Which students' conceptions of OOP can be identified?

Does the work with Greenfoot/BlueJ/or similar eIDEs influence students' conceptions of OOP differently?

Which eIDEs are mostly in usage in German secondary schools?
What are the reasons for the election of a particular eIDE?

How do students' prior knowledge in programming or software usage skills influence their conceptions of OOP?

Which strategies to investigate students' concepts and problem-solving strategies using (science) software can be found?





How Does an Educational IDE Influence Students' Conceptions of Object-Oriented Programming?

Pre-Test

Knowledge

about

programming/

algorithms in

general

Software skills

Conceptions

of computer

programs

Arrangement

Literature review

Analysis of IDEs

Survey of CS teachers in NRW/
Germany

Survey of CS teachers and research associates international

Development of the teaching material

Guideline for the interviews

Questionnaire and tests

1 year

Main Study

Intervention

Introduction to OOP

bluej.org

Greenfoot

47

?

?

Course material, handbook for the teacher, test(s)

Beginning of the school year (Duration: ~ 3 months)

Post-Test

Test of programming skills (with less complex algorithms)

Software skills

Conceptions
of computer
programs and
OOP

Follow-Up-Test

Test of programming skills (with less complex algorithms)

Software skills

Conceptions
of computer
programs and
OOP

End of the school year

1 year

Design of a Ph.D. Research Project to Explore Secondary School Students' Conceptions of OOP

Design and Arrangement of

- programming seems to be challenging for many students
- CS teachers should be competent in identifying and addressing students (mis-)conceptions for creating adequate learning arrangements
- it would be desirable to develop an instrument for teachers from study results to survey students' conceptions of OOP
- more investigations with school students are required
- in German secondary schools object-oriented programming (OOP), especially Java, is compulsory in CS classrooms of the federal state government of North Rhine-Westphalia
- introduction OOP courses are usually taught with educational integrated development environment (eIDE) like *Greenfoot* or *BlueJ*
 - [1] Ira Diethelm, Peter Hubwieser, and Robert Klaus. 2012. Students, teachers and phenomena. In Proceedings of the 12th Koli Calling International Conference on Computing Education Research Koli Calling '12, Mikko-Jussi Laakso and Robert McCartney (Eds.). ACM Press, New York, NY, USA, 164–173.

 [2] Yizhou Qian and James Lehman. 2017. Students'
 - Misconceptions and Other Difficulties in Introductory Programming. ACM Transactions on Computing Education 18, 1 (2017), 1–2.

 [3] **Michael Kölling. 2015.** Lessons from the Design of Three Educational Programming Environments. In the International Journal of People-Oriented Programming 4 (1), 5-32.
 - [4] Mariana Teif, Orit Hazzan. 2006. Partonomy and taxonomy in object-oriented thinking. In Proceedings of the Working Group Reports on ITiCSE on Innovation and Technology in Computer Science Education. Bologna (Italy), June 26-28, 2006. Working group reports. New York, N.Y.: ACM, 55.
- **CS Lessons and Courses Investigation Selection of CS Analysis of** of Teachers' Phenomena **Social Demands Perspectives Clarification of Investigation of Students' Perspectives Science Content Structure** Figure 1. Educational Reconstruction for CS Education. [1] **Lack of Strategies** Programming **Environments Natural** Language Students' Conceptions of Programming Math **Unfamilarity** Knowledge of Syntax
 - **Figure 2.** Factors which are related to students' (mis)conceptions and difficulties in programming. [2]

Inaccurate

Mental Models

Teacher's Knowledge

and Instruction

- approaches for teaching design with attention on pre-instructional conceptions aligned with the scientific domain concepts [1]
- "students exhibit various misconceptions and other difficulties in syntactic knowledge, conceptual knowledge, and strategic knowledge." [2]
- "an integrated language and environment that explicitly supported an object-oriented model and provided visualization and interaction functionality [...]." was designed by Kölling and his team [3]
- the eIDEs Greenfoot and BlueJ are internationally well known and are used in schools and university courses
- "Developers of educational software might use the research results when deciding on the content: what to present, how to present it and in what order." [4]

Fatma Batur

University Duisburg-Essen
Computing Education Research Group
fatma.batur@uni-due.de
http://uni-due.de/fb



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Contact