Research and Teaching

Dr. Ivan S. Zapreev

Neat Software Designs

2020-01-22

General outline:

- Introduction
- Research interests
- Teaching preferences
- Teaching approach
- Questions

Introduction

Introduction: Overview

20 years of work experience:

- Research: 9 years
- Teaching: 5 years
- Engineering: 9 years

International experience:

- Russia
- The Netherlands
- Germany

Introduction: Experiences

- Research:
  - Formal verification
  - Model checking
  - Control systems
  - Machine translation
- Teaching:
  - Mathematics
  - Formal methods
  - Programming languages
  - Data bases
  - Software development
- Engineering:
  - User requirements
  - Specification and docs.
  - Design and Architecture
  - Testing and development
  - Product ownership

Introduction: Software

Experience with languages (*years*):

- C++ (8)
- Java (7)
- UML (6)
- C (5)
- C# (2)
- SQL (2)
- JavaScript (1)
- Bash (10)
- MATLAB (4)
- Mathematica (1)
- Python (1)
- R (1)

Research interests

Research interests: Earlier

Static program analysis: (BSc, MSc)

- Information stream quality
- Hoare-based verification of C

Model Checking Markov Chains: (PhD)

- Statistical model checking CTL
- Steady-state detection

Statistical Machine translation: (PostDoc)

- Distributed Machine Translation Infr.

Cyber physical systems: (PostDocs)

- Computable CTL* model checking
- Symbolic regression for BDD controllers

Research interests: Recent

Deep learning for control (PostDoc, 1 BSc, 3 MSc)

- Neural Networks as Correct-By-Design Controllers:
  - Performance
  - Representations
  - Verifiability
- Compact control law representations:
  - Data science models?

Model driven engineering (Altran, 1 MSc)

- Runtime guarantees by verifying OCL constrains on DMs.

Research interests: Future

Artificial Intelligence:

- True artificial intelligence
  - Self-motivated
  - Unsupervised learning
- Model checking
  - Design, training, robustness?
- Static program analysis
  - –//–

Domain specific languages:

- Evolution of DSL meta models
  - Backwards compatibility
- Designs for DSL implementations
  - Extendible and maintainable
- Runtime guarantees via static constrains

Teaching preferences

Teaching preferences: Earlier

Novosibirsk State University (lecturer): (2000–2004)

- Introduction to UML
- Unified Modeling Language UML
- Introduction to C# language

TU Twente (teaching assistant): (2004–2006)

- Formal Methods for Software Engineering

RWTH Aachen (teaching assistant): (2006–2008)

- Advanced Model Checking

Teaching preferences: Recent

Fontys Hogeschool (docent) (2014–2015)

- Discrete Mathematics:
  - Linear Algebra
  - Regular Languages
  - Grammars and Finite State Automata's
  - Set theory and propositional logic
- Software engineering:
  - C# ASPX .NET
  - Java Enterprise
  - Database Optimizations
  - Operating systems
  - Quality, Testing, and V-Model
  - SQL and Data modeling for RD

Teaching approach

Teaching approach: Classification

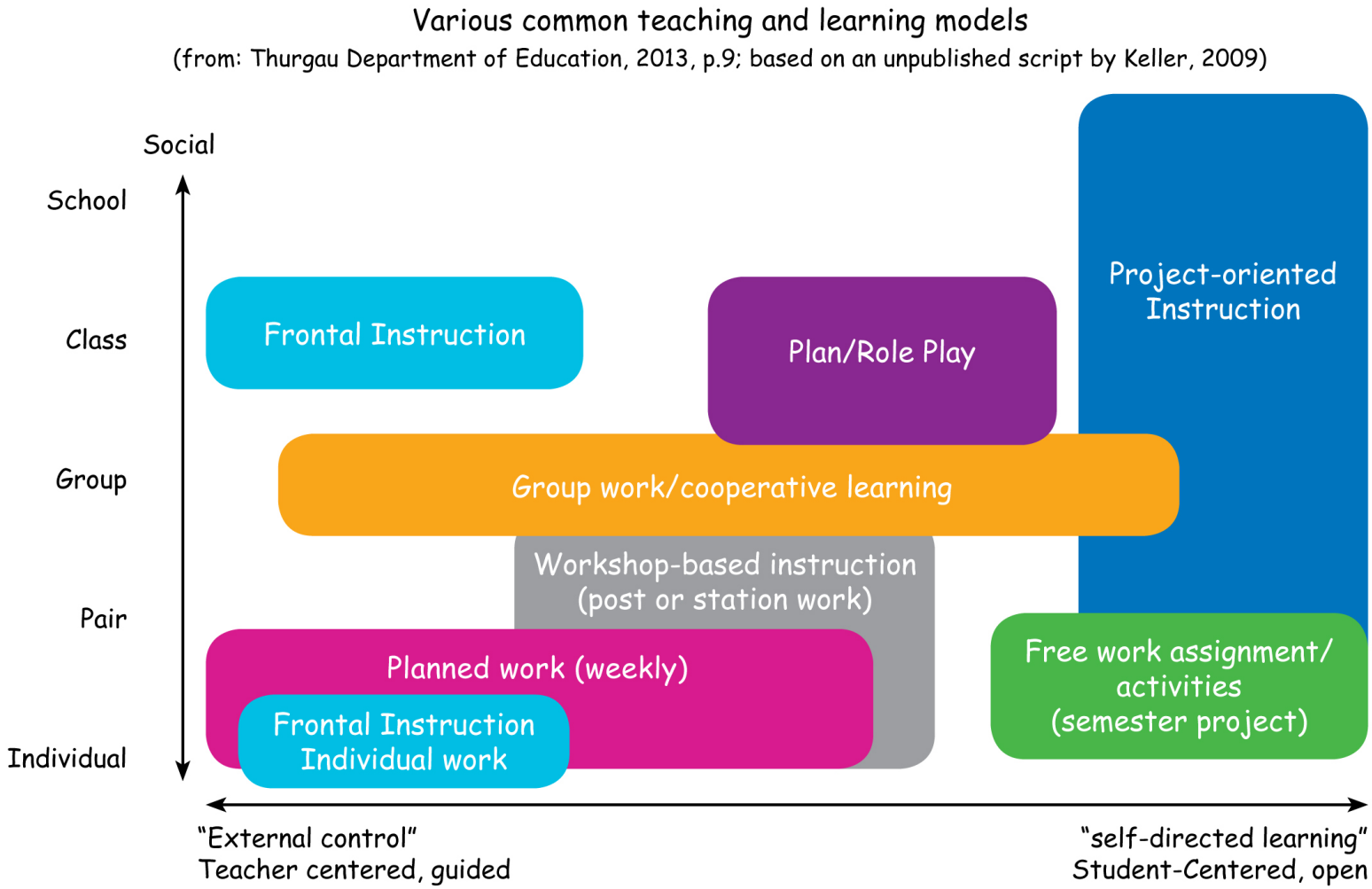

Figure 1: Teaching approaches

Teaching approach: Literature

An extensive study is presented in literature[1]:

- The ideas should follow logically
- The structure of ideas should be created in class
- Create a comfortable environment
- Use theories like: Social Learning, Constructivism, etc

Learning can differ greatly from person to person:

- 5 different teaching paradigms
- 32 different teaching models between them.

"The best and maybe the only possible outcome is to try to determine what methods or combination of methods a teacher should apply to suit the biggest percentage in a class."

[1] "Choosing learning methods suitable for teaching and learning in computer science", Estelle Taylore et al., IADIS, 2013

Teaching approach: Mine[2]

Connect:

- Be personal
- Use Humor
- Be assertive

Motivate:

- Create interest
- Challenge
- Track engagement

Guide:

- Define Structure
- Help if needed
- Keep challenging

[2] Started on doing BKO at Fontys.

Questions

Questions

Teaching:

- What does 80% of teaching include?
- What choices for teaching are there?
- Who creates the lecture materials?

Research:

- What does 20% of research include?
- What are the research topic bounds?
- Participation in conferences?

General:

- Is BKO required and time is given?
- What is to be done during summer vacations?
- What are the vacation restrictions?
- What are the criteria for extension?