### On the Discussion of Mandatory Computing Education: What are the Arguments?

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**Prof. Dr. Torsten Brinda** University of Duisburg-Essen Computing Education Research Group torsten.brinda@uni-due.de http://udue.de/ddi/

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### Structure of the talk

- Introduction
- Method
- Results
- Summary & Outlook

Torsten Brinda On the Discussion of Mandatory Computing Education, Dublin, 07/2017

### Introduction

- ICILS 2013, results: information- and computer-related competences of German learners were much lower than expected
- Nation-wide discussion about digital education
  - Broad agreement on inclusion of ICT education in all school subjects
  - Need to transform learning in schools
  - Very different positions concerning the inclusion of computing education in an overall conception
- Similar discussion going on in many other countries
- Discussions with stakeholders in politics, science, society and economy
- Recurring arguments, discussion patterns
- Question
  - o What are the arguments for and against (mandatory) computing education?

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### Method

### Literature search

- Google and Google Scholar search "mandatory" + "computing education", "computer science education", "informatics education"
- Selection of texts, which contained a noticable argumentation concerning the topic

#### Qualitative content analysis according to Mayring

- 1. Deductive QCA, e. g. Fluck et al. 2016, Passey 2016
- 2. Inductive QCA

#### Texts used for the analysis

- Scientific papers, e. g. Fluck et al. 2016, Schulte 2013
- Political papers, e. g. IBI 2016, ASWNW 2016
- Blog posts, e. g. Guzdial 2014
- Altogether 39 documents

## Arguments for (mandatory) computing education: learner-related arguments

### Facts & claims

- o CE leads to better job options
- CE leads to better (entry) salaries

### • Goals

- Creation of decision-making options on the learner's future career
- o Preparation for working life

### • Expected effects of (mandatory) CE

- Being exposed to CS
- o Life preparation
  - Development of CS interest
  - Promotion of certain skills (21st century skills, precision, resilience, creativity, logical thinking, problem solving, ...)

 Promotion of certain competences (coping with change, application-related competences, technical competences, computational thinking)

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- o Understanding the digital world, e.g. programs
- $\circ~$  Increasing the personal productivity potential
  - Creation of further action possibilities
  - Reduction of the danger of uninformed decisions
     → reduction of social costs
- $\circ~$  Access to career options in the IT sector

# Arguments for (mandatory) computing education: education-related arguments

### Facts & claims

- Relevance of knowledge about automated information processing
- ICT education produces passive users of quickly changing technology
- Application of new technologies requires conceptual understanding
- Subject affinities are shaped at elementary school level
- Goals
  - General educative value of CE
    - Personality development, identity forming, e.g. self expression, self development
    - Effective participation in a free and democratic society, e.g. understanding, creating

- Coping with everyday needs, e.g. learning to program, program to learn
- Preparation for further education
- Longevity of key concepts, ageing products vs. long-lasting principles
- Dealing with self-constructed conceptions of learners
- Expected effects of (mandatory) CE
  - Dealing with CS leads to well-educated learners

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### Arguments for (mandatory) computing education: societal arguments



- Ubiquity of digital technology, change created by computer scientists
- $\circ~$  Grown value of CS
  - For the current and future generations,
     e. g. avoiding further digital divide
  - For other sciences, e.g. bio informatics
  - For the future of mankind
- Differences in the actual and perceived needs,
   e. g. schools vs. parents/students
- o Lack of equality in computing education

#### • Goals

- Adaptation of the education system, because of societal change
- $\circ~$  Ensuring the competitiveness of the country

- Self-determined choice of social role,
   e. g. decider, leader, user, ...
- Avoiding distorted images about computer science, e. g.
  - CE = learning a programming language
  - CE = programming
  - CE = digital literacy
- Expected effects of (mandatory) CE
  - Dissemination, e. g. reduction of stereotypes, inclusion of women
  - o Equality of chances
  - o Life preparation

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# Arguments for (mandatory) computing education: organisational arguments

### Facts & claims

- Lack of relevance of computing education at school (priorities, relevance for graduation, ...)
- Integration of digital literacy in all subjects was not successful yet (equipment, teacher qualification, ...)
- Equal chances for all requires mandatory subject
- Optional subject dependent on local context
- Relation between mandatory subject and teacher education
- o Subject creates responsibility
- Necessity of structuring and networking
- Intellectual demand requires equality with other subjects

- Goal
  - o Equal treatment of all subjects
- Expected effects of (mandatory) CE
  - Mandatory CE given by well educated teachers leads to equal chances
  - Mandatory CE leads to well educated teachers

- + Cultural arguments
- + Economic arguments



## Arguments against (mandatory) computing education: educational arguments



- Questioning the educational value of CE
  - Construction of computers, technical skills, device knowledge has no educational value
  - Negation of usefulness: technical/programming knowledge not necessary in everyday life
  - Logical thinking, problem solving, application in other subjects
  - Programming does not improve logical thinking
  - Separate subject implies theoretical teaching with no practical relevance
  - Computing education is just a demand of economy
  - Competences instead of subjects
  - Application instead of concepts

- Higher relevance of other goals
  - o Traditional cultural techniques
  - $\circ~$  Media education
  - Integration is more important and sustainable than a separate subject
  - Application more relevant than concepts, analogy car driving
  - Preparation for current life more relevant than preparation for future life

# Arguments against (mandatory) computing education: organisational arguments

- Curriculum: what should be dropped?
- School development instead of bringing digitalisation to school
  - $\circ~$  Goals of school do not change
  - Future of school without subjects
  - $\circ~$  Mandatory CE is too short
  - CE "steals" content from other subjects
  - Mandatory subject promotes delegation of digital topics and hinders transformation
- Integration instead of separate subject
  - Contribution of all subjects → no need for a separate one
  - Rejecting new subjects in general

- Other important topics (peace, happiness) are also not taught in separate subjects
- Working groups in schools are sufficient
- Term CS is wasted, negative connotation
- School equipment not sufficient
- + Developmental arguments
- + Societal arguments
- + Teacher-education-related argum.
- + Financial arguments
- + Quality-related arguments

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### **Summary & Outlook**



- Large number of arguments is used to promote or to reject (mandatory) computing education
- · Arguments used are similar world-wide
- Rejecting arguments often show the misunderstanding that CE is the same as ICT education or digital literacy
- CE is abstractly delegated in all subjects assuming that all teachers are willing and competent to teach CS topics in their classes

#### Outlook

- · For all arguments empirical evidence should be collected, where available
- Rejecting arguments should be refuted, where possible
- Implementation concepts need to be collected and adapted
- Goal: convincing educational stakeholders

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### Thank you for your attention!



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#### Prof. Dr. Torsten Brinda

University of Duisburg-Essen Computing Education Research Group torsten.brinda@uni-due.de http://udue.de/ddi/

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