# 16.00–17.00 Questionnaire for schools

# Questionnaires for schools

Tauno Palts, Eno Tõnisson

# Plan

- Programming courses for in-service teachers
  - Impact?!
  - Questionnaire
- Informatics in Estonian schools
  - No clear picture
  - Questionnaire
  - Interviews, …

# 1) Pre-service teacher training

- Curricula of Teacher of Informatics
  - Teacher of Mathematics and Informatics (University of Tartu)
  - Teacher of Several Subjects in Basic School (University of Tartu)
  - Teacher of Computer Sciences, School ICT Manager (University of Tallinn)

- Learning programming?
  - Programming courses
    - Programming (6 ECTS)
    - Educational programming languages (3 ECTS)
    - Programming at school (Python) (3 ECTS)

# 2) Programming courses for in-service teachers in Estonia

- Tutvumine programmiga Kodu Game Lab I (16 h – 0,62 EAP) Tallinn
- Tutvumine programmiga Kodu Game Lab II (16 h – 0,62 EAP) Tallinn
- Raspberry Pi miniarvuti kiirkursus (8 h – 0,3 EAP) Tallinn
- Programmeerimine koolis (Scratch) I grupp (78 h – 3 EAP) Tartu
- Esimesed sammud programmeerimises (26 h – 1 EAP) Tallinn
- Programmeerimine koolis (Python) (104 h – 4 EAP) Tartu
- Programmeerimine – MSW Logo I (26 h – 1 EAP) Tallinn
- Programmeerimine koolis (Scratch) II grupp (78 h – 3 EAP) Tartu
- Programmeerimine – MSW Logo II (26 h – 1 EAP) Tallinn

# Robotics courses for in-service teachers in Estonia

- Arduino mikrokontrolleri programmeerimine (16 h – 0,62 EAP) Tallinn
- LEGO Mindstorms EV3, I aste Tartu
- LEGO WeDo (5,15 h – 0,2 EAP) Tallinn, Tartu
- Miniarvutite ja mikrokontrollerite arendusplatvormid koolidele (52 h – 2 EAP) Tallinn

# 3) Programming courses for **in-service** teachers in the Institute of Computer Science of the University of Tartu

- Programming in school (Scratch)
- Programming in school (Python)

- Includes
  - Few lectures
  - More practical assignements
  - Also didactics
  - Compulsory IT-company visits
- Format
  - Contact lessons
  - Videomaterials
  - …

- 2-3 months
  - 2-4 sessions
  - Between sessions e-learning

# Questionnaires

- 2 questionnaires (36 answerers)
  - **Before** the course
  - **After** the course
- Data from school visits
  - January 2014 – **10** schools were visited:
  - Teachers from **6** schools participated at the teacher training.
- Programming course gave me self-confidence to start teaching (how to use?)
  - Programming at school (Scratch) – 96% answered 4 or 5 points
  - Programming at school (Python) – 85% answered 4 or 5 points

# 4) Impact of such courses for in-service teachers?

- 3. Questionnaire

- **Reality?**
  - Teachers of different subjects teach informatics
  - Lack of knowledge about programming
    - Interest in teaching programming exists
  - What happens after the first simple programming course is taught at schools?
  - Are competitions, activities and advertising included to programming activities to introduce programming?

# Beliefs and practices

- The majority of High School Teachers teachers expressed mixed beliefs (‘empowering’ and ‘constraining’) and reported
  - feeling overwhelmed, with little control over their teaching
  - contextual barriers
  - the rapid evolution of Computing
  - their lack of knowledge about current trends and didactics in this discipline,
  - Students’ culture about **computing as playing games and surfing the Internet**.

# Short overview

1) **Pre-service** teacher training
2) Programming courses for in-service teachers in **Estonia**
3) Programming courses for in-service teachers in the Institute of Computer Science of the **University of Tartu**
4) Impact of such courses for in-service teachers

# Informatics at Estonian schools

# What takes place in Estonian schools?

- Informatics / Computer Science / …
- Schools have quite much freedom
- Nobody has a clear picture

- National level
- School level

# National curriculum for basic schools (Grades 1-9)

- **§ 4. Competences**
  - 8) digital competence …

- **§ 7. Competences sought in the first stage of study (Grades 1-3)**
  - 10) is able to use simple computer programs and technical devices used at home and at school;
- **§ 9. Competences in the second stage of study (Grades 4-6)**
  - 10) is capable of using a computer and the Internet as a means of communication and is able to perform word processing with a computer;
- Optional subject „Informatics“
  - Informaatika õpetamise üldeesmärk on tagada põhikooli lõpetaja info- ja kommunikatsioonivahendite rakendamise pädevused igapäevase töö- ja õpikeskkonna kujundamiseks eelkõige koolis, mitte niivõrd tulevase ametikoha nõudmisi arvestades. Põhikooli informaatikaõpetuses **ei ole tarvis lähtuda arvutiteaduse** kui kooliinformaatika kaudseks aluseks oleva teadusdistsipliini **ülesehitusest ega sisust**, vaid **pigem igapäevase arvuti-ning internetikasutaja vajadustest**. Samas on soovitatav reaalteaduste õppesuunaga koolidel pakkuda õpilastele lisakursust „Sissejuhatus arvutiteadusesse“.

# National curriculum for upper secondary schools (Grades 10-12)

- **§ 4. Competences**
  - 8) digital competence –…
- **§ 8. Subject fields and subjects**
  - 4) natural science: compulsory subjects - biology, geography (nature geography), chemistry, physics; **optional courses** - „Applied biology", „Geographic information science", „ Principals of chemical processes ", „Chemistry of elements", „Chemistry of life", „Physics and Engineering ", „ Another kind of physics", „Natural science, technology and society ", „Mechatronics and robotics", „3D modelling", „Technical drawing", „Use of computers for inquiry ", „ Basics of programming and development of software applications "

# Optional courses (35 hours)

- Applied biology
- Geographic information science
- Principals of chemical processes
- Chemistry of elements
- Chemistry of life
- Physics and Engineering
- Another kind of physics
- Natural science, technology and society
- **Mechatronics and robotics**
- **3D modelling**
- Technical drawing
- **Use of computers for inquiry**
- **Basics of programming and development of software applications**

# Optional courses in Estonian schools (ca 550 school in Estonia)

- Informaatika 237
- Arvutiõpetus 146
- Arvuti kasutamine uurimistöös 47
- 3d-modelleerimine 19
- Geoinformaatika 17
- Mehhatroonika ja robootika 11
- Rakenduste loomise ja programmeerimise alused 11
- Robootika 9
- Programmeerimine 7
- …
- Veebiarendus 1
- Arvutidisain 1

# What takes place in Estonian schools?

- What do we want to know?
- Who wants to know?
- How do we find out?
- ….

- What is the current situation?
- What might happen in the future?
- What is needed?

# Two-phase study

- questionnaire
  - (almost) all schools
  - base for clustering
- more thorough
  - one-two schools from each cluster
  - interviews
  - …

# Example from the USA

- High School Computer Science Surveys
  - http://csta.acm.org/Research/sub/HighSchoolSurveys.html


| | 2005 | 2007 | 2009 | 2011 | 2013 |
|---|---|---|---|---|---|
| **Survey size** | 14,000 | 13,000 | 14,000 | 19,280 | 12,510 |
| **Respondents** | 1047 | 1080 | 1153 | 1589 | 1286 |
| **Response Rate** | 7.5% | 8.3% | 8.2% | 8.1% | 10.3 |

# Some questions

- 1. Does your school offer any introductory (or pre-AP) Computer Science (CS) courses?
- 3. Are students required to take introductory CS?
- 7. What content is covered in introductory CS? Check all that apply.
- 8. What programming languages / software tools are used in introductory CS?
- 12. What percentage of students enrolled in AP CS are female?
- 18. In your judgment, do you think there are students who should be taking or would like to take the CS course(s) your school offers but who are not?
- 19. Why?
- 20. What has been the impact of the No Child Left Behind (NCLB) legislation on your CS program?
- 25. What do you perceive as the greatest challenges in teaching CS?
- 26. What do you perceive as the greatest professional development needs?
- 27. What do you believe to be the most effective methods for delivering professional development to CS teachers?

# USA

**7. What content is covered in introductory CS? Check all that apply.**

| | 2005 | 2007 | 2009 | 2011 | 2013 |
|---|---|---|---|---|---|
| **Programming** | 68% | 55% | 52% | 69% | 81% |
| **Problem solving** | *NA* | 62% | 60% | 65% | 78% |
| **Ethics & social issues** | 56% | 55% | 58% | 54% | 55% |
| **Hardware** | 60% | 57% | 53% | 49% | 47% |
| **Graphics** | 46% | 58% | 49% | 46% | 45% |
| **Web Development** | 43% | 35% | 38% | 37% | 33% |
| **Computer Security** | 14% | 38% | 47% | 35% | 33% |
| **Game Programming** | *NA* | *NA* | 19% | 32% | 42% |
| **Productivity software** | *NA* | 47% | 39% | 30% | 23% |
| **Databases** | 35% | 41% | 39% | 27% | 23% |
| **Networks** | 21% | 21% | 21% | 21% | 19% |
| **Logic** | 11% | 16% | 13% | 16% | 17% |
| **Other** | 27% | 18% | 7% | 13% | 10% |

# USA

**8. What programming languages / software tools are used in introductory CS?**

| | 2011 | 2013 |
|---|---|---|
| **Java** | 38% | 49% |
| **Scratch** | 17% | 34% |
| **Alice** | 29% | 30% |
| **Visual Basic** | 25% | 30% |
| **JavaScript** | 13% | 15% |
| **C++ or C#** | 15% | 18% |
| **Python** | 9% | 14% |
| **AppInventor** | *NA* | 13% |
| **Greenfoot** | 4% | 6% |
| **HTML** | *NA* | 4% |
| **Game Maker** | *NA* | 3% |
| **Jeroo** | *NA* | 2% |

# USA

**12. What percentage of students enrolled in AP CS are female? (Skip if your school is single-sex.)**

| | 2005 | 2007 | 2009 | 2011 | 2013 |
|---|---|---|---|---|---|
| **0% females** | *NA* | 25% | 23% | 22% | 23% |
| **1-20% females** | 58% | 48% | 48% | 53% | 55% |
| **21-40% females** | 24% | 16% | 15% | 20% | 16% |
| **41-60% females** | 15% | 8% | 10% | 5% | 5% |
| **61-80% females** | 1% | 2% | 3% | 0.4% | 1% |
| **81-99% females** | 0% | <1% | 1% | 0.4% | 0% |
| **100% females** | *NA* | 1% | 1% | 0% | 0.5% |

# USA

**18. In your judgment, do you think there are students who should be taking or would like to take the CS course(s) your school offers but who are not?**

| | 2007 | 2009 | 2011 | 2013 |
|---|---|---|---|---|
| **Yes** | *NA* | 77% | 71% | 87% |
| **No** | *NA* | 23% | 29% | 13% |

**19. Why? Please rank each reason below:**

| | 2005 Ranking | 2007 Ranking | 2009 Ranking | 2011 Ranking | 2013 Ranking |
|---|---|---|---|---|---|
| **No room in timetable** | 1 | 1 | 1 | 1 | 1 |
| **Greater interest in other subjects** | 2 | 3 | 3 | 2 | 3 |
| **Elective courses less important** | 4 | 2 | 2 | 3 | 2 |
| **Subject matter too difficult** | 3 | 4 | 4 | 4 | 4 |
| **CS is perceived to be 'geeky'** | *NA* | 7 | 5 | 5 | 5 |
| **Perceived as male-dominated** | 5 | 5 | 6 | 6 | 6 |
| **Perception of limited job opportunities** | *NA* | 6 | 7 | 7 | 7 |

# USA

**20. What has been the impact of the No Child Left Behind (NCLB) legislation on your CS program?**

| | 2007 | 2009 | 2011 | 2013 |
|---|---|---|---|---|
| **Negative impact** | 37% | 31% | 35% | 33% |
| **No impact** | 58% | 62% | 63% | 65% |
| **Positive impact** | 5% | 6% | 3% | 2% |

# USA

**25. What do you perceive as the greatest challenges in teaching CS? Please rank each challenge below:**

| | 2005 Ranking | 2007 Ranking | 2009 Ranking | 2011 Ranking | 2013 Ranking |
|---|---|---|---|---|---|
| **Lack of student interest/enrollment** | 4 | 2 | 5 | 1 | 1 |
| **Rapidly changing technology** | 1 | 1 | 1 | 2 | 3 |
| **Difficult subject matter** | 8 | 8 | 6 | 3 | 4 |
| **Lack of staff support / interest** | 7 | 3 | 2 | 4 | 2 |
| **Lack of student subject knowledge** | 5 | 6 | 7 | 5 | 5 |
| **Lack of curriculum resources** | 2 | 5 | 3 | 6 | 6 |
| **Lack of hardware / software resources** | 3 | 4 | 4 | 7 | 7 |
| **Lack of teacher subject knowledge** | 6 | 7 | 8 | 8 | 8 |

# USA

**26. What do you perceive as the greatest professional development needs? Please rank each need below:**

| | 2005 Ranking | 2007 Ranking | 2009 Ranking | 2011 Ranking | 2013 Ranking |
|---|---|---|---|---|---|
| **Time for training** | 1 | 1 | 1 | 1 | 1 |
| **Training opportunities** | 2 | 2 | 3 | 2 | 3 |
| **Training cost** | 4 | 3 | 2 | 3 | 2 |
| **Facilities and resources** | 3 | 4 | 4 | 4 | 4 |

# USA

**27. What do you believe to be the most effective methods for delivering professional development to CS teachers? Please rank each method below:**

| | 2005 Ranking | 2007 Ranking | 2009 Ranking | 2011 Ranking | 2013 Ranking |
|---|---|---|---|---|---|
| **Workshops / seminars** | 1 | 1 | 1 | 1 | 1 |
| **Online resources** | 2 | 4 | 3 | 2 | 3 |
| **Networking with others** | 4 | 2 | 2 | 3 | 2 |
| **Computer-based tutorials** | *NA* | 5 | 5 | 4 | 5 |
| **Professional conferences** | 3 | 3 | 4 | 5 | 4 |
| **College courses** | 5 | 6 | 6 | 6 | 6 |

# What do we want to find out?

- Courses
  - content
  - structure
  - subsequence, relations between courses
  - compulsory / optinal (tärget group)
  - …
- Methods
  - in class
  - group work, pair work
  - homework
  - …
- Format
  - computer clubs
  - competations, olympiades
  - …

# What do we want to find out?

- Teacher
  - preparation, education
  - what subjects (in addition to informatics)
  - training needs
  - …
- Infrastructure
  - rooms
  - software, hardware
    - computers, robots
  - wifi
  - …

# What do we want to find out?

- Needs
  - What would be needed to accomplish the future ideas?
  - What ideas?

# What do we want to find out?

- Programming
  - level
  - language
  - …
- Should the programming be compulsory for students?
  - for all students?
  - for some students?
- At what age?
- Who teaches?

# Cooperation

- University of Tartu
- Ministry of Education and Research
- Tallinn University
- Tallinn University of Technology
- Estonian Teachers of Informatics and Computer Science
- Information Technology Foundation for Education
- …
- …

Dagiene, V., & Jevsikova, T. (2013). Reasoning on the Content of Informatics Education for Beginners. *Social Sciences*, *78*(4), 84-90.

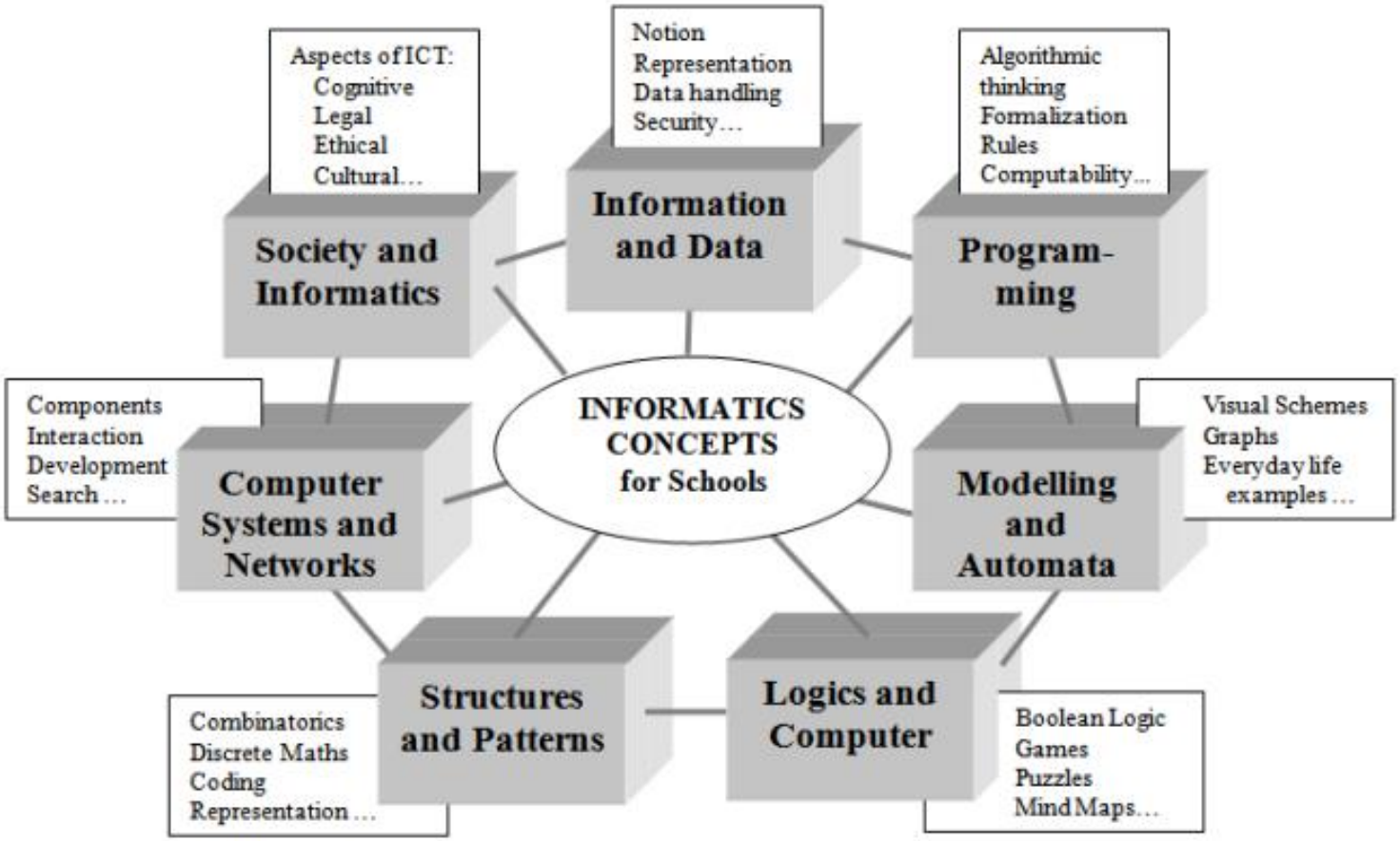


**Figure 1.** Summarized key informatics concepts for schools