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Personalized Planning of Study Course Structure Using Concept Maps and Their Analysis

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Abstract

Four graphs for personalized study planning constitute the personalized study planning framework, namely, a graph representing a conceptual structure of study program; a graph representing study course; a graph visualizing each topic of study course using concept map; a graph representing learning objects. This paper deals with the third graph – a graph displaying study course topic structure and knowledge assessment. Authors describe concept map based knowledge evaluation system integration possibilities with personalized study planning prototype and usage in personal study planning. In order to perform the structure analysis of the concept maps authors propose to use of the methods of structure analysis to calculate the ranks for the nodes of the graphs thus detecting the most significant nodes in the graph structure. The calculation of ranks for the graph nodes allows detecting the most essential concepts in the concept map.

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1. Introduction

In this chapter the personalized study planning framework is described based on the set of graphs and elaborated in previous research[1].

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To accomplish the personalized study planning starting from the creation of study programme plan and ending with the choice of learning objects, there is developed the framework of personalized study planning based on the following set of graphs (see Fig. 1)[2,3,4]:

- Representing a conceptual structure of study program $G_1(V_1,Q_1)$ allows to design individual study plan
- Representing study course $G_2(V_2,Q_2)$ allows to develop individual learning scenario
- Visualizing each topic using concept map $G_3(V_3,Q_3)$ ensures mapping of each topic to the corresponding concept map
- Representing learning objects $G_4(V_4,Q_4)$ describes each concept with learning object

The graphs of personalized study planning framework are mutually related. At first, the learner in order to create an individual study plan needs to select courses to be included in the individual study plan (graph G_1). After that the learner may choose the study courses which he/she wants to master. Study course structure is described using graph G_2 and that allows to develop individual learning scenario. In the study course structure graph G_2 learner needs to choose course topic and graph G_3 describes at the next level the concepts of each topic and their mutual relationship. The learning objects of topics and concepts, that are available for acquiring knowledge are described in the fourth graph G_4 of the framework of personalized study planning.

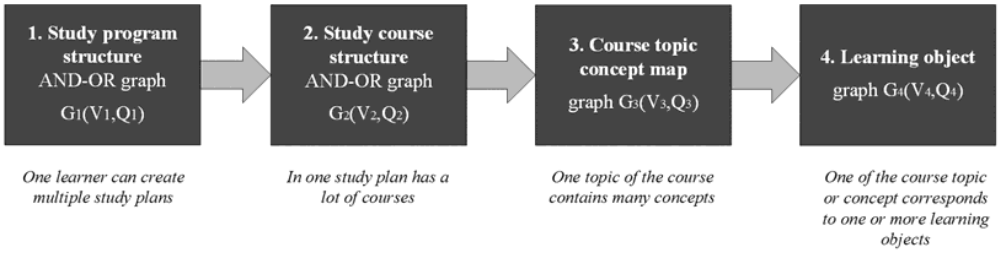

Fig. 1. General structure of personalized study planning framework.

This framework allows any learner to tailor a desired study program by adapting the modularized curriculum structure and to choose the suitable learning strategy for each study course[5,6].

In order to fulfil a personalized study planning framework, a Study Planning System (SPS) as a prototype[4] has been developed according to the personalized study planning framework. Based on the graph $G_2(V_2, Q_2)$ this prototype allows individually to visualize and design the study plan according to the graph $G_1(V_1, Q_1)$ as well as the choice of a study course. Input of learning objects is provided if the graph for representing learning objects $G_4(V_4, Q_4)$ is not visually represented in the prototype. Study Planning System prototype does not implement the graph for presenting course topics with a concept map $G_3(V_3, Q_3)$. In the given paper the authors deal with the graph $G_3(V_3, Q_3)$ integration possibilities with concept-map-based knowledge assessment system IKAS and the concept map structure analysis. The following chapter describes the graph G_3 in more details.

2. Concept maps of the course topics

In course structure graph G_2 learner needs to choose course topic as shown in Fig. 1 and at the next level graph G_3 describes the concepts[7] of each topic and their mutual relationships. Concept maps were introduced in 1972 by J. D. Novak[8]. The presentation of knowledge in the form of a graph is called a concept map[9]. Graph $G_3 (V_3, Q_3)$ is used for representing the concepts and their relationships. The concepts are represented by a set of un-empty nodes V_3, and the relations between concepts are represented by a set of un-empty links Q_3. The relation between concepts is described by the semantics of the links. A concept can describe an event or an object. Two or more correlated concepts form a sentence[8]. Cross links are another concept map characteristics. These are relationships between concepts from different domains. Cross-links allow us to see in what way some domains of knowledge represented on the map are related to each other[8].