Monitoring of a Strategy Proficiency as a Tool of the Pedagogical Decision Support System

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Abstract. The paper presents the use of a computer in the organization of continuous monitoring and evaluation activities for the adoption of pedagogical decisions in the educational process, based on assessments of the level of knowledge of the learner's basic strategies of activity using cognitive science.

Keywords: cognitive science, digital data, human-computer interaction, support for the adoption of pedagogical decisions, strategy of activity, theory of modeling, learning control, monitoring.

1 Introduction

The education system should provide a comprehensive approach to the learning process, taking into account various styles, volumes and ways of dealing with learning material. Actually it also aims at defining multifaceted control over the subject knowledge proficiency in terms of both the self-assessment ability and the complexity of learning material perception, etc. Is it worth lowering an exam grade, if a student himself founded out an inadequateness of the result and localized possible mistakes' sources, but he could not correct them due to some reasons (perhaps, he was very short of time)? Thus, the system development of pedagogical decision support, considering the above-mentioned aspects, is relevant nowadays. In our research paper we assume to specify a strategy theory [1] as the basis for conducting our analysis. We also consider monitoring of a learning process management within the framework of various levels of the basic strategy proficiency as a key factor for investigating not only the mathematic issues but also the strategy proficiency of information formalization and information conversion into another languages as well. Consequently, the continuous control-assessment activity of the system development of pedagogical decision support is of great importance [2].

2 Formation of the strategy proficiency

In modern conditions, the work of a lecturer becomes a priority for the students' management and it is not limited to the knowledge and skills transfer, training for self-

government, the implementation of educational functions. This requires the use of more flexible control mechanisms, not limited to the implementation of algorithms, to obtain a large amount of information about the current level of the learner's potential development. A review of training materials and planned activities is given in article [3]. Issues related to the adoption of pedagogical decisions are highlighted in articles [4, 5, 6]. Article [7] presents a model for predicting results based on the activity data and early estimates. The described approach makes it possible to develop a learning management system that provides self-learning, as well as inform teachers. Article [8] provides a description of the cognitive assistant based on a dialogue that is able to adapt to the student's individual performance. It is shown that the cognitive assistant gives higher learning outcomes than the non-interactive environment. Work [9] describes a training project for an online platform that allows you to create training projects (LD) with support for data analysis. A decision making in the LD process is carried out by two types of analysts: as a result of planning actions ordered by a time scale (LD analytics); and aggregated metadata extracted from several grouped LDs (community analysis).

The activity management is accomplished with a help of modeling. It is not worth identifying a model with its prototype. We consider a model as a binary system, consisting of an interfacing component for information exchange between a prototype and its image and a reference model component for the image formalization [10]. The author's adequacy theory is based on the fact that model quality is assessed by means of the evaluated model comparison with the reference one [11]. Even within the framework of one type of activity we can find out several adequacy peculiarities and related reference models. The formalization of a specific adequacy feature can start either from the reference model design or the comparison method formation (with further reference model differentiation and formalization of the related function). Activity plans are viewed as the popular reference models of any activity. We proposed to consider strategies as tools for the activity plan creation.

The strategy embraces a system of typical objectives and plans for their achievements, available resources, etc. A general scheme of planning mechanism is shown on Fig. 1.

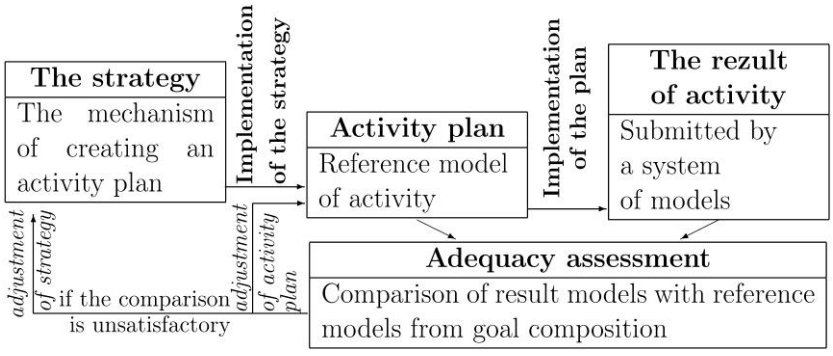

Fig. 1. Description of a planning mechanism.

An actor may perceive the plan items either as a reference to a definite algorithm or as a target, wherein a method of achieving is not elaborated. Strategies and plans (as typical plans like integrated constituencies of a strategy alongside with the strategy implementation results) should be defined as components of the activity management system. It is worth pointing out both the mechanisms of a dominant direct action (based on algorithms) and the mechanisms of a dominant indirect action, including targets and diversified limits. We focus on implementing an algebraic approach to a strategy-setting, its analysis and improvement. In the authors' opinion, the algebraic approach contributes to forming three components: 1) the system of basic elements; 2) the system of typical conversion and typical element compositions; 3) mechanism of an approximation designed for (to some extent approximate) submission of the required or available strategy in the form of implementation results in terms of typical conversion and typical basic element compositions as well.

An assignment referred to the simple strategies may be performed in the form of intrinsic algebraic strategy model, see Fig. 2.

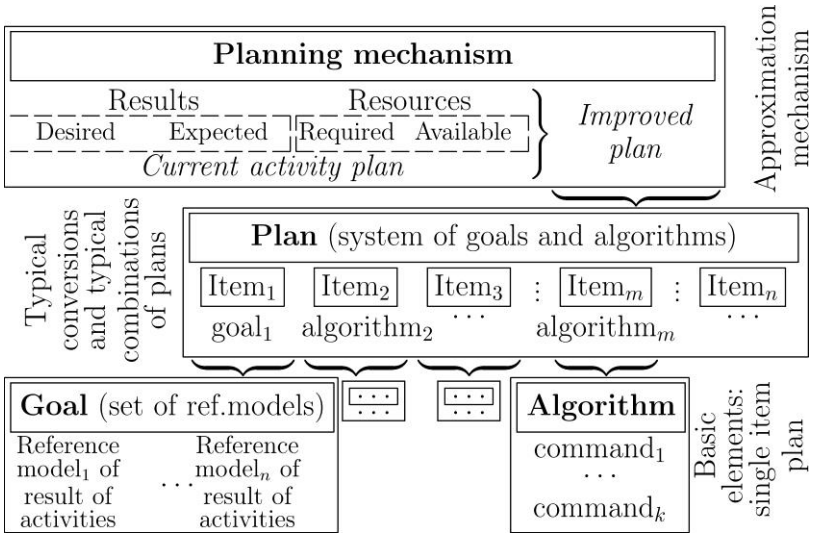

Fig. 2. Intrinsic algebraic model of strategy.

In order to simplify an awkwardness of a complex strategy description for its practical usage, we offer to implement an external algebraic strategy representation to solve this problem:

1) basic elements are viewed as basic activity strategies;

2) the system of typical strategy conversions and their typical combinations embraces such transformations as a substitution of a plan item into a goal-oriented plan, etc.;

3) we proposed to identify the approximation mechanism as an approximate activity submission in the form of typical conversions and combinations of basic strategies. This

mechanism was tested in the learning process and the scientific activity as well. Our article is not focused on describing this mechanism.

The paper [11] contains a list of examples reflecting skills formation in terms of diversified activity assessment within the framework of mathematics learning process, wherein mathematics is viewed as a basic discipline in the computer science.

3 Possibilities of control-assessment activity in strategy formation

A control-assessment activity and its key tools submit major possibilities including the following aspects:

1) actualization of available knowledge;

2) motivation of students to get knowledge and skills for the further subject learning and the applied tasks handling. Thus, motivation contributes to dealing with learning material;

3) complex assessment of student quality is identified as a key factor for realizing differentiated learning approach;

4) effectiveness checking of selected learning methods and their improvements if necessary;

5) submission of basis for effective realization of the students' self-study.

A continuity and a consistency in realization of learning process components are considered as the key factors for improving their quality. It means that system development of a continuous control-assessment activity is required.

A control-assessment activity in the learning process at the higher education institutions exercises definite functions: diagnostic, controlling, motivating, educational, orientation, development and corrective ones. The priority of each function is determined by the activity type.

Under the conditions of the massive open online courses, e-learning and a model of blended learning, it is necessary to organize the continuous control. Its realization requires:

– complex standards development for tasks as well as control and assessment procedures for complete data volume formation enabling the system of pedagogical decision support to offer reasonable recommendations;

– measurement of the knowledge mastering completeness alongside with a complex assessment of learning achievements;

– a holistic perception of a continuous control as the learning system component targeted towards subject matter in terms of providing intra- and interdisciplinary relationships; the control also contributes to methodology basis mastering in particular activity sphere (for example, "how to deal with something unappreciated"), potential development to organize activity optimally, etc.

We carry out an automated decision support system based on the complex, multifaceted level assessment of basic strategy proficiency, see Fig. 3.

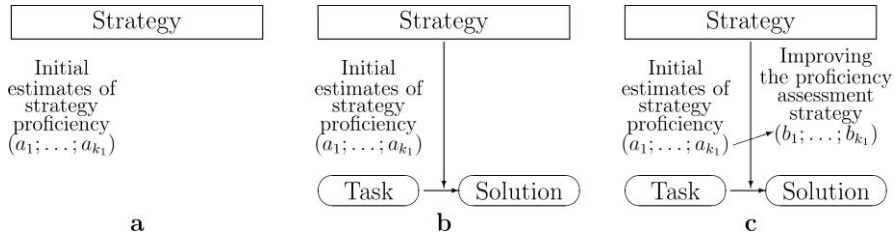

Fig. 3. Illustration of proficiency assessment strategy management.

The examples of assessing the level of ownership of a strategy are the time taken to perceive a problem, the time taken to solve a problem, the number of tasks solved in a given time, etc.

4 Conclusions of the research and prospects for further development

Defining a system of weights and methods for measuring them is a separate task that requires additional research, but is obviously solvable.

A learning goal in these terms may be treated as an inclusion of vector proficiency assessment strategy in a definite area. A choice of target area is viewed as a separate task, which is not the subject matter of this research paper. We regard the system of pedagogical decision support as a tool for getting a complex of some methodical and pedagogical impacts; in this case, the students' vector estimates of strategy proficiency will be focused on the target area.

Accomplishment of assignments individually or in teams is considered as the main tool of this system. It must offer the following variants: sets of assignments recommended for a concrete student or the students' group. At present it is assumed that a final variant of pedagogical decision is undertaken by a lecturer. Upon improving the system, it can be regarded as a totally automatic one.

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