INFORINO 2020
Moscow, Russia
14-17 April, 2020

Decision Support System in Online Training Process Management for Implementing Complex Open Ended Assignments in Engineering Education

Speaker:
Viktoriya Latypova
USATU

Authors:

Viktoriya Latypova

Vitaly Martynov

Anatoliy Turganov

Ufa state aviation technical university

Problem formulation and the relevance of its solving

A great variety of decision support systems is used to make quick and reliable decisions in educational activity in general and in engineering education in particular. The systems are applied in learning path planning, educational programmes implementation, online courses developing, online training process management etc.

Existing methods of decision making are not effective in case of online training process management in implementing complex open ended assignments (COA), which cannot be checked by a test (for example, term papers, calculation and graphic works, laboratory works). The number of COA in engineering education is more than in preparation of specialists in other fields. This make the problem solving relevant for engineering education.

A method and DSS, implementing it, are suggested to overcome such challenge.

A method of decision support based on error classification with the use of intelligent technologies

The method is based on:

- classification of typical errors which are situated in error guide;
- utilization of knowledge base which implement production rules, obtained by means of online learning effectiveness cognitive map and expert methods.

Error classes:

- errors connected with knowledge, skills and abilities (KSA) in the current training course;
- errors connected with KSA in the previously undergone training courses (background errors);
- errors, which are not connected with KSA in training courses.

Decision Support System in Online Training Process Management for Implementing Complex Open Ended Assignments in Engineering Education

A method of decision support based on error classification with the use of intelligent technologies: method scheme

Decision Support System in Online Training Process Management for Implementing Complex Open Ended Assignments in Engineering Education

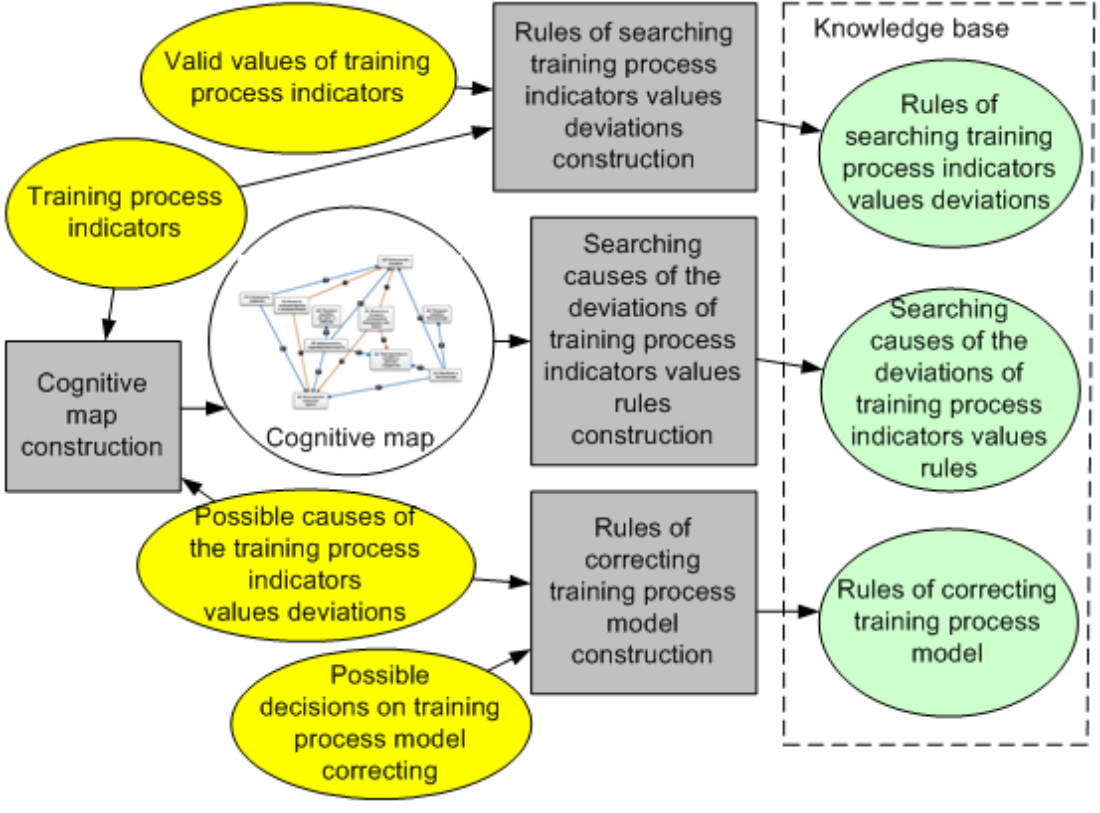
A method of decision support based on error classification with the use of intelligent technologies: knowledge base construction scheme

Indicators of training process:

- errors repeatability among the students;
- a number of attempts of turning a work

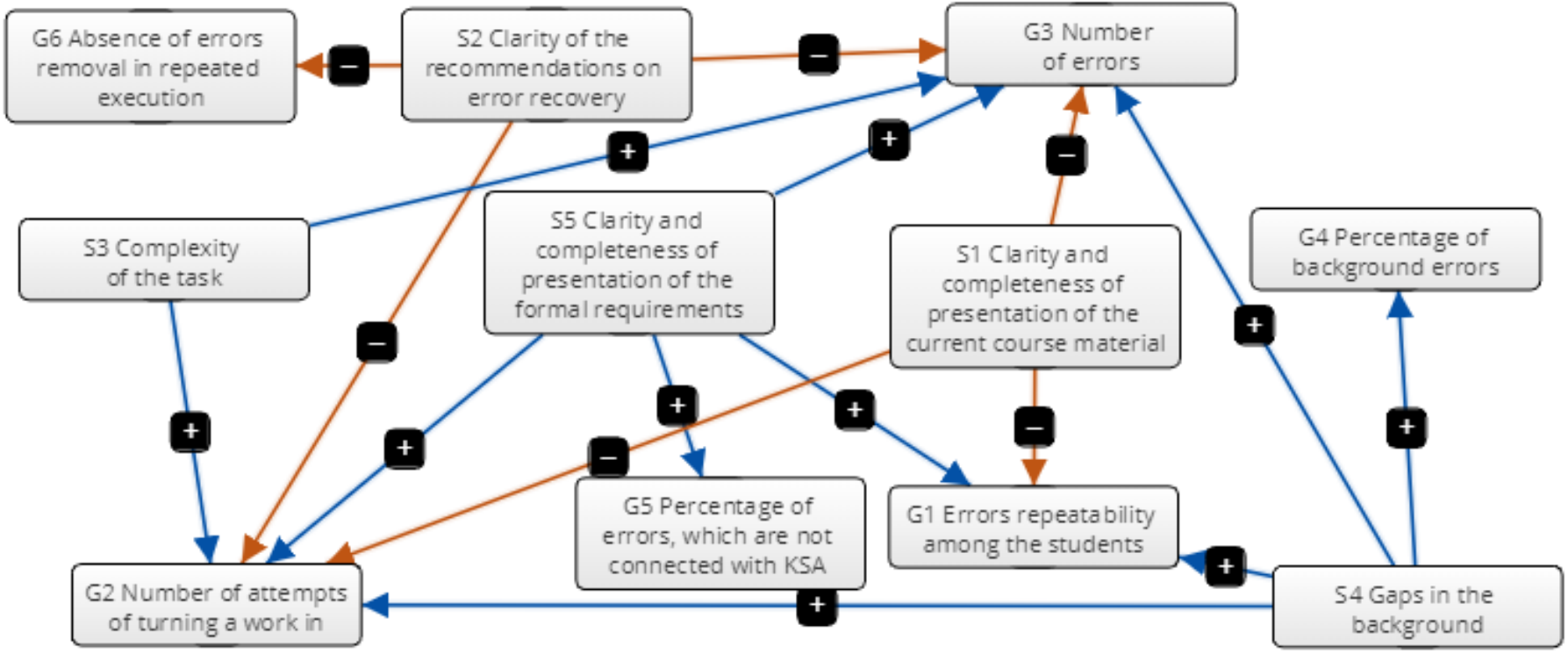
(a stage of work) in;

- a number of errors;
- a percentage of background errors;
- a percentage of errors, which are not connected with KSA in training courses;
- the absence of errors removal in repeated execution.



Decision Support System in Online Training Process Management for Implementing Complex Open Ended Assignments in Engineering Education

A method of decision support based on error classification with the use of intelligent technologies: online learning effectiveness cognitive map



Decision making effectiveness evaluation

The formula for calculating the integral indicator for a course:

$$E_C = \frac{1}{q}\sum_{i=1}^{q} E_i, \qquad (1)$$

where q – a number of stages in the course; E_i – the value of integral indicator of effectiveness of i-th stage.

The formula for calculating the integral indicator for a course stage:

$$E = 0{,}243e_1 + 0{,}2e_2 + 0{,}233e_3 + 0{,}114e_4 + 0{,}086e_5 + 0{,}124e_6, \qquad (2)$$

where e_i – the normalised value of the i-th indicator.

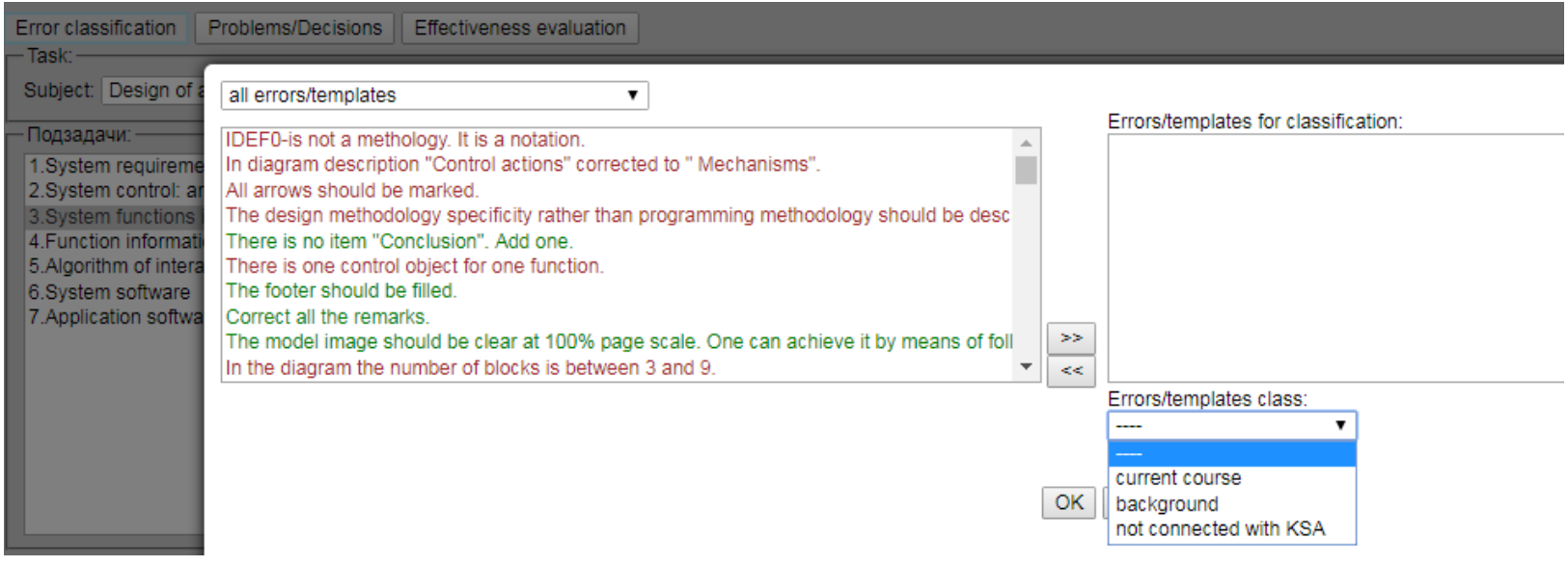
Decision Support System in Online Training Process Management for Implementing Complex Open Ended Assignments in Engineering Education

DSS implementation

- web technologies: HTML, CSS, JavaScript, Ajax, PHP;
- Tau Prolog as Prolog interpreter (JavaScript software);
- MySQL as a DBMS;
- local server Denwer for DSS implementing, testing and introducing.

Decision Support System in Online Training Process Management for Implementing Complex Open Ended Assignments in Engineering Education

DSS implementation: a screen form of typical errors classification



Decision Support System in Online Training Process Management for Implementing Complex Open Ended Assignments in Engineering Education

DSS implementation: a screen form of inference of the decisions

Data for decision making

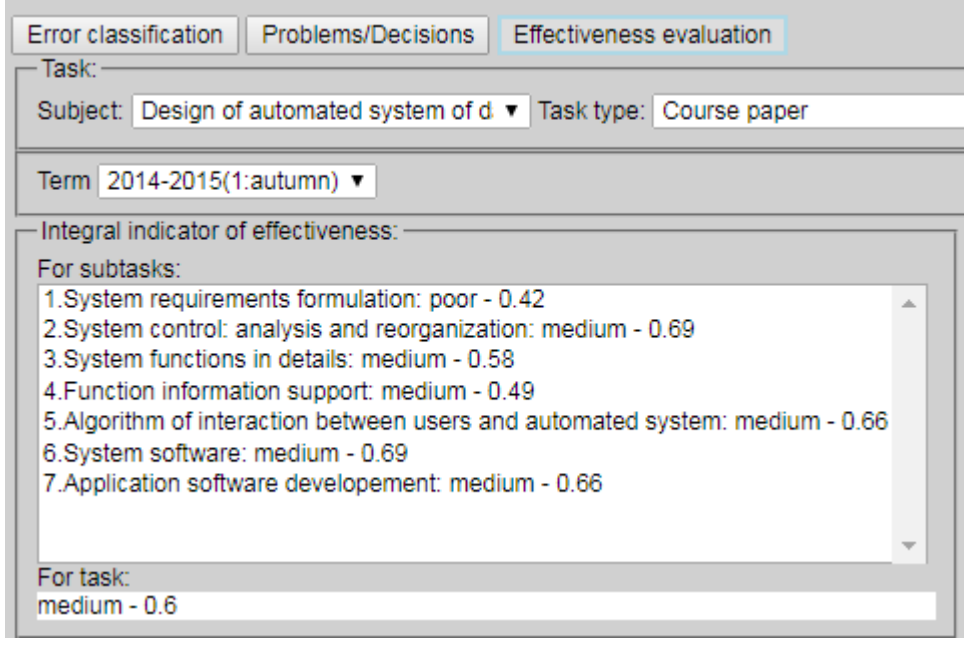
Actual errors repeatability among the students, %	57
Actual number of attempts of turning a work (a stage of work) in	1
Actual number of errors	3
Actual percentage of background errors	34
Actual percentage of errors, which are not connected with KSA	24
Actual absence of errors removal in repeated execution	7
Availability of background material	0
Current course errors with invalid repeatability	0
Background errors with invalid repeatability	1
Errors which are not connected with KSA with invalid	0

Decisions

P1=2 (splitting task (subtask) implementation into two stages is NOT required)
P2=3 (current course materials correction is NOT required)
P3=1 (background material preparing and a step "work with background material" adding is required)
P4=3 (correction of formal requirements for work implementation is NOT required)
P5=2 (correction of the recommendation on error recovery is NOT required)

Decision Support System in Online Training Process Management for Implementing Complex Open Ended Assignments in Engineering Education

DSS implementation: a screen form of solutions effectiveness evaluation

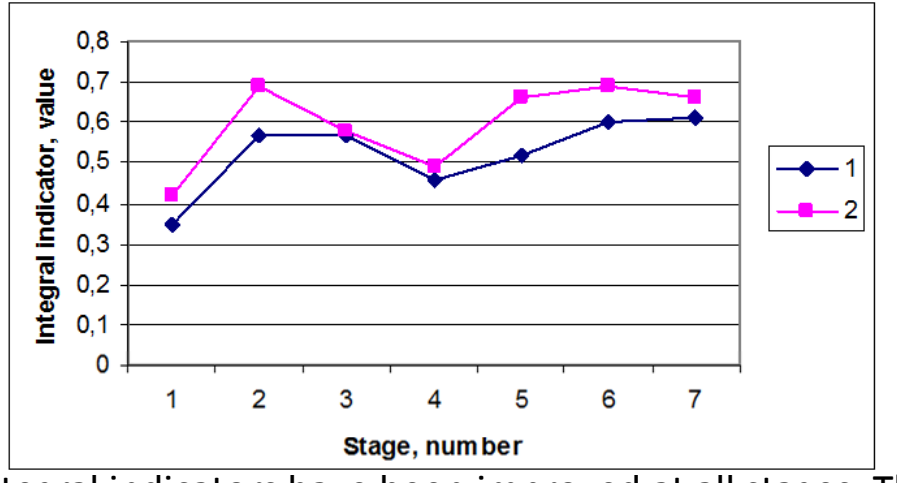


Decision Support System in Online Training Process Management for Implementing Complex Open Ended Assignments in Engineering Education

Experiment description and results

The method was utilized in online training process management during term paper performance on the subject “Design of automated system of data processing and control” in Ufa state aviation technical university.

The trends in the integral indicator at all stages during the maintaining the course in the first and second times



The values of the integral indicators have been improved at all stages. The integral indicator for course paper has been increased from 0,53 to 0,6 in general. This corresponds to 13% improvement.

INFORINO 2020

Moscow, Russia
14-17 April, 2020

Thank you for attention!

Speaker's contacts:

Viktoriya

Latypova

USATU

vikvaphoto@yandex.ru

IEEE

NATIONAL RESEARCH UNIVERSITY

CROC