

Competence Analysis in the Two-subject Study Program Computer Science

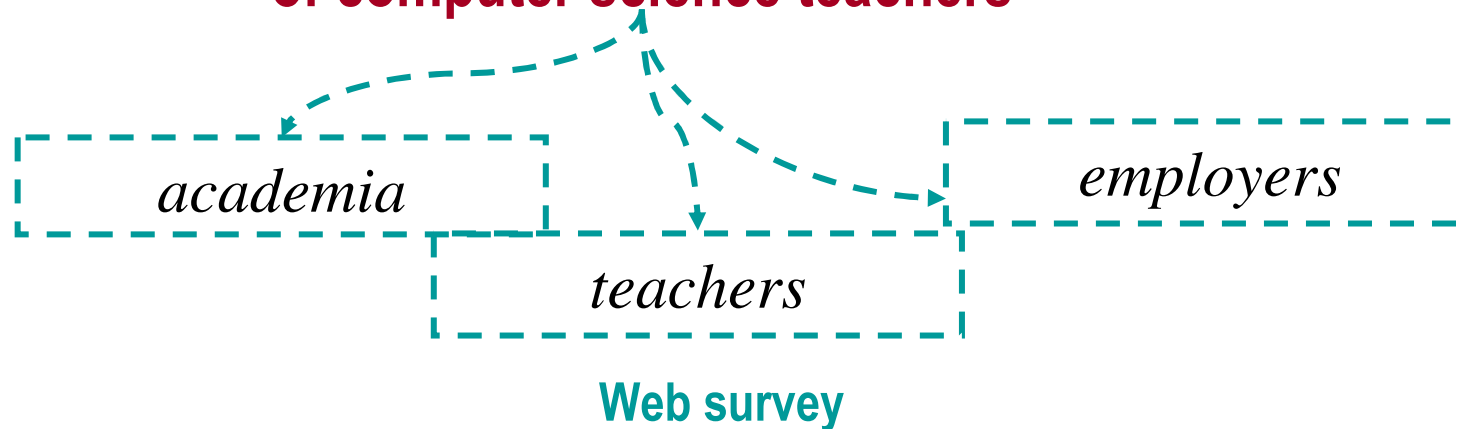
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Purpose

Empirical research on achieved and desired competences of computer science teachers



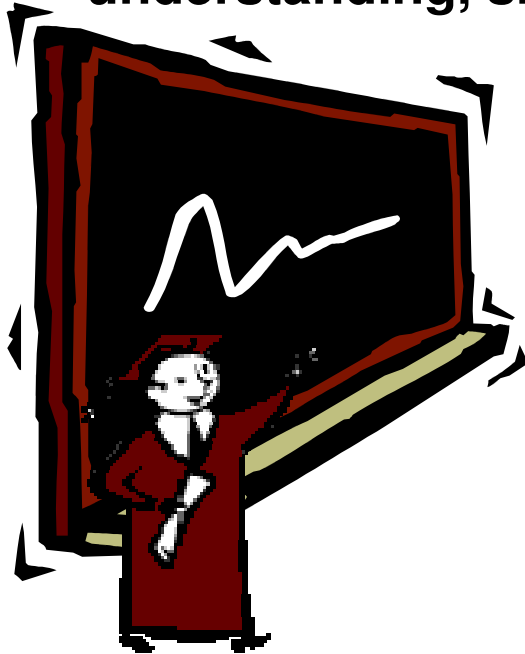
- Determine the current level of competence achievement and estimate the differences between the desired and the achieved level.
- Consider the results of analysis in the design of new curricula in the framework of the Bologna processes.



Introduction - competences

... generally comprehend expert and didactic knowledge and skills from the subject field and pedagogical and psychological knowledge for teaching.

- ... defined as dynamic combination of knowledge, understanding, skills and abilities.



Set of 19 competences:

- **Generic** – according to **Tuning**
- **Subject specific** - according to **Computing Curricula**
 - the **ACM** document's authors are representatives of well-known computer science organizations, (**IEEE Computer Society** and **Association of Computing Machinery - ACM**)

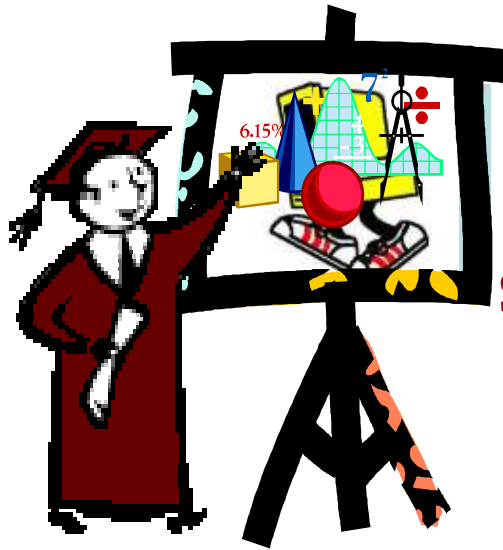


Introduction - list of competences

1. Understanding and application of general and didactical knowledge in the field of teaching.
2. Interdisciplinary knowledge linking.
3. Application of special pedagogical knowledge to teaching pupils with special needs.
4. Pedagogical classroom/group guidance.
5. Organising active and independent learning, qualifying learners for effective learning.
6. Qualification for the assessment of learners' achievements and for preparing feedback information.
7. Communicating with experts from educational fields and ability to establish and maintain partnership relations among them.
8. Collaboration with parents.
9. Formation of integral assessment of individual or group needs, about their strong and weak fields.
10. Knowledge and understanding of essential facts, concepts and theories from computer science.
11. Identification and analyzes of the problems and planning strategies for their solving.
12. Selection and application of adequate theory and tool for specification, planning and realization of the system.
13. Considering the principles of human-computer interaction in the system planning and evaluation.
14. Critical analyses and evaluation of the systems' or their parts in accordance with the specifications.
15. Knowledge and application of social, professional and ethical aspects related to computer technology.
16. Knowledge and understanding of didactic particularity of computer science and informatics.
17. Theoretical and practical knowledge for effective integration of information and communication technology (ICT) into the field of education.
18. Ability for information management.
19. Usage of professional terminology and appropriate language through professional and pedagogical work.



Introduction - competences



Personal: related to determination,

- Parts:
- (1) personal; self-confidence, intelligence,
 - (2) development; initiative, responsibility,

(3) professional; related to the practical activities of the teacher in and out of the classroom, confidence, practical communication skills and other values of the teacher

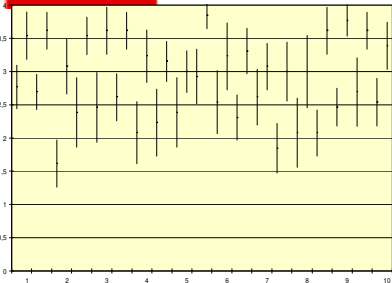
Social part of the competences is related to the techniques of communication, interaction, involves knowledge about and allows recognition of the personal creative use of time for realization of problems solving, motivation and the needs of the pupils and the subject-specific goals organizing team work



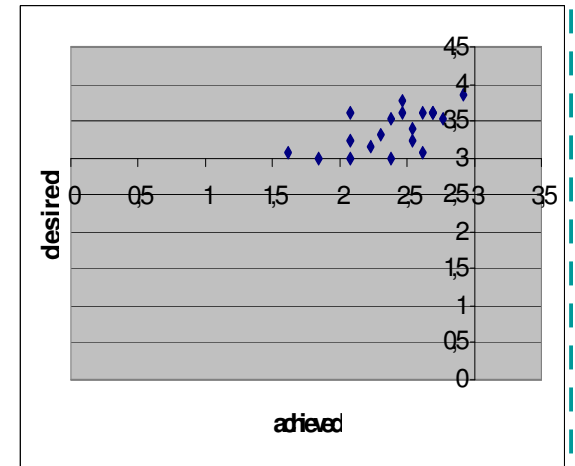
Methods



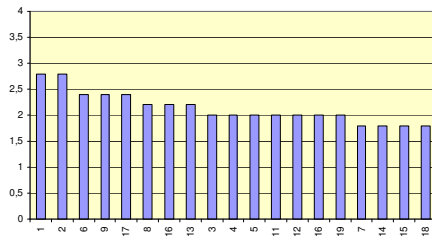
graphs



Confidence intervals

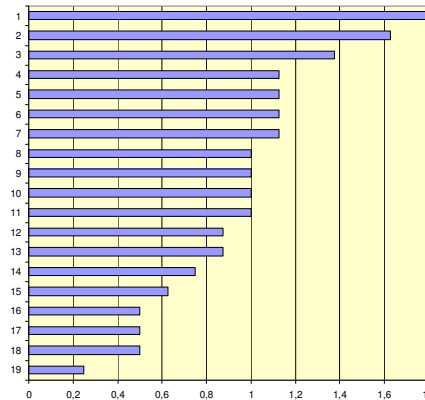


Scatterplot



Sorted estimates

Beaver 2011



Sorted differences



Methods-sample of respondents

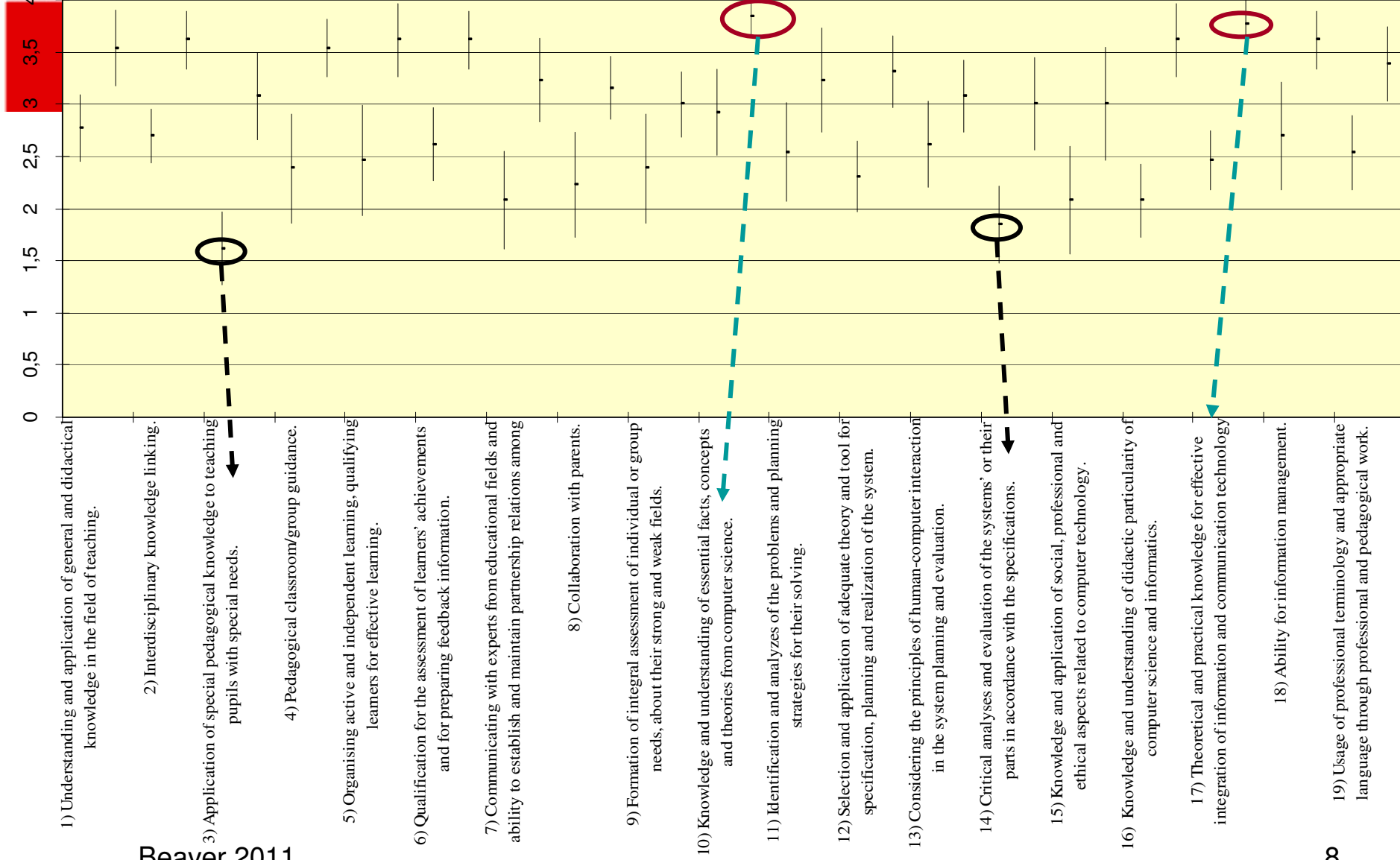


There were 96 participants involved in the web survey.

- The number of participants was relatively small
 - almost all the graduates on the computer science program
 - almost all the teaching staff, professors and teaching assistants who teach in the computer science program.
- The respondents can be divided into two main groups:
 - 77 graduates of the study program Mathematics and computer science on the Faculty of education and headmasters, “*teachers*”,
 - 19 professors and teaching assistants, »*academicians*«.



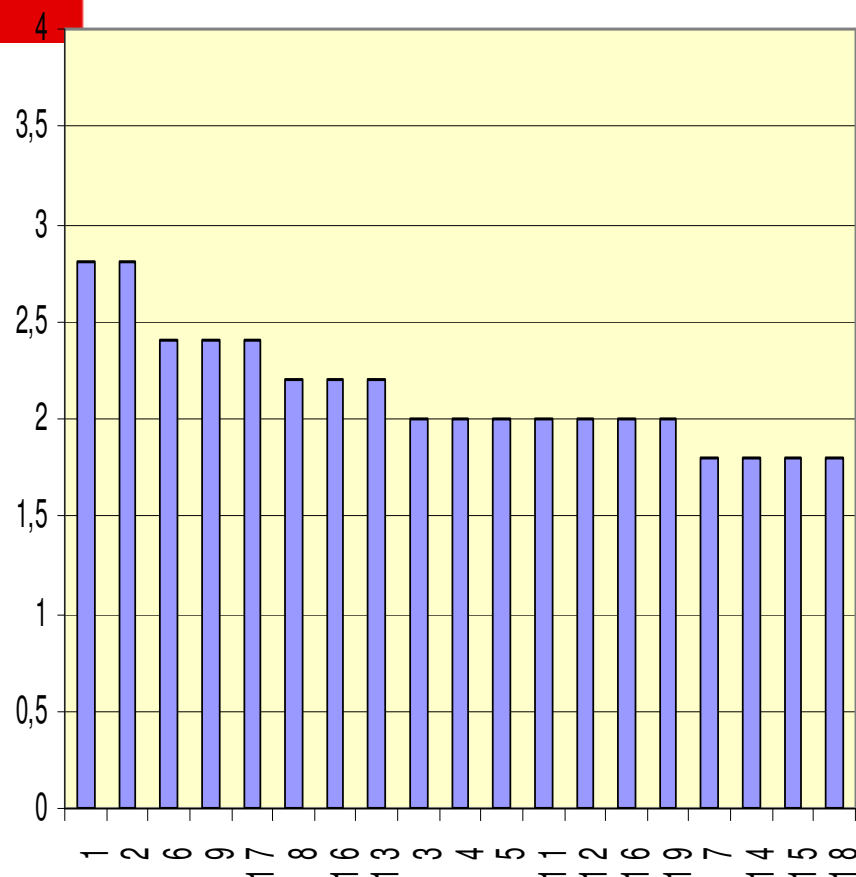
Results - confidence intervals $P > .95$



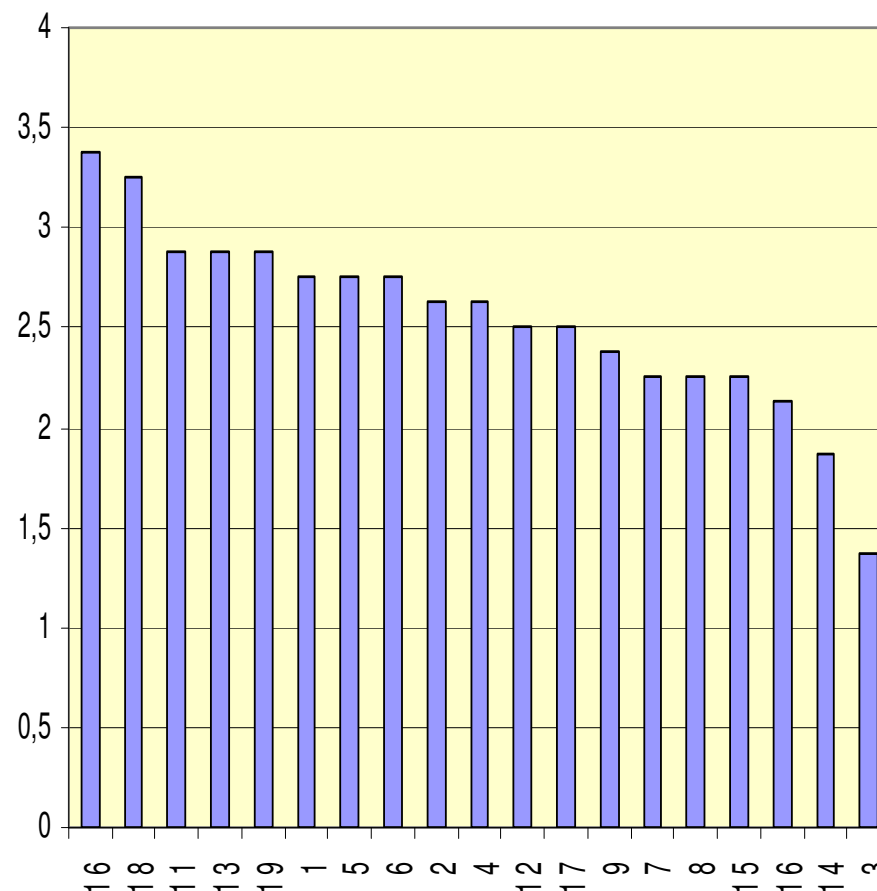


Results- sorted graphs “achieved”

Estimations of achieved competences - "teachers"



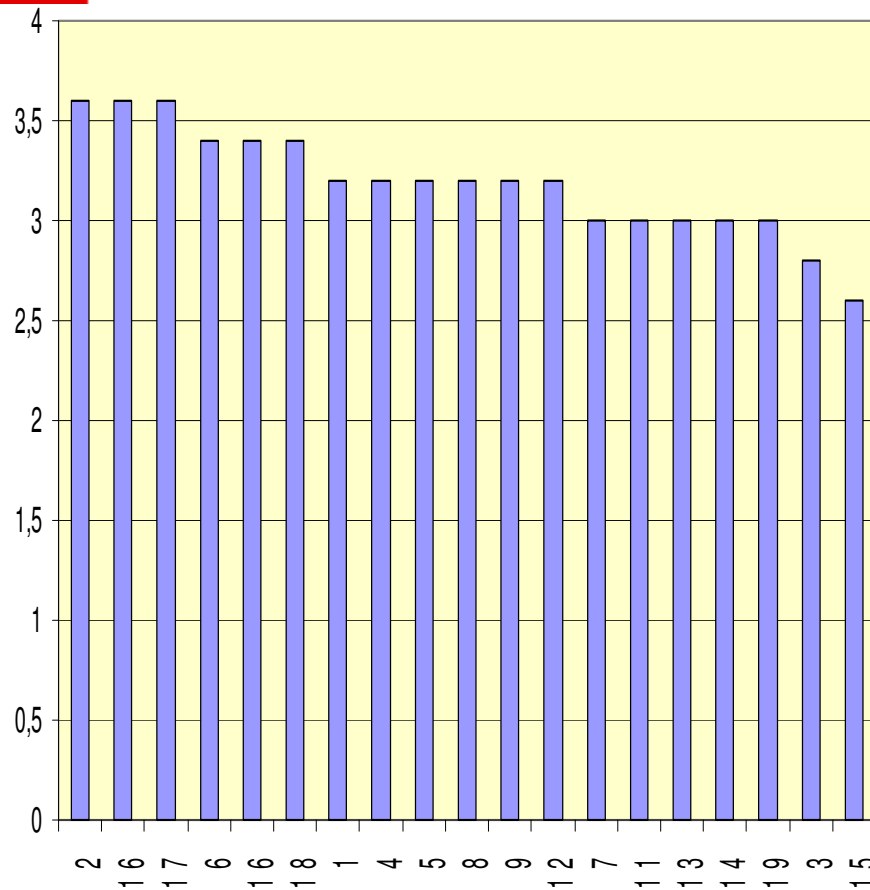
Estimations of achieved competences - "academicians"



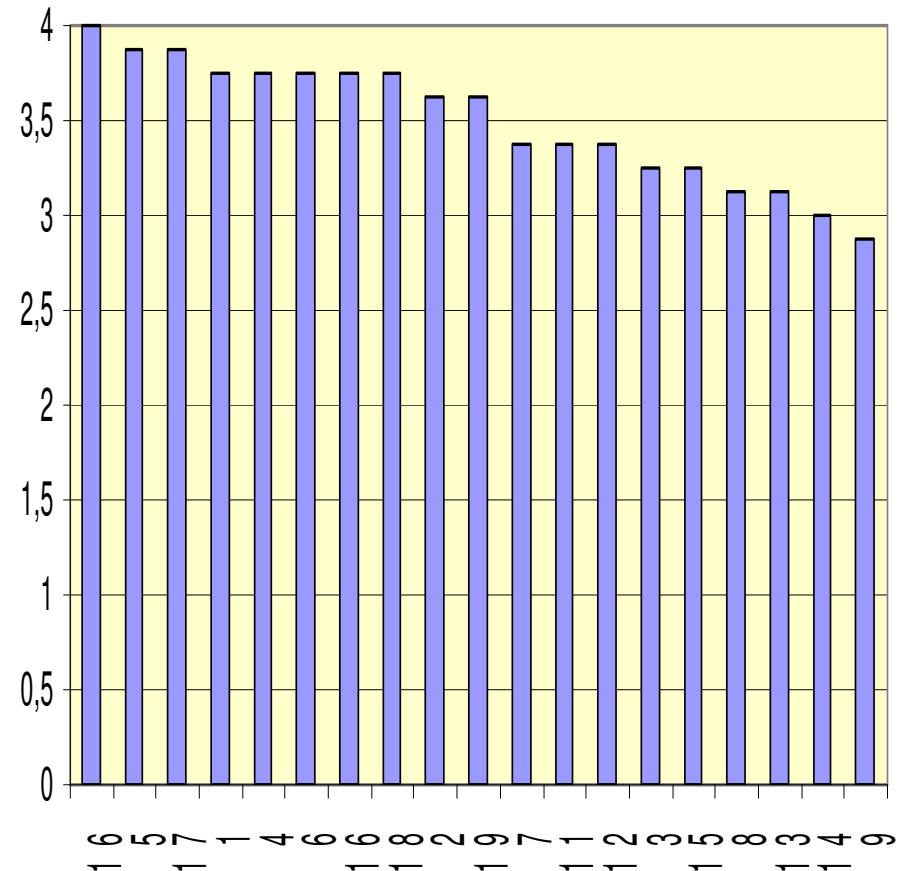


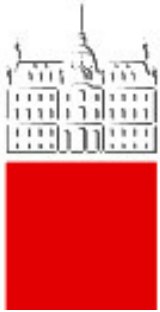
Results- sorted graphs “desired”

Estimations of desired competences -- "teachers"



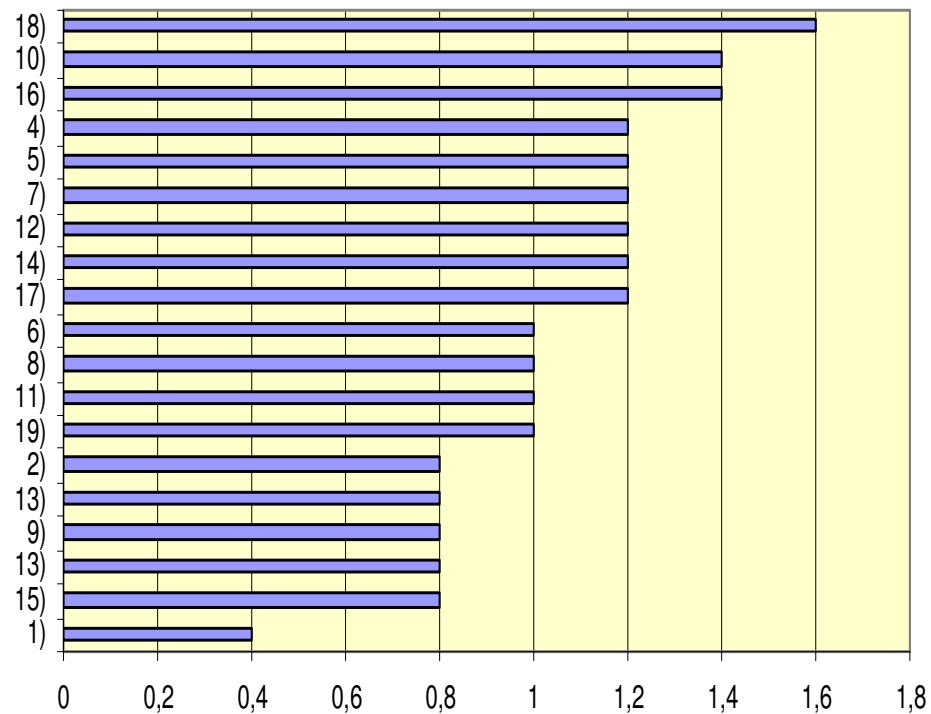
Estimations of desired competences - "academicians"





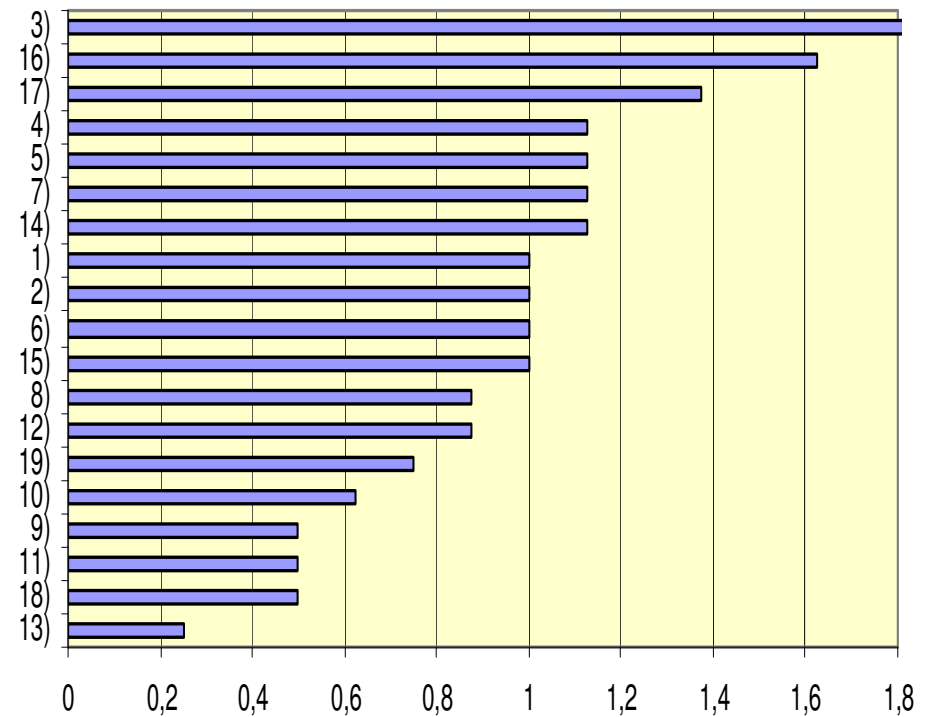
Results- differences

Difference between desired and achieved competences -
"teachers"



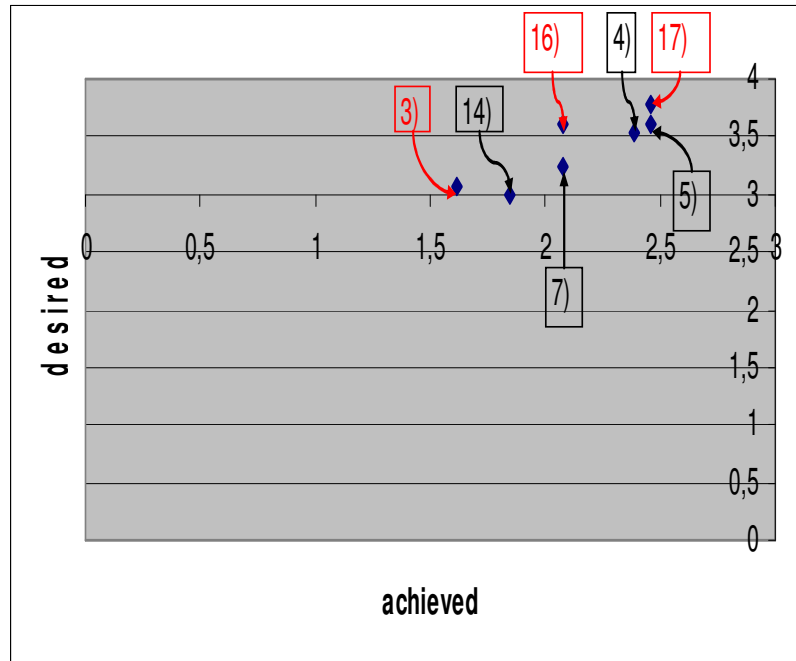
Beaver 2011

Difference between desired and achieved competences -
"academicians"





Results - scatterplot - all



	Competence	achieved	desired	difference
16)	Knowledge and understanding of didactic particularity of computer science and informatics.	2,08	3,61	1,54
3)	Application of special pedagogical knowledge to teaching pupils with special needs.	1,62	3,08	1,46
17)	Theoretical and practical knowledge for effective integration of information and communication technology (ICT) into the field of education.	2,46	3,77	1,31
4)	Pedagogical classroom/group guidance.	2,46	3,61	1,15
5)	Organizing active and independent learning, qualifying learners for effective learning.	2,38	3,54	1,15
7)	Communicating with experts from educational fields and ability to establish and maintain partnership relations among them.	2,08	3,23	1,15
14)	Critical analyses and evaluation of the systems' or their parts in accordance with the specifications.	1,85	3	1,15



Discussion



“*Teachers*” think general teaching competences are achieved better in comparison with specific competences, but “*academicians*” think that specific computer science competences are achieved good enough.



Partnership between faculty and partners in practice - teachers and headmasters - played an important role in the competence analysis.



For all respondents the following competences are important: »knowledge and understanding of didactic particularity of computer science and informatics« and »theoretical and practical knowledge for effective integration of ICT into the field of education«.



Discussion

- There was not enough emphasis on the didactic topics for teaching of computer science in the current study program.
- Students were not adequately taught about the particularity of teaching pupils with special needs.
- They did not obtain enough applicative knowledge for integration of ICT in education.



- The results of the analysis for other teacher education programs are similar with the results Computer science teachers program.
- The results of competence analysis were a base for the design of new Bologna curriculum.
- “Critical” competences were appropriately “covered” and developed through different courses in the renewed computer science program.



CS teacher education study program

- CS core curricula
 - Systems 1 (AR 36)
 - Systems II (OS 18, NC 15)
 - Programming (PF 35)
 - Algorithms (AL 31)
 - Progr. technologies (PL 21, SE 16)
 - Data management (GV 3, IM 11, IS 10)
- Didactic courses
 - Use of ICT in education (HC 8, SP 16, SE 15) **8 ECTS**
 - Didactics of CS **8 ECTS**
- Elective course
- Prerequisites (DS 43, PF 12)