MENTOR: An Emotional Tutoring Model for Distance Learning
MENTOR's Application in the Field of Didactics of Informatics

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Abstract. The aim of this dissertation is to present the MENTOR (Modelling EmotioNal TutORing) which is an emotional learning model that uses an Affective Module in order to recognize the affective state of the student during his interaction with the educational environment and thereafter to provide him with a suitable learning strategy constructing in this way an affective learning path. MENTOR constitutes of three main components, the Emotional Component, the Teacher Component and the Visualisation Component and its main purpose is to motivate appropriately the student in order to accomplish his learning goals. The basic concern of MENTOR is to retain the student's emotional state positive during the learning process. To achieve this, it recognises the emotions of the students and takes them under consideration to provide them with the suitable learning strategy. This kind of strategy is based both on the cognitive abilities and the affective preferences of the student and is stored in the student's model. The student model supplies the educational system with necessary information with the aim to adapt itself successfully to the student's needs.

1 Introduction

During the learning process in the real class, a creative teacher usually invests a significant amount of his efforts and time to identify the personality and the mood of his students in order to find the suitable ways of increasing their motivation [1]. The intrinsic ability of a good teacher to balance subtly and accurately their students' emotional predisposition, their individual needs and preferences and their current disposition, while he directs them adroitly to their goals' achievement, is one of the major factors to the student's progress and successful attainment of learning. Despite the importance of the affective factor, in most educational systems, this crucial parameter seems to have been ignored, since the significant process of learning is supported by methods which are mainly concentrating on the cognitive abilities of the student.

As a result, few contemporary educational systems began to consider their operation under an affective perspective with the aim of modelling the emotional processes which are taking place during the educational session [2]. Corresponding affective techniques are being incorporated more frequently in educational systems

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with the aim of recognising student's emotions, mood and personality [3]. The traditional student model starts to be modified in order to be capable of storing affective information.

According to this point of view, we developed the MENTOR which is an Affective Educational Module capable of supporting the learning in the distance education [4]. MENTOR consists of three main components, which are the Emotional, the Teacher and the Visualisation Components respectively. MENTOR takes into account the personality and the emotional state of the student, in order to decide which is the appropriate affective tactic for him. Taking the above points into consideration, it seems clearly that the main purpose of the MENTOR is to create or to maintain a positive mood to the student, keeping him in track of his learning goals. To achieve this, we need to be aware of the student's emotional state in every moment. That is stored in the affective student model, which consists of cognitive and emotional information, and it is provided by the Emotional Component. In accordance with this plan, the model selects and supplies accurately the student with the proper affective tactics. In this manner, it involves effectively the student into the learning process under a fruitful pedagogical perspective.

2 Basic Issues of Affective Computing

The term Affective Computing involves the intention of Artificial Intelligence researchers to model emotions in intelligent systems. According to Picard [5] an affective system must be capable of recognizing emotions, respond to them and react "emotionally". Among the basic terms that determine the affective computing are personality, mood and emotions.

The personality determines all those characteristics that distinguish one human being from another. It is related to its behaviour and mental processes and has a permanent character [6]. The most known model of personality is the Five Factor Model (FFM) and results from the study of Costa and McCrae [7]. It is a descriptive model with five dimensions: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. Due to these dimensions the model is also called OCEAN model. The descriptive character of FFM and the particular characteristics that accompany each type of personality (traits) allow us to model the student's personality [3] and use this information in educational applications [2]. The FFM provides us with a reliable way in order to connect a student's personality with his mood and emotions that he possibly develops during the learning process. This is very useful because we are able to initiate a student's emotional state and select the suitable pedagogical strategy.

Mood is a prolonged state of mind, resulting from a cumulative effect of emotions [6]. Mood differs from the emotion because it has lower intensity and longer duration. It can be consequently considered that mood is an emotional situation more stable than emotions and more volatile than personality. Based on this definition we categorize mood into two categories named, positive and negative. We consider that the student has either a positive mood when he feels emotions like joy, pride, hope, satisfaction, gratification, love, or a negative mood when feels emotions like sadness, fear, shame, frustration, anger, disappointment, anxiety. Depending on this mood we speculate the possible emotions of the student.

The emotion is the synchronized response for all or most organic systems to the evaluation of an external or internal event. Emotion is analogous to a state of mind that is only momentary. Nevertheless, various attempts have been made, but the cognitive theory of emotions, known as OCC model, which formulated by Ortony, Clore and Collins [8], keeps a distinctive position among them. The three authors constructed a cognitive theory of emotion that explains the origins of emotions, describing the cognitive processes that elicit them. The OCC model provides a classification scheme for 22 emotions based on a valence reaction to events, objects and agents.

In our work we adopt the OCC model, because it elicits the origin of emotions under a cognitive aspect and it is possible to be computerized. So, based on this model we are able to classify and interpret a student's emotions in the learning process. The authors of the OCC model consider that it could be computationally implemented and help us to understand which are the emotions that the human beings feel, and under which conditions. Furthermore, they believe that relying on this model we could predict and explain human reactions to the events and objects. This is the main reason we use the OCC model in our study. The perspective by which, we construct the following component is interdisciplinary and focuses in the intersection of Artificial Intelligence and Cognitive Psychology.

3 The architecture of the MENTOR

MENTOR is an "affective" module which aims to recognize the emotions of the student during his interaction within an educational environment and thereafter to provide him with a suitable learning strategy [9]. The operation of MENTOR is based on the FFM [7] and the OCC model [8]. The module is being attached to an Educational System providing the system with the essential "emotional" information in order to determine the strategy of learning in collaboration with the cognitive information. The architecture of MENTOR is presented in Figure 1.

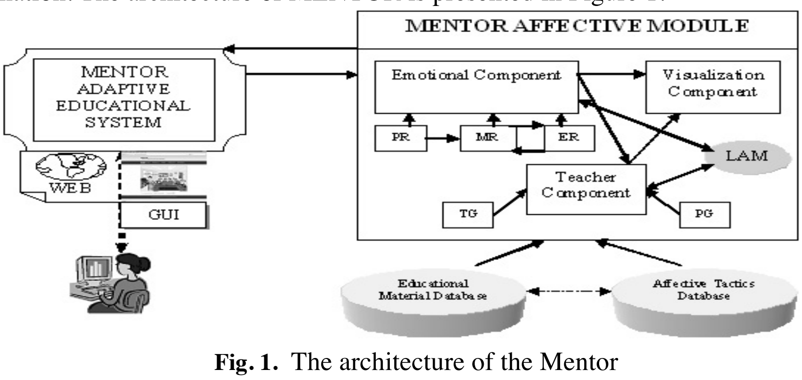

Fig. 1. The architecture of the Mentor

The MENTOR has three main components: The Emotional Component (EC), the Teacher Component (TC) and the Visualization Component (VC), which are respectively responsible for: a) the recognition of student's personality, mood and emotions during the learning process, b) the selection of the suitable teaching and pedagogical strategy and c) the appropriate visualization of the educational environment. The combined function of these components “feeds” the AES with the affective dimension optimizing the effectiveness of the learning process and enhancing the personalized teaching.

The architecture of the MENTOR is designed with equal respect to the cognitive and the emotional dimension of teaching as well. So, we consider that the Teacher Component which is in charge of the formation of teaching consists of two sub-components, the Teaching Generator and the Pedagogical Generator which are responsible for providing the cognitive and emotional tactic respectively. Therefore, we use the term affective tactic so as to denote that the learning method which is suggested by the Teacher Component is a two-dimensional combination of cognitive and emotional guidance and support. The main purpose of MENTOR is to create the appropriate learning environment for the student, taking into account particular affective factors in combination with cognitive abilities of the student offering in this way personalized learning.

3.1 Recognizing the emotions of the student

The necessity of recognizing the student’s emotion during the learning process, especially in distant learning environments is crucial and has been pointed out by many researchers in the e-learning field ([10],[11]). Concerning the MENTOR, responsible for the recognition of the student’s emotions is the Emotional Component. This component (Figure 1) is composed by three subcomponents, the Personality Recognizer (PR), the Mood Recognizer (MR) and the Emotion Recognizer (ER), which are responsible for the recognition of the personality, mood and emotions of the student. When the student uses the system for the first time, the PR subcomponent assesses the type of a student's personality. As a result, the student's traits are being recognized and are being used by the Teacher Component for the suitable selection of pedagogical and teaching strategy. For example, a student that has been recognized as Openess, according to FFM is imaginative, creative, explorative and aesthetic [7]. These characteristics are evaluated by the TC providing the system with an exploratory learning strategy, giving more autonomy of learning to the student and limiting the guidance of the teacher. The MR subcomponent recognizes and categorizes the student's mood either as positive or as negative. In our approach, good mood consists of emotions like joy, satisfaction, pride, hope, gratification and bad mood consists of emotions like distress, disappointment, shame, fear, reproach. As a result, we have an initial evaluation of the current emotions of the student. Thus, if the student is unhappy for some reason, the MR recognizes it and in collaboration with TC, it defines the suitable pedagogical actions that decrease this negative mood and try to change it into a positive one. Finally, the ER subcomponent is in every moment aware of the student's emotions during the learning process, following the forthcoming method.

So as to deal effectively with the emotions elicitation process, the Emotional Component has an affective student model where the affective information is stored [12]. An ontology of emotions is used for the formal representation of emotions. Ontology is a technique of describing formally and explicitly the vocabulary of a domain in terms of concepts, classes, instances, relations, axioms, constraints and inference rules. It is a formal way to represent the specific knowledge of a domain, providing an explicit and extensive framework to describe it [13]. Our ontology has been built to recognize 10 emotions which are: joy, satisfaction, pride, hope, gratification, distress, disappointment, shame, fear, reproach [14]. The former five emotions compose the classification of positive emotions and are related to the positive student's emotional state. The latter five emotions compose the classification of negative emotions and are related to the negative student's emotional state. The construction of the ontology was based on the OCC cognitive theory of emotions. Thus, the concepts of the ontology are defined in terms with this theory. For instance, the positive student's emotional state and the emotion of joy are described as follows:

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(POSITIVE-EMOTIONAL-STATE
(SUBCLASSES
(VALUE (JOY, SATISFACTION, PRIDE, HOPE, GRATIFICATION)))
(IS-A
(VALUE (EMOTIONAL-EVENT)))
(DEFINITION
(VALUE ("emotions or states, regarded as positive, such as joy, satisfaction, pride, hope, gratification"))))
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In this way, the formal and flexible representation of an emotion can be efficiently achieved in relation to the learning goal of a student. The proposed ontology of emotions was implemented with the Protégé tool. Furthermore, we adopt an approach based on Bayesian Networks in order to extract information from the proposed "emotional" ontology and to make inferences about the emotions of the student [14]. This approach, which is used for carrying out the representation and the inference of emotions is based on the OCC model which combines the appraisal of an Event with the Intentions and Desires of a subject. Thus, taking advantage of this model, MENTOR infers about the student's emotions after the occurrence of an educational event which is related to his learning goal.

3.2 Providing the student with the appropriate affective tactic

As it has already been stated, the objective of the MENTOR is to foster the appropriate affective conditions, since these are a crucial factor for the learning process and to obtain the student with the suitable learning method. The latter goal is achieved by the Teaching Component which is responsible for providing the student with the appropriate affective tactic considering his emotional state. It consists of two subcomponents, the Teaching Generator and the Pedagogical Generator, which are responsible respectively for the appropriate teaching and pedagogical strategy as illustrated in Figure 1.

The Teaching Generator is a sub-component which is responsible for the selection and the presentation of the suitable educational material, according to the student model. The student model provides information about the cognitive status of the student such as his learning style, the knowledge that has already been acquired and his learning preferences and goals. Evaluating this information the Teaching Generator decides about the sequence of the educational material, if a theoretical or practical subject will be presented next to the student and what kind would this be, for example a more or less detailed theoretical topic or an easier or a trickier exercise [15]

The Pedagogical Generator is a sub-component which is responsible for the formation of the pedagogical actions which will be taken into account during the learning process. Once the recognition of the student's emotions and his emotional state has been stored in the affective student model, the Pedagogical Generator has all the necessary information in order to support and motivate the student to the direction of the achievement of his learning goals. As a teacher does in the real class, the Pedagogical Generator encourages the student, gives him positive feedback, congratulates him when he achieves a goal, and keeps him always in a positive mood, with the view of engaging him effectively in the learning process [16].

Combining the interaction of its two sub-components, the Teacher Component forms the appropriate affective tactic for the student. In this way, a traditional instructional tactic is enhanced with a motivational one and this would be proved beneficial to the student from two aspects. The first concerns the planning of the teaching strategy and the educational content, which and what topic will be taught to the student next and which method will be used for it. The second is more related to the delivery planning, how this topic will be taught. The role of the Pedagogical Generator, however, is not restricted only to the reassurance of the appropriateness of the teaching method or the educational material. It is concentrated also on providing the student with encouraging actions in order to preserve his positive emotional state. The pedagogical actions which have been implemented are shown in Table 1.

Table 1. The pedagogical actions of the Pedagogical Generator

Ask for giving some help	Explain the need for help
Give Help to student	Reassure the appropriateness of help
Express satisfaction after a successful help	Express unhappiness after an unsuccessful help and ask for trying again
Give explanations in an appropriate way	Express sympathy in case of fail
Encourage the student	Congratulate the student
Praise the student	Express admiration for the student
Reinforce student's efforts	Play a game with student
Give hope	Open a dialogue with the student
Play a music video clip	Present a part of a movie
Present a photo	Tell a joke

The main concern of the Teacher Component, as it is already mentioned, is to ensure that the student's mood is positive every time. To achieve this, the Teacher Component has to be aware of the student's emotions. The input that comes from the Emotional Component, which is in charge of the detection of the student's motivational state, is evaluated appropriately and thereafter the Teacher Component adapts his reaction adequately to motivate the student either by encouraging him or by praising him and in every case sustain his disposition flourishing [16]. Once the Teacher Component is aware of the student's emotions, it can proceed into the selection of the proper affective tactic.

4 Evaluation

The evaluation of the MENTOR is deployed in two axes. The first concerns the impact of the system in the learning process of students. The second examines the accuracy of MENTOR's Affective Module prediction and is concentrated on the suitability of the suggested affective tactics. Thus, we have the ability to identify factors that make the affective dimension of the educational material beneficial for learning. We hypothesized that the enhancement of the traditional educational material with the affective dimension of MENTOR's learning framework leads to higher learning performance. In addition, we assumed that the more accurate is the prediction of the student's affective state the better is the appropriateness of the selected affected tactic and the greater is the advantage of learning with the MENTOR's educational environment in comparison to the environment of the traditional adaptive educational system.

4.1 The Framework of the Evaluation Study

4.1.1 Participants of the Experiments

In order for the process of sample gathering to be the appropriate the following procedure has been followed. A sample of 120 students in the field of computer science has been selected. Their age was between eighteen and twenty-five years old (M=20.9, SD=2.27). The students were assigned with a questionnaire containing items relative to the field of Artificial Intelligence. From the statistical evaluation of their answers a group of 108 out of the initial 120 was selected. The criterion was the lowest average which signifies the lowest starting knowledge on the domain and the lowest possible dispersion around it (M=6.24, SD=3.18). In this way, a homogeneous group was formed with the same average a-priori knowledge about the learning domain. In total, there were 65 male and 43 female students. They were randomly divided into two groups, the experimental group A and the control group B with 54 students in each group. The students of group A make use of the affective version of MENTOR, while the students of group B with the normal version of the adaptive system.

4.1.2 Questionnaires

To evaluate the student's acquired knowledge after the interaction with the system as well as the appropriate and accurate operation of the MENTOR's Affective Module, the following three questionnaires were built and proposed:

Pre-test questionnaire:

The students of the experimental and the control group attended an individual test. The test was formed by 20 items in order to check the starting knowledge of the sample. The main aim of the test was to measure the initial knowledge of each participant in the field of Artificial Intelligence. It was designed as a set of multiple choice and true/false items. A domain expert and an instructional designer contributed to the structure of the test. An item example was: "Alan Turing proposed a test that has served as a benchmark in measuring progress in the field of artificial intelligence?" In the pre-test, the students additionally asked for biographic data (for example age or sex) and for a subjective rating regarding the participants' expertise in the domain of Artificial Intelligence. The answers of each student are analyzed by statistics methods and the results compared with the post-test.

Post-test questionnaire:

The students of the experimental group A and the control group B employed different methods of learning during their interaction with the MENTOR. The students of group A made use of the affective version of the web-based adaptive educational system while the students of group B did not. That is to say, group's A learning process was enriched with the affective dimension of the e-learning system but group's B did not. After a short break of 15 minutes all participants were assigned with a post-test questionnaire, with the aim of assessing their learning performance. The post-test questionnaire, consisting of 30 items, aimed to measure the acquired knowledge after having interacted with the MENTOR, in order to verify if and how much the system itself was useful in helping learners to reach the didactic goals. The structure of the post-test questionnaire was designed, similarly to the pre-test questionnaire, as a set of multiple choice and true/false items, with the support of a domain expert and an instructional designer.

Questionnaire on the evaluation of the Affective Module Accuracy

This questionnaire which was assigned only to the students of group A, who interacted with the affective version of MENTOR, was designed to measure the students' ratings on the basic operation of the Affective Module. The objective of this questionnaire was to assess the accuracy of the MENTOR's affective state prediction and the suitability of the suggested affective tactics as well. It was formed by eight 5-point Likert Scale items and two Fill-in items.

4.1.3 The Knowledge Domain

The learning environment of the MENTOR's web-based adaptive educational system was used in order to teach beginner's topics in Artificial Intelligence. The Knowledge Domain is constituted by 15 learning nodes, each one having theory, examples, exercises and a final evaluation test. Every student had the opportunity to interact with a pre-selected course of MENTOR for 45 minutes.

4.2 Affective versus non-affective version comparison

The affective version of MENTOR incorporates the Affective Module, while the non-affective version deprives of the Affective Module, that is operates only as a traditional web-based adaptive educational system. Taking this sceptical into account, the whole evaluation experiment was designed focused on whether the MENTOR's Affective Module and its affective learning model can improve the effectiveness of the students' study. There were two groups A and B in experiments. Group A was used as the experimental group and group B was used as the control group. The experiment started with the pre-test questionnaire. The students of two groups were asked to complete the pre-test using pencil and paper. The achieved score of each student was recorded. The results were subjected to a statistical analysis which is shown in Table 2. The pre-test results demonstrate that both groups had similar knowledge level on the knowledge domain of Artificial Intelligence.

After completing the pre-test, students interacted with the system. The group A deal with the educational material of the affective version of MENTOR, while the group B with the educational material of the non-affective version of the web-based adaptive educational system. At this phase the students had the chance to practice and enhance their knowledge dealing with the educational material via the system's interface. During this interaction, the students' actions were recorded in the system's log files, with the aim of providing information concerning the time they spent and their performance. Afterwards, the student's were assigned with a post-test and were asked to complete it using again pencil and paper. Also, the results of the post-test were subjected to a statistical analysis that is shown in Table 2.

4.2.1 The Research Question

The value of the proposed affective-learning model can be evaluated by the differences between the two groups' real study effectiveness. We consider the study effectiveness primary from the aspect of the test score, so the research question (RQ) is formulated as:

RQ: Do students interacting with the affective version of MENTOR achieve better learning results than students interacting without the affective version of MENTOR?

4.2.2 Group Analysis

In order to answer the research question we performed the analysis of the statistical differences between groups by means of the two-sample independent *t*-test. Based on the research question the null and the alternative hypotheses are formed as follows:

Null Hypothesis H_0: There is no difference, between the experimental group A and the control group B, after the interaction with the learning environment of the two versions of MENTOR.

Alternative Hypothesis H_a: The two groups A and B are different in terms of the learning performance after the interaction with the learning environment of the two versions of MENTOR.

Since a preliminary Levene's test for equality of variances indicated that the variances of the two groups were not significantly different, a two-sample *t*-test was performed that does assume equal variances, defining the significance level at $\alpha=0.05$. The provided results are presented in Table 2. By analyzing furthermore the results from this table we realize that the mean grades of the students who interact with the affective version of MENTOR (EG) ($M = 74.67$, $SD = 6.70$, $N = 54$) was significantly different from these using the non-affective version of MENTOR (CG) ($M = 71.39$, $SD = 6.90$, $N = 54$), $t_{(106)} = 2.26$, $p = 0.026$, where $p < 0.05$ is considered to be significant. The standard deviation is small which means all the students expressed a consensus opinion. Moreover, the standard deviation is almost the same for both groups while the small standard error indicates that our sample means are similar to the population mean and therefore is likely to be an accurate reflection of the population. In this way, we can draw the conclusion that we can reject the non-difference null hypothesis H_0 between the experimental group A and the control group B and to accept the alternative hypothesis H_a. Namely, the group of students who interacted with the affective version of MENTOR demonstrated significant improvement in their learning progress comparing to the students who interacted with the non-affective version of MENTOR.

Table 2. Statistical Results of grade from the pre / post-test and t-Test Results for the Difference between Experimental and Control Group Means

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
grade	Equal variances assumed	,968	,328	2,261	106	,026	3,2795	1,4507	,3125	6,8579
	Equal variances not assumed			2,261	105,123	,026	3,2795	1,4507	,3122	6,8581

Group Statistics (Pre-test)

	group	N	Mean	Std. Deviation	Std. Error Mean
grade	EG	54	39,241	2,6913	,3662
	CG	54	42,185	4,6177	,6284

Group Statistics (Post-test)

	group	N	Mean	Std. Deviation	Std. Error Mean
grade	EG	54	74,673	6,7047	1,0108
	CG	54	71,393	6,9025	1,0406

From the above analysis, it is also apparent that both experimental and control groups have significant improvement in the post-test in relation to the pre-test, as it shown in Table 2. Based on this, it could be assumed that MENTOR supported successfully the students in their learning process improving their performance. Nevertheless, after the interaction with the system, the results of the post-test indicate clearly that the group A achieved better results than the group B. Consequently, it is evident that the improvement in learning of the group's A students is greater than group's B students. Therefore, it is reliable to presume that the interaction with MENTOR contributes to the student's study process significantly.

4.3 The evaluation of the Affective Module Accuracy

During the interaction with the MENTOR the students had the opportunity to deal with the educational events of MENTOR's learning environment and had been provided with various affective tactics. Every student's action was recorded by the system's log files. Consequently, in every moment MENTOR was aware of the emotional state of the student in order to offer him the appropriate affective tactic. In this phase of evaluation participated, only the students of the experimental group A, which had interacted with the MENTOR. Firstly, with the aim of recognizing the student's personality, they were given with the NEO-PI-R personality test [17], which was presented to them via the MENTOR. According to this test, MENTOR classified twenty-one students who belonged to the Extraversion category, fourteen to the Agreeableness category, nine to the Conscientiousness category, six to the Openness category and four to the Neuroticism category. In this way, students formed five groups and they were asked to fill in the questionnaire on the evaluation of the Affective Module Accuracy.

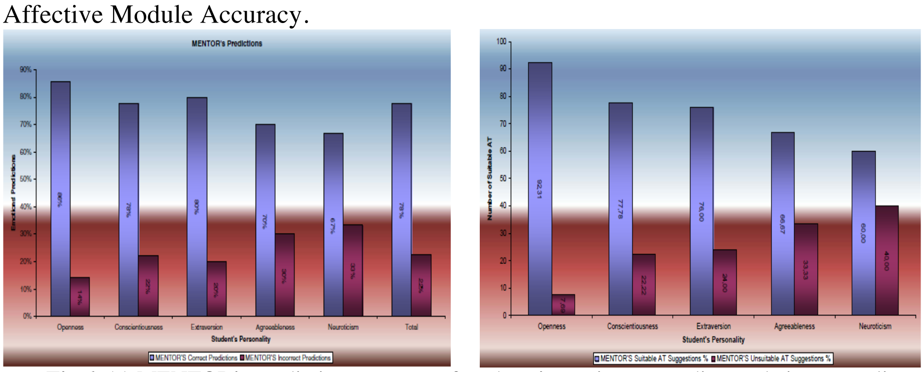

Fig.6. (a) MENTOR's prediction accuracy of students' emotions according to their personality, (b) The accuracy of MENTOR's Affective Tactic suggestions according to the students' personality.

The objective of the experiment was to measure the accuracy of the MENTOR's affective state prediction and the suitability of the suggested affective tactics as well. In order to achieve this, the students asked to declare their affective state before and after they obtained the affective tactics. Also, they asked to state if the suggested affective tactics helped them to preserve a positive mood and to achieve their educational goal. Finally, the students were given the evaluation questionnaire to fill in where they wrote down their impressions from the interaction with MENTOR. The questionnaire examined two factors, which were the students' opinion in relation to the prediction accuracy of MENTOR as well as the appropriateness of the provided affective tactics in relation to the impact in their learning process. Then taking the students' responses into consideration and after the examination of the system's log files, we were provided with the results that are shown in the Figure 6. In this figure the categories of the students' personalities and the related system's prediction values as well as the corresponding suitability of the suggested affective tactics are demonstrated in a graphical way.

More specifically, from Figure 6 we can infer that the percentage of MENTOR's correct predictions is about 78%. We can also easily draw the conclusion that for the categories of Openness and Neuroticism, MENTOR had better and worse accuracy respectively in the prediction of their emotional states. In addition, it provides us with the inference that for the categories of Openness, Conscientiousness and Extraversion, MENTOR had better accuracy in the suggestion of the proper affective tactics.

5 Conclusions

The research presented the MENTOR Affective Learning Model which is responsible for inferring students' emotions and providing them with the appropriate affective tactic in distance learning, as well as its application in the field of the didactics of informatics. The main purpose of the MENTOR, except from the recognition of emotions, is to create and / or preserve a positive mood in the student, since this is a crucial factor for the learning process. Moreover, it aims at providing the system with suitable information about the personality and emotions of the student and also with appropriate pedagogical actions enhancing the student's motivation to "conquer" the intended knowledge. In MENTOR, the elicitation of emotions is based on a formal representation of emotions using an appropriately designed Ontology, the Affective Ontology which is implemented with the Protégé tool and is achieved by a BN-based method.

An experiment has been also conducted with the aim of evaluating MENTOR's performance and impact in learning process. The experimental results are encouraging for the educational value of the proposed model in the learning process. More specific, the research findings support the hypothesis that the affective version of a web-based adaptive educational system seems to have a significant effect on the students' attitude towards the tasks that they should perform in order to achieve their learning aim. Furthermore, all the participants reported that the system had a major contribution to their learning gain and helped them to improve their problem-solving skills. These opinions validate the accuracy of the incorporated Affective Module which is the essential element of MENTOR from the aspect of dealing with the affective information. The evaluation also verified the exactitude of MENTOR's prediction in relation to the student's affective state as well as the correctness of the suggested affective tactics. As a result, the participants reported that the guidance of the system was the appropriate by supporting them with encouraging actions in order to preserve a positive mood and to achieve efficiently their educational goal, contributing in this way to a more interesting and effective study.

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