Dialog Based Planning in Intelligent Tutoring System

HEBA ELBIH, Mohamed Elkawkagy and Haytham Tawfic
Computer Science Department
Imam Abdulrahman Bin Faisal University
Dammam, Community College
KINGDOM OF SAUDI ARABIA
hmElbih@iau.edu.sa mmElkawkagy@iau.edu.sa htaalfeel@iau.edu.sa

Abstract: - A computer system that evaluates the students learning the process is so-called Intelligent Tutoring System (ITS). The important issues in constructing the ITS is the student cognitive level and the emotional status of them. There are many approaches were presented for ITS, but considering emotional intelligence of students still not existed on it. Today, the important factor for increasing the student's performance is Emotional intelligence. This paper will introduce a new approach for modeling the dialog in tutoring system. The proposed approach depends on the hierarchical Planning technique. During this dialog, the system recognizes the student's appraisal to construct a particular interpretation for the extrinsic events that are related to the student goal and at the same time overcoming their emotional reasoning. Accordingly, the dialog will try to maintain the emotional, motivational and cognitive student states, as well as enhancing the student's emotional intelligence. In this approach, the type of personality of students is considered to select the suitable dialog, and according to the student emotional and motivational, the suitable regulation strategy is determined.

Key-Words: - Intelligent Tutoring System, Hierarchical AI-Planning, Classical AI-Planning.

1 Introduction

ITS is an educational system which tries to optimize the learning process and can be adapted according to the student needs. Although several approaches have been constructed for ITS, which consider intellectual intelligence, enhancing emotional intelligence has not be enhanced so far. In general, during the learning process, traditional educational systems do not consider stress, frustration anxieties, failure, depression problems, and do not manage emotions i.e., coordination, interaction, communication, Adjustment.

Emotional Intelligence (EI) is considered as a backbone of the learning process [7]. Generally, the Intelligence Quotient (IQ) contributes 20% to success in life, the other percentage 80% of success comes from Emotional Quotient (EQ). Note that the intellectual people are not necessarily emotionally intelligent. So, if you have a high skilling in solving problems and perfect memory, does not mean you are able to deal with emotions and motivates yourself. Therefore, the ability to recognize, interpret, and influence someone emotions means EI. Consequently, it is essential to consider the students emotional state during the learning process as well as dealing with them emotionally.

ITS with the emotional intelligence gives the system able to identify the status of student's emotional, and according to his/her emotional appraisal, the system can interact with the student. So, the ITS should integrate EI to improve the student's performance.

This paper will present a new dialog approach to generate particular course in ITS. The generated course is a personalized course, a structured subject representation, and helping students to keep up his emotional state [4]. In addition, we will present a new approach for modeling a personal dialog based HTN planning system. One of the essential techniques to recognize the student appraisal and improve the student emotional intelligence is the dialog system. It also helps us to overcome their emotional reasoning and elaborate the relation between external events and student goal. The error in thinking that happens when the student ratify that his feeling is right regardless of the evidence is called Emotional reasoning. The foundation of the emotional plan was inspired by Gratch[8]. The emotional plan is represented as a plan-based appraisal. This plan relies on the assessment of the incoming event to goal devotion. After that, according to the appraisal and coping theory [11], a plan-based appraisal is revised. In state of the art, different ITS systems consider conversation and the emotional planning during human-computer-interaction [17, 13, 21]. In addition, some of them consider appraisal and coping theory during the learning process [3, 1]. As opposed to these approaches, the proposed approach able to produce

many different dialog styles according to the type of the student personality. Moreover, during the dialog, the proposed approach considers student's personality types, appraisal and coping to manage his emotion; considering the attribution theory [23] and the cognitive model of emotion OCC [14] during the appraising process and different coping studies that relate the personality type with their coping ways and different regulation strategies.

The paper is structured as follows: In section 2 the proposed architecture is discussed. In section 3 the Emotional intelligence in the proposed approach is presented. Related to that, the appraisal theory and the emotional regulation are explained. After that section 4 will introduce the hierarchical planning framework and then explain the proposed dialog system in section 5. Finally, this paper is concluded with some remarks.

2 System Architecture

As shown in Figure 1, the proposed architecture includes three different modules: pedagogical module, course module, and , student module. In addition, the proposed architecture defines an authoring phase over the course module. The phase of course generation is identified over the pedagogical module. Therefore, In this paper, we will develop general educational ontologies for the modules of course and student. This ontology is used in many domains. Note that ontologies will allow reusing, sharing, and make reasoning about the student information[4]. According to the planning technique, the pedagogical module composite of dialog and course generation processes. Note that, the course is generated according to course module and student module as well as the student appraisal during the dialog phase. The generated plan deliver the course for students as a set of querying statements which ask the course ontology to retrieve the learning objects.

The developed architecture consists of four different scenarios type; companion games, revision, Lesson, and test scenarios. The scenario is defined as a separate consequence steps in the teaching process. These scenarios are used with the motivational and emotional states to generate the course that achieves the goal. This article will focus only on the dialog process.

3 Emotional intelligence in the Proposed Approach

During the learning processes (i.e., understanding, memorizing, analyzing, reasoning, or applying), the students' performance depends on their emotional state. Therefore, the system always tries to enhance or maintain the emotional state of the student. The students' EI elaborates the meaning of emotion with their relationships. At the same time, EI finds out the reasons about emotions to improve thinking and to growth the emotional and intellectual.

The EI concept was inspired by Goleman[7]. He introduced the EI competencies of High Achievers. These competencies are organized as follows; self-motivation, self-regulation, self-awareness, managing emotions, and empathy. The proposed architecture considers the EI competencies of Goleman as follows;

- **Emotions and Self-Regulation**: The student learns how to change the status of student emotion.
- **Self-awareness:** The relation between beliefs and feelings are recognized by the students.
- **Self-motivation:** The strategies of the emotional regulation are used to help the students to achieve the goal.
- **Empathy:** The system interacts with students' feelings if we construct good relationships with them.
- **Social Skills:** To deal with the student emotions, you should understand the emotion factors.

Salovey et al. [17], introduced conceptual related mental processes including emotional information which consists of regulating emotion in the self and other. In addition, it includes expressing emotion in self and other as well as adapting the emotion.

3.1 Appraisal Process

To organize the student behavior, the cognitive theory uses appraisal and coping processes. The correspondence between a student and environment are studied in the Appraisal process. It supposes that the event alone does not have meaning, but has a

significance corresponding to the student's evaluation [5]. Marsella et al., [13] introduced a relationship between the event and achieved goal like effects of the emotion on activities that facilitate a student's goal. According to the relationship between students and its environment, the appraisal process generates emotion status [12].

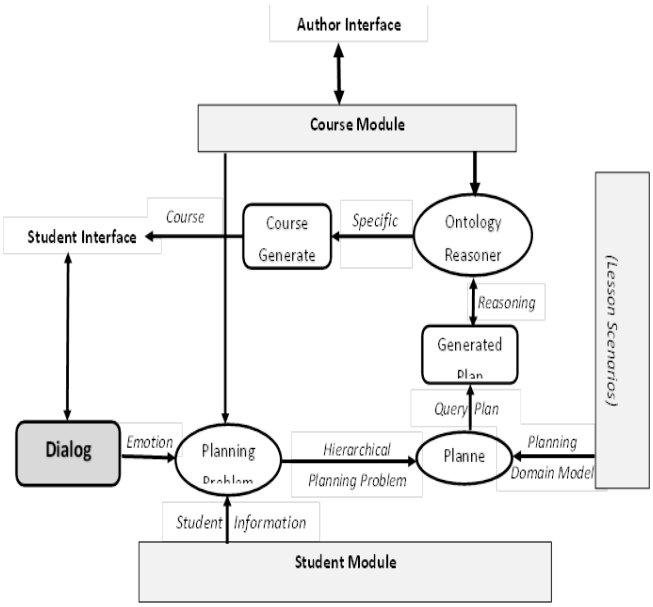

Fig. 1: The System Architecture

The first appraisal studies the evaluation of student impression and motivation. The second appraisal is based on evaluating the events controllability and ability to change the harmful situation. [15].

In general, there is a difference between cold and hot emotions [13]. Hot emotion influences the behavior of people and is not under the complete control of a person. On the other side, the cold emotion explains the internal feeling process that discusses the emotion reasoning, but it does not necessarily appear during the personal behavior.

Appraisal process gives us the ability to analyze the emotional responses towards the new events. The emotional reasoning is considered one of the main drawbacks in the learning process. Learning how to recognize the error of thinking like reasoning of emotional is a backbone of this approach. It identifies the student appraisal and decides if it includes thinking error. Note that, according to the coping style, the proposed system determines the reaction of student appraisal.

At this point the role of the system is to understand student's appraisal and try to regulate the emotional state of the student. The objective from this point is to change the student appraisal to a confidant student and enhancing the student emotional intelligence. The proposed approach considers the attribute theory in the appraisal process to analyze the student beliefs [23], and OCC cognitive model to hierarchical classification the 22 emotions [14].

3.2 Appraisal Ingredients

The emotional reason during dialog cycles is analyzed with considering the OCC model and attributes theory as follows:

1–**Happening confirmation:** the event is tested if it occurred or will occur in the future. Accordingly, the following emotion can be induced Hope, Fear (a desired/undesired event will happen). Satisfaction, Fears-confirmed (a desired/undesired event happened).

2– **Self-consideration:** the event is tested if it happened to the student or someone else. Therefore, if the event happened to the student itself, the student emotion will be Joy or Distress; otherwise, the student emotion will be Happy-for, Pity, gloating, resentment or envy.

3–Controllability: check the emotion reason, it is controllable/ uncontrollable.

4–Stability: check the emotion reason (stable / unstable).

5–**Locus of reason:** check the emotion reason(internal / external).

6–**Commendation:** ask the student, if someone praises the student. Therefore, the proposed approach considers the following emotion: Pride or Shame, Admiration or Reproach.

3.3 Coping Process and Student Personality

On the other Hand, coping defines how we can interact with the appraised significance of events. Thus, coping process has the same representation of plans, goals, and a person's appraisals beliefs. The proposed architecture considers the personality types [22]. As shown in Table 1, the personality types are identified by Extroversion (E), Neuroticism (N), and Conscientiousness (C). The conscientiousness indicates the ability to cope, and

Neuroticism and Extroversion have denoted the stress.

Table 1: The Personality Type

Spectator(E- , N- , C-)	Insecure(E-, N+, C-)
Skeptic type (E- , N- , C+)	Brooder type (E-, N+, C+)
Hedonist type (E+, N- , C-)	Impulsive type (E+, N+, C-)
Entrepreneur type (E+, N- , C+)	Complicated type (E+, N+, C+)

For the combination between these factors, the researchers in Julie et al. [10] elaborate the highly neurotic students that become more pressured and change to a negative emotion, distress and coping in the inactive and maladaptive way. On the other hand, the highly Extrovert person will be more stressful in events and can change to a positive emotion by easy way, and cope in an active manner and seek social support. Based on these researches results, the proposed approach can expect the coping method of the student and accordingly tries to regulate the student's emotion.

3.4 Emotion Regulation

In order to increase positive emotions, and decrease negative emotions, we will use emotion regulation. "Emotion regulation includes all of the conscious and non-conscious strategies we use to increase, maintain, or decrease one or more components of an emotional response" [9]. Thus, to inhibit a person to increase or decrease the response level of emotion, we should use different strategies to study the level of emotional response.

Recognition and understanding emotions are the basic components of regulation. These emotions are managed by modulating, inducing, preventing them, and at the same time use emotions as an action to achieve the goal. In general, emotional regulation strategy types are antecedent-focused strategy (AFS) and Response-focused strategy (RFS). AFS is used to prepare the response inclination before they are fully activated. In the Gross model, there are many kinds of these strategies. When emotion is getting underway, the RFS utilized to the stimulation of the actual emotional response. The emotional regulation in the proposed approach occurs during the dialog phase and course generation phase. Generally, the proposed technique considers two different regulation strategies: the First strategy focused on acting in the world that is called problem focused regulation strategy, and the second one focused on representing changing person's interpretation in the situation that is called emotion-focused regulation strategy as shown in table 2.

In this paper, we will consider the regulation strategies of the dialog phase, which are as follows; suggesting seeking social support, take vacation, play game; change student belief from low ability to low effort; promotion for increasing difficulty level; ignoring the emotion reason, positive interpretation to the actual reason; shift blame from the actual reason to another, praiseworthy as well as blameworthy; remind student about his/her previous success; praise ability, praise/punish student award high/low effort; encourage student; or suggest challenges.

Table 2: Regulation Strategies In the proposed approach

Strategy	
Problem focused regulation	Change the scenario type
	Change the game strategy
	Change learning style
	Change type of example or exercise
	Change the level of example or exercise
	Facilitate success.
Emotion focused regulation	Encourage student.
	Praise/punish student high/low effort
	Pries ability
	Suggest challenges
	Remind student for his/her the previous success
	Praiseworthy as well as blameworthy
	Shift blame from the actual reason to another
	Positive interpretation to the actual reason
	Ignoring the emotion reason
	Promotion for increasing difficulty level
	Change student belief from low ability to low effort
	Suggesting seeking for social support, take vacation, play game, ect

4 HTN Planning Framework

The used AI planner is a hybrid planning framework [19]. Hybrid planning [2,20,23] integrates hierarchical planning [6] and classical planning paradigm. The produced system has the ability to use predefined standard solutions such as HTN planning paradigm. In the proposed framework, a partial plan $P=<TE,<,VC,CL>$ includes task network (or plan steps) (TE), ordering (<) between plan steps TE, variable constraints (VC), causal links(CL). CL has the form $<te_i,Q,te_j>$. It means that the pre-condition Q of a $task(te_j)$ is a post-condition of $task(te_i)$. A domain model $D=<T,M>$ consists of tasks either primitive or abstract, and a set of methods. A task $t(\tau)=<prec(t(\tau)),eff(t(\tau))>$

consists of pre-conditions and the positive and negative effects *(add(t(τ)),del(t(τ)))* of a task (post-conditions). Pre-conditions and post-conditions are defined as literals. The task parameters are represented by symbols $\tau^{-}=\tau_1,....\tau_n$. Both tasks either primitive or abstract have pre-conditions and post-conditions.

A decomposition method $m=<t,P>$ is used to implement an abstract task *t* by a partial plan *P*. A partial plan *P* denotes an abstract solution for the corresponding abstract task. Note that, every abstract task is refined by one or more decomposition methods.

A planning problem *(Π)* includes a domain model D, S_{init} represents the initial state, while P_{init} denotes initial partial plan *($\Pi=<D,S_{ini}t,P_{init}>$)*. Refinement step replaces abstract tasks by suitable decomposition methods, solve open precondition flow by inserting causal links, variable constraints, and change ordering constraints.

5 The Proposed Dialog Planning

HTN planning is a suitable paradigm to construct dialog with the students for more reasons. (1) The HTN planning paradigm is suitable for the huge-scale dialog planning. (2) The HTN planning reduces the required time to find a solution. (3) The hierarchy representation is helpful in selecting the suitable method to refine the corresponding abstract task. Hybrid planning helps the dialog planning to identify different emotion and also POCL help the dialog to consider the reasoning between emotion development and event and between the appraisal of student and the suitable method to cope with the personality of students.

In the proposed dialog approach, the appraisal process evaluates events effect on the student. And then use student's appraisal to guide the student action. In other words, we will consider the appraisal of student's and their beliefs to regulate the student emotion with considering their coping methods according to the student personality type. Therefore, students accomplish learning goals by efficient way when adapting the pedagogical procedures to differentiate between student personalities. The planner constructs the solution plan by simulating the operator effects on the student model. Starting from the current student state, the planner tries to find operators sequences which accomplish goals of the planning problem. An operator consists of pre-conditions which identify the conditions that should be performed before invoking the operator, and a set of post-condition, which represent changes in the Student states.

The planner uses the preconditions and expected post-conditions of the operators to invoke the various steps of dialog plan, and thereby determine the success or failure of the plan.

Note that, when you try to accomplish the identical goal, different plans could be constructed although they have the same initial state. The different plans come from the differences in the emotional and motivational states and student personality type.

The dialog planning begins with the AI-hybrid planning problem which includes a set of facts called initial world state: *Student_Info (?student_id,?student_name)* such as *Student_Info (101ID, Sara), Student_Personality(?student id, ?Personality_Type) such as Student_Personality (101ID,Brooder)* and *Student_Cognitive(?student id, ?quantity_level, ?quality_level)* such as *Student_Cognitive(101ID,Intermediate, V_good).* The initial plan includes only one abstract task so-called *Start_Dialog.*

Table 3: Example of some questions and student answers

Task	Student answer
Task Name: CheckCurrentEmotion **Pre-Condition:** student_info(?st_id, ?St_name) **Effects (Post-Conditions):** Welcom_how_are_you_today(st_name) Are_you_Angry(Y / N) Are_you_Happy(Y / N) Are_you_Afraid(Y / N) Are_you_Annoy(Y / N) Are_you_Sad(Y / N) Are_you_Normal(Y / N)	Welcom_how_are_you_today(Yousuf) Are_you_Angry(N) Are_you_Happy(Y) Are_you_Afraid(N) Are_you_Annoy(N) Are_you_Sad(N) Are_you_Normal(N)
Task Name: CheckTheReason **Pre-Condition:** True **Effects (Post-Conditions):** What_is_the_reason(st_name) Course_reason(Y / N) Exam_reason(Y / N) Your_friend(s)(Y / N) other_reason(Y / N)	What_is_the_reason(Heba) Course_reason(N) Exam_reason(Y) Your_Teacher(N) Your_frind(s)(N) other_reason(N)
Note that: The effects of the task will appear to the student as a question. The student answers will added as facts to the initial state in the planning problem	

The most abstract task *"Start_Dialog"* is defined by eight decomposition methods according to the student personality type. In each decomposition method, the dialog planning begins by asking the student question about the current emotion and another question about what is the reason for this

emotion? The first step to enhance the emotional intelligence is teaching the student how to recognize the emotional state and understanding the reason for the current emotion. At the first step in the planning cycle, the student should interact with the planner to answer some questions about the emotions and the reason for the current emotion. These questions are the operator effects. As shown in Table 3, there are some questions and student answers.
According to the interaction between the system and the student, the AI-planning problem is refined via different cycles of planning and dialog. Also, the initial state of the giving problem is updated by adding new predicates as new facts to move the planner to a new state as shown in table 4.

Table 4: The produced planning problem (XML file) after applying dialog system

```
<xml version="1.0" encoding="UTF-8" >
<problem domainModel="DialogDomainModel" name="Dialog_Problem_1">
<initialStateDescription>
 <fact name=" Are_you_Angry">
  <constant name="No" sort="no" type="rigid" />
 </fact>
<fact name=" Are_you_Happy">
  <constant name="yes" sort="yes" type="rigid" />
 </fact>
<fact name=" Are_you_annoy">
  <constant name="No" sort="no" type="rigid" />
 </fact>
<fact name=" Are_you_sad">
  <constant name="No" sort="no" type="rigid" />
 </fact>
<fact name=" Are_you_normal">
  <constant name="No" sort="no" type="rigid" />
 </fact>
<fact name="  Course_reason">
  <constant name="No" sort="no" type="rigid" />
 </fact>
<fact name=" Exam_reason">
  <constant name="yes" sort="yes" type="rigid" />
 </fact>
 </initialStateDescription>
- <initialTaskNetwork>
  <taskNode name="DialogTask" taskRef="Start_Daialog" />
 </initialTaskNetwork>
 </problem>
```

Note that, the student's emotion is managed and regulated by the dialog system. For example, after many cycles of the dialog system, it produces output as shown below.

"Congratulation i am happy for you"
" You are cleaver student continue"

The actual effects of the two massages that appear in the previous dialog are; call Massage *(Congratulation M)* and call *Massage (encourage M)*. The querying statements in the generated plan will be retrieved from the course ontology to generate the dialog for the student. The author phase in the developed architecture can also change the contents of these massages if s/he wants.

Note that, the appraisal ingredients are considered in the dialog phases. In the end, the output of dialog is a set of literals which are identified as diagnosis facts for the student emotion. These facts are used in the process of constructing the suitable course generation to a specific student. These literals include the student motivational and emotional states. Through the planning generation, the planner considers different emotional and motivational goals such as increase confidence and decrease fear.

The appraisal theory considers how one event influences the other and uses the result of appraisal to help the person's action. It is used to evaluate the learner performance in their emotional state. For that, you should use the student appraisal and their beliefs to regulate their emotion by considering the coping ways according to the student's personality type.

The student self-appraisal allows the proposed system to change the student appraisal and emotion. This means that the student beliefs about the reason for failure can be changed from low ability to another status such as low concentration. Therefore, our system will assist students to identify the student emotions and link emotion by the reason behind the emotion. In addition, the student's appraisal allows the proposed dialog to understand the reason of student emotion by making a comparison between the student's beliefs and his/her performance history. The proposed system constructs a dialog to manipulate the error of thinking. For example, in case of student does not ratify his ability to pass the exam, regardless his quality level, then the proposed dialog will help the student to change student's beliefs by increasing self-confidence and encourage him / her to accomplish learning tasks.
Note that, the student personality type plays an important role in deciding the appropriate scenario of the dialog. For example, in case of there is a nervous student, you have to avoid blaming him or dealing with him by the aggressive way, and you have to relax him. In addition, the proposed dialog system constructs a different dialog for each type of personality with considering the student appraisal. Note you do not cope with the situation on the event in the correct way. Each one copes with the incoming event according to his appraisal and depending on the coping method and personality type. Therefore, we will increase the good coping

way and adapt or adjust the poor way to taught the student how to be emotionally intelligent. On the other side, the proposed dialog system analyzes the effectiveness of positive and negative student emotion performance, checks the reason behind this emotion is internal or external and tries to increase/decrease the internal emotion by increasing or decreasing the external one. For example, suppose we have two different types of personality: complicated student (high E, high N, high C), and Brooder student (low E, high N, high C). Concerning the first type, the extroversion factor helps him to be less depressed than the introversion factor in the second type which is a brooder. While in the Brooder type, if the student fails in the exam, he will blame his self, and lose his confidence more efficiently than the complicated type. In contrast that, the complicated will be more anxiety than the Brooder type, but he has confidence in his self. So, the proposed system helps to reduce the nervous level for both brooder and complicated, and at the same time increases the level of confidence of the brooder type. To this end, the proposed dialog will apply ARS and FRS. For example, the dialog system will change the current situation of the student appraisal. As in traditional learning, the instructor can choose the optimal situation for learning the students and especially the emotional conditions. For example, the instructor can present a joke to the students to change the emotional states of student's. Therefore, the student that feel bored, anxious, angry or depressed, could not learn efficiently. In addition, the dialog will be empathetic and very helpful for the sensitive person, blaming the careless student and teach him how to appreciate his response. Moreover, the proposed dialog will behave vigorously with the student who have not big effort in exam preparation such as ”You should”, ”let’s” , and behave in an easy-going way ”Perhaps you would ” or ”Maybe you could” etc. with the student who make a big effort but acquired bad score.

6 Conclusions

Although several ITS approaches have been established, improving students’ emotional intelligence has not been considered so far. Modeling the emotion and motivation have an big role in emotional computing to make human computer interaction more effective and natural. The developed approach is an intelligent tutoring system depends on personality type; the objective of the proposed system is to enhance the student emotional intelligence and the intellectual intelligence. In this paper, we have introduced a dialog based on HTN planning. The goal of the dialog system is to enhance the student’s performance by considering the emotional intelligence.

References

[1] Aylett, R., Louchart, S., Dias, J., Paiva, A., Vala, M., Fearnot - an experiment in emergent narrative. Proc. of 5th International Working Conference on Intelligent Virtual Agents(IVA) 3661, 305–316 (2005)

[2] M. Elkawkagy, P. Bercher, and S. Biundo, Improving Hierarchical Planning Performance by the Use of Landmarks. In Proceedings of the 26th National Conference on Artificial Intelligence (AAAI 2012), page 1763--1769. Herausgeber: AAAI Press, Juli 2012

[3] C. Conati, X. Zhou, Modeling students and apos; emotions from a cognitive appraisal in educational games. In Springer-Verlag Berlin Heidelberg. pp. 944–954 (2002)

[4] H. Elbeh, S. Biundo, An emotional intelligence course generation system based on HTN planning. In Proc. of the 14th International Conference on Artificial Intelligence 2012.

[5] C.D. Elliott, The affective reasoner: A process model of emotions in a multi-agent system. Ph.D. Thesis (TR32), Northwestern University (1992)

[6] G. Behnke, P. Bercher, S. Biundo, B. Glimm, D.K. Ponomaryov, M.R.G. Schiller, Integrating ontologies and planning for cognitive systems. In Proc. of the 28th Int. Workshop on Description Logics (DL), 2015.

[7] D. Goleman, Emotional intelligence. Bantam Books, New York (1995)

[8] J. Gratch, Why you should buy an emotional planner. Proc. of the Agents ’99 workshop on Emotion-based Agent Architectures (EBAA’99) and ISI Research report pp. 99–465 (1999)

[9] J.J. Gross, Emotion regulation in adulthood: Timing is everything. Current Directions in Psychological Science 10(6), 214–219 (2001)

[10] P. Julie, T. Joe, Associations among the big five, emotional responses, and coping with acute stress. Personality and Individual Differences 32(7), 1215–1228 (2002), http://linkinghub.elsevier.com/retrieve/pii/S0191886901000873

[11] R. Lazarus, Emotion and adaptation. Oxford University Press (1991)

[12] R. Lazarus, Emotion and adaptation. Oxford University Press, ISBN: 978-0-19-506994-5 (1991)
[13] S. Marsella, J. Gratch, Modeling coping behavior in virtual humans: Don't worry, be happy. In Proc. of AAMAS-03. pp. 313–320. ACM Press (2003)
[14] G. Behnke, D. Ponomaryov, M. Schiller, P. Bercher, F. Nothdurft, B. Glimm, S. Biundo, Coherence across components in cognitive systems – one ontology to rule them all. In: Proc. of the 25th Int. Joint Conf. on Artificial Intelligence (IJCAI). AAAI Press (2015)
[15] E. Peacock, P. Wong, The stress appraisal measure (sam): A multidimensional approach to cognitive appraisal. Stress Medicine 6, 227–236 (1990)
[16] J. Porteous, M. Cavazza, F. Charles, Applying planning to interactive storytelling: Narrative control using state constraints. ACM TIST 1(2) (2010)
[17] P. Salovey, J.D. Mayer, Emotional intelligence. Imagination, Cognition, and Personality 9, 185–211 (1990)
[18] M. Elkawkagy, Improving the performance of Hybrid planning, International Journal of Artificial Intelligence (IJAI2016). Vol. 14, Issues number 2. 2016.
[19] B. Schattenberg, A. Weigl, S. Biundo, Hybrid planning using flexible strategies. Proc. Of KI-05 pp. 258–272 (2005)
[20] A. Abdelatey and M. Elkawkagy, Genetic-based approach for security policies negotiation in web service environment, The International Journal of Applied Sciences, Engineering and Technology, 2018.
[21] M. Vollrath, S. Torgersen, Personality types and coping. Personality and Individual Differences 29(2), 367–378 (2000)
[22] B. Weiner, An attributional theory of motivation and emotion. New York: Springer-Verlag (1986)
[23] M. Elkawkagy and H. Elbeh, Landmarks in Hybrid planning, International Journal of Intelligent Systems and Applications (IJISA2013). Vol 5 Nr. 12, PP.23-33 2013.