Considering Sensing-Intuitive Dimension to Exposition-Exemplification in Adaptive Sequencing

Pedro Paredes and Pilar Rodriguez

Escuela Técnica Superior de Informática, U. A. M., Cantoblanco, 28049 Madrid, España
{Pedro.Paredes, Pilar.Rodriguez}@ii.uam.es

Abstract. This paper shows a way of using sensing-intuitive dimension of learning styles of students in order to improve the efficiency of adaptive learning systems. Firstly, it introduces the procedure of extracting information about sensing-intuitive students from the Felder-Soloman ILS questionnaire. Then, it presents a mechanism of application of sensing-intuitive dimension to exposition-exemplification sequencing. The example used to explain the adaptation effects is taken from a chess course developed with TANGOW, Task-based Adaptive learNer Guidance On the Web.

1 Motivation

The theory of learning styles states that people have different approaches to learning and studying [1]. We all have learning preferences that enable us to learn more effectively. Adapting the course to the learning style of the student changes the point of view of the learning process from teacher's perspective to learner's perspective. In this sense, it is necessary to mention the experience of Arthur [2]. It is one of the first systems which incorporates learning styles as a significant feature to their student models.

There are a large number of learning styles models: The Myers-Briggs Type Indicator (MBTI) derived from the theory of psychologist Carl Jung [3]; Kolb's Learning Style Model classifies students depending on how they perceive and process information [4]; Herrmann Brain Dominance Instrument (HBDI) is based on four different task-specialized quadrants of the brain [5]. Felder-Silverman Learning Style Model categorizes an individual's preferred learning style along a sliding scale of five dimensions [6][7]. One of them is called the *sensing-intuitive* dimension.

Sensing learners prefer learning first concrete and practical information oriented toward facts and procedures while intuitive learners prefer conceptual and innovative information oriented toward theories and meanings. In this paper we propose an adaptation procedure for moderate and strong sensing-intuitive learners, as detected by means of the Felder-Soloman ILS questionnaire. In our approach, adaptation lies in presenting examples before expositions to sensing learners and quite the opposite to intuitive learners. In doing so, it makes use of this adaptation in TANGOW [8][9].

2 Extracting Information about Sensing-Intuitive Students

Based on the Felder-Silverman classification, Felder and Soloman have built a questionnaire called ILS, *Index of Learning Styles* [10]. The aim of ILS questionnaire is to determine the learning style preferred by each student. ILS questionnaire is still under construction and nowadays it is formed by 44 questions with two possibly answers; *a* or *b*. These questions are divided into four groups, with eleven questions each, corresponding to four categories in Felder and Silverman's classification.

To take measurements of student's preferences in a given dimension, we have to subtract the answers relating to one extreme to the other one of the same dimension. Therefore, someone could be sensing-intuitive in a scale of odd values between 1 and 11. For example, if a student chose four of the answers classified as sensing and seven of the answers classified as intuitive, then it is intuitive with a score of 7-4=3.

Felder and Soloman [10] interpret the results in sections. If you obtain a score of 1 or 3 you have a mild preference but you are well balanced. Otherwise, if your score is 5 or 7, you have a moderate preference and will learn more easily in teaching systems which favor that dimension. Finally, if you score 9 or 11, you could have difficulty learning in a system which does not support that preference.

We have chosen the Felder-Silverman model among the existing learning style models because its ILS Questionnaire gives us the possibility of linking directly its results to automatic adaptive environments. Thanks to the distribution of the ILS Questionnaire in four different dimensions with two extremes we can build user models corresponding to each of these four dimensions.

3 Adapting Exposition-Exemplification Sequencing

Felder [7] claims that the goal of the teacher is to strengthen those learning styles that students do not prefer. This procedure should improve the global learning capability of the students. It is a long-term objective and the aim is that students perceive and process information in all the ways. However in a Web based learning environment we try to attain a short-term goal: an easiest and most effective learning process through adaptation of learning courses to individual learning styles.

In this environment, we propose to make use of the ILS results to adapt the exposition-exemplification sequencing in a Web-based learning environment. The procedure is as follows: firstly the student fills out the questionnaire; then the score obtained points out the sensing-intuitive preference of the student: mild, moderate or extreme; finally we use that preference to adapt the exposition-exemplification sequencing in case of moderate and extreme sensing-intuitive learners.

We have implemented the described adaptation procedure on TANGOW, Task-based Adaptive learNer Guidance On the Web [8][9]. In TANGOW a course is described in terms of Teaching Tasks and rules. Knowledge is represented by means of TTs that need to be achieved. TTs may be exposition tasks (E), practical or examples (e).

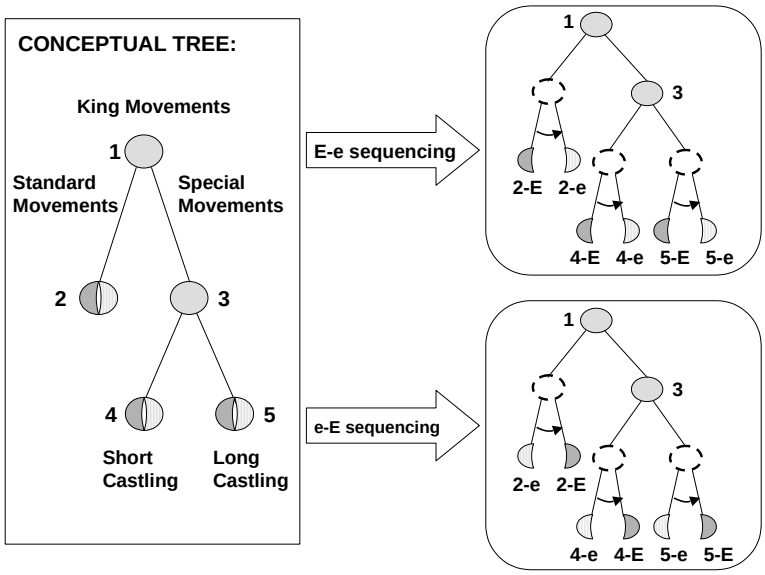

Figure 1. Exposition-exemplification sequencing in sensing (lower) and intuitive (upper) students in a piece of chess course about king movements.

Exposition TTs can have an example associated. Designers establish the default order, that is, the order of the tasks and, consequently, the order of the task types (examples first or exposition first). Our approach is to dynamically modify that last order according to the learning style. If the student obtains a score of 1 or 3 his/her preference to one or the other style is balanced and we apply the default order. On the contrary if the student scores 5 or more than 5, the order of exposition-example tasks will be in harmony with his/her learning preference.

In Fig.1 it is presented a conceptual tree with three E-e nodes. Nodes 2, 4, and 5 are E-e nodes; this means that student could see exposition before example (E-e) or vice versa (e-E). This tree shows the King standard and special movements (short and long castling). On the right side two different trees are presented showing the run-time sequencing based on sensing-intuitive adaptation. The lower tree with e-E nodes corresponds to moderate and extreme sensing students. The upper tree with E-e nodes will be presented to moderate and extreme intuitive students. The default sequencing is suitable for students with a mild preference and we assume that it is a common practice to expose firstly and provide examples later (E-e sequencing).

4 Conclusions and Future Work

This paper suggests the application of the results of the ILS questionnaire to adapt the sensing-intuitive dimension to the exposition-exemplification sequencing. We assume that a strong relationship between examples and their related theoretical expositions exists with independence of the conceptual representation. This relationship is more powerful than any other sequencing consideration, and can eventually be combined

with other dimensions. In this sense, we are exploring the adaptation effects of combining the *sensing-intuitive* with other dimensions [11].

In addition to sequential-global and sensing-intuitive dimensions, at present our research examines the incorporation of other learning style dimensions, according to the ILS, to the general model. It involves the study of possible conflicts between adaptive actions based on different learning style dimensions and the resolution of these conflicts by establishing a priority of some dimensions against others.

5 Acknowledgments

The Spanish Interdepartmental Commission of Science and Technology (CICYT) has sponsored this paper, project number TEL1999-0181 and project number TIC2001-0685-C02-01.

References

1. Dunn, K., Dunn, R.: Teaching students through their individual learning styles. Reston, VA.: National Council of Principles (1978)
2. Gilbert, J. E., Han, C. Y.: Adapting instruction in search of 'a significant difference'. Journal of Network and Computer Applications, 22 (1999).
3. Briggs Myers, I., McCaulley, M.: Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator. Consulting Psychologist Press (1985)
4. Kolb, D.: Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ: Prentice-Hall (1984)
5. Herrmann, N.: The Creative Brain. Lake Lure, NC, Brain Books (1990)
6. Felder, R. M., Silverman, L. K.: Learning Styles and Teaching Styles in Engineering Education. Engr. Education, 78 (7) (1988) 674-681
7. Felder, R. M.: Reaching the Second Tier: Learning and Teaching Styles in College Science Education. J. Coll. Sci. Teaching, 23 (5) (1993) 286-290
8. Carro, R.M., Pulido, E., Rodríguez, P.: Task-based Adaptive learNer Guidance on the Web. Proc of the 2nd Workshop on AS and UM on the WWW. CS Report 99-07, Eidenhoven University of Technology (1999) 49-57
9. Carro, R.M., Pulido, E., Rodríguez, P.: TANGOW: a Model for Internet Based Learning. IJCEELLL, 11 (1-2) (2001).
10. Felder, R. M., Soloman, B. A.: Learning Styles and Strategies. Available online at December (2001) in: http://www2.ncsu.edu/unity/lockers/users/f/felder/public/ILSdir/styles.htm
11. Paredes, P., Rodríguez, P.; Tratamiento de los casos secuenciales-globales moderados y extremos en un sistema de enseñanza adaptativa. Submitted to IPO2002, December (2001)