

Novices' Expectations and Prior Knowledge of Software Development – Results of a Study with High School Students

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OUTLINE

- Objectives and Hypotheses
- Design
- Results
- Conclusions

OBJECTIVES / INTERESTS

Constructivism: Prior knowledge affects learning and understanding



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- Differences in interests and expectations?
- Interaction between learners' prior Knowledge
- Preconceptions of software development

DESIGN OF THE STUDY











- Instruments:
 - Questionnaires: Interests, Expectations (from Pilot-Study)
 - Preconceptions of Software development (open question)
 - INCOBI / FIM, CIM (from psychological tests)
- Conducting:
 - Mailing-list: biased group
 - Beginning of grade 11
 - 22 schools, 28 classes, 573 students
- Methods:
 - Factor Analysis
 - Regression Analysis
 - Qualitative 'content analysis'

HYPOTHESES

- Hypotheses
 - H1: Groups with different *interests*
 - H2: Different *expectations* regarding subject matters
 - H3: Different *preconceptions* of software development
 - H4: Interests and expectations are *gender-specific*
 - H5: *Mutual influences* of interests, expectations and preconceptions
 - H6: Influence of computer literacy courses attended at *junior high school level*

GENDER DIFFERENCES: Interests and Expectations

	General Interests In Computing	Programming Course	Interested in computer usage	Applications
				
				

Strongly agree
 agree
 Neutral (neither agree nor disagree)
 disagree
 Strongly disagree

GENDER DEIFFERENCES: Previous Knowledge, Job-Oriented Motivation

Job-oriented Motivation

- I'm interested in a job related to computer science
- I'm interested in a job which includes computer usage

Category	Girls (%)	Boys (%)
1	~40	~15
2	~55	~65

Knowledge related to Computer usage (4.8 girls, 6.3 boys)

Motivation to use a computer (CIM: 2.7 girls; 3.0 boys)

Self-Confidence in computer usage (SUCA: 2.40 girls; 2.95 boys)

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GROUPS WITH DIFFERENT INTERESTS

Type 1 experienced with interests in informatics: 18% (25% m, 5% w)

Type 2 novices with interests in usage and applications: 18% (16% m, 23% w)

Type 3 job-oriented interests: 18% (23% m, 11% w)

Type 4 unable to specify particular motive / no specific motives: 12% (8% m 19% w)

Type 5 informatics just to fill a gap: 6%

Type 6 computer users with few interests related to informatics: 1%

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DIFFERENT EXPECTATIONS REGARDING SUBJECT MATTERS

Type 1 Programming Languages and Software development: 16% (20% m; 8% w)

Type 2 Introductory Course, Usage of Computers, Dealing with Social Impacts: 17% (12% m; 26% w)

Type 3 Co-operative work in diverse, partly indistinct application: 16% (13% m; 22% w)

Type 4 Computer-centred work with few discussions in the group: 15% (15% m; 16% w)

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MODEL / CODING SCHEME OF SOFTWARE (DEVELOPMENT)

technical

product

- Formal
- Parts
- (G)UI
- Datastructure
- Algorithm

process

- Team
- Coding
- Planning
- Test
- Steps
- Iteration
- Abstraction

social

customer

- Gather Needs
- Analyse Needs
- Cost Estimation
- Task Analysis
- Cooperation

evolution

- Reengineering
- Versions
- Antizipate HCI / Workflow

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DIFFERENT PRECONCEPTIONS OF SOFTWARE DEVELOPMENT

technical

product

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evolution

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Blue: < 5 % of answers
Normal: - 10 %
Italic: - 22 %
Bold: > 40 %

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INTERESTS AND EXPECTATIONS ARE GENDER SPECIFIC

- Computer usage
- Questions of social impact
- computer skills are generally important without being able to go into details

- programming and software-development
- experienced with computers
- Higher self-confidence in computer usage

Preconceptions of software development

Differences in process-scale: in 'Teamwork', 'Testing' and 'Steps', girls have significantly lower values

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MUTUAL INFLUENCES BETWEEN INTERESTS, EXPECTATIONS AND PRECONCEPTIONS

H5

- 'Experienced with interests in informatics'
 - Expecting 'Programming Languages and Software development'
 - Better computer knowledge (significant correlation with FIM)
 - Regarding process-aspects of software development
 - Positive correlation to software-development: process-scale (0.28)
- 'Novices with interests in usage and applications'.
 - Expecting 'Introduction-, Usage- and Impact-Courses'.
 - Lesser computer knowledge
 - Disregarding process-aspects of software development
 - Negative correlation to software-development: process-scale (-0.22)
 - But: open for other aspects???

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INFLUENCE OF COMPUTER LITERACY COURSES ATTENDED AT JUNIOR HIGH SCHOOL LEVEL

Process Aspect	Computer	No Comp. lit., mean	All, mean
Teamwork	0.20	0.15	0.15
Planning	0.35	0.15	0.20
Coding	0.45	0.45	0.45
Testing	0.40	0.40	0.40
Steps	0.15	0.15	0.15
Iteration	0.15	0.15	0.15

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CORRELATIONS WITH PROCESS SCALE

H6

Whole group

- Testing (0.29) - Iteration (0.17)
- Testing (0.18) - Planning (0.18)
- Iteration (0.24) - Abstraction (0.17)
- Planning (0.17) - Teamwork (0.17)
- Steps (0.28) - Teamwork (0.17)

With previous computer literacy course at lower secondary level

- Testing (0.45) - Iteration (0.15)
- Steps (0.15) - Iteration (0.15)
- Abstraction (0.15) - Teamwork (0.15)

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CONCLUSIONS I: TEACHING METHODS

- Process-aspects of software development
- Similarities to teaching writing:
 - Novices are given a topic to write about:
 - immediately produce text by writing their first idea, then their next idea, ...
 - in contrast, experts: also planning and revising
 - naive beliefs about the nature of expert writing: thinking that writing is a smooth and easy process for "good" writers." -> discouraging
 - Possible teaching strategy:
 - providing students with a model of (writing) programming that involves planning and revising
 - teaching control strategies

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CONCLUSIONS: SUBJECT MATTER

- Programming Languages, Software Development
- Usage and Applications and social impacts
- Product as well as Process aspects of Software Development
 - à methods: beginners courses differentiated by subject matters?
- Teaching programming affects understanding of process aspects
 - developer-user interaction and evolutionary aspects should be integrated: socio-technical view.
 - there is prior knowledge, teaching concepts can rely on
 - include multiple perspectives (customer etc.)
 - Include socio-technical characteristics of the product software

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