Considering Student's Emotions in Computational Educational Systems

Patricia Augustin Jaques, Everton Bocca, Rosa Maria Vicari

Instituto de Informática – Universidade Federal do Rio Grande do Sul (UFRGS)
Caixa Postal 15.064 – 91.501-970 – Porto Alegre – RS – Brazil

{pjaques,rosa}@inf.ufrgs.br

***Abstract**: This work aims at handling the affectivity in a learning interaction between student and tutor in MACES educational system: a collaborative environment with a multi-agent architecture based on Vygotsky's Socio-cultural Pedagogical Approach. The student's emotions are handled by the Mediating Agent of the system which has the goal of motivating and engaging the student to learn as well as promoting a positive mood in the student which is more appropriate to learning. We believe that the student can experience a more positive feeling through the exposure to emotional behaviour and encouragement messages sent by the Mediating Agent. In order to accomplish its function, it should recognise student's emotions to respond appropriately. Thus, it catches the student's emotions by his observable behaviour, stores this information in an affective model; and applies affective tactics according to these emotions. As these affective tactics can be emotive behaviour, we chose to represent the Mediating Agent as a lifelike character who has a personality and which interacts with the student through messages and emotive animations.*

Key words: Affectivity in learning, Artificial Intelligence in learning technology, Agents technology, Affective Computing, Animated Pedagogical Agents

1 Introduction

Psychologists and pedagogues have already pointed out the way that emotions affect learning [Goleman 1995] [Piaget 1989] [Vygotsky 1994]. According to Piaget [Piaget 1989], it is incontestable that the affectivity has an accelerating or perturbing role in learning. A good part of the students that are weak in mathematics fail due to an affective blockage [Piaget 1989]. Coles [Coles 1998] suggests that negative emotions can impair learning; and positive emotions can contribute to learning achievement.

This way, some educational systems have given attention to generation of emotion in pedagogical environments (emotion expression and emotion synthesis) [Abou 1998] and to the emotion recognition [Vicente 1999] [Bercht 2001], pointing out the richness presented in affective interaction between student and tutor.

In this paper we present our proposal for handling student's emotions in a collaborative system: an agent, the Mediating Agent, responsible for considering student's emotions in a collaborative educational system. This collaborative system, called MACES, is related to situated learning, i.e., the conception of cognition as a social practice based on the use of language, symbols and signs. It is a distance learning environment, implemented as a multi-agent system composed of artificial and human agents, and inspired by Vygotsky's socio-interactionist theory [Vygotsky 1978].

The *Mediating Agent* has the goal of motivating and engaging the student to learn as well as promoting a positive mood in the student which is more appropriate to learning. We believe that the student can experience a more positive feeling through the exposure to emotional behaviour and encouragement messages sent by the Mediating Agent. In order to accomplish its function, it should recognise student's emotions to respond appropriately. Thus, it catches the student's emotions by his observable behaviour, stores this information in an affective model; and applies affective tactics according to these emotions. As these affective tactics can be emotive behaviour, we chose to represent the Mediating Agent as a lifelike character who has a personality and which interacts with the student through messages and emotive animations.

In section 2 we present a brief discussion about the role of affectivity in learning. Section 3 presents some educational environments that already address the student's affectivity. In section 4, we present our proposal of a collaborative educational system which handles student's emotions, and in section 5 we describe the animated pedagogical agent which is responsible for adapting the system to student's affectivity in our system. Finally, in section 6 we present the conclusion and perspectives for future works.

2 Pedagogical point of view: Affectivity and Motivation in Learning

Some pedagogues, such as Piaget [Piaget 1989], Vygotsky [Vygotsky 1962], Goleman [Goleman 1995], Vail [Vail 1994] and Mahn and Steiner [Mahn 2000] [Mahn 2002] [John 2000a], **point out the importance of motivation and affectivity in learning**. According to Piaget [Piaget 1989], there is not cognitive mechanism without affective element. Affectivity motivates the intellectual activity.

Goleman [Goleman 1995] has pointed out the way in which emotional disturbances affect mental life. He recalls the well-known idea that depressed, bad and anxious students find greater difficulty in learning.

[Coles 1998] points out some links between learning and emotions. For example, poor learning can produce negative emotions; negative emotions can impair learning; and positive emotions can contribute to learning achievement and vice versa. Izard's works [Izard 1984] show that induced negative emotions seem to damage performance on cognitive tasks, and positive emotions have an opposite effect. Coles shows other studies made by Masters, Barden and Ford which found that inducing a sad mood in very young children increased the time that they took to respond to a task, and it also increased their number of errors; opposite results were achieved by inducing happiness. Tanis and Bryan (quoted on [Coles 1998]) showed that young people identified as being at risk in school completed math problems significantly more accurately under induced positive-mood conditions.

The interest and the pleasure in the action are considered the elements that will go strongly influence the development of affectivity in the student. According to Piaget [Piaget 1989], feelings associated to the actions or activities are always remembered. Children are attracted by activities that are successful and pleasant. We can associate this premise to the use of computational environments. Although some failures can become challenges and activate the interest and persistence of the students, we all will keep interested in activities where we got success.

Another basic factor to learning is motivation. While motivated, students search responses to their problems and to satisfy their needs. For Vygotsky [Vygotsky 1962], motivation is the reason of the action. It stimulates needs, interests, desires and particular attitudes of the citizens:

"the thought has its origin in the sphere of consciousness, a sphere that includes our inclinations and needs, our interests and impulses, and our affect and emotions. The affective and volitional tendency stands behind thought. Only here do we find the answer to the final "why" in the analysis of thinking." [Vygotsky 1962, p. 282]

As to the role of affectivity in learning, Vygotsky considers that there is unity between the intellectual, evolutionary and affective processes. Vygotsky considers that the affect can not be separated from cognition.

"When we approach the problem of the interrelation between thought and language and other aspects of mind, the first question that arises is that of intellect and affect. Their separation as subjects of study is a major weakness of traditional psychology, since it makes the thought process appear as an autonomous flow of 'thoughts thinking themselves' segregated from the fullness of life, from personal needs and interests, the inclinations and impulses of the thinker." [Vygotsky 62, p. 10]

Although Vygotsky's work, mainly the ZPD notion, is largely known by pedagogues and educator's community, few attention has been paid to his writings about the role of emotion in learning [Vygotsky 1999] [Vygotsky 1962]. This can be explained by the fact that Vygotsky's works about emotions ("Teaching about Emotions") were published only in 1999 with the Volume 6 of Vygotsky's Collected Works [Vygotsky 1999].

In another of his last publications [Vygotsky 1994], Vygotsky presented an important concept introducing the affectivity in learning: *perezhivanie*.

"The emotional experience [*perezhivanie*] arising from any situation or from any aspect of his environment, determines what kind of influence this situation or this environment will have on the child. Therefore, it is not any of the factors themselves (if taken without the reference of the child) which determines how they will influence the future course of his development, but the same factors refracted through the prism of the child's emotional experience" [Vygotsky 1994, pp. 339].

So, as Mahn [Mahn 2002] indicates, "the *perezhivanie* describes the ways in which the participants perceive, experience, and process the emotional aspects of social interaction". There is great relation between the ZPD and the *perezhivanie* (affectivity). In a certain stage in development (in ZPD), children can solve a certain range of problems **only when they are interacting** with people and in cooperation with peers. In this case, the interaction is fundamental and the way the student perceives the emotional aspects of this interaction (perezhivanie) will interfere in his learning. As [Mahn 2002] points out, there is a great relation between the ZPD and the student's experience of his interaction (perezhivanie), and "when there is a breach in this relation because the cognitive demands are too far beyond the learner's ability or because negative affective factors such as fear or anxiety are present, the zone (ZPD) in which effective teaching/learning occurs is diminished." Thus, "**affective factors play a substantial role in the construction of the ZPD**" [Mahn 2002].

The teacher is an important person in the student's learning process, since he/she will offer support to the student when he achieves the ZPD zone. A teacher aware of student's ways of perceiving, processing and reacting to classrooms interactions – their *perezhivanija* - will engage more significantly the student in his learning [Mahn 2000] [Mahn 2002].

[Coles 1998] considers that as a teacher can contribute to the development of student's cognitive abilities, he can also assist the emotional development of the child through guidance and support. As Coles points out:

"Fear of failure may be changed to feelings of self-confidence; motivation may change from low to high; intellectual insecurity may become confidence in one's intelligence. These transformations can occur through a teacher's "scaffolding" and guidance in the formation of new emotional states a learner can achieve and sustain by him- or herself." [Cole 1998, p. 4]

Mahn and John-Steiner [Mahn 2002] carried out a study, with adult learners in an English as second language classroom, which aimed at exploring the role of affectivity in learning. The experience consists of students and teacher writing collaboratively a journal in English for 15 minutes at the beginning of class on whatever topic they choose. In this study they showed that **teachers could instil the student's confidence by offering caring support**: "careful listening, intense dialogue and emotional support sustain the cooperative construction of understanding [Mahn 2002]".

As we can see in the works mentioned above, emotions play an important role in learning. This way, they can not be neglected by teachers and computational/educational systems.

3 Affectivity in Intelligent Educational Systems

Some studies have given attention to generation of emotion in pedagogical environments (emotion expression and emotion synthesis) [Abou 1998] and to the emotion recognition [Vicente 1999] [Bercht 2001], pointing out the richness presented in affective interaction between student and tutor.

An emotive pedagogical agent, which shows that it cares about the student's progress, can encourage the student to give more attention to his own progress. Besides, the use of emotions makes possible to transmit more enthusiasm for the subject to be learned and, thus foster the enthusiasm into the learning [Elliot 1999].

According to Johnson and colleagues [John 2000b], the modelling of emotions is also important in educational environments which consider interpersonal relations, including environments for group training. The virtual students must show and react to students' emotions. For example, if a simulation represents a war, it is important that the participants react in a real way to the situation in order to increase

the scenario's realism. In this specific case, the artificial characters must have an architecture which allows them to react emotionally to situations, which are known as "emotion synthesis" [Picard 1997].

People tend to see emotions and attitudes in animated characters and expect that these characters react emotionally, in the same way that humans do. So, it is essential to take into account the representation of an animated behaviour by the lifelike agent. Otherwise, the agent seems monotonous and robotic.

Besides, the agents that are represented as animated characters must be able to represent different types of emotions. Just as it happens in real-life characters, the agents must show emotions as happiness, sadness, fear, jealousy, shame and others. However, as the animated pedagogical agents are projected to further positive learning experiences, a set of behaviours must be chosen that is appropriate to learning [Lester 1999b]. It is necessary to identify which behaviour is more appropriated for promoting a positive mood in the student, in order to provide a better learning.

In order to respond to the student, the agent must interpret the student's emotions rightly. For example, we suppose that the student finds difficult to accomplish the exercises because he is very anxious. If the agent misinterprets the student's emotional state, it can generate an action that will let the student more anxious, instead of helping him. This way, it is necessary that the agent has**, besides a cognitive model of the student, an emotional one that takes into account his emotions**. A first work that proposes the integration of affective modelling in pedagogical agents is the Elliot and colleagues' works [Lester 1999a]. The model, like ours, is based on OCC theory [Ortony 1988], but this model was not implemented yet and it does not show how to identify student's goals to infer his emotions.

Due to human psycho-social tendency of anthropomorphizing software, recent studies had shown that educational computational systems that have animated agents are more effective pedagogically [Lester 1997b], besides having a strong motivational effect for students [Lester 1997a]. Besides, as some cartoon designers point out, the dramatic impact in the communication, as the quality, can be increased through the creation of emotive movements that communicate the affective content of the message [John 2000b].

According to Elliot and colleagues [Elliot 1997], an animated pedagogical agent, which cares about student's progress, can make the student believe that they are together and so encourage him to pay more attention in his own progress. Yet, an animated pedagogical agent that is sensitive with the student's emotions can intercede when the student shows to be disappointed or loses the interest, giving him encouragement and assistance. It can transmit enthusiasm to the subject and, so, promote greater enthusiasm in the student. As the enthusiasm is a human emotion, it is better represented by a program if it has an emotional structure. It can engage the student in the study interacting with him by his social tendencies. Finally, the authors point out that the animated pedagogical agent, due to its appearance with life and personality, can make learning funnier. A student who likes to interact with the agent will have a more positive perception of learning. Besides, if the student appreciates the educational environment, he will use it for a longer time, and therefore will learn more.

Faivre and colleagues [Faivre 2002] proposes the integration of two emotional agents in an ITS. The first agent, SAEA, is responsible for infering student's emotions. It detects student's emotions by his actions in the ITS interface. This emotion-recognition process is modelled through a collection of rules that match specified external situations with emotions and that were specified according to OCC model. The affective model is formed by two types of temporal modules: (1) the Short Term Mood Memory that stores the emotions detected in a session; and (2) the Long Term Mood Memory that maintains information about the student's mood average profile on several learning sessions. It also uses rules for choosing the appropriated pedagogical tactic according student's emotions. The tutor is represented by a 3-D embodied agent that shows emotional expressions and gestures, but is does not have any kind of verbal communication. Its model of emotion is also modelled according to OCC model and implemented as "if-then" rules. In this work, the student's emotional states are used for adapting student's pedagogical tactics. Although the character has an emotional model that allows him to express emotions, it doesn't present any behaviour that can contribute to student learning; differently from this work that proposes a character that presents emotional behaviours that have the function of engaging and promote positive moods in the student that are better for learning. Another limitation that we see is that as the character presents an emotional model, it will react emotionally showing expressions of, for example, sadness and

disappointment that can be not good for the student's emotions and can interfere negatively in student's learning.

In the next section, we describe an educational environment based on Vygotsky's theory and which address the emotion (*perezhivanija*), also pointed out by Vygotsky, but forgotten by the research in educational system.

4 The Educational Environment

The proposed agent, Mediating Agent, is part of the multi-agent architecture of the educational collaborative system MACES (Multi-agent Architecture for a Collaborative Educational System) which is based on Vygotsky's socio-cultural pedagogical approach [Jung 2002]. This system is formed by five types of artificial agents – Diagnostic Agent, Mediating Agent, Collaboration Agent, Social Agent and Semiotic Agent and by human agents – teacher and students. This research uses the technology of Distributed Artificial Intelligence (DAI), in particular multi-agent systems, to implement this social model for distance learning. The features of autonomy, collaboration and learning can assist in the construction of a student model and assist in the interaction among students, stimulating their socio-cognitive development.

The system is composed of human agents (students and tutors) and by five classes of artificial agents: the *Diagnostic Agent* has the function of describing the cognitive diagnosis, modelling the group and suggesting pedagogical tactics; the *Mediating Agent,* is an animated pedagogical agent responsible for the interface of the environment with the student and for applying (1) domain-based tactics in accordance to student's intellectual profile (sent by the Diagnostic Agent) and (2) affective tactics in accordance to student's emotions (determined by the Mediating Agent); the *Collaboration Agent* is responsible for mediating/monitoring the interaction among students' groups in synchronous tools of communication among the students (for example, chat); the *Social Agent* that should establish the integration of the society forming students' groups for study and creating a Collaboration Agent for each formed group; and the *Semiotic Agent* responsible for using signs, concepts and language that will be presented to the student. Further details of the system may be found in [Jung 2002].

The social model implemented by the proposed system is strongly inspired by Sociocultural Vygotsky's Theory [Vygotsky 1978] [Vygotsky 1962]. Socio-cultural approaches originate from Vygotsky and his collaborator's works and are based on the concept that human activities take place in cultural contexts, are mediated by language and other symbols systems, and can be best understood when investigated in their historical development [John 1996]. The socio-cultural approach is suitable to our computational model for offering a pedagogical theory that explores the role of interaction and collaboration in learning.

The proposed computational educational environment is domain-independent and can be employed as a distance educational system in any domain of knowledge. In this architecture, the artificial agent has the function of monitoring and assisting the human agents in their collaborative activities.

One of the central ideas of Vygotsky's theory, the ZPD (Zone of Proximal Development), emerges when two or more people form a collaborative learning partnership in which the more skilled members enable the less skilled ones to achieve their goal. In a real class, the teacher (or other more able colleague) provides support to the student who needs help. In a computational system, it is necessary to offer a more able partner to the learner. It must provide challenging activities and the right quantity and quality of assistance.

This role of a more able partner for the student is accomplished by the Mediating Agent in our system. In order to offer appropriate scaffolding, the educational system must model the student's knowledge, based on ZPD, and decide which tactics for performance and competence it must apply for the student. The cognitive learning model and the cognitive tactics[1] planner are supported by the Diagnostic Agent. This way, accomplishing the cognitive diagnosis is not a function of the Mediating Agent and it interacts with the Diagnostic Agent to send student's information (as student's action which are used by

[1] Cognitive tactics, also called, tactics for performance and competence, promote actions that give support to the student in the learning of concepts and the domain [Bercht 2001].

the Diagnostic Agent for student's modelling) and to receive cognitive tactics and apply them to the student.

We see two important scenarios for the implementation of *perezhivanija* in collaborative educational environments: (1) considering the student's emotions when interacting with the instructional content and his personal partner - the Mediating Agent; and (2) considering the student's emotions when he interacts with other colleagues in the chat tool or in other collaborative tools. We are working with the student's emotions in the first situation: when the student interacts with the Mediating Agent and the instructional content. The first scenario was chosen because we see that much study and implementation made for this one could be employed also in the second situation.

For dealing with student's *perizhivanija,* we propose the implementation of an animated pedagogical agent, the Mediating agent (which also accomplishes the role of a more able partner of the student), that is responsible for promoting positive emotions in the student. In order to accomplish this objective, the agent must catch the student's emotions to respond to him appropriately through affective tactics represented by messages and emotional behaviour. The implementation of this agent is discussed in the next sections.

5 The Proposed Agent

The Mediating Agent catches the student's emotions by his observable behaviour and choose the appropriate affective tactics to be applied, i. e., promotes actions that aims at adapt the system to the student's emotions [Bercht 2001]. This affective tactics can be (1) domain-based tactics to motivate and encourage the student or (2) an emotional behaviour to promote a student's positive mood, more appropriate to learning. Therefore, we chose to represent it as an animated character who has a personality and which interacts with the student through speeches. In order to interact in an affective way with the student, the Mediating Agent must interpret the student's emotions correctly and must have an affective model to store this affective information. In the next sections, we address how the Mediating Agent handles these aspects.

5.1 How are we going to acquire the student's emotions?

In order to accomplish its function, the Mediating Agent must recognise the student's emotional states to respond appropriately. For example, when the student is disappointed with his performance, he will probably give up the task. The agent needs to know when the student is disappointed to encourage him to keep on studying and accomplishing the task. For this reason, the Mediating Agent has a sensor component responsible for identifying student's emotions and an affective model for storing this information.

The Mediating Agent catches the student's emotions by his observable behaviour, i. e., the student's actions in the system's interface. So, the tutor obtains information about the student's emotions by analysing his actions. Some examples of observable behaviour are: the execution time of an activity, the success or failure in the execution of an exercise and the frequency of need for help. We chose this method because it seems the most natural way for the student to interact with the educational system. As Picard [Picard 2000] pointed out, people can feel uncomfortable with video-cameras and it can interfere in the recognition. The student's emotion recognition by his observable behaviour has been adopted by other researchers, as show the works of Bercht [Bercht 2001], de Vicent [Vicente 1999] and Martinho [Martinho 2000].

5.2 Which student's emotions will the Mediating Agent recognise?

But there is yet the question "Which emotions are important to be modelled in a situation of teaching and learning with an artificial agent?"

Another important concept that links emotions, cognitive process, learning and motivation is self-efficacy. According to Bandura [Bandura 1994], self-efficacy is concerned not with the skills one has but with judgments of what one can do with whatever skills one has.

Research shows that the strength of one's self-efficacy judgment prior to learning a task has an influence on how much effort one then expends or how persistent at the task one is [Wood 1989]. People

who are in doubt about their capacities feel discouraged more easily because of their failures. As they see insufficient performance as deficient aptitude, it is not necessary much failure for them to have doubts about their capabilities. On the other hand, those who are confident about their efficacy intensify their efforts when they fail in obtaining what they are searching and they are more persistent. They quickly recover their sense of efficacy after failures, because they attribute failure to insufficient effort or deficient knowledge and skills which can be acquired.

We chose **satisfaction** and **frustration** because these emotions, jointly with the effort, also allow us to determine the student self-efficacy. According to Compeau & Higgins [Compeau 1995] "individual with a weak sense of self-efficacy will be frustrated more easily by obstacles to their performance and will respond by lowering their perceptions of their capability".

5.3 How do the agent recognize student's emotions?

As we are going to infer the student's emotions, satisfaction and disappointment, by his observable behaviour (his actions in the computational system's interface), we need a psychological theory that allows us to do it. The **cognitive theory of emotions** is adequate, because it considers that emotions are elicited by a cognitive evaluation (appraisal) made based on stimulus of the world and user's behaviour. More precisely, we are going to use the OCC model [Ortony 1988] which is based on the cognitive theory of emotion and is possible to be implemented computationally. The OCC model provides information about the cognitive evaluation (appraisal) that a person does and which elicits each one of the 22 emotions cited in the book. This approach was also used by [Martinho 2000] and [Conati 2002].

According to OCC model, emotions of satisfaction and disappointment are elicited when events of the world that already happened are appraised according to their desirability with respect to the user's goals [1]. The *satisfaction* emotion arises when one is pleased about the confirmation of a desirable event and *disappointment* when one is displeased about the disconfirmation of the prospect of a desirable event. Figure 1 presents a scheme that illustrates the appraisal for Satisfaction and Disappointment emotions.

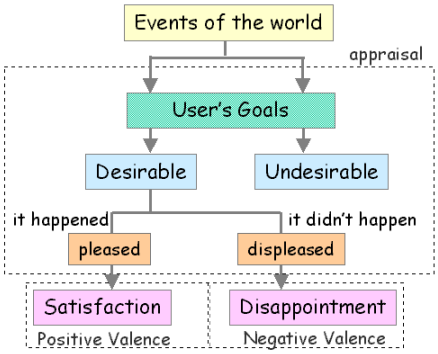

Figure 1. Scheme representing Appraisal for Satisfaction and Disappointment According to OCC model

So, what we want to do is verify when an event of the educational environment is desirable for the student (according to his goals) and when the student is pleased because the event happened or displeased because it didn't happen. This way, we need to define the **events** that can happen in the educational system, the **user's goal** (to know if the event is desirable or not) and how are we going to classify an **event as pleasant or not** in order to know if it elicits disappointed or satisfaction emotion?

So, **firstly**, we defined some events that can arise in the educational system. Some examples of events are: the student didn't accomplish the task; the student provided a wrong response for the exercise; student asked for help (Due to space limitation, we just cite some examples of events).

Secondly, we need to determine the student's goals in order to verify the desirability of the events (see Figure 1). But, **what goals does the student have in an educational situation**? According to [Ames 1990], students can have *mastery* or *performance* goals that are the reasons for students engaging in learning and choosing to engage in academic tasks. Students who have a *learning/mastery goal* are oriented toward developing new skills and abilities, trying to understand their work, improving their level of competence and learning new things. When students have *performance goals* they believe that

performance is important and they want to demonstrate that they have abilities [Ames 1990]. They feel successful when they please the teacher or do better than other students, rather than when they understand something new. In order to identify the student's goal orientation we use the *Motivated Strategies for Learning Questionnaire (MSLQ)* [Pintrich 1991]. The MSLQ is a self-report instrument which allows to determine students' motivational orientation and learning strategies they use. It is based on a cognitive view of motivation and learning.

Thirdly, once we know the student's goal and the events that can arise in our educational system, we can determine the desirability of the events and also when the student is pleased/displeased with an event. This process is necessary to infer the student's appraisal, i. e., the cognitive evaluation that elicits emotions. Once we know the student's appraisal, we can infer student's emotions. This way, we made a table when we classified the pleased/displeased of which one of the events according to what we know about student who have mastery or learning goals. With this information, we can determine student's emotion in our system. When the student is pleased about a desirable event that happened, he feels satisfaction emotion. When he is displeased because a desirable event didn't happen, he feels disappointment emotion.

In our system, we use a mentalist approach to implement the affective student model and the affective diagnosis. The proposed agent will be implemented as a BDI (Belief, Desire and Intention) agent. The BDI [Bratman 1990] [Rao 1995] approach is based on describing the internal processing of the agent through mental attitudes - belief, desire and intention, which represent information, motivational and deliberative state of the agent. More details about student's emotion modelling and inference can be found in [Jaques 2003a] [Jaques 2003b].

Once the agent knows the student's emotion, it chooses the affective tactic to be applied. The affective tactics promote actions that aim at adapting the system to student's emotions [Bercht 2001]. This tactics can be: (1) emotive behaviour presented by animated animations of the lifelike character which aims at promoting a positive mood in the student that is more appropriate to learn; and (2) domain-based tactics. For example, the agent can decide to present an easier exercise when the student is having difficulties, in order to increase student's confidence and show him that he is able to resolve the problem. Based on studies about affectivity and learning, we defined the tactics that are applied by the Mediating Agent. Due to space limitation, we do not address the affective tactics in this paper.

5.4 The Animated Pedagogical Agent's Character

Due to its affective function, it would be interesting for the Mediating Agent to have an interface that would allow it to exploit students' social nature. Due to psycho-social human tendency of anthropomorphizing software, recent studies have shown that educational tutorial systems that have animated agents can be more effective pedagogically [Lester 1997b], besides having a stronger motivational effect in the students [Lester 1997a]. Therefore, we chose to represent it as an animated character who has a personality and which interacts with the student through messages and emotional behaviour. The representation of the agent as a character allows it to show emotional behaviour that can promote a positive mood in the student.

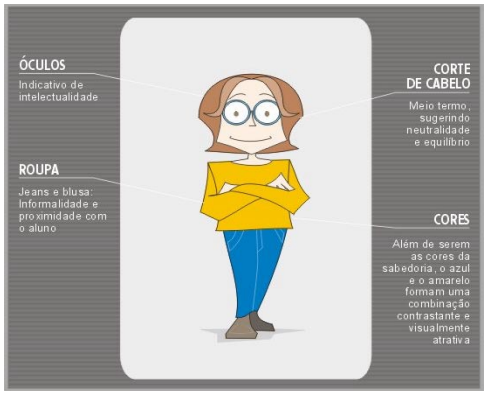

Figure 2. Pat's appearance.

The definition of the character appearance was made based on interviews with psycho-pedagogues, pedagogues and psychologies by the Everton Bocca's master dissertation. The animated character, called PAT (Pedagogical and Affective Tutor), is a female with entire body. She has brown eyes and long hair, she wears jeans pants and a coloured shirt and she is approximately 30 years old, because the goal is to represent a young, extrovert and informal character. The Figure 2 shows the final appearance of PAT.

6 Conclusion and Future Works

In this paper we addressed the role of emotion in educational systems. As we saw, emotions have an important role in learning and cannot be neglected. We presented some pedagogical theories that point out the importance of affectivity and motivation in learning and some educational systems that already handle emotional aspects of students.

Last, we presented our proposal of handling emotions in an educational system. It is a pedagogical agent responsible for inferring student's emotions and to present to the student emotive behaviour that aims at promoting a positive mood in the student which is better for learning. The Mediating Agent is already modelled and its interface (the lifelike character) is ready. Now, we are working in the implementation of the affective diagnosis and modelling in BDI.

For the validation of the animated pedagogical agent, we are going to demonstrate our agent acting in a simulated class and show the defined affective tactics for pedagogues and psychologists expert in education. For the validation of the agent's character, we intend to present a questionnaire (prepared by a psychologist) for, at least, 10 psychologist or pedagogues. We are also developing the questionnaire that aims at validating the affective tactics proposed by this work. We aim at presenting these affective tactics also to 10 distinct pedagogues and psychologists in education.

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