# Chapter 9
# Individual Learning and Emotional Characteristics in Web-based Communities of Practice

**Nikos Tsianos**
*National & Kapodistrian University of Athens, Hellas*

**Zacharias Lekkas**
*National & Kapodistrian University of Athens, Hellas*

**Panagiotis Germanakos**
*University of Cyprus, Cyprus*

**Constantinos Mourlas**
*National & Kapodistrian University of Athens, Hellas*

## ABSTRACT

*The knowledge management paradigm of communities of practice can be efficiently realized in Web-based environments, especially if one considers the extended social networks that have proliferated within the Internet. In terms of increasing performance through the exchange of knowledge and shared learning, individual characteristics, such as learners' preferences that relate to group working, may be of high importance. These preferences have been summarized in cognitive and learning styles typologies, as well as emotional characteristics which define implications that could serve as personalization guidelines for designing collaborative learning environments. This chapter discusses the theoretical assumptions of two distinct families of learning style models, cognitive personality and information processing styles (according to Curry's onion model), and the role of affection and emotion, in order to explore the possibilities of personalization at the group level of CoP.*

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## INTRODUCTION

Traditionally, the social aspect of learning from a psychometric point of view has been correlated to personality traits. For example, a widely used personality psychometric tool is the Myers Briggs Type Indicator (MBTI) classification of types (Myers-Briggs et al, 1998), that separates the way people perceive and learn in mutually exclusive preferences that involve (or not) social interaction (specifically, orientation to people: Feeling vs. Thinking types).

Moreover, major factor analysis approaches to personality (Feist and Feist, 2006) refer to extraverted and introverted persons, whose behavior is more or less socially oriented, with consequent effects to group dynamics. It must be stated that this extraversion-introversion scale is not the equivalent to MBTI extraverted/ introverted types, which are derived from the work of C.G. Jung and refer to the conceptualization of the outer world.

However, personality traits and their integration in an adaptive mechanism might seem rather vague in terms of quantifying and optimizing possible implications; still, the role of social interaction in learning has already been summarized in a number of cognitive and learning style theories, providing a useful personalization guideline for Web-based CoP designers.

The term Communities of Practice obviously emphasizes on collaborative learning processes that are conducted horizontally within groups of people. The three elements that comprise a Cop are (Wenger, 1998):

- Domain – the area of knowledge
- Community – the group of people
- Practice – body of knowledge, methods and tools

The concept of incorporating individual characteristics in the context of a Web-based environment could fit both in the Community and Practice elements, since:

- The usage of adaptive tools and methods (Practice element) can increase the level of comprehension by matching the learning material to the cognitive and emotional style of the learner, or by providing different types of knowledge resources to groups of participants with common cognitive and emotional characteristics.
- Collaborative learning processes can be optimized by assigning equally distributed different types of individuals in groups. Such an allocation would increase the number of problem solving approaches, since different types of learners approach problems in distinct ways (e.g. rely on others or work alone, theoretical vs. practical etc).

At the generic level of learning, Web-based environments need to integrate individual and group characteristics in order to facilitate effective learning for every single user. It has been argued that the distribution of learning material in ways that match learners' ways of processing information is of high importance, since it "can lead to new insights into the learning process" (Banner and Rayner, 2000). Regarding these individual differences, there have been many attempts to clarify cognitive and learning parameters that correlate to the effectiveness of learning procedures, often leading to comprehensive theories of learning or cognitive styles (Cassidy, 2004).

Amongst these theories, some deal with the most intrinsic individual cognitive characteristics, such as Riding's CSA (Rayner and Riding, 1997) or Witkin's Field Dependence (Witkin et al, 1977), whilst some also take into account group interrelationship characteristics, such as Kolb's Learning Style Inventory (Kolb and Kolb, 2005) or Felder/ Silverman's Index of Learning Style (Felder and Silverman, 1988), regardless of their theoretical classification. As a result, the selection of the appropriate cognitive or learning style theory to be integrated in a Web-based application should

be in accordance to the context or the goals of each environment, and of course the availability of between learners' interactions.

Communities of Practice are essentially based on participants' interactions and socializations (Wenger, 2004), which subsequently seem to favor personalization on the basis of a theory that emphasizes on the social aspect of learning. In any case, an effort to personalize the way an individual learns through a Web-based CoP environment could follow three distinct approaches:

a. By incorporating a theory such as Kolb's LSI, different types of learners that have a different approach in problem solving could be equally distributed in Web-based CoPs, in order to avoid the possibility of one-sided approaches to the building of knowledge. Thus, this leads to personalization at the group level, since the CoP Web-environment allocates users according to their profile.
b. By choosing a more individually focused theory (e.g. CSA), application designers could offer to users learning material that matches their cognitive preferences; at a second level, the exchange of similar material between same types of learners could be enhanced. It could also be hypothesized that interactions between same types may increase comprehension or performance, which is the case of i-Help (Bull and McCalla, 2002).
c. By taking into consideration the affective and emotional attributes of all the community members in a way that a further adaptation to the individual characteristics and to the community behavioral style can be achieved. In order to make this possible, team dynamics and intra-group interaction principles must be examined, as well as the emotional intelligence and emotional regulation mechanisms of the individual must be analyzed and adapted to the whole.

The issue of personalizing content for each single user has already been under the scope of Adaptive Hypermedia research, and relevant functional applications have been developed (Papanikolaou et al, 2003; Gilbert and Han, 1999; Carver et al, 1999; Triantafillou et al, 2002), while the significance of cognitive/ learning styles, emotional mechanisms and intrinsic individual parameters in hypermedia environments constitutes a main research question (Germanakos et al, 2005; Graff, 2003, Lekkas et al, 2007). The authors have already conducted experiments that demonstrate that matching Web-based learning environment to a number of cognitive and emotional characteristics increases learning performance (Germanakos et al, 2007).

On the basis of Adaptive Hypermedia, cognitive/learning styles research and emotional processing mechanisms analysis, this paper examines how these theories describe distinct ways in which individuals could fit in collaborative working groups, setting a corresponding strategic context for personalized participation in Web-based CoPs.

One of the main challenges in Personalization research is alleviating users' orientation difficulties, as well as making appropriate selection of knowledge resources, since the vastness of the hyperspace has made information retrieval a rather complicated task. By personalizing Web-based content, taking into account emotional processing, we can avoid stressful instances and take full advantage of his / hers cognitive capacity at any time. We primarily aim to ground our hypothesis that personalizing Web content according to the participants' emotional characteristics (an individual's capability or incapability to control his / hers emotions and use anxiety in a constructing way), is of high significance in optimizing computer mediated learning processes.

*Table 1. Classifications of Learning Style Theories according to Curry's onion model*

| Cognitive Personality Style | Information Processing Style | Instructional Preferences |
|---|---|---|
| Witkin's FD/FI | Kolb's LSI | Dunn & Dunn Model |
| Riding & Rayner's CSA | Honey & Mumford Model | |
| MBTI | Gardner's Multiple Intelligences | |
| Felder & Silverman ILS | McCarthy's 4MAT model | |
| | Gregorc's Learning Style Types | |

## THEORETICAL BACKGROUND

### Learning Styles

The hypothesis that learning styles provide Web-CoP designers a useful tool for incorporating individual and group characteristics can be supported by the argument that as implied above learning styles are a link between cognition and personality (Sternberg and Grigorenko, 1997). It is a fact that it would be extremely ambitious to construct a model of users or groups that involve numerous personality and cognitive traits combined together, not to mention the psychometric challenges; therefore, learning style typologies could be the "next best thing". Learning styles, on the other hand, are widely varied, and some of them fail to exhibit satisfactory reliability and validity (Markham, 2004). However, as research often demonstrates, learning style is an important factor in computer mediated learning processes (Tsianos et al, 2006), though not always in an expected way (John and Boucouvalas, 2002; Redmond, 2004).

Curry's 3-layer onion model (Curry, 1983) classifies learning styles in a way that they are not mutually exclusive, but co-exist at different levels of learning processes. Specifically, moving from the inside to outside, the innermost layer is called *cognitive personality style*, and is the most stable trait. The middle layer is the *information processing style*, whilst the outermost consists of *instructional preferences* (see table 1).

Theories that fall into the inner layer are mostly related to cognition or traditional personality research, while more learner-centered approaches fit in the middle layer. The outer layer is more unstable, and it should be mentioned that according to Sadler and Riding (Sadler-Smith and Riding, 1999) it is affected by the inner layer. However, the Dunn & Dunn model that belongs to the layer of instructional preferences exhibits high reliability and validity, but its implications are not discussed here, since they are not easily related to Web environments.

Learning style theories are classified by Atkins, Moore and Sharpe (2001) on the basis of this onion model as shown in table 1.

In educational settings, all of these well-known theories have been tested; still, most hypermedia research focuses on theories that fit in the inner layer (with the exception of INSPIRE system (Papanikolaou et al, 2003). We believe that is strongly related to the fact that inner layer theories usually include scales of terms easily represented in hypermedia applications, such as preference for visual or verbal information, and structural organization of the presented content. On the other hand, middle layer theories provide a less cognition-based approach, since they focus on behavior and style in traditional learning environments, from a wider perspective.

### Inner Layer Theories

Between theories that belong at the same layer, there are great similarities. At the inner layer, Witkin's construct of psychological differentia-

*Table 2. Types of learners as defined by information processing style theories*

| Kolb's LSI | 4MAT Model | Gregorc's Learning Styles | Honey & Mumford Model |
|---|---|---|---|
| Converger | Dynamic Learning | Concrete-Random | Pragmatist |
| Assimilator | Analytic Learning | Abstract-Sequential | Theorist |
| Accomodator | Common Sense Learning | Concrete-Sequential | Activist |
| Diverger | Imaginative Learning | Abstract-Random | Reflector |

tion (Field Dependency vs. Field Independency) is strongly correlated with CSA's Wholist/ Analyst Scale, since the latter is derived from the former (Sadler-Smith and Riding, 1999). Felder Silverman's ILS adds to CSA's two scales (Visual-Verbal, Wholist- Analyst) the similar to MBTI scales of Extraversion-Introversion and Sensing-Intuition.

It would seem that Felder Silverman's ILS could be a very inclusive theory, but it needs yet to provide further evidence for its theoretical and statistical grounding (Cassidy, 2004). The long history of MBTI certainly guarantees for its grounding and wide acceptance, but its extended questionnaire and personality rather than learning orientation are somehow impractical for Web settings.

In our opinion, though there are still reliability and validity issues to be resolved (Peterson and Deary, 2003), Riding & Rayner's CSA seems to be the appropriate representative of the *cognitive personality style* layer, and its individual and group implications will be further discussed.

## Middle Layer Theories

With the exception of Gardner's Multiple Intelligences, all theories that have been classified in the middle layer of Curry's onion model, share common characteristics in the way they define types of learners (Kolb and Kolb, 2005; McCarthy, 1990; Gregorc 1982; Honey and Mumford, 1986) (see table 2).

Each horizontal row of Table 2 shows types of learners that share common characteristics, according to their theoretical description. We should mention at this point that these similarities haven't been unnoticed by Gordon and Bull who have proposed a meta-model that combines multiple similar learning style models (Gordon and Bull, 2004), taking also under consideration theories that are not mentioned here.

These middle layer models directly refer to learners' attitude towards collaborating and working in groups; speaking in terms of personality theories, some types are people oriented and some are more logical (feeling vs. thinking). This is especially true for the case of Kolb's LSI, where convergers and assimilators are thinking types, while accommodators and divergers are feeling types, according to correlations with MBTI scores. We should clarify that these types (regardless of specific theory) are not absolutely stable, but one person can gradually change style; it is possible that a learner can alter his type as years go by. Moreover, belonging to a type doesn't necessary exclude the possibility that at instances a person can perceive information in any of these four styles, even though his persistence on a specific style is relatively stable (Sharp, 1997).

For the purpose of exploring the possible integration of middle layer learning styles into CoP environments, we believe that Kolb's LSI is the most appropriate representative of the aforementioned models, due to extended research on its implications and correlation with other psychometric constructs (such as the MBTI) (Kolb and Kolb, 2005). However, analogous considerations can be projected on other models that share the same theoretical assumptions.

## Emotional Processing

Research on modelling affect and on interfaces adaptation based on affective factors has matured considerably over the past several years (Kort and Reilly, 2002), so that designers of educational products are now considering the inclusion of components that take affect into account. Emotions are considered to play a central role in guiding and regulating learning behaviour by modulating numerous cognitive and physiological activities. The purpose in our research is to improve learning performance and, most importantly, to personalize Web-content to users' needs and preferences, eradicating known difficulties that occur in traditional approaches. The emotional aspect of our model attempts to apply rules that help the system regulate user emotions on a Web-based learning environment, since we are attempting to measure and include emotional processing parameters, by constructing a theory that addresses emotion and is feasible in Web-learning environments.

In our study, we are interested in the way that individuals process their emotions and how they interact with other elements of their information-processing system. Emotional processing is a pluralistic construct which is comprised of two mechanisms: emotional arousal, which is the capacity of a human being to sense and experience specific emotional situations, and emotion regulation, which is the way in which an individual is perceiving and controlling his emotions. We focus on these two sub-processes because they are easily generalized, inclusive and provide some indirect measurement of general emotional mechanisms. These sub-processes manage a number of emotional factors like anxiety, boredom effects, anger, feelings of self efficacy, user satisfaction etc.

### Emotional Arousal

Among these, our current research concerning emotional arousal emphasizes on anxiety, which is probably the most indicative, while other emotional factors are to be examined within the context of a further study. Anxiety is an unpleasant combination of emotions that includes fear, worry and uneasiness and is often accompanied by physical reactions such as high blood pressure, increased heart rate and other body signals like shortness of breath, nausea and increased sweating. The anxious person is not able to regulate his emotional state since he feels and expects danger all the time. The systems underlying anxiety are being studied and examined continuously and it has been found that their foundations lie in the more primitive regions of the brain. However, given the complexity of the human nature, anxiety is characterized as a difficult to be understood construct of emotions which is at a balance between nature and nurture and between higher perception and animal instinct (Kim and Gorman, 2005).

Barlow (2002) describes anxiety as a cognitive-affective process in which the individual has a sense of unpredictability, a feeling of uncertainty and a sense of lack of control over emotions, thoughts and events. This cognitive and affective situation is associated as well with physiological arousal and research has shown that an individual's perception is influenced in specific domains such as attentional span, memory, and performance in specific tasks. In relation to performance, the findings are controversial but there is a strong body of research which supports that anxiety is strongly correlated to performance and academic achievement. (Spielberger, 1972; Spielberger and Vagg, 1995)

### Emotion Regulation

Accordingly, in order to measure emotion regulation, we are using the construct of emotion regulation. An effort to construct a model that predicts the role of emotion, in general, is beyond the scope of our research, due to the complexity and the numerous confounding variables that would make such an attempt rather impossible. However, there is a considerable amount of references concerning the

role of emotion and its implications on academic performance (or achievement), in terms of efficient learning (Spielberger and Vagg, 1995). Emotional intelligence seems to be an adequate predictor of the aforementioned concepts, and is surely a grounded enough construct, already supported by academic literature (Goleman, 1995; Salovey and Mayer, 1990). Additional concepts that were used are the concepts of self-efficacy, emotional experience and emotional expression.

Self-efficacy is defined as people's beliefs about their capabilities to produce and perform. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave. Such beliefs produce these diverse effects through four major processes. They include cognitive, motivational, affective and selection processes.

Emotional experience is the conceptualization of an emotion, the way in which the individual is dealing with it and how he perceives it.

Emotional expression is the way in which the individual is reacting after an emotion triggers. It is his behaviour after an affective stimulus. It can be argued that emotional expression is the representation of an emotion (Schunk, 1989). We created a questionnaire based on the aforementioned concepts of emotional intelligence, self-efficacy, emotional experience and emotional expression that we named emotion regulation. The questionnaire provides us with measures of the individual's ability to control his emotions and use them in a creative manner.

According the abovementioned theoretical approaches, it is evident that participants in CoPs differ in a variety of ways, at least as long as learning and problem solving are involved. Cognitive personality style theories demonstrate that different types of learning materials and objects in the information space should be used according to individuals' preferences, whilst information processing style theories show that each individual can be classified to a specific problem solving approach. Additionally, the moderating role of emotions seems to have an effect in participants' interactions in such a setting. The next section proposes a way of integrating these considerations in on-line CoPs.

## INDIVIDUAL CHARACTERISTICS CONSIDERATIONS FOR COPS

According to our rationale, there are two distinct ways to group users in CoP applications:

- Learners with common cognitive styles (as classified by Riding's CSA that we use in our paradigm) and emotional profiles (as can be extracted from the combination of emotional arousal and emotion regulation mechanisms), could be grouped together and collaborate in an environment that serves better their preferences- this is the case with i-Help that we mentioned above. Learners, in general, prefer to send information the way they receive it, and vice versa.
- In addition, each group of people should consist of practitioners of all different types of learners (according to LSI taxonomy that will be further discussed and their emotional attitude towards the learning procedure), in order to increase the variety of proposed problem solving approaches (with regards to social interaction) and to promote more efficient Knowledge Management practices.

These two ways of integrating cognitive and learning style typologies, and emotional and motivational attributes in Web-CoPs are not mutually exclusive: the first case refers mainly to the material used and its structure, whilst the second paradigm deals rather with group composition.

*Table 3. Wholists/Analysts Characteristics*

| Wholists | | Analysts | |
|---|---|---|---|
| View a situation and organize information as a whole | Organize material in loosely clustered wholes | View a situation as a collection of parts and often stress one or two aspects at a time | Organize information in clear-cut groupings (chunking down) |
| Proceed from the whole to the parts | Exhibit high assertiveness | Proceed from the parts to the whole | Exhibit low assertiveness |

## The Paradigm of CSA

The CSA taxonomy is consisted of two independent scales, Imager/ Verbal and Wholist/ Analyst. The Imager/ Verbal scale affects the way learning resources are presented, and is probably less important in terms of overall CoP grouping; it is important though in Web-content presentation. Within adaptive Web architectures, users who have been identified as Imagers or Verbals, could be presented with the corresponding learning resources (e.g. images or text).

The Wholist/ Analyst scale, though, is about organizing and structuring information (see table 3), and is consequently related to navigational patterns. It would make much sense that users with common navigational route and structural approach would work collaboratively more efficiently, the same way that matching teaching and learning style is expected to increase performance.

Otherwise, a radically differentiated approach on behalf of learners could hamper communication and the way tasks are perceived, since wholists move from the whole to the parts, while analysts follow the exact opposite route. Intermediate learners are expected to perform equally well in both structural settings.

Additionally, to the extent that the wholist/analyst scale coincides with Witkin's FD/FI scale, it can be argued that wholists are little more oriented towards other people, whilst analysts are more introverted. Moreover, wholists exhibit higher assertiveness than analysts.

Safe conclusions could be drawn only after this hypothesis is tested in a Web-CoP environment, and the aforementioned matchmaking is proven as important as the matching of teaching and learning style.

## The Paradigm of LSI

On the contrary, the aforementioned middle layer theories (as represented by Kolb's LSI) describe learner types also in terms of collaboration. In other words, working in groups is perceived differently by each type; some types rely on others whilst some simply do not.

As in Riding's CSA (and the rest of the middle layer theories), Kolb's 4 types are drawn from two independent scales: Concrete Experience vs. Abstract Conceptualization, and Reflective Observation vs. Active Experimentation. People-oriented types are those that tend to Concrete Experience rather than Abstract Conceptualization, which in terms of personality theories are rather Feeling than Thinking.

More specifically, by focusing on group collaboration preferences according to Kolb's LSI [37], learners' characteristics are summarized in table 4.

As it is clearly defined by theory, diverger and accommodator's individual characteristics demonstrate a strong preference in group working, since collaboration may be a necessary prerequisite for maximizing learning performance. It also could be argued that the present modus operandi of Web-learning in general favors types of learners that prefer working alone (convergers and assimilators), than those who are people-oriented.

Implications for designers of CoP applications

*Table 4. Learners' Characteristics in terms of group working preferences according to LSI*

| Divergers | Accommodators | Convergers | Assimilators |
|---|---|---|---|
| Are oriented towards people | Learn by teaching others | Prefer usually to work alone | Prefer working alone |
| Excel at brainstorimg and working in groups | Excel at influencing others | See group work as a waste of time | Will work in groups if assigned |
| Learn by sharing ideas and feelings | Rely on others for information in solving problems | Appear bossy and impersonal | Prefer the instructor reader to be an authority |
| Prefer the instructor/leader to be a motivator | Work well in groups | | |

can be summarized in the equal distribution of the different types of learners, and in further motivating convergers and assimilators to participate. For example, if for any reason a group consists only of these latter two types, then the CoP's functionality may be impaired.

## A Combined Approach

Whether should an information processing style theory be chosen over a cognitive personality style theory (e.g. LSI vs. CSA), and which would that theory be, is still a matter of debate. Practical and convenience reasons, as much as reliability and validity scores, determine at some extent the final selection.

On the other hand, since these theories are not mutually exclusive, it is possible that they could be combined in a unified model that separates the practical implications of each theory according to the CoP element they relate to. Theories such as the CSA focus on the individual (practice methods and tools), while theories such as the LSI can be applied on group composition (community). Ideally, the concept of personalization in a Web-based CoP should address both these levels (see figure 1).

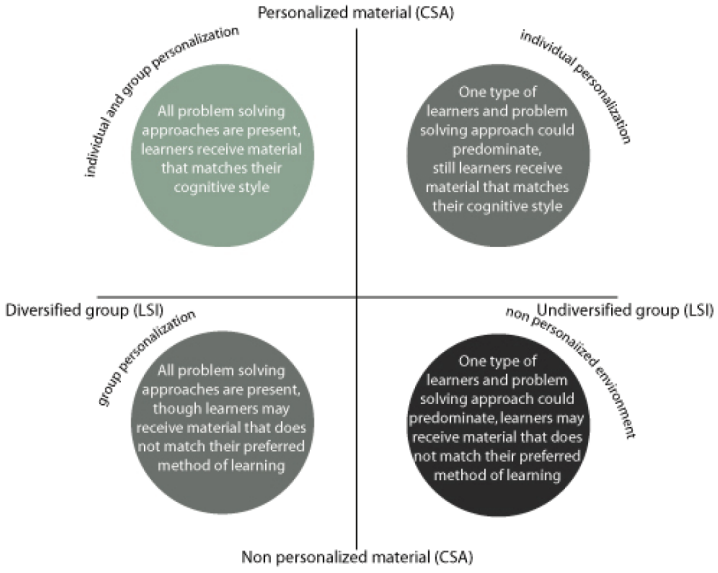
It should be clarified that the term "problem solving approaches" refers mainly to learners' preference (or not) to work with other people to promote efficient learning through practice, since this is of relatively higher importance in the context of CoPs. Moreover, some people tend to "lead" others in collaborative learning processes, while some tend to "follow". Therefore, it is of importance to mix these types within a group.

This model demonstrates how cognitive and learning style theories may serve as well-defined guidelines for designers that are interested in expanding their center of attention to individual characteristics and their implications on group considerations, the same way that CoPs have changed the way Knowledge Management is conducted.

## The Moderating Role of Emotions

Human emotions and qualities are developed through participation in social contexts (Vygotsky, 1985). This makes it possible for individuals to interact as feeling human beings and effective members of the various communities to which they belong. Through participation in the society or societies to which they belong, individuals learn more about human behaviour and develop an understanding of their role and function. People can become more effective participants through the interpretation given to these social interactions. Communities of Practice as a social setting are one location in which people may learn about their behaviour and emotions. This is in part due to the idea that effective learning and human relationships play a vital part in helping community members to achieve their learning objectives.

*Figure 1. Unified approach to personalization in CoPs*




The competence of emotional awareness, defined as the ability to ``recognise one's emotions and their effects'' (Goleman, 1998) is ``our guide in fine-tuning on-the-job performance of every kind, managing our unruly feelings, keeping ourselves motivated, tuning in with accuracy to the feelings of those around us, and developing good work-related social skills, including those essential for leadership and teamwork'' (Goleman, 1998). If this competency is truly enhanced it could suggest that they are much more in control of their emotional states and possibly less inclined to be emotionally reactive.

Enhanced emotional awareness may help them to identify their attitudes and the main power relationships, and provide the means for them to understand and manage the group dynamics more effectively (Langley, 2000).

Another important issue is the feeling of safety that some individuals have to feel in order for them to function properly and perform their best within the boundaries of a team, group or community. This feeling of safety requires the existence of trust within the group and the lack of uncertainty and anxiety. Teams that show high levels of trust and are provided with an environment which is perceived as safe and aesthetically appealing to the user, tend to perform better. It is strongly recommended that trust and safety should be of primary focus to the community culture and that behavior and other elements that promote trust and protection should be encouraged in teamwork (Erdem and Ozen, 2003).

Our proposal concerns the implementation of an interface that can appraise human emotion through the use of a set of parameters that can adapt according to the emotional condition of the user. An emotionally tense or unstable individual will be able to adjust the contents of a Webpage based to what he considers boring or entertaining and exciting etc. A certain emotional condition demands a personalization of equivalent proportions. The user will have the capability to respond emotionally either after being asked or after a question from the system. Another important aspect of a related system should be the ability to inform the database about the user preferences and inclinations.

At the interface level, the above notions would necessarily lead to the integration of an adaptive mechanism in CoPs supporting systems. A short practical overview of the personalization techniques that could be employed follows:

- First of all, users are required to build their profiles by the corresponding psychometric tests.
- Content selection and presentation is affected by each user's cognitive style (CSA). Navigation menus are either sequential or extensively hyperlinked (wholist or analytic mode of processing), while textual or imagery content predominates (verbal or imagery preference). This applies to the individual level of interacting with the interface.
- The assignment of users to each CoP is performed automatically by the system, ensuring that all types of problem solving approaches are included, as defined by the LSI.
- As it concerns the role of emotions, users should be able to provide emotional feedback to the system. Besides the inclusion of the corresponding psychometric tests, a self report measurement (i.e. a bar of anxiety) could serve as an indicator of emotional state, triggering the response of the adaptive mechanism of the system. The response is a) additional help, support and reinforcement and b) aesthetical enhancement of the interface.

The positive effect of the abovementioned personalization techniques (excluding the assignment on the basis of the LSI) in a hypermedia learning setting has been reported in previous work of the authors (Tsianos et al, 2008).

## SUMMARY AND FUTURE WORK

The number and types of group interactions that learners are involved in a Community of Practice are strongly related to individual characteristics, which determine the degree of preference to group working, or at least common ways of structuring information.

Even if these social preferences are directly linked to personality factors, personality theories have far too complicated implications for CoP environments that focus on Knowledge Management, while theories that address low-level cognition processes are often too individualistic to consist a basis for user grouping.

Learning style theories and mechanisms that regulate emotions could be described as a much needed link between personality and cognition; still, one must not be too optimistic until issues of reliability and validity of psychometric instruments are resolved. Nevertheless, at theoretical level, these constructs provide useful insights for Knowledge Management applications that intend to explore the integration of learning methods of group working into Web-based CoPs.

As shown above, not all learning style theories address issues of group interaction at the same extent. Therefore, Web-CoPs designers that wish to incorporate individual learning characteristics should distinguish that each cognitive/learning style theory addresses issues of different elements of a CoP:

- *cognitive personality style* theories relate to the Practice element, since their implications may lead to a personalized approach to methods, tools and material.
- *information processing style* theories are relevant to the Community element, in the sense that different types of learners should be combined together in order to assure the occurrence of interactions at the level of shared learning and the building of coherent knowledge.

Subsequently, this leads to the need of experimentally evaluating the positive effects of a) matching content to practitioners according to their cognitive style (personality cognitive style models like CSA), and b) assigning to each group equally distributed different types of learners (information processing style, such as Kolb's LSI).

In any case, collaborative working is not a mere result of random real-time dynamics, but also the resultant of learner characteristics that individuals carry along, whatever the circumstance. Therefore, taking into account their preferences may promote efficient cooperation, or at least alleviate difficulties that occur from widely varied methods of learning between practitioners in CoPs.

More than a technologically driven determinism, personalization provides a very flexible platform for individual differences to be taken into account, and to assess their importance and role in cognitive processes. Still, there is the issue of which users' characteristics are to comprise the basis of personalization, since it is not yet clarified which cognitive science theories apply to human-computer interaction. The issue of Emotional processing is under research, since its role and effect on academic performance and learning is yet to be proven. There are indications though that taking emotions into account can help people to adjust easier into a group and find their role while at the same time cooperate with other group members with different emotional characteristics. Emotion regulation can be the motivational factor that humans need to activate their capabilities at a cognitive and a social level simultaneously.

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