

The Working Mechanism of Implicit Affect in Online Language Learning Based on PSI Theory

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Abstract—In the age of intelligence, the new information technology greatly expanded the frontier of online language education, which also complicated the educational field. Along with the embedding of technologies like virtual reality, augmented reality and mixed reality, the interaction of learners' personality systems changed drastically in the mixed virtual-real online language learning environment characteristic of technology immersion, resulting in the infiltration of implicit affect. Implicit affect exerts an indelible influence on learners' mentality unconsciously via the explicit affect triggered up by blended language learning and teaching activities. Modelling Quirin's empirical paradigm of implicit affect and the IPANAT scale he developed, the paper presents a small-scale quasi-experimental study to identify the implicit affect aroused in online language learning, categorizing the implicit affect in accordance with the discrete emotion model and specifying the working mechanism of different implicit affect through descriptive analysis and correlation analysis. Finally, the paper constructs an interpretive frame for implicit affect's influence on learners' mentality on the basis of PSI theory.

Keywords—PSI theory, online language learning, implicit affect, working mechanism

I. INTRODUCTION

Nowadays, the smart language learning environment becomes the enabler of the intrusive identification and analysis of learner's emotion, consciousness and volition. However, in the ubiquitous and virtual language learning space, learners are confronted with the subjectivity split between the "self" and the "non-self", in which the explicit self gradually alienates from the implicit self, causing the self-infiltration in the in-depth interaction and intelligent diagnosis in online language learning. The alienated virtual personality could evolve into the potential personality shadow which in turn induces personality disorder symptoms such as learning burnout and procrastination, low motivation level and decreased self-efficacy.

So far, the traditional psychometry in emotion research in the SLA field is being overshadowed by sociocultural and humanistic orientations. More and more scholars have been theorizing on the dialectical relationship

between L2 learners' cognition, emotion, language performance and self-efficacy [1]. Allegedly, affective obsession may elicit the Directed Motivational Current (DMC) which accounts for the sustained motivated engagement and investment in SLA [2]. In the interdisciplinary field of educational technology and SLA, emotion recognition has been applied to achievement prediction [3] aided by sensor technology, cloud computing and EEG.

However, in foreign language learning, the genesis of the emotive is an inherent component of human psychology and is intertwined with the cognitive. Altogether, the cognitive-emotive unity mediates learners' performance. Following Vygotsky, this functional unity of cognition and emotion is termed *perezhivanie*, which forms the lived experiences of human beings [4].

The present research unveils the complex interaction between learners' cognition, emotion and implicit personality systems based on the PSI theory, advancing a new descriptive and interpretive framework of the implicit affective as an effective self-regulation mechanism and enhancer of learning performance and achievement in online foreign language learning.

II. CONCEPTUALIZING PSI THEORY AND IMPLICIT AFFECT

A. PSI Theory

PSI (Personality Systems Interactions) theory originates from Professor Julius Kuhl's relevant research on intuitive behaviour control. It is a theory on all aspects of personality functioning.

From a phylogenetic perspective, PSI theory posits a hierarchical organization of personality functioning. Each level in the functional hierarchy affords different degrees of freedom: at the lowest level, people's actions are determined by rigid stimulus-response links which afford little freedom, whereas at the highest level, people's actions are determined by more abstract goals and values, which afford many alternative courses of action, and hence much more freedom in action control [5].

PSI theory holds that the complex personality systems at the highest level do not directly make contact with the external world. High-level personality systems must therefore interact with lower level, elementary systems, in order to guide the individual's actions. The dynamic interactions between low-inferential and high-inferential

personality systems are essential for adaptive personality functioning [5]. Accordingly, PSI theory puts forward two low-inferential personality systems, Object Recognition and Intuitive Behavior Control and two high-inferential personality systems, Intention Memory and Extension Memory.

1) Object Recognition (OR)

OR enables the individual to concentrate on single objects and isolate them from particular contexts. Its main function is to detect the perceptual or conceptual information inconsistent with individual's expectations or needs. OR's construal of perceptual or conceptual objects is sequential-analytic. The outcome of OR's processing of perceptual objects is the incongruity between individual's expectation and perceived reality. OR may lead to brooding over the past or a given state and the obsession and fixation on the causative objects or contents [6–8].

2) Intuitive Behavior Control (IBC)

The primary function of IBC is to prompt the individual to execute habits and spontaneous actions and enact intentions.

In coordination with Intention Memory, IBC can translate an intention into action. It is a parallel-processing system that integrates momentary perceptual parameters that are sensitive to orientation, movement, and contextual information related to actions. It automatically processes the enactment-relevant information without the need of conscious action control. It can be activated through imitation, indirect cues (primes), and parameter specification [5].

3) Intention Memory (IM)

IM is based on explicit intentionality and sequential-analytic processing. When immediate and automatic execution of action is infeasible, IM maintains the symbolic representations of intended actions activated in working memory, resulting in behavioral inhibition to create a time window for appropriate future planning or timing.

Generally, IM is mandatory for individual's fixation on intention and decisiveness in corresponding implementation.

4) Extension Memory (EM)

As a high-level parallel-processing system, EM is specialized in integrating implicit congruent and incongruent cognitive and emotional experiences, providing information about individual's needs, motives, values, and emotions [5]. It supports the enactment of creative tasks and the holistic conceptualization of contexts in pursuit of one's goal. The processing of EM does not require explicit conscious awareness, however, the contents processed by it are mostly related to emotions and may enter consciousness via intentional memory. The outcome of EM processing is the novel schematization of congruous and incongruous life experiences, which leads to self-actualization and self-growth.

PSI theory distinguishes seven levels of personality functioning with unique explanatory power for human behavior [7, 8], namely, low-level cognition: habits,

temperament, affect valence, regression, motives, high-level cognition and agency: self management.

At different personality level, PSI theory does not focus on mental contents (e.g., expectations, self-ascriptions, intentions, goals, values) but rather on the functional description of behavior and experience in terms of the relative activation of the above-mentioned mental systems.

On each level, behavioral cognitive macrosystems interact with experiential cognitive macrosystems, which form the essence of personality.

B. Implicit Affect

The notion of implicit affect was first advanced by Quirin based on Hofmann's dual-systems model. It refers to the automatic activation of cognitive or memory representations related to affective experiences. Implicit affective mechanism operates at the preconscious and pre-conceptual level without the individual's conscious reflection, which involves the simultaneous activation of a great amount of affective information such as episode memories and declarative memories (affect labels) of affective experiences. Implicit affective mechanism activates and schematizes memory representations that constitute emotional experiences, which includes perception, kinesthesia and subjective feelings.

By contrast, explicit affect normally operates at the conceptual level and capitalizes on propositionally organized memory structures that are subject to conscious reflection and comparisons between emotional episodes. Explicit affect helps construct individual's self-concept related to emotionality, which may be attained by volition.

Quirin postulates two parallel information processing systems that modulate individual's social behavior: one is the reflective system that is responsible for the deliberative processing of explicit affect representations via parallel system control in accordance with facts and value judgment; the other is the associative (impulsive) system that processes implicit affect representations via automatic spreading activation of associations.

The interplay between the reflective system and the associative system takes place in the cognitive subject's transitory or long-term introspection, in which the reflective system may gain access to the implicit affect representations activated in the associative system [8, 9].

III. RESEARCH DESIGN

A. The Design of IPANAT Questionnaire

Quirin adopts affect priming of judgments as a method to assess implicit affect in the Implicit Positive and Negative Affect Test (IPANAT). In the test, 6 meaningless artificial words (SAFME, VIKES, TUNBA, TALEP, BELNI, SUKOV) are presented along with 3 positive (happy, cheerful, energetic) and 3 negative (helpless, tense, inhibited) emotion words, thus, generating 36 items. Participants are asked to make intuitive affective ratings of the emotion-loaded words in the putative artificial language as the expression of certain moods. For each item, participants were asked to

provide a rating for the relevance between the artificial words and emotion adjectives on a four-point Likert scale. Then, the respective scores of positive and negative emotion words are calculated to obtain the observed value of the Implicit Positive Affect (IPA) factors and Implicit Negative Affect (INA) factors. High score in the rating indicates high degree of implicit affect infusion.

IPANAT is very effective in determining the nature of implicit affect, however, the measurement and assessment of implicit affective mechanism requires the longitudinal physiological tracking of the participants. Another research conducted by Markus Quirin and Miguel Kazen suggests implicit affectivity predicted cortisol reactivity. Specifically, implicit negative affect was positively associated with cortisol increase and endocrine stress reactions [10].

Quirin believes pre-conceptual implicit affective representations may be primed by releasing contextual clues of interest to the affective subject as stimuli. The more ambiguous a stimulus is and the less of a predefined meaning it has for an individual, the smaller is the amount of available knowledge directly related to the stimulus, and the more affective states tend to influence judgments about the stimuli.

Once activated, implicit affect will mould subjects' judgment about the extent to which the artificial words describe specific affective states. Meanwhile, if implicit affect reaches certain level, it will enter consciousness and constitute reflective affective experience or become explicit self-reported emotion.

In view of the sophistication and intricacy of the aforementioned research procedures in IPANAT, the present research localized the IPANAT scale developed by Quirin, replacing the artificial emotion words with names of specific online language learning activities, which function as the contextual stimuli that elicit implicit affect. Whereupon, a discrete emotion model of online language learning is constructed to comb the emotions possibly aroused in those online language learning activities. Afterwards, participants are asked to make affective ratings in which words designating those emotions are to be paired with names of online language learning activities.

Finally, a linear modeling analysis is performed on questionnaire data in SPSS 26.0, taking online language learning activity and one category of positive or negative affect as fixed variables and other affects as dependent variables, to explore if online language learning activities can simultaneously trigger up both implicit and explicit emotion and define the co-occurrence relation between implicit and explicit affect and the functions of implicit affect in particular.

B. Research Hypothesis

(a) As external stressor, online language learning may induce learner's physiological and affective stress state. Through mental parallel processing, explicit affect arouses implicit affect, causing affective infiltration.

(b) The procedural affective experience induced by online language learning is mostly implicit, which can be measured by the adapted IPANAT scale. Nevertheless,

reaching certain level, the implicit affect related to online language learning can be processed by the reflective system and become self-reported affect.

(c) The task-based and consequential affective experience is mostly explicit and can be measured by self-report or PANAS.

(d) Through affective infiltration, the implicit mechanism activated by online language learning may directly act on learner's self-efficacy, motivation level and academic self-concept.

C. Participants

Participants in this quasi-experimental study are 558 junior students from Xi'an Fanyi University, including 489 English majors who specialize in language education and 69 Students majoring in electronic commerce. All of the students have prior experience of blended learning aided by Superstar Fanya Platform and learning APP and they are familiar with the operation procedures of relevant online language learning activities. In addition, the 489 English majors attended the course named Psychology of Foreign Language Teaching delivered by the author, therefore, they have certain understanding of the correlation between emotion, motivation and leaning efficacy.

D. Data Collection

Based on the affective dimension theory, the research devised a new IPANAT scale. Drawing reference from Watson and Tellegen (1985) model of Positive and Negative Affect (PANA), the research expanded the 6 emotion types in the original scale of Quirin to 16 emotion types along the two relatively independent arousal or activation dimensions, namely, the positive and the negative. Positive emotions are used to describe individual's perceived degree of enthusiasm, energy and alertness, while negative emotions are used to describe individual's perceived state of sadness, apprehension and inertness. According to the affective dimension theory, both positive and negative emotions can realize energy activation and stress arousal. The activation dimension is related to circadian rhythm, while the arousal dimension is based on a variety of emotional and stress responses.

As is shown in Table I, the scale selects 8 positive and 8 negative emotion adjectives as affect descriptors which are supposed to capture the affective fluctuation learners experience in online language learning, ranging from excitement, happiness, expectation to boredom, disappointment, fear and anger. Hypothetically, positive affects and negative affects form a continuum.

TABLE I. POSITIVE AND NEGATIVE AFFECTS

Positive Affects	Negative Affects
Excited	Bored
Happy	Ashamed
Expectative	Disappointed
Contented	Depressed
Active	Anxious
Energetic	Nervous
Focused	Afraid
Relaxed	Angry

The above 16 positive and negative emotion types were matched with 17 online learning activity types to form Likert five-point scale. The categories of online language learning activities involved include Audio-Video Learning, Chapter Learning, Online Discussion, Online Homework, PBL Project, Sign-in, Random Selection, Online Test, In-Class Practice, Quick Response, Questionnaire, Voting, Rating, Group Chat, Whiteboard, Live Broadcast, Synchronous Classroom.

Participants are asked to rate the extent to which the above 16 positive and negative affective states can be associated with specific types of online language learning activities based on their own affective experience in blended language learning.

Following Quirin’s research findings, affective ratings of online language learning activities will trigger the affective priming effect, which will not only activate the explicit affect but also arouse the implicit affective state, and through affective infiltration, this emotional state will diffuse the activities or events related or even unrelated to the rated online learning activities. To conclude, implicit emotional infiltration can modulate and influence individual cognition and behavior at the unconscious level.

The reliability and validity of the scale were tested in SPSS 26.0. The Cronbach’s Alpha coefficient was 0.910, indicating that the scale had high reliability. The confirmatory factor analysis of the scale shows the load coefficients of the common factors in the positive and negative emotion dimension are both close to 1. Therefore, the positive and negative dimensions of affective variables in the scale are valid.

E. Data Processing

In the original data derived from the questionnaire, the categorical data designating the types of online learning activities and the numerical data designating affective ratings are mixed together. For the convenience of data analysis, they were separated into the categorical variables of online learning activities, the numerical variables of affective ratings, and the categorical variables of positive and negative emotions in SPSS 26.0. On a 5-point Likert scale, a participant’s affective rating greater than or equal to 3 is identified as having a corresponding affective experience. It is worth noting that the numerical variable, the number of students participating in the rating of specific affective types in the study is significant for the prediction and diagnosis of their academic performance but is not the focus of this study.

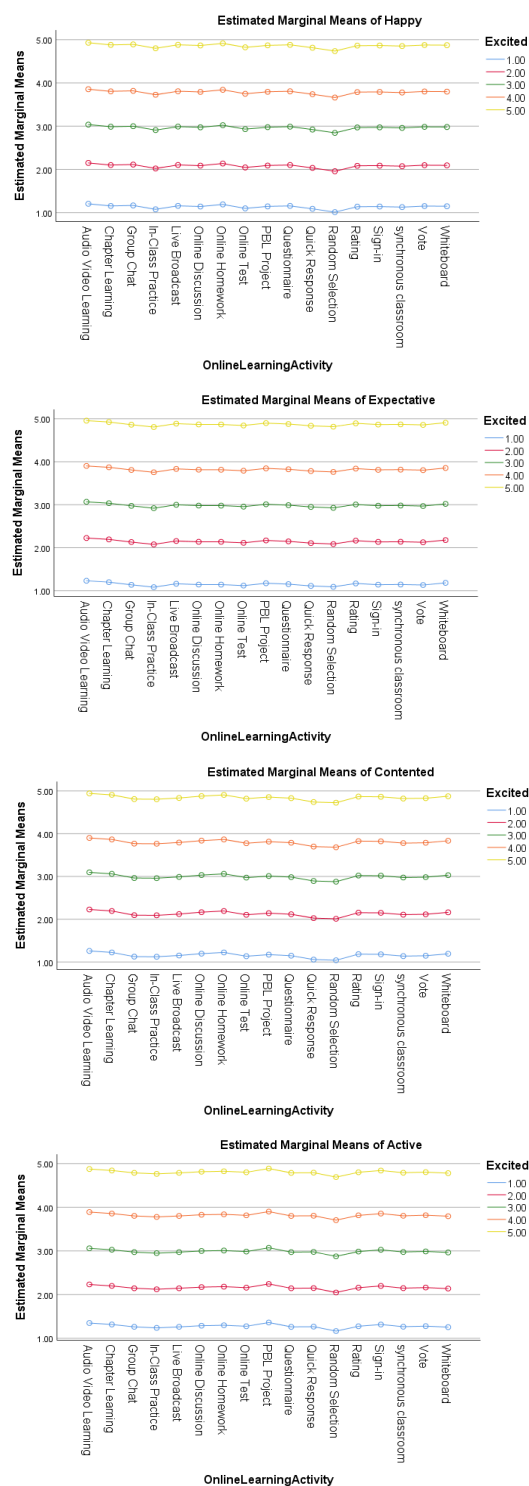
F. General Linear Modeling and Result Analysis

In order to define the interplay between positive and negative affective variables, general linear modeling is performed on relevant data in SPSS26.0. Taking the categorical variables of online learning activity and a specific positive or negative affective variable as a fixed variable, and other positive or negative affective variables as dependent variables, the primary goal of the general linear modeling is to determine whether a specific online language learning activity may arouse

implicit positive or negative affects while triggering up explicit positive or negative affects that is, the co-occurrence relationship between positive and negative affects.

For that end, an interactive analysis is conducted to determine the covariant effect between a specific positive affect and other positive or negative affects, in which the affective variable “excited” and online language learning activities are selected as the fixed variable and other 15 affective variables as dependent variables.

The modeling results are shown in the following profile plots of Fig. 1:



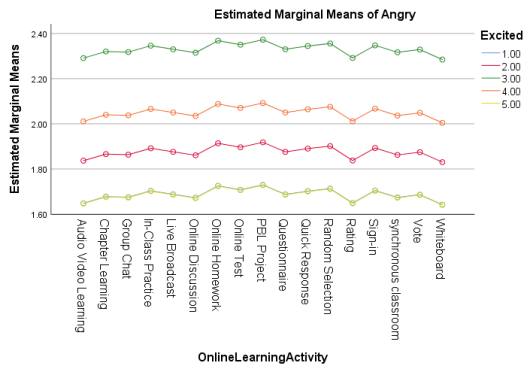


Figure 1. Univariate general linear modeling results of “excited”.

To verify the interaction between negative affects, an interaction analysis is performed, taking the negative affective variable “bored” and online language learning activities as fixed variables and other negative variables as dependent variables. The modeling results are shown in the following profile plots:

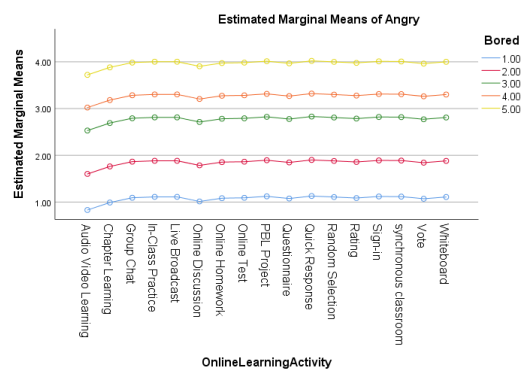
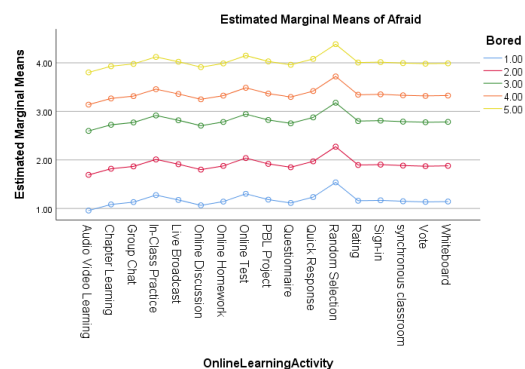
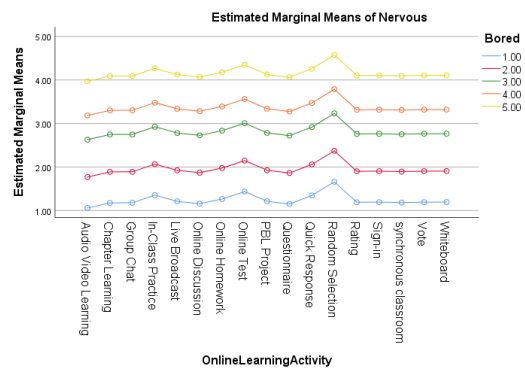
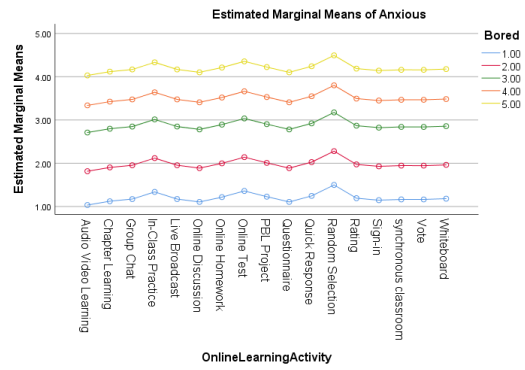
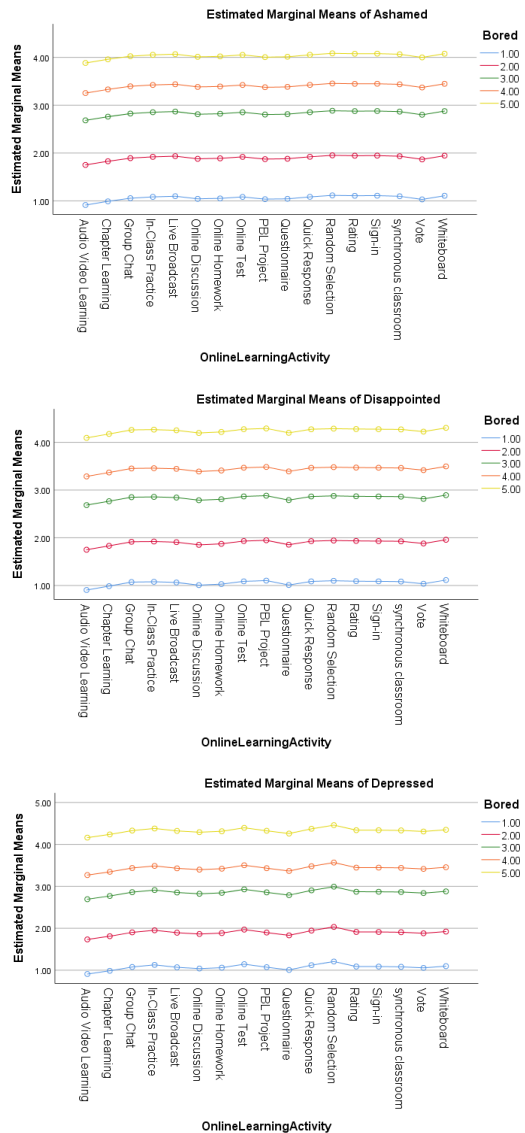


Figure 2. Univariate general linear modeling results of “bored”.

In the above profile plots of Fig. 2, similar variation trends normally suggest similar affective rating score. Accordingly, it can be inferred that when the presumed positive affect type triggered up by online language learning is “excited”, participants’ rating pattern of other positive affects is basically consistent, indicating that there is high covariant effect among positive affects; similarly, when the presumed negative affect type

triggered by is “bored”, participants’ rating pattern of other negative affects is also consistent, illustrating the high covariant effect among negative affects.

Furthermore, when the positive affects like “excited” is used as the trigger cue, the participants have similar rating pattern for two matrices of negative affects, one is the combination of “ashamed”, “disappointed”, the other is the combination of “depressed”, “anxious” “nervous” and “afraid” respectively. Due to inconsistent rating pattern, negative affective variables like “bored” and “angry” have been ruled out from consideration. To conclude, there seems to be parallel activation between the positive affect “excited” and other negative affects. That is, sometimes, positive affects may randomly arouse any negative affect in the parallel affective matrices. However, the present research can not verify if the two affective matrices are in complementary distribution, that is, the negative affects in the two matrices never occur simultaneously.

In the Between-Subject Effect Test of the above positive and negative affective variables, in which the affective variables “excited” and “bored” were taken as fixed variables, the other positive and negative variables and the categorical variables of online language learning activities all passed the significance test (sig.=0.000), which attests to the prominent interaction and co-occurrence among “excited”, “bored” and other positive and negative affects.

However, when the dependent variables were “ashamed”, “disappointed” and “angry”, the online learning activities did not pass the significance test, with the significance above 0.5 (0.977 for “ashamed”, 0.979 for “disappointed” and 0.998 for “angry”), indicating that the affective infiltration effect of the above affective experiences was stronger and could be generalized to other events and things unrelated to online language learning activities. It also supports Quirin’s research findings on implicit affect infusion.

The above modeling results suggest:

(1) The correlation between positive affects is greater than that between positive affects and negative affects. However, positive affects and negative affects have certain interaction, that is, some negative affects may be synchronously aroused when online language learning activities are used as situational cues to elicit some positive affects.

For example, when participating in online language learning activities such as Synchronous Class, Online Discussion, Whiteboard, Random Selection, In-class Practice, Audio and Video Learning, participants may feel bored, anxious, ashamed, disappointed and depressed while feeling energetic, excited, expecting, happy and nervous at the same time.

(2) The correlation between negative affects is more significant than that between positive affects and negative affects. Namely, if participants feel bored while engaging in online language learning activities, they are most likely to feel ashamed, disappointed, depressed, anxious, nervous, afraid and angry as well.

(3) The interaction between positive affects is stronger than that between negative affects. Participants’ ratings of concurrent positive affects approached 5, while the ratings of concurrent negative affects was close to 4.2, which means positive affects exerted more salient impact on the participants than negative affects.

(4) Both positive affects and negative affects are prone to priming effect. However, the priming effect between negative affects is weaker than that between positive affects, indicating that implicit positive affects may become more explicit through the working of reflective system in online language learning.

IV. RESEARCH CONCLUSION AND DISCUSSION

A. *Implicit Affective Mechanism Affects Learners’ Online Language Learning Strategy through Implicit Self*

Learners’ prior online language learning experience defines their emotional reaction to online learning activities, which can not be detected through conscious perceptualization or introspection.

Baumann *et al.* [11] and Quirin *et al.* [12] equated extension memory in PSI theory with the implicit self. In light with the research findings of this quasi-experimental study, learners process vast amount of self-relevant information through parallel processing while generating explicit affective experience in online language learning, as a result, the implicit self is activated. According to PSI theory, the implicit self is a holistic, autobiographic memory system which prompts individual’s self-determined and mindful goal system, so, it is related to individual’s decision-making ability.

Once the implicit self is activated, mental representations of individual’s needs and interests (or preferences), as well as their social environment will also be constructed. As a consequence, the activation of the implicit self along with representations of emotional preferences is related to positive affect, at least at an implicit level [13, 14]. Therefore, in designing online language learning activities, teachers should be aware that the activation of positive affect can enhance learners’ participation motivation. Most importantly, the positive self-referential information stored in the implicit self should lead to positive self-esteem or positive affect, generating self-positivity.

In line with the PSI theory, the implicit self activated in online language learning activities would bias individual’s identification of the consistency between the positive aspects of one’s life and one’s expectations or ideals through recognizing learning outcomes. Thus, inadequately developed or activated implicit self will impede learners’ effective affect regulation in challenging situations.

B. *Positive and Negative Affects can Modulate the Working Mechanism of Learners’ Cognitive System in Online Language Learning*

PSI theory holds that personality differences can be attributed to differences in the activation threshold of the four macro cognitive systems, specifically, the

dominance of different cognitive systems, and the connectivity between the four cognitive systems, specifically, the interaction validity between different cognitive systems.

Individual's affective change is essential to the actualization of the dynamic interaction between explicit and implicit personality systems. The interaction between opposing cognitive systems can only be achieved through affective change or the dialectical influences between explicit and implicit positive and negative affects. In view of this, the implicit affective mechanism provides the inner drive for the interaction between micro systems of personality, which determines learners' cognitive behavior and affective experience in online language learning [10].

Firstly, implicit positive affects regulate the interaction between Intention Memory and Intuitive Behavior Control, which affects learner's learning strategy. Explicit and operable online language learning activities are conducive to learners' goal-setting, whereas the attainment of online language learning goals generates self-referential positivity. The emergence of implicit positive affects entails that learners' will present more intuitive, spontaneous and creative cognitive behaviors.

If the attainment of online language learning goals is more difficult than expected, implicit positive affects will be suppressed and Intention Memory will be activated for the retention of goals. If the goals or intentions are too complex, Intuitive Behavior Control will be inhibited to separate thoughts from action, allowing learners to produce feasible action plans and solve the expected difficulties through analytical thinking. If the individual finds satisfactory solution, implicit positive affects will be generated to restore the inhibited connection between Intention Memory and Intuitive Behavior Control to initiate volitional acts.

Secondly, implicit negative affects influence the interaction between Extension Memory and Object Recognition, which determines the proper functioning of learners' metacognition. Extension Memory enables the individual to develop holistic cognition and integrate the unexpected, undesirable, and painful life experiences into the implicit self. The activation of implicit self further hinders the operation of Object Recognition, preventing the individual from focusing on specific problems. However, implicit negative affects like fear, anxiety, helplessness, and sadness will activate Object Recognition, which blocks the Extension Memory, causing learners to deviate from the holistic learning situation and concentrate on the perception or memory pertaining to specific problems or tasks [14].

Implicit negative affects make problematic situations the primary object in learners' cognitive and affective experience, therefore, learners can not integrate current online language learning experience into the Extension Memory with conscious awareness, which means they can not correlate online language with their life experience.

In challenging online language learning situations, the self-representation that activates Extension Memory

enables the individual to generate a higher-order inferential overview of his own life experiences, enhancing learners' self-confidence and down-regulate the negative emotions induced by specific problems or tasks.

V. CONCLUSION

Based on the discrete emotion model, this research delineates the implicit and explicit affective categories activated in online language learning activities, probing into the correlation between explicit and implicit affects and the working mechanism of implicit affects. The research findings reveal that positive and negative affects form a continuum. In mental activities associated with online language learning activities, the activation threshold of positive affects is lower than that of negative affects, whereas, positive or negative affects of the same category have similar activation thresholds.

In online language learning, learners' implicit affective mechanism is activated via the perceptualization of explicit affects. The interaction between explicit and implicit affective mechanism maintains the equilibrium between the macro cognitive systems of personality, ensuring the stability of learners' online language learning performance and learning outcome. Moreover, through parallel processing of the reflective system and associative system and affective regulation, learners' metacognition comes into full play, leading to the successful adjustment of learning strategy and the maturity of academic self-concept.

Accordingly, in online language learning, teachers should take into full consideration the concurrence between explicit and implicit affects to devise the affective intervention model that enhances learners' affective regulation ability through the manipulation of the cognitive and affective experience in blended learning.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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