Educational System based on Cognitive styles and/or Learning styles?

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Abstract

The concept of cognitive styles is frequently applied in the field of educational systems research (Chou, Chan & Lin, 2003). Roberts and Newton (2001) suggested that although the concept of cognitive styles is a useful starting point, it is unable to account for many finds in the literature, and that any model of strategy usage that is reduced itself to mechanisms governing strategy selection is incomplete. It is necessary to consider which strategies people have available and how they discover new ones. Therefore, the aim of the present study was to investigate the learning strategies of undergraduate students of Psychology and Computing Sciences courses in order to explore possible variables to implement in a Intelligent Tutorial System. Thus, to evaluate learning strategies, the Ross Test of Cognitive Process, which evaluates the student individual performance of thinking process and strategies, was used. The results suggests that each group have different learning strategies choices. According to this, it is discussed the use of learning strategies to implement educational systems.

Educational systems

Educational systems are a kind of system which act as tutor and it is known as Intelligent Tutor System (ITS). The ITS are systems which help in learning process and permit the devolpment of a cooperative enviroment between system and student. The objective of these systems is to improve learning process, promote cognitive flexibility and guide the students through learning process. This objective is made through identification of students interests and needs. So, these systems work with the individual differences of students, including cognitive/learning styles (Carver et al, 1996; Papanikolau et el, 2001; Triantafillou, 2003).

The Educational Systema is compound by three modules: Dominium Module (set of dominium content); Student Module (student features); Adaptative Module (according student’s cognitive/learning style and information, the dominium content is adapted). The modules work integrated with different aspects of learning process, adapting the content according student’s knowledge, combining presentation midias of the content, adapting learning strategies (tactics) and modifying examples and links.

There are two principal systems: Intelligent Tutor System (ITS) and Companion System. The main focus of ITS is manage with students individual necessities and give an adaptative feedback of the system to the student. The ITS must comprehend student’s need and offer interactive strategies to the student. In general, these systems have four modules (Wenger, 1987): Dominium Module (Knowledge which represents learning objectives); Student Module (detects student’s beliefs, actions and mistakes. It is used to give adaptative feedback to the student); Pedagogical Module (it is the pedagogical strategies used to guide student’s interaction with the system); Interface (comunication module with student). The other system, Companion System, uses educational agent in its structure and this agent has two plays: intelligent tutor and learning companion (Chou et al, 2003). A leaning companion acts like a student’s companion during interaction and offer activities within the enviroment, it can colaborate or compete like a human student. The human student can observe campanion’s actions while solving problems or explaing the solutions as a part of programmed actions of the companion. The purpose of the enviroment is to use several companion’s agent in order to identify student’s features such introversion, extroversion, among others. This agents are a kind of educational agents with human caracteristics (showed by text, graphs, icons, voice, animation, and others) which facilitates social learning.

The pedagogical and didatic propousals of software products with ITS caracteristics are extenses (Corredor, 1993), because it confirms the importance of student’s individual features, recognizing that instruction could be individualize in order to facilitate the development of student’s conceptual and methodological structures.
Cognitive Style / Learning Style

The concept of cognitive style refers to a consistent and distinct way a person has to coding, organizing and performing with information, leading to a cognitive managent of learning strategies (Riding & Cheema, 1991; Atkinson, 1998, Souto, Verdin, Wainer, Madeira, Vicari & Oliveria, 2002). Cognitive style implies in a cognitive control which gives organizational and representational interfaces of inner state and extirior world (Riding, 1997; 2000). Thus, cognitive style and learning style could be just different names to the same caracteristic. However, Sandler-Smith (2001) point out that cognitive style is an independent caracteristic from personality, as well as cognitive style is independent from learning style, which would involve comprehension, tranformation, representation and organization. Moreover, the author suggest that both styles are complementaries.

In educational system research the concept of cognitive style is widely used (Chou, Chan & Lin, 2003). Roberts and Newton (2001) suggested that although cognitive style is a very important starting point, there are in the literatura several evidences showing that any model of estrategies use which resume itself to a mechanisms that govern strategies selection is incomplete. It is neccesary to consider which strategies people have and how they discover new ones. In real world, a variety of strategies are used, even in the most ordinary task, and this is a testimony of human capacities of thinking and imagining. Roberts (1993, 2000) concluded that for any task which involves thinking, problem solving or judment, in which individual differences in the use of strategies are pratically inevitable, the research which assumes that people use same methods will inevitably fail. In contrast, efforts could be directed to comprehend individual differences about strategies uses. To this author, strategy would be any procedure that is not obligatory or have a directed goal, been a set of cognitive processes which, in theory, could be modify, i.e., through discovery or instruction. Therefore, the processual constitutes of certain cognitive activities could be imutable, i.e., visual perception, and the process used in other activities could be modify at any moment, and a set modify cognitive processes could constitute a new strategy.

Aim of the study

The aim of the present study was to investigate the learning strategies of undergraduate students of Psychology and Computing Sciences courses in order to explore possible variables to implement in a Intelligent Tutorial System.

Method

Participants: 135 undergraduate students (79 from Computing Science and 56 from Psychology), with age between 18 to 40, was invited to participate in the study.

Instruments and Material: The Ross Test of Cognitive Process was used to measure cognitive strategies. The main objective of the test is to evaluate student’s individual performance in thinking processes (Ross & Ross, 1976). The test was conceived to measure 3 general abilities, analyses, syntheses and avilication, and in each of the 8 subtest (Analogy, Deductive Reasoning, Missing Sentences, Abstract Relations, Sequential Syntheses, Questioning Strategies, Relevant and Irrelevant Information, and Attribute Analyses) specific habilities are defined (table 1).

Table 1 – Abilities tested in Ross Test - Bloom (1976)

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<thead>
<tr>
<th>Abilities tested in Ross Test - Bloom (1976)</th>
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<tbody>
<tr>
<td>Ross Test</td>
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<tr>
<td>Analyses</td>
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<td>- Analogies (AN)</td>
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<td>- Missing Sentences (PA)</td>
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<td>- Relevant and Irrelevant Information (IN)</td>
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Procedures: The test session took place in a classroom and thouse students who did not want to take part of the study could leave the room freely.

Results and Discussion

To a better analyses of the results, the sample was divided into 2 groups: Group 1 (Pschology students) and Group 2 (Computing Science students). Through the analyses of the test, there is a small difference about reasoning strategies used in both groups (Tabelas 2 and 3). Although, the variance within the students was very large. In group 1, subtests with bigger means were Deductive Reasoning (RD), Attribute Analyses (AT) and Missing Sentences (PA), respectively, 58,286; 57,143 e 56,929. On the other group, the sutests with bigger means were Relevant and Irrelevant Information (IN), Attribute Analyses (AT) and Deductive Reasoning (RD), respectively 74,114; 72,608 e 69,481.
According to Bloom (1976), all teaching plan should be an adaptable module with tactics, knowledge, media, links, a base of student’s strategies frequently used, and also prepare learning style to the student module would imply building a representation and external world. Thus, aggregating style refers to a cognitive control between inner state and preferences in relation to content structure, because cognitive style implies in a group of tools used to access information, performing information, leading to a cognitive management and distinct way a person has to coding, organizing and representing information, resulting in a cognitive control of organization and representation, but not to a fixed group of learning strategies. Thus, in order to improve student’s ability to acquire information it is necessary to consider which are the most frequent learning strategies he/she uses or his/her learning style. Moreover, if we consider that depending on the content to be acquired by the student, he/she has to show some cognitive flexibility to adapt old strategies or create new ones, this means that new strategies were created in order to provide information to be coded, represented and organized according to characteristic student’s cognitive style. As a result, the concept of cognitive style implies in a personality characteristic while learning style implies in a group of tools used to access information, showing a more adaptive component of student’s learning process (Sandler-Smith, 2001).

In the field of educational systems, cognitive style is used to build student module which shows the consistent and distinct way a person has to coding, organizing and performing information, leading to a cognitive management of learning strategies. So cognitive style implies in a cognitive control of organization and representation, but not to a fixed group of learning strategies. Thus, in order to improve student’s ability to acquire information it is necessary to consider which are the most frequent learning strategies he/she uses or his/her learning style. Moreover, if we consider that depending on the content to be acquired by the student, he/she has to show some cognitive flexibility to adapt old strategies or create new ones, this means that new strategies were created in order to provide information to be coded, represented and organized according to characteristic student’s cognitive style. As a result, the concept of cognitive style implies in a personality characteristic while learning style implies in a group of tools used to access information, showing a more adaptive component of student’s learning process (Sandler-Smith, 2001).

In every Educational System the principal goal is to promote cognitive flexibility and guide the students through learning process. To achieve these objectives the system must be capable to adapt itself to the learning needs and interests of the students. So, using learning styles concept it is possible to arrange a variety of variables that are independent of cognitive style and personality, but have correlations to these. This makes the system more capable of adaptability, specially to promote cognitive flexibility. Moreover, this variable makes possible to identify student’s preferences in relation to content structure, because cognitive style refers to a cognitive control between inner state and (representation) and external world. Thus, aggregating learning style to the student module would imply to build a base of student’s strategies frequently used and also prepare an adaptive module with tactic, knowledge, media, links and examples considering these strategies as a teaching plan. According to Bloom (1976), all teaching plan should be constructed considering student’s learning strategies. The author suggests that within teaching plan it should be consider the strategies that are less used by the student in order to develop a reasoning flexibility.

The present study indicates that there is a strong variation within students in relation to strategies use. However, the test gives some interesting variables to build an educational system based on preferred strategies, opening a possibility to have a system which could be capable not just to instruct students about chosen dominion of content, but also to make possible the development of metacognitive abilities.

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