

An Investigation into the Learning Styles and Self-Regulated Learning Strategies for Computer Science Students



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Outline

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Introduction

Computer Science Education

- Learning and teaching of Computer Science (CS) concepts are challenging tasks for both students and teachers.
- It is difficult to teach some CS concepts using traditional education methods (Ben-Ari, 2001).
- CS is a rapidly changing area, driven by technology rather than pedagogy (Holmboe, McIver, & George, 2001).
- “Only recently have CS educators begun to explore important issues and methodologies in computer science teaching” (Haden, et al., 2004).

Introduction


Computer Science Education

- Computer Science Education Research (CSER).
- Difficulties in the understanding of different CS concepts.
 - Learning programming (Milne & Rowe, 2002).
 - Object-oriented concepts (Ragonis & Ben-Ari, 2005).
- Studies that investigated students' learning styles in computer science courses are limited (de Raadt & Simon, 2011).
- Cognitive and social aspects introducing a new direction for research and design of learning material in CS education (Machanick, 2007).

Introduction

Student-centred education

- Educational paradigm shift into student-centred paradigms.
- Our vision of designing the learning material should be changed.
- More emphasis on students' preferences and learning strategies.

Teacher-centred Learning	Student-centred Learning
	
Behaviourism learning theory	Constructivism and social learning
Teacher is dominant	Teacher as facilitator
Passive learner	Active learner
Single point of view of learning material	Students' preferences
Low level of students' interaction	High level of students' interaction

Theoretical Background

Learning Style Theory

- Learning is a process in which individuals acquire knowledge.
- Students use different methods to acquire and process information.
- These differences are known as learning styles.
- Students learn better with approaches that match their learning styles (Layman, Cornwell, & Williams, 2006).

Theoretical Background

Learning Style Theory

- Problems arise from mismatch between teachers' expectations of the way students learn, and students' preferred learning styles (Mills, Ayre, Hands, & Carden, 2010).
- Students' motivation is low if their learning styles are not taken into account (Felder, Felder, & Dietz, 2002).
- “Teachers can appreciate that being fair really means providing equal opportunities for each student to learn in the manner that best suits his or her own natural learning style” (Capretz, 2002).

Theoretical Background

Felder-Silverman Learning Style Model

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Learning Style		Learner's Characteristics
Perception	Sensing	<ul style="list-style-type: none">•Facts and procedures.•Real world examples of applying the concepts.
	Intuitive	<ul style="list-style-type: none">•Abstract concepts and Theories.•Innovative ideas of applying the concepts.
Medium	Visual	<ul style="list-style-type: none">•Pictures, charts, diagrams.•Animations.
	Verbal	<ul style="list-style-type: none">•Audio learning resources.•Written or spoken explanations.
Processing	Active	<ul style="list-style-type: none">•Try things out first.•Working in groups.
	Reflective	<ul style="list-style-type: none">•Think first before trying.•Prefer working alone.
Understanding	Sequential	<ul style="list-style-type: none">•Logical step-by-step approach.•From parts to the whole.
	Global	<ul style="list-style-type: none">•Learn better if they grasp the big picture.•From the whole to the parts.

Theoretical Background

Self-Regulated Learning (SRL)

- SRL Strategies categorized into the following (Pintrich, 2004):

Cognitive Strategies

- ☐ Elaboration
- ☐ Organization
- ☐ Critical Thinking

Metacognitive Strategies

- ☐ Planning
- ☐ Monitoring

Resource Management

- ☐ Time
- ☐ Learning resources
- ☐ Learning environment

Research Objectives

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- Design an educational framework based on contemporary education paradigms to improve CS education.
 - Investigation of students' learning styles.
 - SRL strategies.
- The main objective of the study is not to generalize the results, but to provide a baseline to improve the next iteration of the sample course (*Programming Languages and Paradigms*).

The Study

Participants

- Students enrolled in “Programming Languages and Paradigm” course.
- The first semester 2011 at the University of Newcastle.
- Compulsory second year course for undergraduates (CS and SE).
- **The course covers many topics including:**
 - Language theory and specifications.
 - Advance object-oriented concepts.
 - Introduction to functional, logic and concurrent programming.

The Study

Participants

- The course follows a traditional teaching method.
 - Theoretical concepts covered in the lectures.
 - Workshops provide hands-on experience.
 - Individual assignments, midterm and final exam.
- Blackboard LMS.

The Study

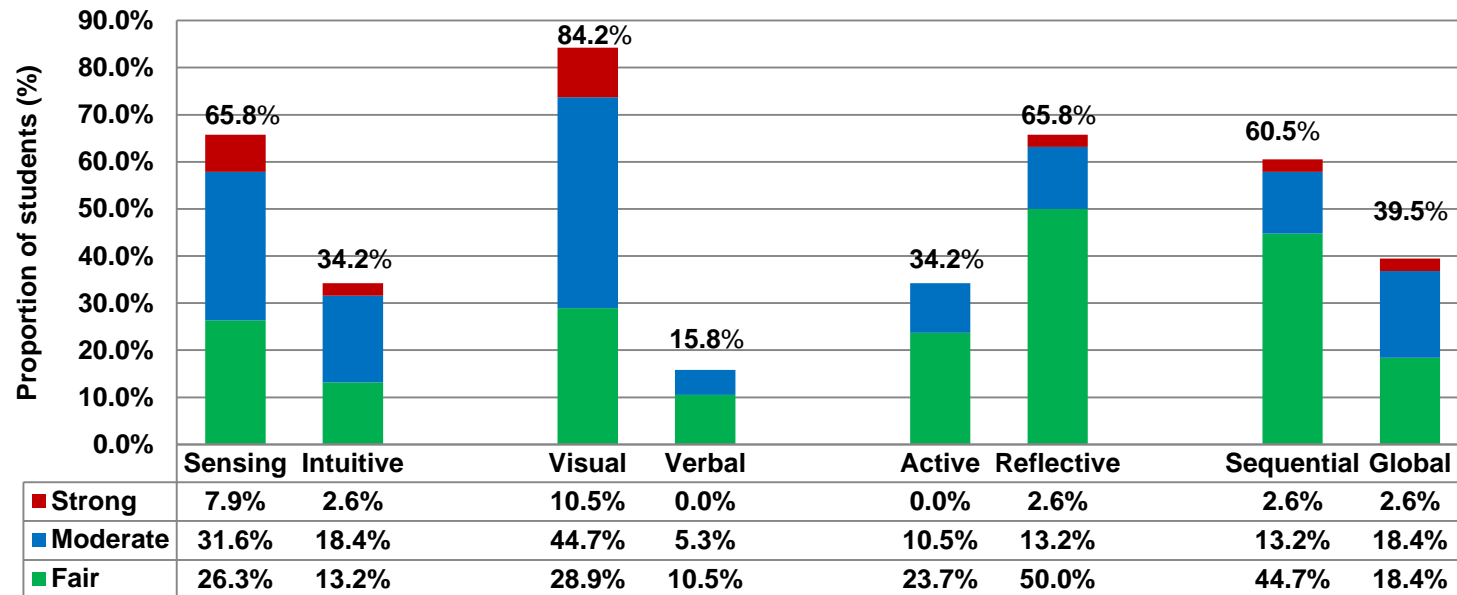
Data Collection Instruments

- **The Index of Learning Styles**
 - Instrument associated with Felder-Silverman Model.
 - Categorise students' preferences based on four dimensions.
- **Self-Regulated Learning Strategies Questionnaire**
 - Elaboration, organization, critical thinking.
 - Metacognition.
 - Management of learning resources.
- **Paper-based Exam**

Results

Learning Style Distribution

Students' Preferences



Results

Self-Regulated Learning

- Students' use of self-regulated learning strategies was moderate.
- Metacognitive strategies were significantly correlated with elaboration, organizational and critical thinking strategies.
- Metacognitive strategies were the least used.
- Animations were the least used learning resource.

Implications on Computer Science Education

- Help students to construct the right mental model.
 - Reduce the abstraction of CS concepts:
 - Visualization of dynamic processes.
 - Teaching in context.
- Explicit use of SRL strategies
 - Self-assessment.
 - More accurate and tailored feedback.
 - Reflections.

Conclusions and Future Work

- This study presented the results of an investigation into students' learning styles and their use of different self-regulated learning strategies in a core computer science course.
- A collaborative learning object repository
 - Different learning objects.
 - Learning style assessment.
 - Recommendation system.

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THANK YOU

A presentation to ASCILITE11
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