CHALLENGES OF TEACHING PROGRAMMING IN STACKOVERFLOW ERA

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BACKGROUND

Author has been teaching computer programming since 1982 – Assembler(s), Forth, Basic, Fortan, PL/I, Pascal, Java, Python, …

- Beginners courses for non-programmers
- Beginners courses for programmers
- Intermediate courses for programmers
- Advanced courses for programmers

All levels differ in details – choice of tools, choice of assignments and forms of cooperation, methods of teaching and giving feedback, etc.

This presentation concentrates on experiences obtained from teaching an intermediate course („Algorithms and Data Structures“) for future professionals.

TAL TECH

COMMON CHALLENGES

- Number of students per instructor is too big for individual supervision - how to guarantee consistent quality of feedback?
- Students are not interested in the subject, just want to pass the course - how to keep students motivated?
- Methods and tools used to teach the subject are not fully suitable for the particular audience (or for the particular subject) – how to choose appropriate tools?
- The choice of assignments and the way in which they are checked entices the use of outside assistance or other issues of cheating – how to fight plagiarism?

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TECHNICAL TOOLS

- IDE vs. command line tools
- Version control
- E-learning environment
- Unit testing

TAL TECH

CHOICE OF ASSIGNMENTS

- Real life projects – potentially unique, laborious both for students and supervisors, suitable for advanced courses with modest number of participants, work in groups (3 – 5 students per group), thorough human feedback
- Tiny exercises – large variety of easy tasks that are checked automatically, risk of cheating is quite low, suitable for beginners, individual learning, MOOC, automated feedback, the tutor intervenes by need only
- Classical non-trivial „school exercises“ – generation of essentially different versions is not easy, risk of cheating is high, automated feedback is not sufficient, number of students is remarkable

TAL TECH

FLIPPED CLASSROOM

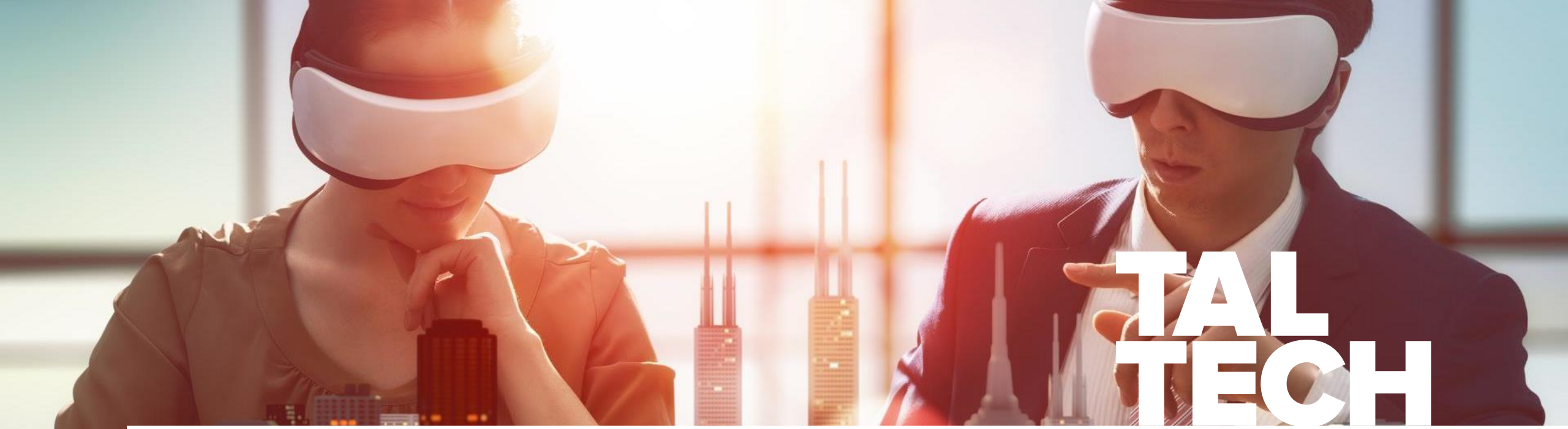
Before the lab:

- Students submit solutions to an e-learning environment, e.g. Moodle, that takes care of bookkeeping (e.g. submission deadlines)
- Technical correctness is checked with unit tests (integrated into Moodle) and automated feedback is generated
- Human feedback is given by supervisor to technically correct submissions

During the lab:

- Student finds a partner (dynamically)
- Solutions of both partners are discussed and some new aspect is developed together (e.g. error handling), contact time is used fruitfully
- Work in pairs is documented in a version control system, e.g. git + bitbucket (or git + github)
- Supervisor interviews each pair shortly and grades the work

TAL TECH



WORK IN PAIRS

IDEAS FOR WORK IN PAIRS

- Make at least two suggestions to the partner of how to improve her code based on „Clean code“ methodology (starting from style issues up to full refactorization of code). Both partners create git commits with the improvements agreed during the discussion and present these to the supervisor (it is possible to check them quickly).
- Find a new solution to a given problem together so that it would be different from initial solutions of both partners. This exercise provides enough variations and is convenient to be checked using version control. We applied it to the binary insertion sort method where there are at least four essentially different solutions.
- Defend the homework of your partner.
- Arrange a competition of solutions (used for comparison of speed of sorting tasks).

TAL TECH

RESULTS - DROPOUT RATE OF THE COURSE „ALGORITHMS AND DATA STRUCTURES“

Semester	Total number of students	Not passed	Dropout rate
Fall 2017 (strict methods)	87	47	54 %
Spring 2018 (hidden tests for flipped classroom)	67	35	52 %
Fall 2018 (work in pairs – partial, flipped classroom - partial)	99	24	24 %
Spring 2019 (all previous methods for distance learners)	60	24	40%
Fall 2019 (flipped classroom, work in pairs)	115	20	17 %

TAL TECH

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