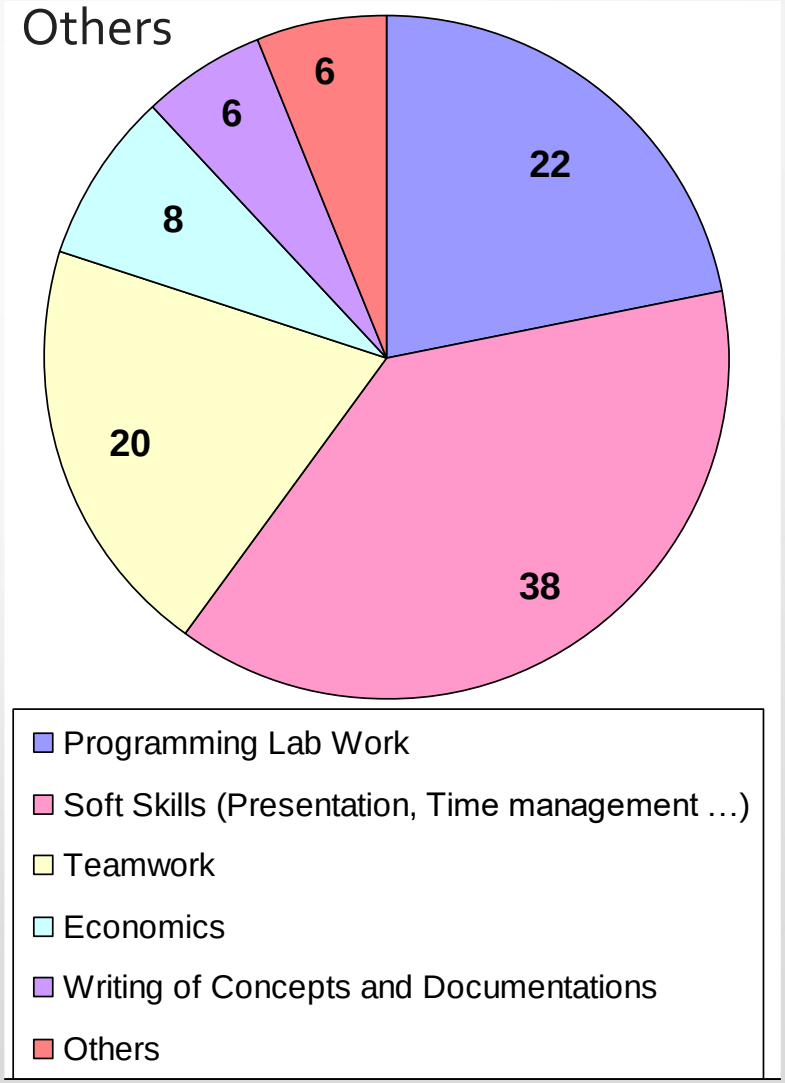
Q1: … contributed mostly to my professional work





Q2: … recommend to your university to be better represented in the informatics study





Survey from 2023.

Students of informatics, UNIRI; N=36

- Which fields you expect to be the most important for your future job?
- What would you like to be your future job?
- What type of work best suits your character?
- Of the areas listed below, which do you think may need the most experts in the near future?
- Of the new areas listed below, in which would you like to be employed?

Which fields you expect to be the most important for your future job?

Databases	75.00%
Web or Mobile application development	66.70%
Programming languages	52.80%
General principles of programming	50.00%
Software engineering	38.90%
Information systems	38.90%
Operating systems, Networks	36.10%
Multimedia	36.10%
Basic studies in informatics	36.10%
Algorithms and data structures	33.30%
Information security	33.30%
Artificial intelligence	33.30%
Mathematics and theoretical informatics	19.40%
Internet of Things	13.90%
Development of AR/VR systems	11.10%
Distributed applications	8.30%
Blockchain technologies	2.80%
E-learning	2.80%
Compiler construction	0.00%

What would you like to be your future job?

Development - regardless of development environment	58.40%
Content creator - designer, analyst, etc.	41.70%
Project management, team and task management	33.40%
Technical support - networks, operating systems, databases	25.00%
New product creator - from an idea to its realisation (e.g. startup)	25.00%
Educator - knowledge transfer	16.70%
Quality assessment	11.10%
Cybersecurity	2.80%
Computer maintenance	0.00%

What type of work best suits your character?

Working in a team with intensive cooperation with others	47.20%
Working independently on assigned tasks with as little interaction as possible with other team members	27.80%
Task analysis and management (e.g. project management)	19.40%
Education	5.60%

Of the areas listed below, which do you think may need the most experts soon?

AI	72.20%
Bioinformatics	38.90%
Intelligent information systems	38.90%
Robotics	33.30%
Data analysis	33.30%
AR/VR	30.60%
Autonomous vehicles	27.80%
Automation of business applications	19.40%
Quantum systems	16.70%
Wearable technology	2.80%
Cybersecurity	2.80%

Of the new areas listed below, in which would you like to be employed?

AI	55.60%
Intelligent information systems	38.90%
Data analysis	33.30%
Autonomous vehicles	30.60%
Automation of business applications	25.00%
Robotics	19.40%
AR/VR	19.40%
Quantum systems	11.10%
Bioinformatics	8.30%
Wearable technology	2.80%
Cybersecurity	2.80%

Survey from 2023.
Employed alumni who recently finished their study; N=20

- What kind of work do you do?
- How would you describe your job?
- When you were studying, did you expect the work you would do to be like the work you do today?
- Which of the listed topics that you studied during your studies or later researched independently are most needed for your work?
- Now that you have professional experience, evaluate which of the listed contents you think faculties should include more in ICT studies.

Survey from 2023.
Employed alumni who recently finished their study; N=20

- Based on your professional experience, which of the mentioned approaches should faculties use more, or which elements of students' personal development should they work on more during ICT studies?
- Of the areas listed below, which do you think may need the most experts in the near future?
- How well prepared did you feel for the job market after completing your studies?
- After employment, I realized that I am for the job market:
- Of the new areas listed below, in which would you like to be employed?

What kind of work do you do?

Development - regardless of development environment	80%
Technical support - networks, operating systems, databases	20%
Quality assessment	20%
Computer maintenance	5%
Project management, team and task management	5%
Educator - knowledge transfer	5%
Content creator - designer, analyst, etc.	5%
New product creator - from an idea to its realisation (e.g. startup)	5%

How would you describe your job?

Working in a team with intensive cooperation with others	70%
Working independently on assigned tasks with as little interaction as possible with other team members	30%
Education	0%
Task analysis and management (e.g. project management)	0%

When you were studying, did you expect the work you would do to be like the work you do today?

My expectation was partially fulfilled	60%
I always wanted to do this kind of work	25%
I'm doing a job I never thought I'd do	10%
I had no idea what could my job be	5%

Which of the listed topics that you studied during your studies or later researched independently are most needed for your work?

Databases	70%
Programming languages	60%
General principles of programming	60%
Web or Mobile application development	45%
Basic studies in informatics	40%
Operating systems, Networks	35%
Information systems	35%
Algorithms and data structures	25%
Software engineering	20%
Mathematics and theoretical informatics	20%
Information security	15%
Multimedia	10%
Distributed applications	10%
Internet of Things	10%
Artificial intelligence	5%
Compiler construction	0%
Blockchain technologies	0%
E-learning	0%
Development of AR/VR systems	0%

Now that you have professional experience, evaluate which of the listed contents you think faculties should include more in ICT studies.

Software development in general	73.70%
Software testing	57.90%
Data analysis	47.40%
Project planning and managing, effort estimation	42.10%
Databases	42.10%
Software architecture	36.80%
Standards, tools, frameworks	36.80%
Usability, UI/UX design	36.80%
AI	36.80%
Software engineering, quality management	31.60%
Requirements analysis, Process models	26.30%
IoT	15.80%

Based on your professional experience, which of the mentioned approaches should faculties use more, or which elements of students' personal development should they work on more during ICT studies?

Programing lab work	85%
Writing and managing documentation (project documentation, evaluations, reports)	70%
Team work	50%
Economics (e.g. knowledge required to start your own business)	40%
Soft skills (presentations, time management)	30%

Of the areas listed below, which do you think may need the most experts in the near future?

AI	85%
Robotics	50%
Data analysis	50%
Bioinformatics	40%
Intelligent information systems	40%
Automation of business applications	35%
Autonomous vehicles	20%
Quantum systems	15%
AR/VR	10%
Wearable technology	0%

How well prepared did you feel for the job market after completing your studies?

1 - not ready at all	15%
2	40%
3	30%
4	15%
5 - completely ready	0%

After employment, I realized that I am for the job market:

More ready than I thought	30%
Less ready than I thought	40%
I had a good assessment of my readiness for the job market	30%

Of the new areas listed below, in which would you like to be employed?

AI	45%
Data analysis	30%
Intelligent information systems	30%
Automation of business applications	25%
Robotics	15%
Bioinformatics	10%
AR/VR	10%
Autonomous vehicles	5%
Cybersecurity	5%
Web development	5%
Quantum systems	0%
Wearable technology	0%

Comparison of survey results

- High score: Databases and Programming languages – recognised as important for current/future job
- Important in the future: AI, Data analysis, Inteligent IS, Bioinformatics and Robotics

How can universities keep up with the challenges of the future?

- **Updating curricula** – regulary review and update their curricula (incorporate the latest technologies, tools, and concepts)
- **Industry collaboration** – establish collaboration with companies, startups, and other industry players to gain insight into real market needs and how technology is being applied in current projects (guest lectures, internships, mentoring, involvement in curriculum development)
- **Fundamental concepts** – focus on fundamental concepts that remain the same despite the rapid pace of technological development. Teach students the fundamentals of computer science, mathematics, and engineering. Fundamental concepts remain the same regardless of technological changes

How can universities keep up with the challenges of the future?

- **Interdisciplinary approach** – ICT is becoming a part of various aspect of society and industry – facilitate collaboration among students from different fields (e.g. The routes of the Frankopans)
- **Support research among students** – create research labs to explore new technologies, support students projects and competitions
- **Online courses** – provide access to online resources and knowledge from around the world (e.g. UNIRI – Coursera). These keep pace with changes faster than traditional curricula
- **Continuous teacher training** – provide teachers access to the latest technology, and additional education if needed
- Stay flexible in general and open to adaptation

What about the future ICT jobs?

- The specifics of future job roles may not always be predicted accurately
- But core skills and knowledge gained are essential for addressing new challenges
- Many universities emphasize critical thinking, problem-solving, and adaptability, which are crucial qualities for professionals in the ICT sector

Top 10 skills of 2025

Type of skill

- Problem-solving
- Self-management
- Working with people
- Technology use and development

Source: Future of Jobs Report 2020, World Economic Forum.

Some examples of professions that could become relevant in the future

- Ethics and technology specialist – focus on the ethical implications of the new technologies (AI, autonomous vehicles, biotechnology)
- Quantum technology engineer – develop quantum computing systems, cryptographic techniques and quantum sensors for various applications
- Cyber-physical systems expert – integrate physical and digital components – smart cities, wearable technology, etc.
- Human-AI interaction specialist – create natural and effective interactions with AI driven systems

Some examples of professions that could become relevant in the future

- Social media and consumer data analyst – provide insights from large datasets to help understand target groups
- AR/VR healtcare engineer – develop AR/VR systems for healthcare sector – surgical simulations, remote diagnostics, etc.
- Engineer for genetic design and biotechnology – design tools for gene manipulation and analysis of biological data for new therapies and diagnostic tools
- Autonomous aerial vehicle engineer – develop safe and efficient flight systems, e.g. – drone deliveries

Conclusion

- Even students cannot foresee their personal development, their careers
- They often think that they are less prepared than they are
- We should listen to their opinions and interests, question them and then critically analyze the results
- The learning journey for students cannot stop on graduation day
- In education, provide general knowledge that is important in all fields, no matter what field they choose to work in

Conclusion

- Collaboration with industry, research centers and technology experts also helps universities keep up with the latest developments and align their curricula with the needs of the job market
- In this way, universities help shape the future workforce by producing graduates who are able to compete in a variety of emerging ICT roles

Thank you!
Comments?