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Recommendation in E-Learning Based On Learning Style

Aleksandar Kotevski[1] , Gjorgi Mikarovski[2] and Ivo Kuzmanov[3]

Abstract – **This paper proposes a prototype of intelligent system for recommendation and delivering learning material to students in format and design that is adequate to students learning style. On the other words, the system should meet the needs of students, showing learning materials in acceptable format and style to the user. In order to make decision about the most adequate learning style, system is going to using VART classification to detect the student learning style. Furthermore, teachers can post learning materials in the system. They are going to receive suggestion for the most adequate category by using Vector-space models for information retrieval.**

Keywords – **VARK, e-learning, learning style, learning material, data mining.**

I. INTRODUCTION

Intelligent web-based learning systems aim to improve the quality of services and applications in e-learning systems. In this context, they deliver the most adequate content to users, based on their requirements and learning styles. Moreover in intelligent systems, users not searching through a large repository of learning materials – they search in smaller set of materials, that are most adequate for the users, based on their experience, previous content and needs. Also, the data is supplied in a form acceptable to the user, and in the course of using the system user often receives advice and guidance for its next action.

II. LEARNING STYLES

Individual learning styles differ, and these individual differences become even more important in the area of education[1]. Therefore, the real challenge in e-learning is keeping the people it is designed for in mind (Canavan, 2004). Individual learning style refers to style or learning methods used in the process of learning. According to Jantan and Razali (2002), psychologically, learning style is the way the student concentrate, and their method in processing and obtaining information, knowledge, or experience. On the other hand, from the cognitive aspect, learning style can be referred to various methods in perception creation and information processing to form concepts and principles (Fleming & Baume 2006) [1].

Learning style is a cognitive composite, affective, and psychological factor which act as an indicator on how individuals interact and respond to learning environment (Duff 2000).

There are many models on learning styles that can be identified from earlier studies, but according to the Malaysian Education Ministry (2008), there are two learning style models that are commonly used; Dunn & Dunn and VARK. In this paper we are going to using VARK model for determination of student learning style.

III. VARK

The VARK (stands for Visual, Aural, Read/Write, Kinesthetic) is model for detecting learning styles by providing questionnaires with 16 questions. It's authored by Fleming and Mills and has been used as a guide to help people learn more effectively. It is VAK modification and includes a systematic presentation of questions to identify preferences for the ways information and ideas can be taken in or put out [4].

A. What is VARK

The VARK model is based on principles of sensory perception so the instructional methods must be a stimulus for the student to gain any understanding of the subject [2]. It makes students classifying to four different modes (aural, reading, visual, kinesthetic), based on different senses, namely visual, aural, reading, and kinesthetic, and the name of the model itself.

Based on Fleming (2006), aural mode students tend to attain information by discussion and listening. For reading mode, these students have the ability to accept and interpret printed information. For visual mode, the students are more prone to accept learning through interpreting charts, graph figures, and pictures. While kinesthetic mode leans more towards accepting learning based on behavior such as touch, feel, see, and listen. Based on each mode's tendency, researcher hopes to conduct a study to obtain students' feedback on computer based learning [4].

Users complete the questionnaire online or on paper. They can have more than one answer per question, so they get a profile of four scores - one for each modality. That begins a process of thinking about how they prefer to learn. VARK is a catalyst for meta cognition, not a diagnostic or a measure. The questionnaire is deliberately kept short in order to prevent student survey fatigue.

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B. Related works

There are many authors that were using VARK to identify the most adequate student learning style. Based on Murphy et al. (2004), learning based on VARK learning style model provides a medium for self-knowledge and exploring opportunities in classrooms, thus, making a more productive learning experience and enjoyment among students. According to Drago and Wagner (2004) it has been proven that students possess diversity in learning styles, which has become their priority, and teachers should effectively deliver the course according to the students' needs. Research by Bachok et al. (2000) discovers that students have different learning style practice, in which unsuitable lessons and learning style usage can effect to students' learning and behavior quality in class.

C. Using VARK in the proposed system

Students have to complete the online questionnaire. They can have more than one answer per question, so they get a profile of four scores - one for each modality. That begins a process of thinking about how they prefer to learn. The questionnaire is deliberately kept short in order to prevent student survey fatigue. It also tries to encourage respondents to reflect and answer from within their experience, rather than from hypothetical situations.

System is going to provide online questionnaire with 16 questions. To be more reachable, questions will be shown in text and audio format. After passing the questionnaire, based on the student answers, system is going to set adequate learning style to the student.

IV. PROPOSED SYSTEM

The proposed intelligent system is going for deliver learning material to students in format and design based on students learning style. The student learning style is going to be detected via VARK questionnaire. In additional, teachers are going to receive suggestion for the most adequate category while they are posting new learning materials in the system, by using Vector-space models.

A. System architecture

The general architecture of the proposed system contains three main units:

- Student unit
- Teachers and system administrator unit
- Hardware and software

Fist, student need to be registered to be able to read learning materials that are post from the teachers. In the process of registering, student has to go through 16 questions from VARK questionnaires. As a result, VARK will give the most adequate learning style for the student, based on his answers.

Then, learning material will be delivering in format that is predicted with selected learning style for the student.

Teachers, as a separate unit of this system, can upload learning materials. For each learning material, teachers have to add abstract first. Then, in manner to deliver the learning materials in the most adequate format, teachers need to post learning materials in few formats:

- Visual format (using shapes and the different formats that are used to highlight and convey information)
- Aural format (audio materials, providing materials in group discussion boards, sending learning content to email while it is upload to server)
- Read/write format (providing some additional links, dictionaries, quotations and words
- Kinesthetic format (simulations, videos and movies of "real" things, as well as case studies, practice and applications)
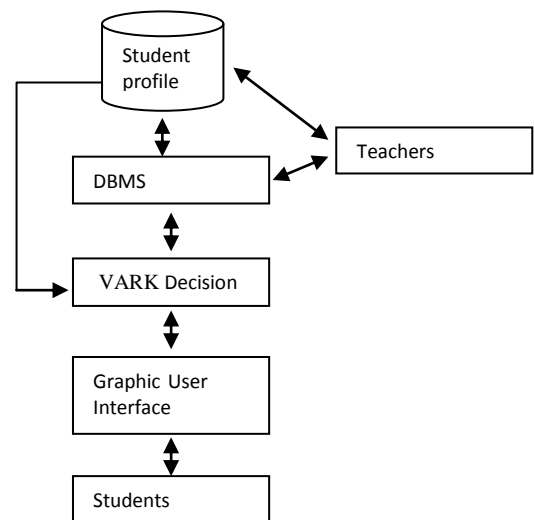

Figure 1: System architecture

The abstract of all learning materials in the proposed system will be saved in textual files.

The system is going to have several defined categories. Each of them has keywords that are using in the process of determination and proposing the most adequate category for the learning material.
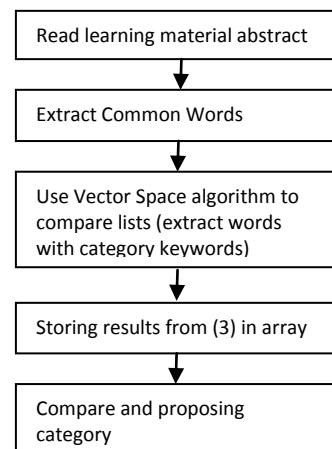

Figure 2: Process of category detection

Category detection will be made by vector space models, with searching through learning articles abstract that are published by teacher. The result of text mining process will be proposing the most relevant category for learning material. Category list is dynamically and editable by system administrator. This technique mainly relies on the analysis of keyword in the learning content abstract.

In order to make the process of information retrieval efficient, each category contains a list of synonyms and keywords, and the categories are manageable by administrator and users

The vector-space models for information retrieval are just one subclass of retrieval techniques that have been studied in recent years. Although the vector-space techniques share common characteristics with other techniques in the information retrieval hierarchy, they all share a core set of similarities that justify their own class [2]. The Vector Space Model (VSM) is probably the most widely used model for retrieving information from text collections [3].

B.System functionality

The main idea of this paper is proposing system that will detect the most adequate student learning style and delivering learning material based on VARK questionnaire results. For better understanding the proposed system, we are going to review one process of using the system:

1) *Students:*
- A student visit application URL
- Students need to go through questionnaire to be determinate his learning style. In this step, student have to select questions format type: textual or audio format
- After completing the questionnaire, system is going to check student answers and generate final results. There are 4 possible results:
    o Visual
    o Aural
    o Read/Write
    o Kinesthetic
- System will insert new record in student table (will create student model)
- System is going to set learning style for that student model
- Students login to application
- Select category (learning area)
- System is going to delivery learning material in format based on his learning style

2) *Teachers*
- Teacher is login to application
- Teacher can manage his learning materials
    o Add new learning material – he has to select category (to accept proposed or select new one) and upload learning material in four formats (Visual, Aural, Read/Write and Kinesthetic)
    o Change or delete his learning materials
-
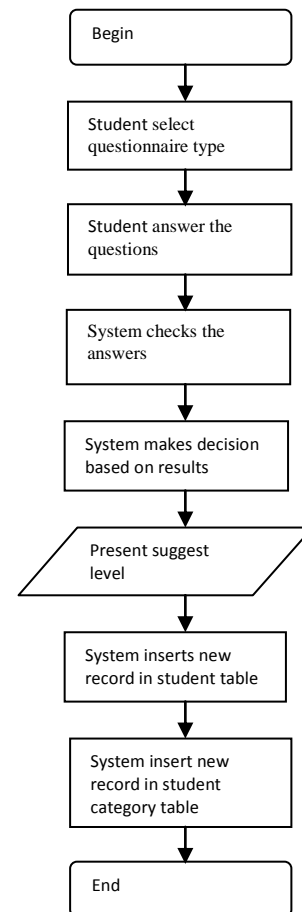
Figure 3: Creating new student model

C.System monitoring and improvement

In order to be the proposed system more efficient (learning materials to be delivered to students in the most acceptable form for them), system is going to check for students activity.

When a student receive a learning material, the system will check if the student uses the format set by the system (according to the learning style determinate by VARK) or student chose a different format to display the learning material.

On certain period of time, the system is going to check this statistics. There are two possible situations:

1) The student is satisfied - use the format suggested by the system. It means that his learning style, determinate by VARK is adequate for the student.

2) The student often changes the format of the delivery of learning content. It means that his learning style, determinate by VARK is not adequate for the student. In this case, the system will change the selected student learning style. The new learning style will be selected based on the most chosen learning style from the student.

V. CONCLUSION

The main goal of this system is to provide the learner with suitable learning material thus possibly enhancing their potential for learning. There are a lot of models for determination of learning style, but we propose using a VARK. It was selected for determination student learning style due to the fact that it seemed to be the most concise tool and had the most relevant questions. On the other hand, it does not contain too many questions, so student will give answers to all of them without problems. Also, it gives clear results, so the proposed system can make decision about format of learning materials, based on questionnaires results. This paper shows how the VARK learning style can be incorporated into the e-learning system and thus shows how it will be used to provide the relevant learning material for the learner based on their learner type.

Except determination of student learning style, proposed system is going to propose the most adequate category for learning material, while teacher post new learning article.

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