

Design an Expert System for Virtual Classmate Agent (VCA)

S. Fatahi , N. Ghasem-Aghaee, and M.Kazemifard

Abstract— Personality and individual differences are effective parameters in human activities such as learning. Thus e-learning environments have begun to consider the personality of the learner in order to enhance his/her performance. In this paper we design a model based on the learner's personality. We use an expert knowledgebase for selecting suitable Virtual Classmate Agent (VCA). Our expert knowledgebase uses the Mayers-Briggs Type Indicator (MBTI) as personality assessment tools, to select suitable VCA for learner. The VCA selects tactics to interact with the learner and will be able to cooperate intelligently with him/her. The results show that the presence of the VCA leads advancements in the learning process and attractiveness of virtual learning environment.

Index Terms— Learning Styles, MBTI Indicator, Personality, Virtual Classmate Agent (VCA), Virtual Learning.

I. INTRODUCTION

E-learning is usually defined as a type of learning supported by information and communication technology (ICT) that improves quality of teaching and learning. E-learning system is a powerful tool for achieving strategic objectives of the university (teaching, research and serving the society) [3]. E-Learning like all other tools offers advantages such as: access to differentiated online resources, Self-directed learning, and Learning matches learners' lifestyles, etc. Despite of all the advantages this kind of learning lacks the necessary attractiveness most of the time. It seems that regarding the human characteristics and inserting them in virtual learning environments, it would be possible to show these environments more real.

Obviously humans are different in personality and characteristics, and this difference in the characteristics of the individuals is reflected in their daily activities and their works. In the case of education and learning, personality difference between learners plays an important role. The learner's personality will be effective in his learning style [7]. In virtual learning projects this point should be taken into account that the learners' personalities are various and the teaching method used for each learner should be different from the other learners.

In this paper, section 2 is a review of the previous works and literature. In section 3 personality, learning styles, and MBTI indicator are discussed. Section 4 explains the proposed model. Sections 5 and 6 state the simulation and

implementation of the VCA respectively and finally Section 7 presents the conclusion and the future works.

II. PREVIOUS WORKS

In virtual learning systems created up to now, the learner's emotions received much more attention and the emotional agents were more employed. In a few of these systems personality drew our attention as an independent parameter that some of them are mentioned here:

In ERPA architecture by using ID3 algorithm, the learner's emotional reaction towards an event is predicted (for example taking an exam score) [6]. Chaffar and his colleagues used the Naïve Bayes Classifier method to predict the learner's emotions [5]. In ESTEL architecture, the Naïve Bayes Classifier method is used to predict the optimized emotional status. In this architecture, in addition to emotion, the learner's personality is also considered. In this system, a module tries to create and induce an optimized emotional state. For instance, when the learner enters the system, after the identification of learner's personality, for example extrovert, and recognition of optimal emotional state, such as happiness, an emotion is induced to that learner by showing various interfaces (e.g. music, picture, and etc.) to him [4]. In Passenger software designed by German researchers, cooperative learning methods are used. This software examines a series of emotions for the virtual teacher that is present in the system based on OCC model, and invites the learners to group work. The virtual teacher traces the learners' activities and helps the learners who are not able to do cooperative activities [13]. Abrahamian and his colleagues designed an interface for computer learners appropriate for the type of their personality using MBTI test and concluded that learning through this interface as a result of using personality characters leads into developments in learning process [1]. In implementation performed by Maldonado and his colleagues, a virtual classmate agent is used. This agent is placed beside the learners, and mostly plays the role of a co-learner and a support. In this project each of the teacher, learner, and classmate has own emotions and the learner's emotions affected his/her classmate [14].

III. PERSONALITY

Personality and individual differences are effective parameters in human activities such as learning. Many definitions are presented for personality that some of them are mentioned here: In Schultz's view, the unique, relatively constant internal and external aspects of a person's character that influence his behavior in different situations are called personality [9]. In Brody & Ehrlichmann's view, personality includes thoughts, feelings, desires, intentions, and action tendencies that contribute to important aspects of individuality [9]. Better to say, personality refers to the sets

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of predictable behaviors by which people are recognized and identified [8]. Everybody needs special learning style according to his/her personality characteristics. The learning style will be discussed in the next section.

A. Learning Styles

The recognition learning school stresses the importance of personal differences. People have different learning styles. According to the definition of learning styles by Keefe[12]: “the learning style is composed of cognitive and emotional characteristics and physiological factors of every individual and is applicable as a set of permanent indices for recognizing how the learner comprehends the concepts, and interacts with the learning environment and responses to the environment.” The learning style is in fact the criterion for personal differences. In other words, learning styles are different methods of understanding the knowledge and evaluating the result of this understanding. Some tools are used to evaluate the different learning style to determine the learner’s learning style. There are many questionnaires that categorize people based on their learning style. MBTI is the well-known questionnaire used for personality and learning style determination.

B. MBTI

MBTI was devised by Isabel Myers–Briggs and her mother Katherine Briggs in 1940, and was used first as an employment questionnaire. Myers–Briggs believed that different occupations favored different personality orientations [15], [17]. In 1957, this test was used for physical education [2], [17]. According to MBTI classification, every individual has a set of instinctive preferences that determine how he or she behaves in different situations [15]. This questionnaire helps to identify personality characteristics and learning preferences of the individuals and to elicit the suitable learning styles from these characteristics [16]. MBTI uses four two-dimensional functions according to the Jung’s theory. According to the theory that Jung proposed the four functions of mind are thought, emotion, comprehension, and exploration. These functions are the main ways for understanding, and they explain the truth. These functions are related to each other and they simulate one another.

Nevertheless, one of the functions is often dominant and that dominant function inclines the person to a state. The Jung theory distinguished three dimensions of Extroversion/Introversion (E/I), Sensing/Intuition (S/N) and Thinking/Feeling (T/F), but in MBTI another dimension of, Judging/Perceiving (J/P) also was added [1], [16]. Irrational mental functions, Sensing (S) or Intuition (N), relate to how an individual perceives information, while rational mental functions, Thinking (T) or Feeling (F), provide insight into how one makes judgments or decisions based upon their perceptions. Mental functions of extrovert/introvert and judgment/perception are related to how individuals interact with the external environment and the around world. 16 personality types are resulted from mixing these 4 two-dimensional functions that each learner would be placed in one group [10]. The extroverts are often inclined to the external world, have many friends, and are active people. These people prefer collaborative learning. The introverts prefer the introversion of ideas and, have few friends. These people are interested in thinking about affairs. Those who receive information using the five senses from the environment are realistic and fix their attention on scientific subjects. The opposite points of them are those who receive information by understanding the relations and results. The other group is thinking persons who decide by objective information and like topics objectives. The feeling ones insist on harmony and balance and enjoy collaborative works. The judging people prefer a totally structured life and are successful in learning subjects and analyzing the materials. The perceiving people have a pliable way of life, are intelligent but postpone doing their homework [16].

IV. PROPOSED MODEL

As it was mentioned in previous section, personality plays an important role in learning processes, and learners with different personalities need special learning style. Moreover, the presence of a VCA appropriate for the type of learners’ personality can assist them in learning. The model presented here includes personality parameter for learner and VCA. This model is displayed in figure 1.

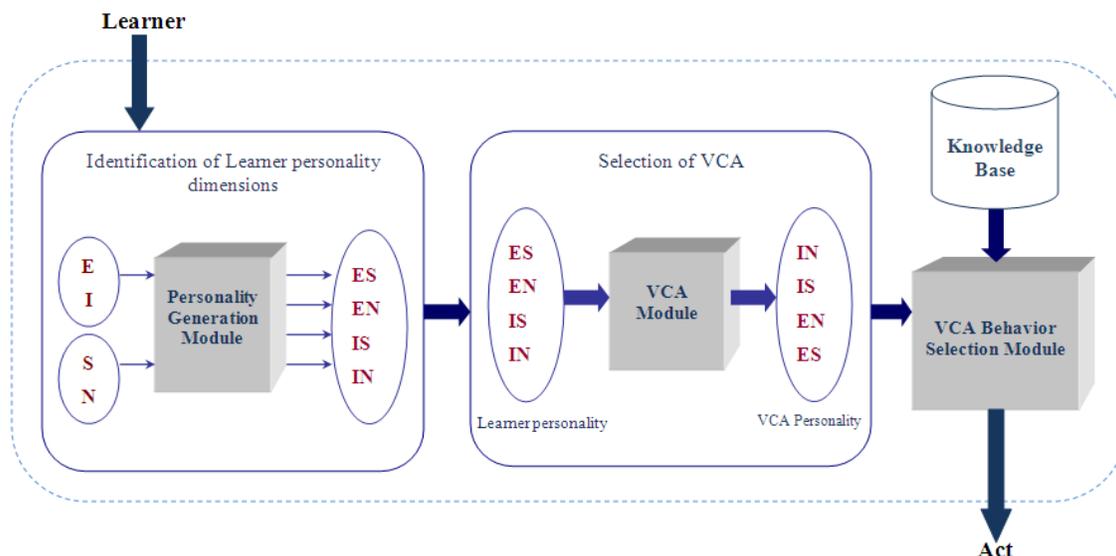


Figure 1. Proposed Model

As is shown in figure 1, the model includes three main modules, each of them described below:

The module of personality generation: In this module, using the MBTI questionnaire, the personality of the learner is recognized. In this paper we only considered two dimensions of E/I and S/N which are important in learning process [1]. Considering two dimensions, 4 types of personality that are EI, EN, IS, and IN would be resulted.

The module of classmate selection: In this module, a VCA appropriate for the learner's personality is selected. Selected VCA is completely opposite in his MBTI dominant with learner. Based on research, the opposite personality displays a higher performance than the similar personality [11]. The personality selection for the VCA is so that it would result in improvements in learning process.

The module of classmate behavior selection: During the learning process, regarding the events that happen in the environment and the learning situation of the individual, the VCA exhibits appropriate behaviors. Tactics knowledgebase is used to interact with the learner.

For two personality dimensions considered in this paper four parameters are elicited. Independence and replying speed parameters for the E/I dimension and detail-oriented attitude and attention for the S/N dimension, now based on the extent of these parameters in each type of personality, the VCA exhibits a certain behavior. These behaviors are shown separately for each dimension in tables 1 and 2.

Table 1. The VCA behavior with E and I personality dimensions

Learner's personality	VCA's personality	characteristics	Independence parameter	characteristic	Replying speed parameter	Events and VCA tactics (solving problem)
I	E	The introvert person mostly acts independently and is inclined to do the exercises alone.	The E VCA decreases the independence of I.	The introvert person takes a lot of time solving the problem, the extrovert person mostly acts without thinking and replies.	The E VCA tries to increase the speed of I.	1) The E VCA tries to cooperate with I. 2) The E VCA tries to activate I by announcing the remaining time so that I answer the questions sooner.
E	I	The extrovert person is interested in group work and rarely acts lonely.	The I VCA increases the independence of E.		The I VCA tries to decrease the speed of E.	1) The I VCA do not cooperate with E so that he act independently. 2) The E VCA tries to make I more relaxed so that he thinks more on problems.

Table 2. The VCA behavior with N and S personality dimensions

Learner's personality	VCA's personality	characteristics	detail-oriented attitude parameter	Characteristic	Attention parameter	Events and VCA tactics (solving problem)
S	N	The S person mostly pays attention to details, while N pays attention to the relation in the problems, and the result is important to him.	The N VCA tries to explain the relation between the problems for S.	The N person never pays attention to your words and predicts the words you want to say. The S person if there was any need to ask for help asks N and do not react negatively to his mistaken views.	The N VCA pays attention to S and helps him if necessary.	1) The N VCA tries to shed some light on the relation between problems for S, clarify the problem to S and explains the general points to the learner. 2) The N VCA helps and cooperates with the learner if he asks for that.
N	S		The S VCA tries to decrease the amount of attention N pays to the details.		The S VCA tries to attract the N's attention to himself.	1) The S VCA reminds the details to N. 2) The S VCA tries to convey his views to N.

Mixing the two dimensions' functions, 4 personality types would be resulted, that are IN, IS, EN, and ES. A sample of these tactics is presented in table 3.

Table 3. VCA tactics

Learner's personality	VCA's personality	Events and VCA tactics (solving problem)
IS	EN	1) The E VCA tries to cooperate with I. 2) The E VCA tries to activate I by announcing the remaining time so that I answer the questions sooner 3) The N VCA tries to shed some light on the relation between problems and explains the general points of the exercise for S. 4) If the learner asks for help, the N VCA helps and cooperates with him.

V. SIMULATION OF VIRTUAL CLASSMTE AGENT

As it was mentioned in the previous part, based on personality recognition module, according to MBTI test, the learner would be categorized in one of the four personality groups. Then, based on this categorization an appropriate VCA is selected for him. According to four types of personality elicited for the learner, four types of complementary personality are implemented for him using four rules. A sample of these rules is presented below:

Rule 1:
 IF Learner's Personality Is EN
 THEN Virtual Classmate's Personality Is IS

Regarding the events that happen in the environment, the VCA reacts properly based on his personality. Using the personality characteristics of each dimension of MBTI, one of the knowledgebase's rules will be fired and VCA present his behaviors. A sample of these rules is presented below:

Rule1:
 IF Personality IS IN
 AND Event IS Asking for Help
 THEN Tactic1 IS Virtual Classmate Persuade Learner to be Independent

Rule2:
 IF Personality IS IS
 AND Event IS Asking for Help
 AND Asking for Help IS High
 THEN Tactic1 IS Virtual Classmate Cooperate With Learner
 AND Tactic2 IS Explain Details of Problem

The learner who has an ES personality, is inclined to his activities with the group all the time, and has very little self

independence. To moderate this state, a VCA with introvert personality is used. This personality helps the learner's independence. As it is mentioned in rule 1, if learner asks for help, the VCA tries to strengthen his independence feels by sending messages like "what is your opinion about this exercise?" and "you can definitely do it by yourself!". But if the request for help by the learner is very strong, VCA cooperates with him (rule 2). The type of his cooperation depends on the other dimension of his personality, for example, in the rule 2 VCA has IS personality and is mostly detail-oriented; cooperating with the learner tries to explain the details of the problem for him.

VI. IMPLEMENTATION

For implementing the learning environment, a series of mathematic exercises were used. In this environment it was assumed that the learner has already learnt the subject and refers to this software for solving the problem. The exercises are categorized in 5 levels by difficulties. The learner begins to solve the problems together with the VCA, and regarding the events that happen in the environment interacts with the VCA. An image of this environment is presented in figure 2. Visual C#.Net and SQL Server database were used for implementing.

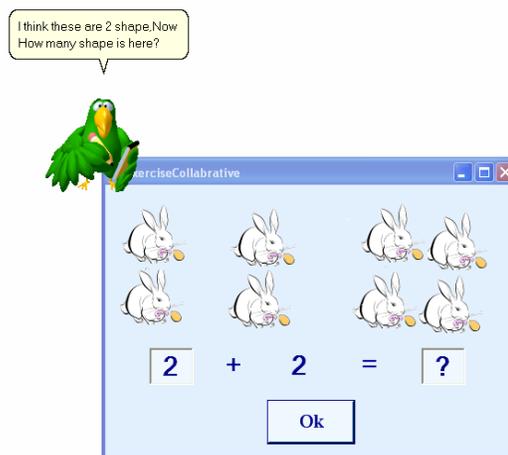


Figure 2. Educational environment with classmate agent

Also, to show the VCA, we selected Peedy agent from Microsoft agents.

VII. CONCLUSION AND FUTURE WORKS

In this paper a model for using in virtual learning was presented. In this model some modules for personality recognition and selecting an appropriate VCA for the learner's personality, were considered to develop the interaction with the learner. The Behavior of VCA saved in knowledgebase of system. The results show that placing the learner beside an appropriate VCA, lead to improvement in learning and makes the virtual learning environment more enjoyable.

In the future, attempts are made to add the emotion recognition module to this model, and in addition to personality, the learner's emotions also be effective in VCA designation.

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