Design and Implementation of a Configurable Software Architecture for Peer Learning

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GOAL

- *Peer learning* is a pedagogical method to increase the effect of training.
- ***To propose an approach for the easy configuration of a software architecture for peer learning*** which is **evaluated against defined criteria classified in six software configuration categories**.
- The proposed ***architecture is validated as it is installed, configured, and used in a university course***.
- keywords: peer learning, software architecture, system configuration.

Introduction and definitions

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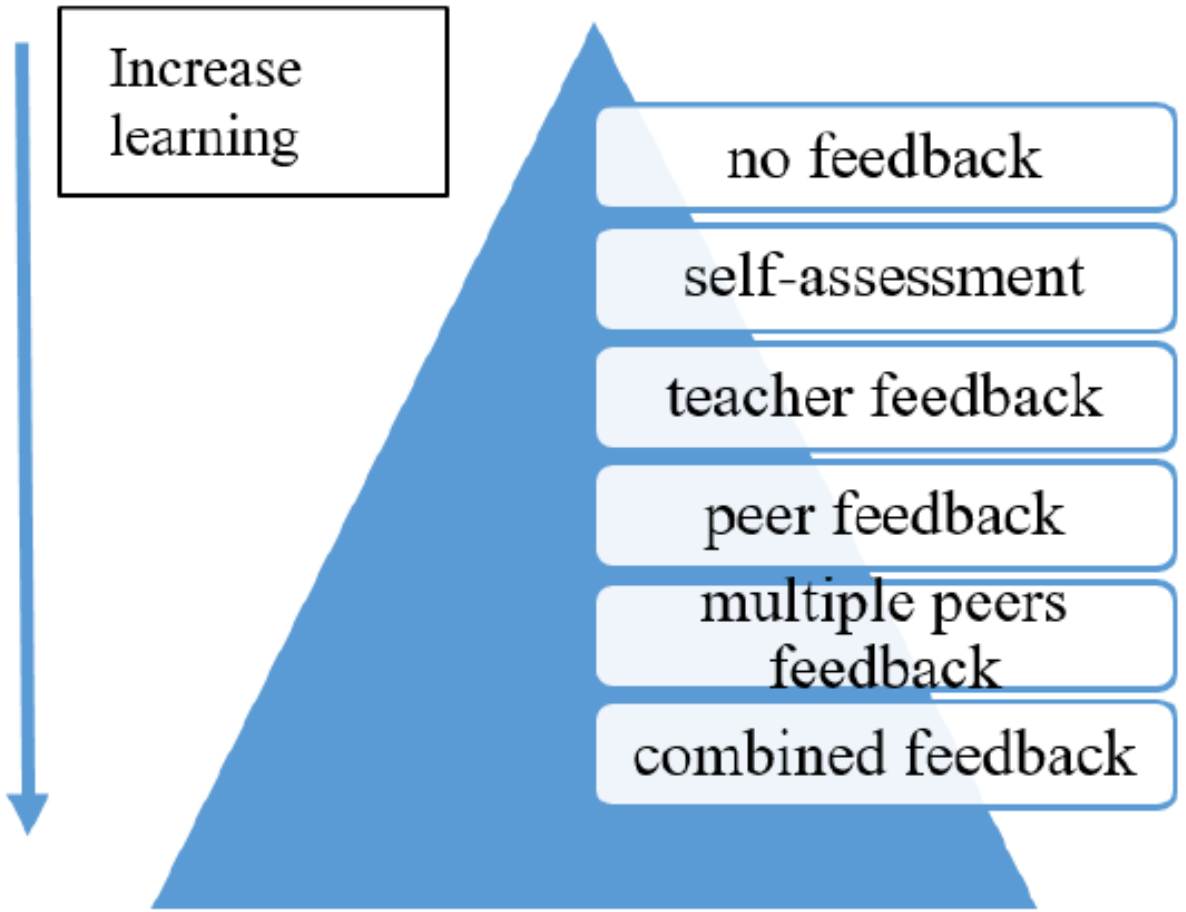
- **Assigning the role of evaluator to the learner has several advantages** such as **critical thinking** [1], **analytical reasoning** and **improving academic performance** [2].
- **Peer assessment**, **peer feedback** and **peer review** are some peer learning approaches which could be used for that purpose.
  - **Peer assessment** is defined as "an arrangement in which **individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status**" [3]. Peer assessment refers to the processes in which students evaluate the quality of their colleagues' learning task performances by producing numbers that represent the evaluation of students' work [4].
  - **Peer feedback is about producing comments** that help the author to improve the document. Also, the use of peer assessment is a formative practice which is more effective than no assessment and teacher assessment [2].
  - **Peer review** is defined as "*the process of subjecting an author's scholarly manuscript to the scrutiny of others who are experts in the same field, prior to publication in a journal*". Peer review is about improving the quality of the published paper [5].

Feedback-related impact on learning



METHODOLOGY

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- paper makes **three main contributions**:
  - 1) **proposing an approach for the easy configuration** and criteria for evaluation of a software architecture for peer learning (SAPL);
  - 2) **implementing a system** based on that method;
  - 3) **validating the system** by using a real case study.

The scope of this work involves applying three peer learning processes: peer assessment, peer feedback and peer review in a flexible and easy reusable and configurable architecture of software system.

This effort is part of APTITUDE, a project for developing a flexible platform which supports the recommendation and adaptation of learning contents and activities based on learning analytics from different systems, tools, and services in education. The APTITUDE platform has a role as interoperable middleware of e-learning systems and tools [7] and system for peer learning is a part of that platform - both as a source of learning data and as consumer of services, offered by the APTITUDE.

DESIGN OF A CONFIGURABLE SOFTWARE ARCHITECTURE - REQs

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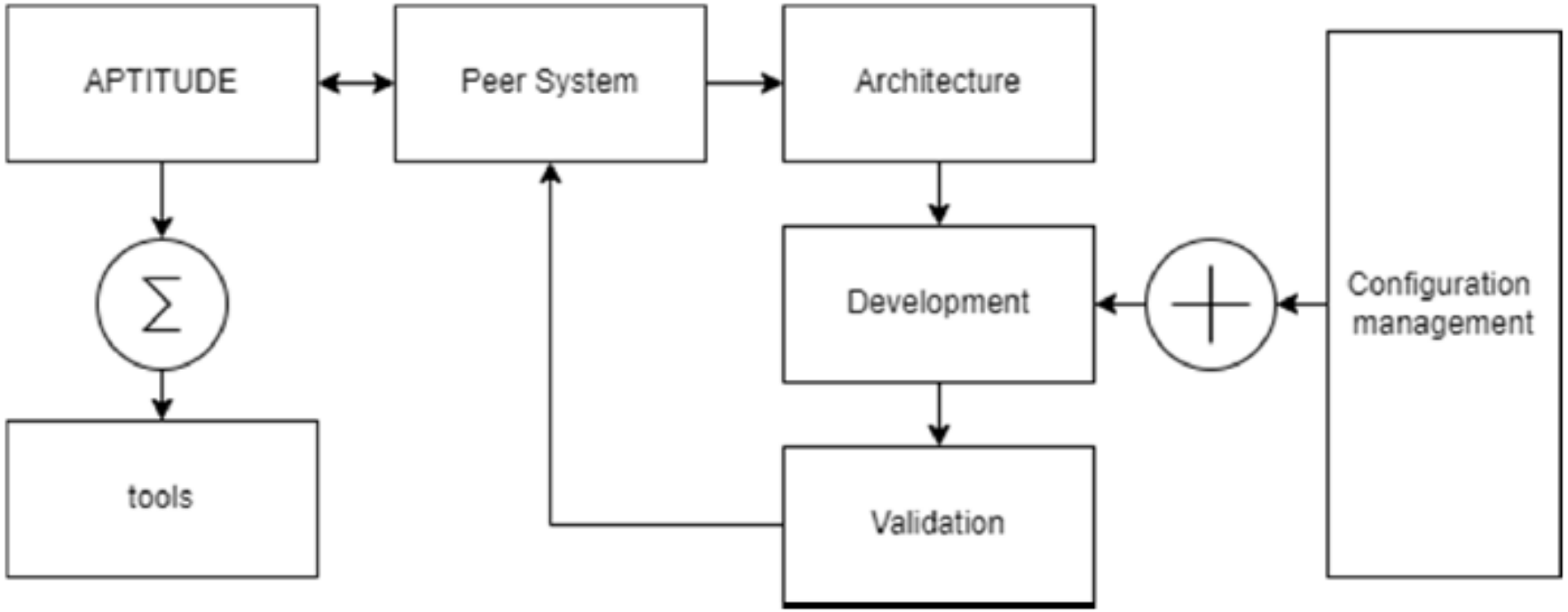
The basic system requirements (REQs) which define the structural components in the software architecture are identified, namely:

- **REQ1:** (a) The topics of the essays can be set by the lecturer using an external source and they can be loaded into the system; (b) visible to all participants.
- **REQ2:** (a) The system allows students to anonymously comment on individual parts of a submitted abstract (peer feedback); (b) to write a general comment on the abstract (peer review); and (c) to assign a grade (peer assignment).
- **REQ3:** The system allows to set how many people can make comments; (a) none; (b) one; (c) two or more.
- **REQ4:** Distribution of essay reviewers; (a) randomly; (b) reviewer preference; (c) author preference.
- **REQ5:** The student sees the comments and grades, but without knowing which student wrote the comment. (b) doubleblind review; (c) author blind-review; (d) reviewer-blind review. (e) limited time double blind review, then blind-review.
- **REQ6:** All registered students see (a) all uploaded abstracts; (b) can see the comments posted; (c) can see the grades.
- **REQ7:** The learner is (a) not allowed to comment on the work himself; (b) not allowed to return direct feedback to the reviewers.

WEB-BASED SYSTEM FOR PEER LEARNING implementation



- The system for peer learning is a dynamic web application where students can complete the entire essay submission process.

System configuration model: main categories

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cfg_ver	1
cfg_structure_md5*	check-sum
configuration	•
initial_setup	•

section_number	1
section_name	cfg_mgmt
cfg_system_mgmt	w18ref
system_ver	18
cfg_system_name	system-name
dns	subsection_dns
vhost	subsection_vhost
db	subsection_db
OS	subsection_osb
analytics	subsection_analytics
file_mgmt	subsection_file_mgmt
file_cache_mgmt	subsection_file_cach
tenant_mgmt	subsection_tenant_mgmt

import_data	import_data
review_process_cfg	subsection_review_process
acount_mgmt	subsection_acount_mgmt
security	subsection_security
anonymization	subsection_anonymization
ENABLED_MODULES	subsection_modules
integration	subsection_integration

Architecture

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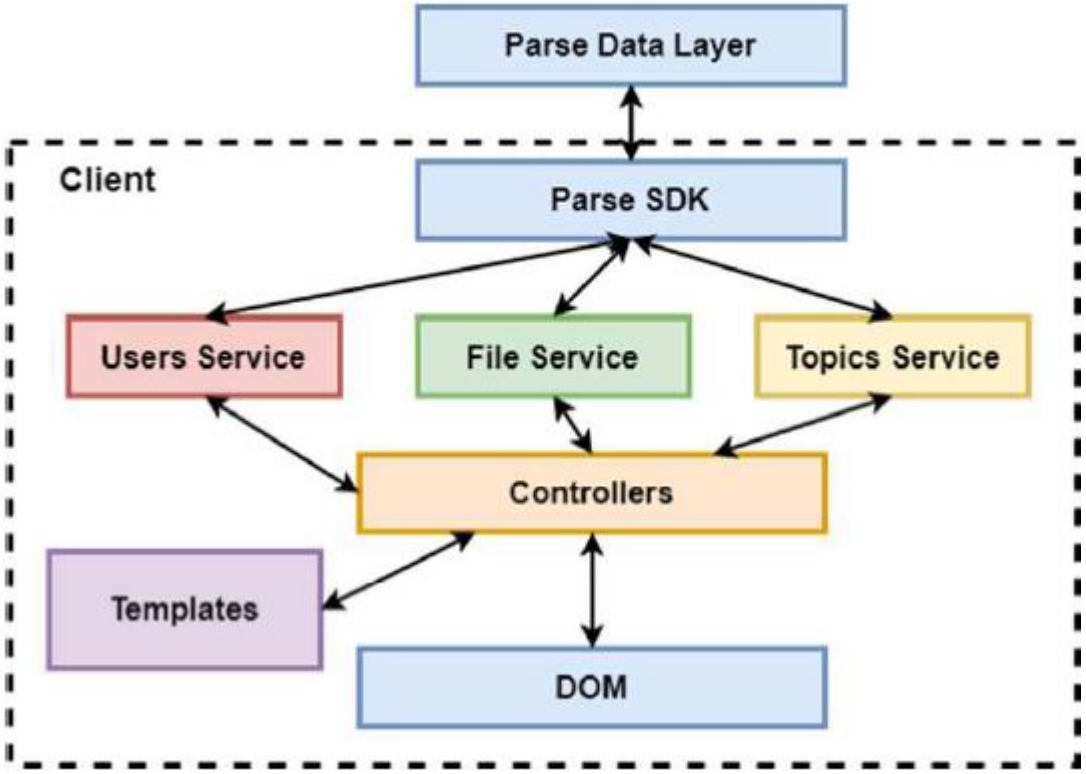

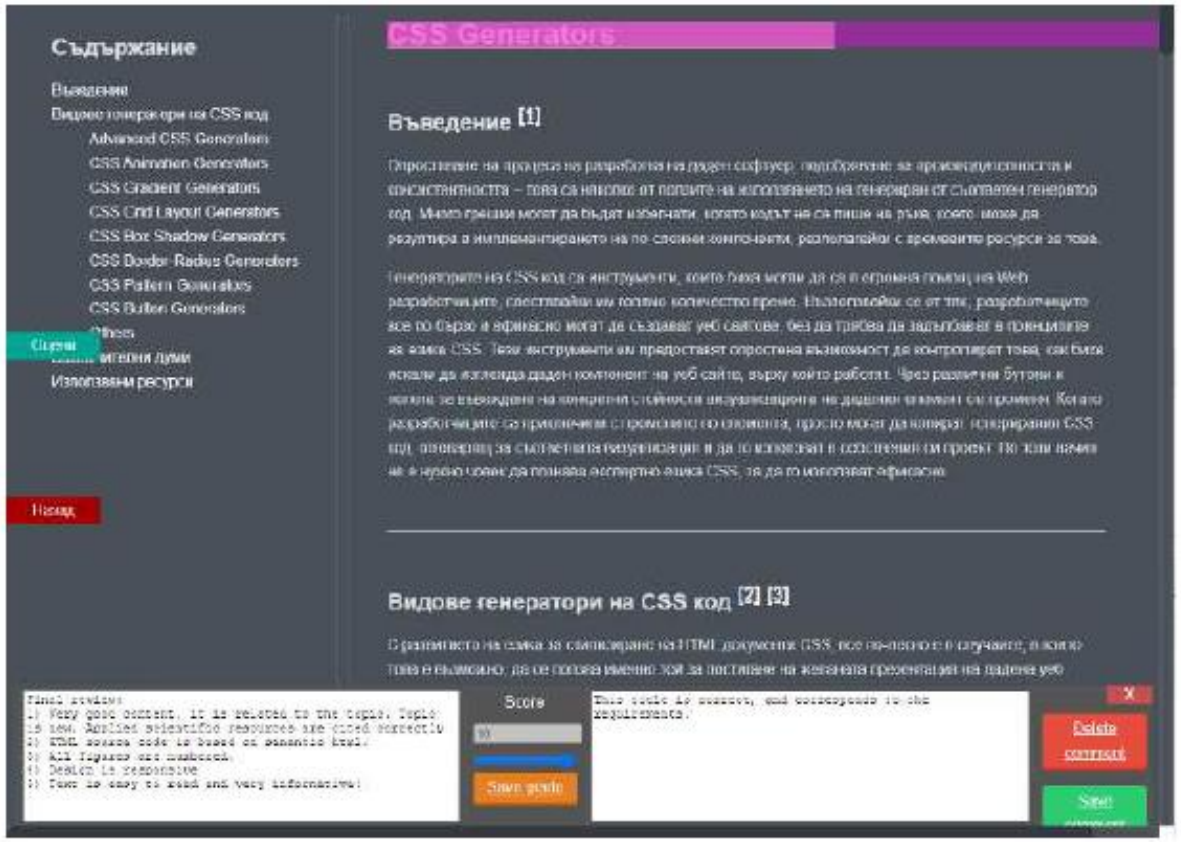

Configuration level groups

- **C1 - Zero-force Configuration (ZC):** the system does not need any configuration;
- **C2 - Auto Configuration (AC)**: self-configuration system, which can confirm a few options, according to the needs;
- **C3 - Hot Configuration (HC):** defines minor changes in some of the parameters/criteria;
- **C4 - Warm Configuration (WC)**: detailed configuration and tuning is needed;
- **C5 - Cold Configuration (CC):** minor to average development and configuration is needed;
- **C6 - Glacier Configuration (GC):** significant research and development activities and configuration are needed.

CONFIGURATION CATEGORIES AND CRITERIA DEFINITION

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TABLE I
CONFIGURATION CATEGORIES AND CRITERIA DEFINITION

Config/C Criteria/Q	1. ZC	2. AC	3. HC	4. WC	5. CC	6. GC
1: **D**ifficulty of Config.	Not needed	Preview needed	+edit up to 5 options	+filter, manage, enrich configs	+develop config	+composition of configs
2. **H**ow **L**ong	Very fast/auto config	1-15 min. / preview config	1/4 to 2h decision	1 hour up to 2 day	1 to 2 weeks	> 2 weeks
3. **D**omain **E**xpertise	No expertise needed	Minimal	Educated choice Beginner up to intermediate	Iterative process of exploring conf. options	Expert with strong R&D skills	Expert and R&D team is needed
4. **W**ork **R**equired	Not needed	Minimal choice selection	analysis of available config	+transforming & extending conf.	+fixing, and extending conf	+developing, R&D is required
5. **T**ech **S**kills	Not needed	Minimal	Expertise in the domain	Expert in configuration and R&D	+ R&D capabilities.	+team with strong R&D capabilities.
6. **C**ost of **O**wnership	High initial, low support	Medium initial, low support cost	Medium initial, medium support	Low initial, high support	Medium initial, high support	High initial, high support

EXPERIMENTAL EVALUATION AND RESULTS

TABLE 2
EVALUATION RESULTS

Configuration.	C1	C2	C3	C4	C5	C6
Q1:Difficulty				4	5	6
Q2:how long			3	4		
Q3:expertice		2	3	4		
Q4:work amount		2	3	4	5	
Q5:tech skills			3			
Q6:cost	1	2	3			

CONCLUSIONS

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- The study **proposes an approach for the easy configuration and criteria for evaluation** of a software architecture for peer learning which is validated by implementing and deploying a system in a real case study.
- The **basic functional requirements for the peer learning system have been defined** in order for its software architecture to be designed.
- The features of **different peer learning processes and their integration in different systems** have been introduced.
- The **configurational categories have been defined**, which allows different systems or different versions of the same system to be easily compared in terms of how easy it is to configure and run a software system with rich configurations as a peer learning system.
- The ***Classification of the Software Configuration*** Categories Maturity Level (CCML) are:
  - simplicity of categories,
  - allowing the evaluation of the system's software configuration maturity;
  - easy switching between categories and predicting the expected cost – in terms of time, complexity, and expertise;
  - allowing easy requirements for the system, depending on who, how long and how will use the system.

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THANK YOU

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