An Exploratory Investigation of Change in Students' Subjective Perception of Informatics

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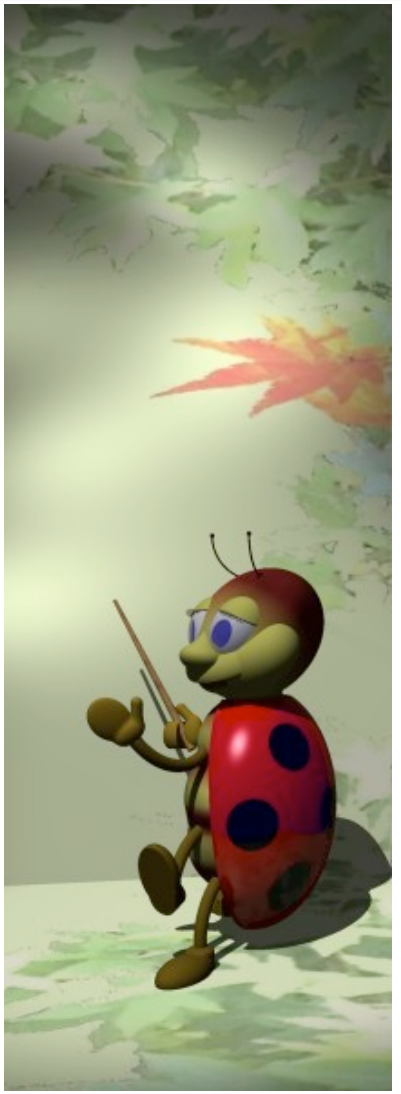
Outline

1. Aims and Scope
2. Analysis of the Answers
3. Conclusions



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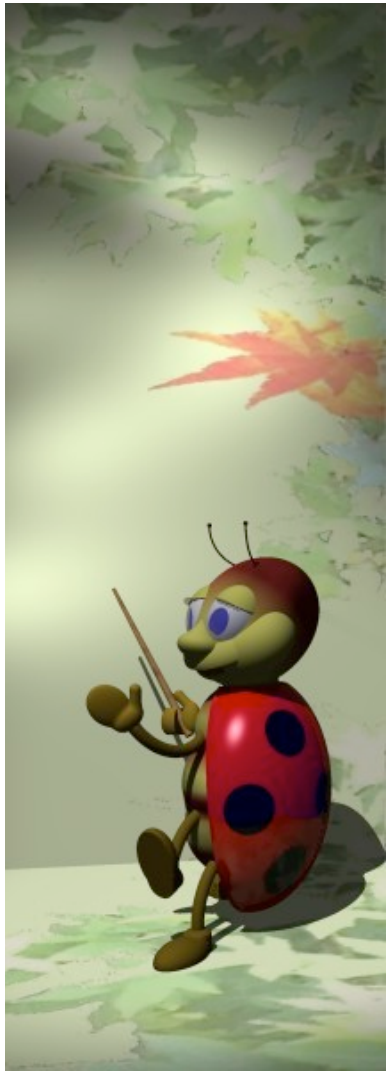

Aims: Research Questions

RQ1. How does students' perception of informatics change across subsequent instruction levels?

RQ2. Is the perception of first-year students in Informatics the same as that of students in general high schools?

RQ3. How central is programming in students' perception of informatics?

RQ4. Does the perception of informatics change after exposition to short-term outreach activities?

Scope: Approach and Context

- Approach:
  - subjective perception questionnaire (pre-/post-test)
  - both open- and closed-ended questions
  - *change* analyzed almost “syntactically”
- Context:
  - student attending/coming from *general* schools
  - secondary school: K7 ($\sim$ 40), K10 ($\sim$ 40) and K12 ($\sim$ 40)
  - first-year students in informatics ($\sim$ 40)
- Small-scale exploratory investigation

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Background

- Students' *views*, *attitudes* and *intentions*, Taub et al. (2012) [5]
- (Pre)conceptions, mismatch w.r.t. computer scientists' perceptions, e.g. Carter (2006) [1], Hewner (2013) [3]
- Most outreach programs (allegedly) successful in terms of declared attitudes/intentions, Decker et al. (2016) [2]
- Some caution is however suggested, Decker et al. (2016) [2], Taub et al. (2012) [5]
- Approach and treatment similar in spirit to Lakanen & Isomöttönen (2015) [4]

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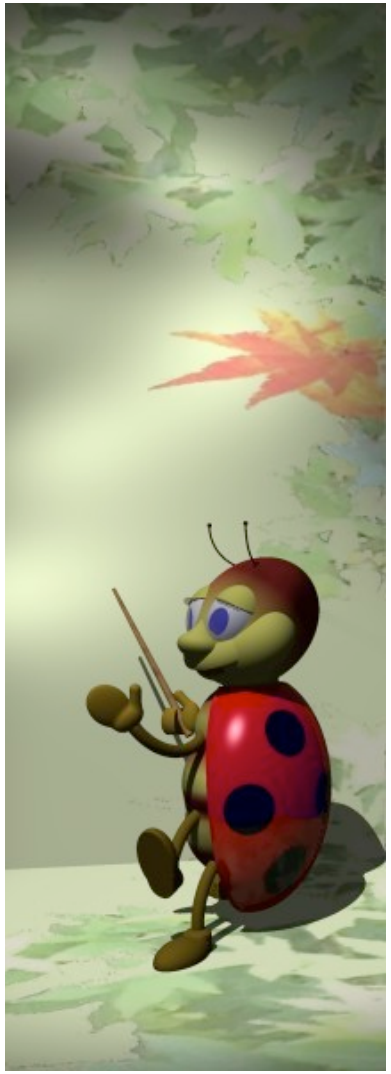

Analysis and Results

- Here focus on the first two items of the questionnaire
- Other items... See appendix

Question: Definition of *Informatics*

Based on your perception, provide a short definition of "informatics".

Treatment of the open answers (inductive coding):

- Identification and annotation of relevant keywords;
- Removal of text copied from other items of the questionnaire;
- Revision of definitions to look for synonyms and uses of a same word with different meanings;
- Organization of key terms into areas with some shared feature;
- Merging of sporadic codes into codes of broader ideas;
- Consistency checks.

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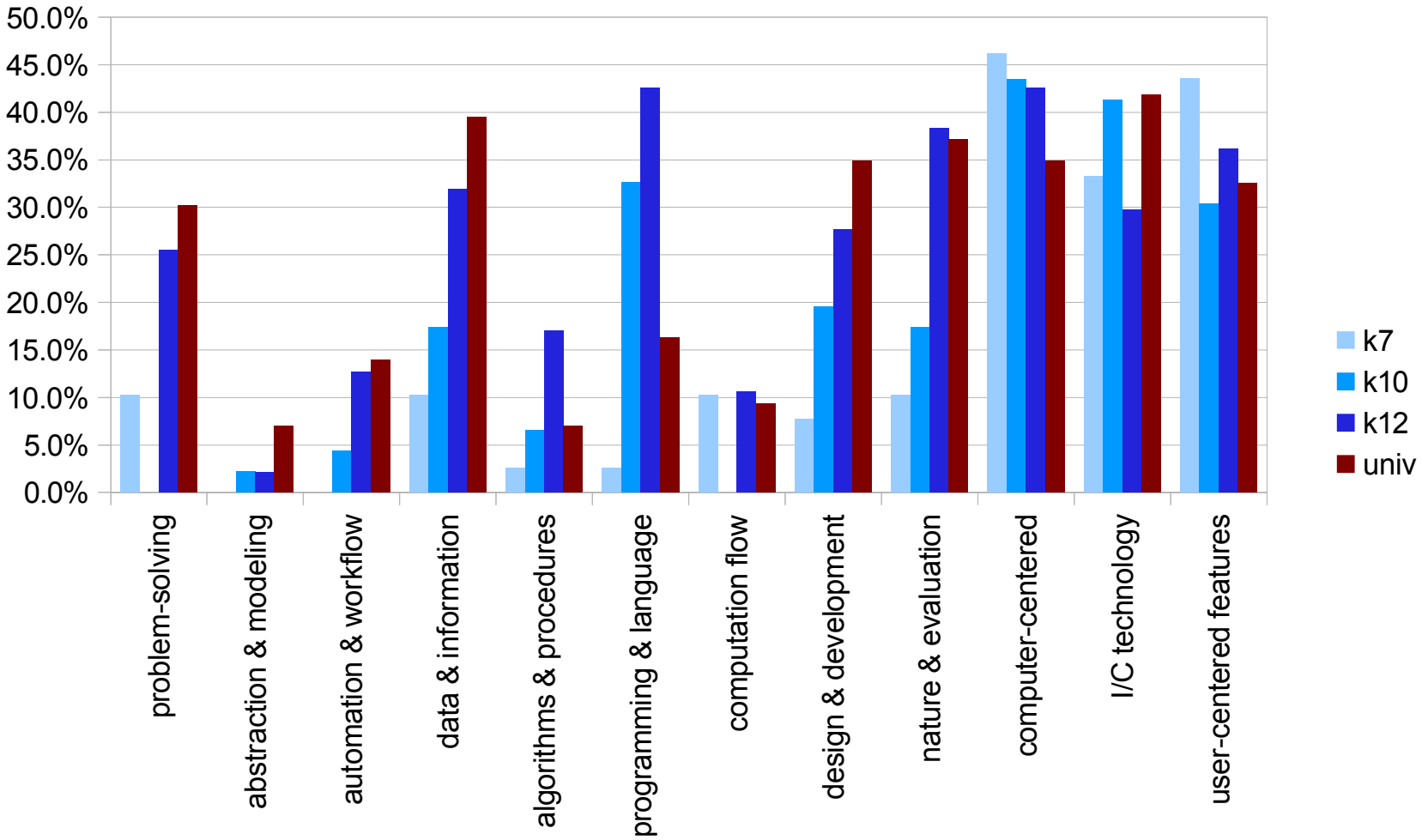
Results: Definition of *informatics*



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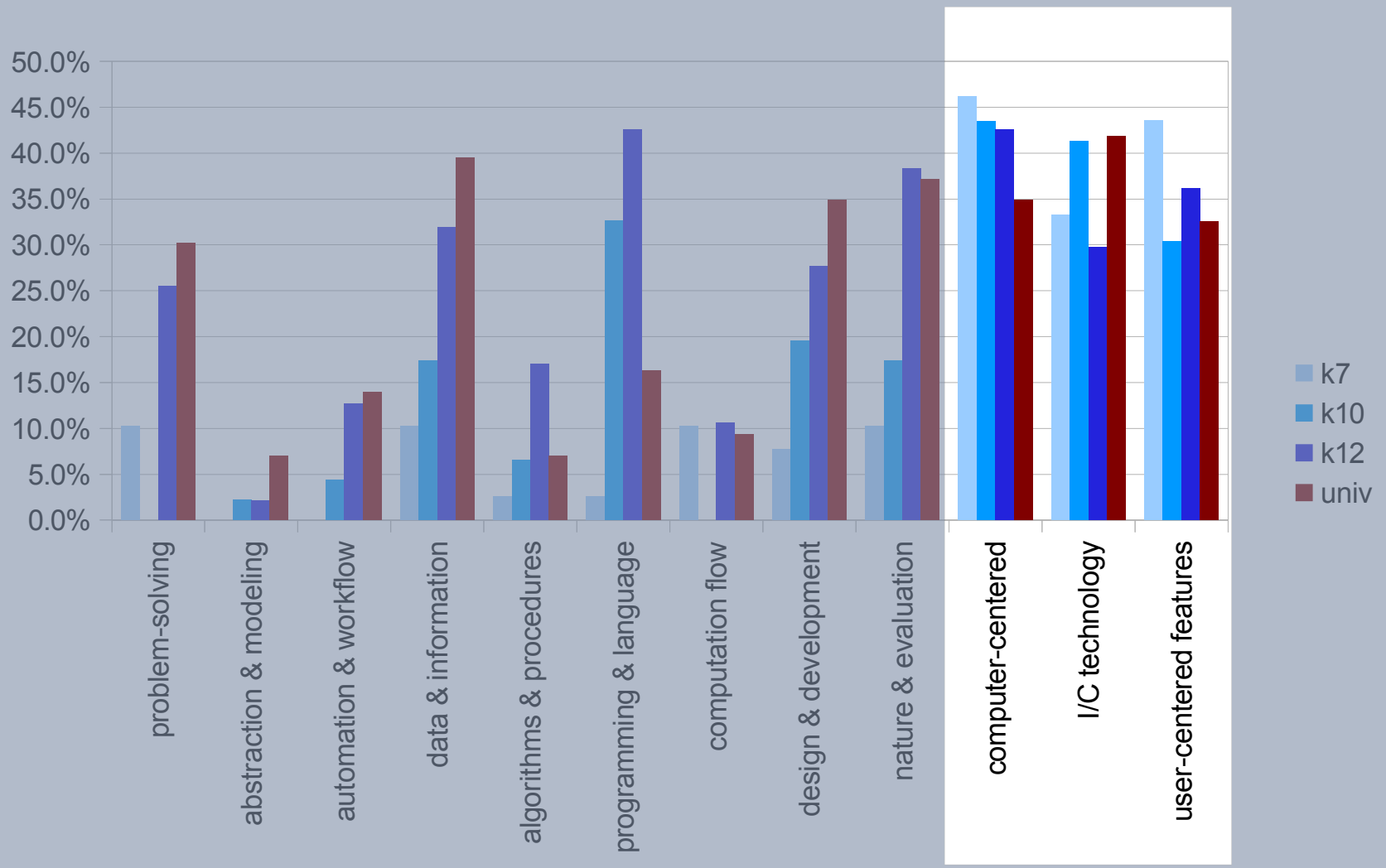

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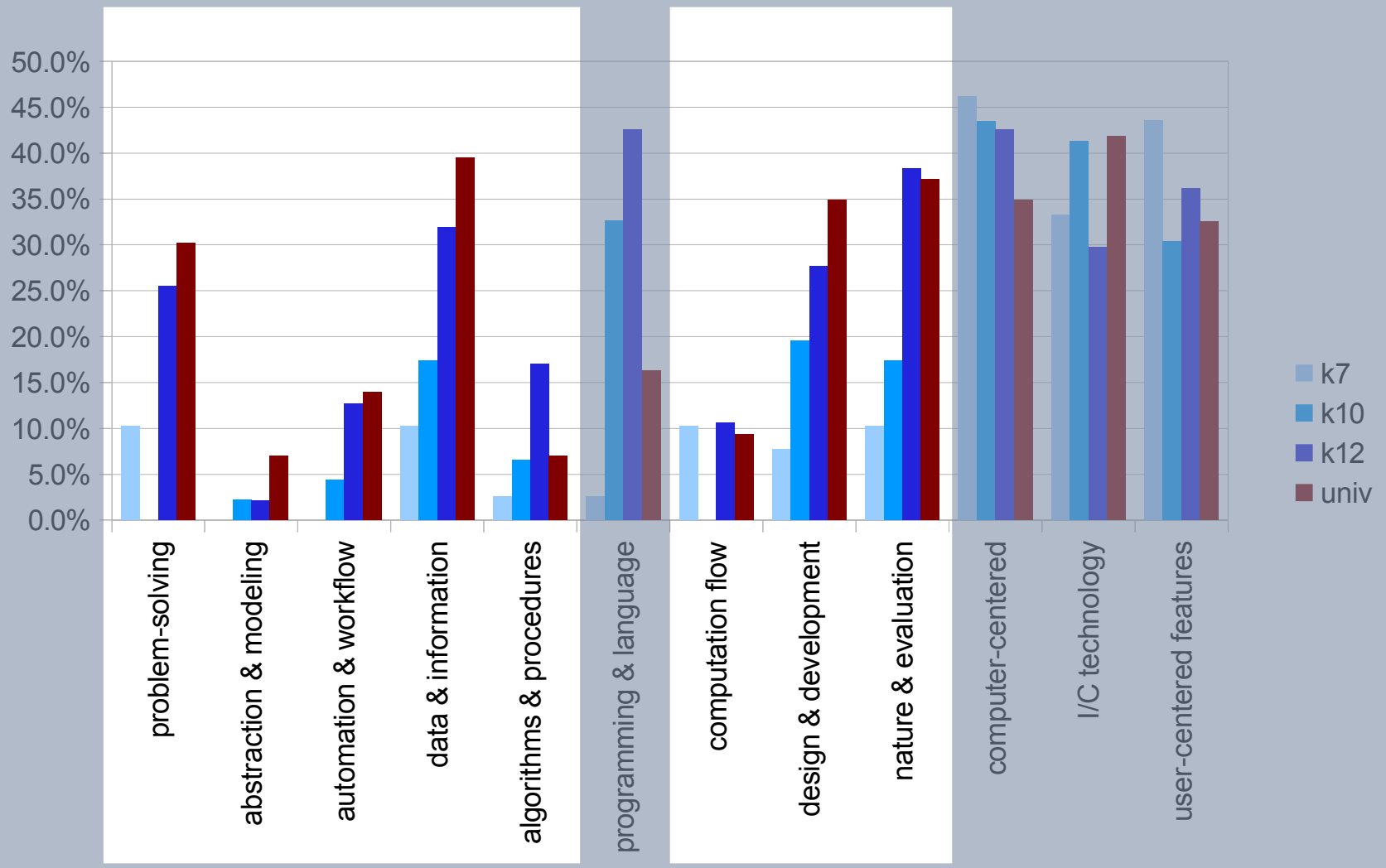

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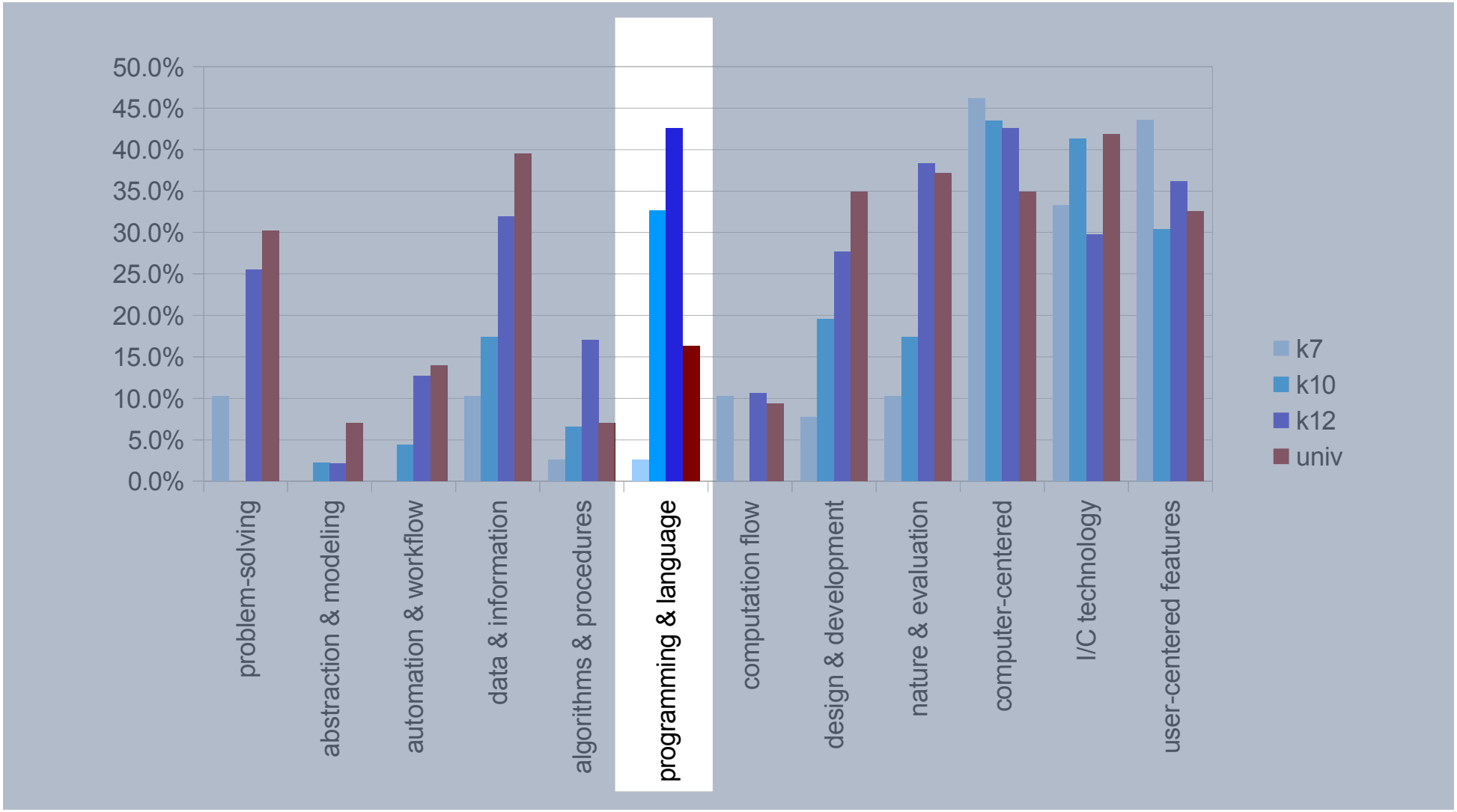
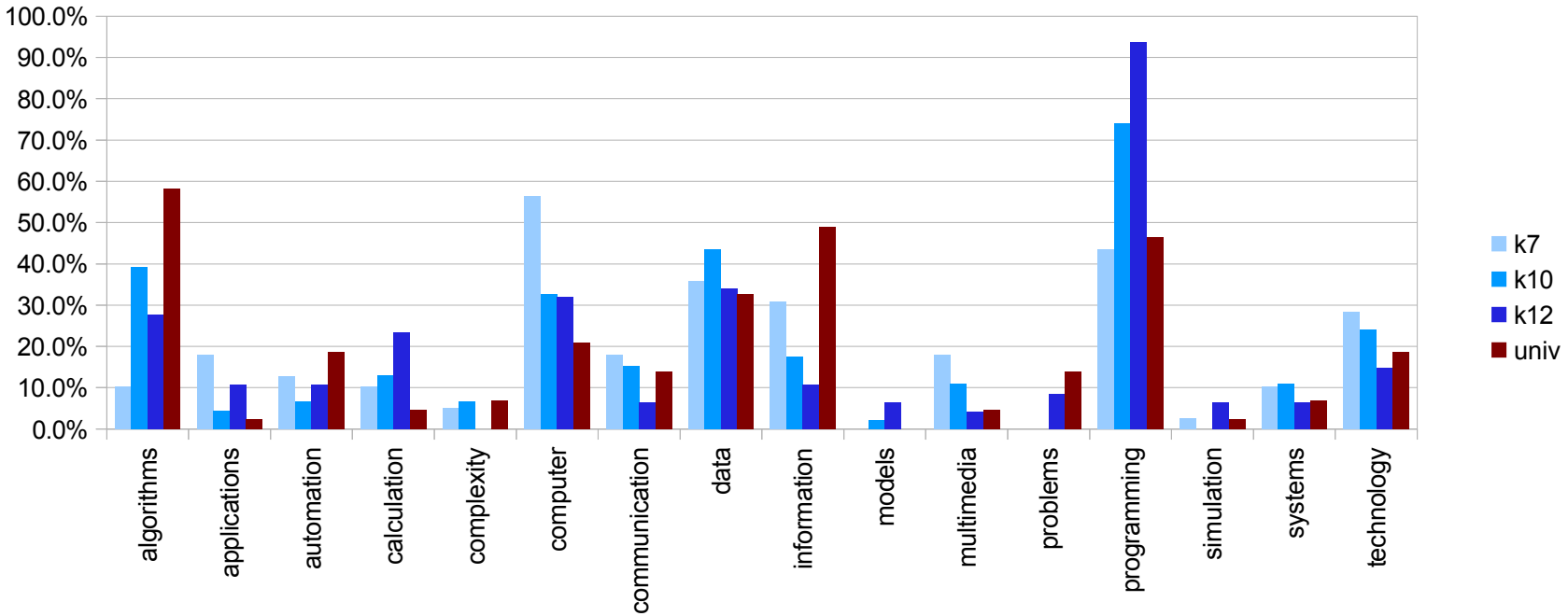


Question: Key Terms linked to *informatics*

What is informatics primarily about? From the following list choose the three terms that appear most relevant to you

algorithms
applications
automation
calculation
complexity
computer
communication
data
information
models
multimedia
problems
programming
simulation
systems
technology

Results: Key Terms linked to *informatics*



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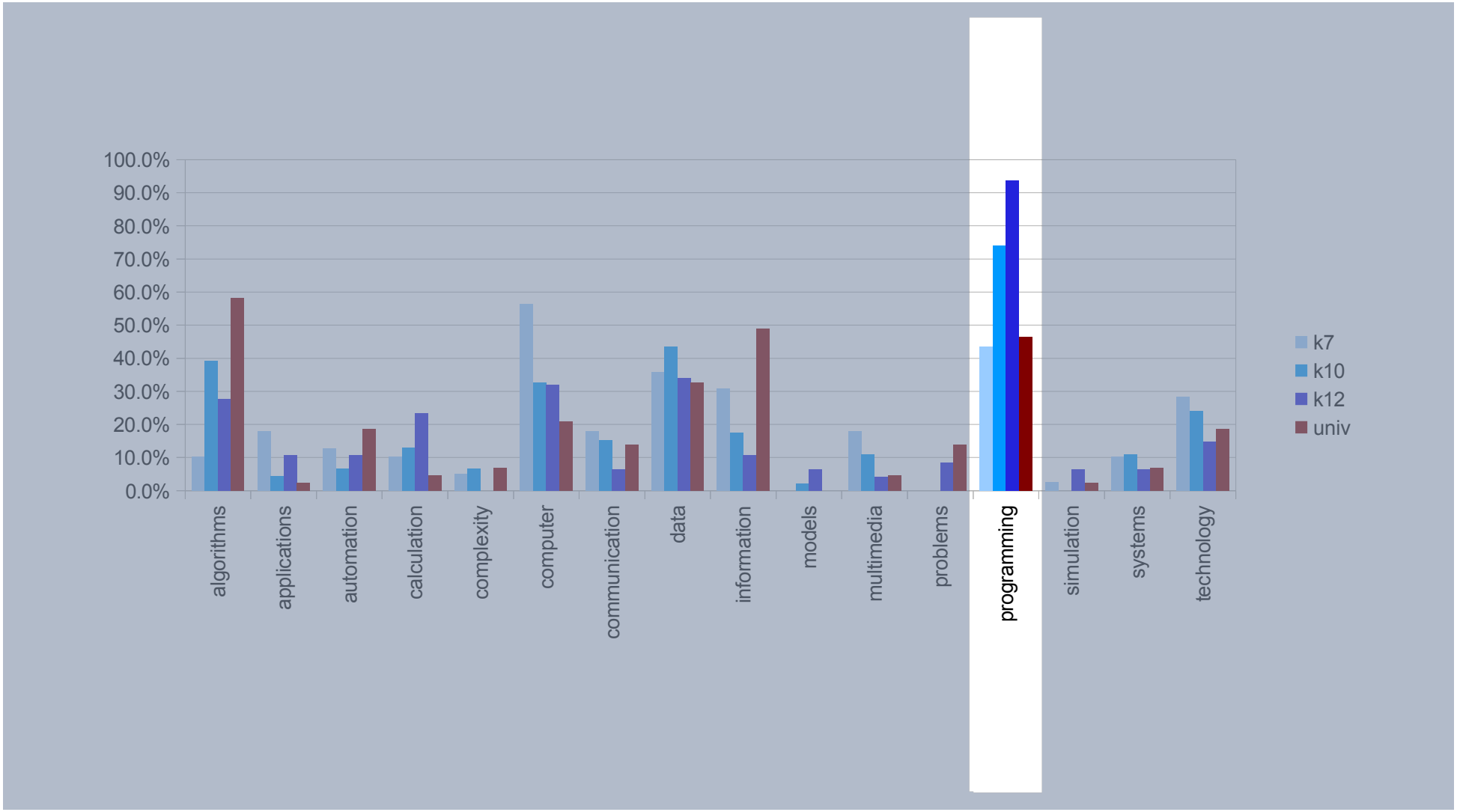

Diversity? Change?

Appropriate treatment $+$ χ^2-test :

- Options selected to answer question 2 by high school (K12) vs. university first-year students in Informatics:

  strong evidence of diversity (*p-value* = 0.005)

- Options selected to answer question 2 in the pre-test vs. the post-test:

  unclear impact of the outreach programs. . .

  no evidence of change for K7 ($p = 0.48$) and K10 ($p = 0.47$)

  but significant evidence of change for K12 ($p = 0.003$)

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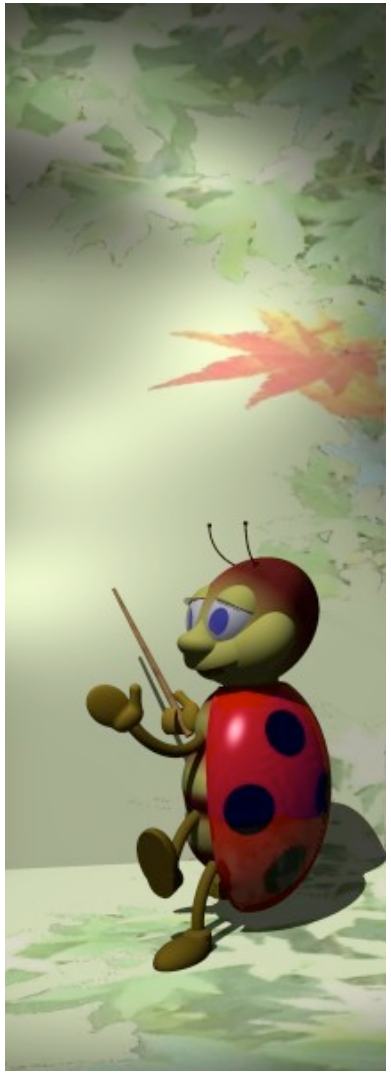

Provisional Conclusions

RQ1: Across subsequent school levels, students' views of informatics are enriched with new (in particular abstract) ideas.

RQ2: The perception of 12th-grade students does not match that of the freshmen who choose Informatics as their vocation.

RQ3: Programming is firmly regarded as a core activity in high school, whereas university first-year students in Informatics assign a less prominent role to it.

RQ4: The potential of outreach interventions to impact students' view of informatics cannot be clearly assessed; however, it may have the effect of anticipating the recognition of some conceptual aspects of the computing sphere.

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References

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A. Decker, M. McGill & A. Settle (2016)
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Thanks

Thanks for your attention...

Thanks

...and thanks to:

Federico Battistutta

Maria Cristina Lusiani & Paola Pignoni

Chiara Barbina & Carlo Cassola

Thanks

Any questions?

Appendix: Questionnaire

Two sections:

- First section about the perception of *informatics*
  — questions 1 2 3
- Second section about the perception of *programming*
  — questions 4 5 6 7

Appendix: Item 1

Based on your perception, provide a short definition of “informatics”.

Appendix: Item 2

What is informatics primarily about?
From the following list choose three terms that appear most relevant to you and sort them by decreasing importance by indicating a number from 1 to 3 (1=most important).

algorithms	information
applications	models
automation	multimedia
calculation	problems
complexity	programming
computer	simulation
communication	systems
data	technology

Appendix: Item 3

What are the principal aims of informatics?
From the following list choose two aims that appear most relevant to you and sort them by decreasing importance by indicating the numbers 1 and 2 (1=most important aim).

- *understanding* what can be explained in terms of information processing
- *constructing* new multimedia tools
- *coordinating* and facilitating the interaction with/between information-processing devices
- *formalizing* problem-solving procedures in a rigorous language
- *dealing with* and providing access to huge data sets
- *organizing* work in a rational and efficient manner
- *designing* highly complex systems
- *solving* problems by applying systems with a certain level of “intelligence”
- *studying* complex phenomena in order to control their evolution
- *developing* “computational” models of everyday life situations
- *using* information technologies effectively

Appendix: Item 4

Based on your current understanding of the topic,

provide a short definition of computer “programming”.

Appendix: Item 5

Which one of the following characterizations better matches your idea of *program*? (choose only one option)

- a program is the product of carefully planned work, carried out with suitable tools, usually by a professional team.
- a program is the formal coding of an algorithm, based on which we can rigorously verify if it solves a problem correctly and efficiently.
- a program is an object with the potential of giving rise, with the aid of a computing device, to interesting processes to analyze and study.

Appendix: Item 6

Based on your perception, which one of the following *program* purposes is most important? (choose only one option)

- communicating clearly and precisely to others problem-solving ideas in the sphere of information processing.
- experimenting with models and algorithmic ideas in order to analyze their properties in detail in a wide range of situations.
- providing a service that meets as much as possible the needs of potential users, in order to make their work and everyday tasks easier.

Appendix: Item 7

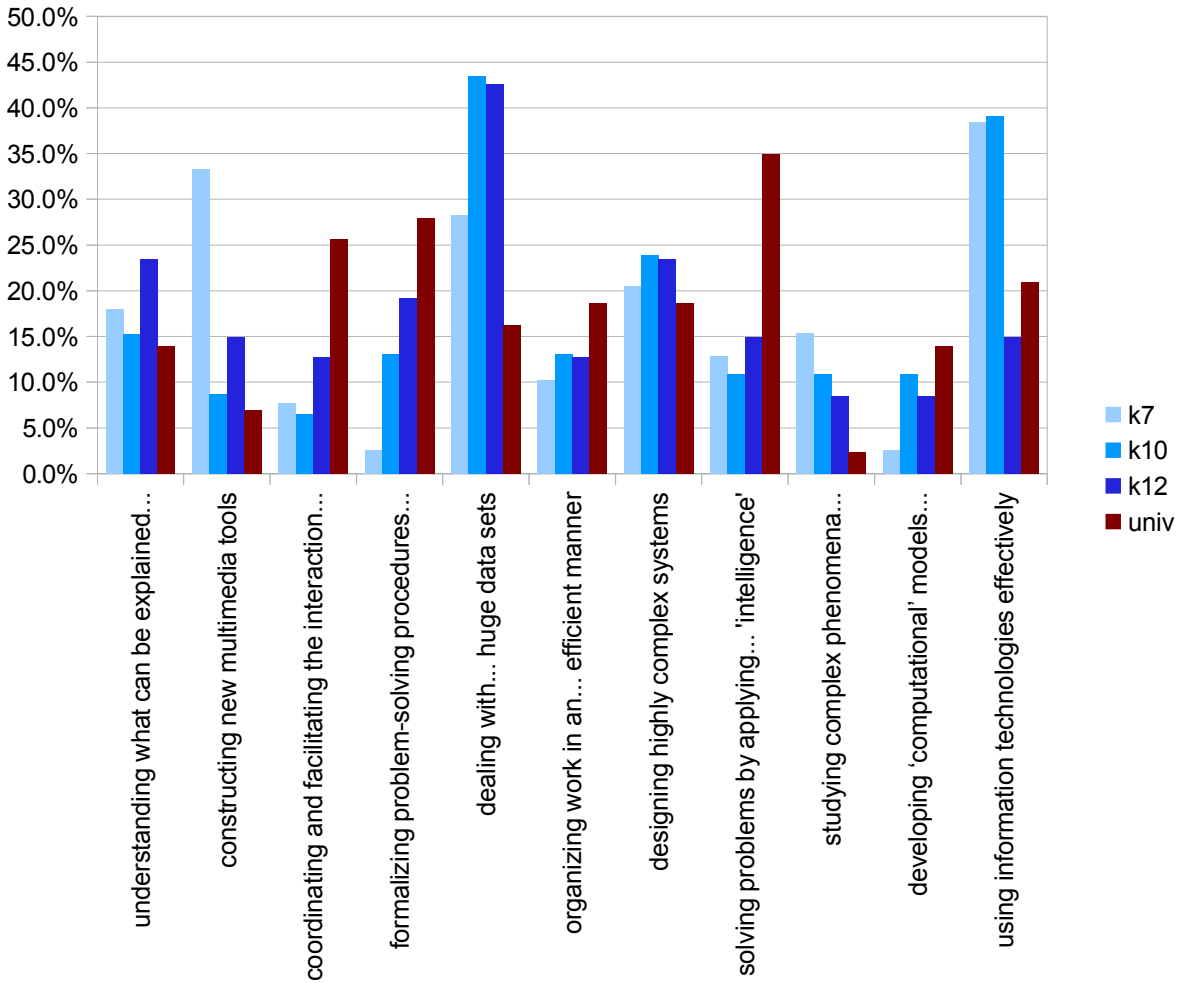
Which one of the following is an important reason you are/may be interested in learning to program? (choose only one option)

- the opportunity of experimenting with my own ideas about how to accomplish certain tasks or to solve some problems.
- the opportunity of being able to create myself new applications useful for work, study, or entertainment.
- the opportunity of sharing programs with friends and mates in order to understand the program structure and possibly modify its behavior.

Two-Layer Coding

1. problem-solving (problem-solving, problem approach, task complexity)
2. abstraction & modeling (abstraction, modeling & simulation, virtual machine)
3. automation & workflow (automation, task efficiency, data massiveness)
4. data & information (data/information, data collection & analysis, data processing)
5. algorithms & procedures (algorithms, algorithm logic, procedures & processes)
6. programming & language (programs & programming, task accuracy, formalism)
7. computation flow (computation, instructions & stepwise flow, input/output)
8. design & development (design & products, artifact function, artifact structure)
9. nature & evaluation (mathematical features, scientific features, evaluation)
10. computer-centered (computer, computer operating, hardware architecture)
11. I/C technology (information technology, applications, network & communication)
12. user-centered features (instrumental use, task-oriented tools, learning & sharing)

Results: Characterization of *informatics*



Results: Definition of *programming*