

Examining the Dynamic Interface between Motivation and Affect in Foreign Language Development with the Moderating Role of Gender and Working Memory

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Abstract

Motivation and affect as two salient variables in L2 development are no longer seen as the stable individual difference factors they were once believed to be. Influenced by process-oriented approaches and by increasing understanding of how the complex dynamic system theory (CDST) works, researchers have emphasized the holistic, non-modular, dynamic, and changeable nature of motivation and affect to-date. Accordingly, this study utilized the principles underlying the CDST perspective to examine the interrelationships between Iranian EFL learners' motivational and affective factors mediated by working memory and gender over an academic semester. To this end, 445 pre-intermediate male and female students completed the motivation questionnaire and L2 Enjoyment Scale four times with one-month intervals during an academic semester and Working Memory Scale once in the beginning of the term. Relationships that emerged indicated both motivational and affective stability and fluctuation over a semester of instruction at one-month intervals. The findings also illustrated how these factors are inseparable from students' learning context. Implications of the study and directions for further research were also provided.

Keywords: Motivation, Complex Dynamic System Theory, ideal L2 Self_{own/other}, ought-to L2 Self_{own/other}, L2 Enjoyment, Working Memory

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INTRODUCTION

Over the past decade, researchers showed interest in utilizing various aspects of the complex dynamic systems theory (CDST) in their studies (Dörnyei, 2009; Mercer, 2011). CDST considers the cause-effect relationships as insufficient and incomprehensive tools to explain the complex patterns of second language (L2) development. CDST views language development as interconnected, nonlinear, adaptive, and sensitive to initial conditions emphasizing the Butterfly Effect (Larsen-Freeman, 1997). Variability within such a framework is thus explicated as an inseparable part of the development and is not viewed as a measurement error any further. In fact, different learners start learning an L2 with different backgrounds (language aptitudes, attitudes, etc.) and the outcome would be determined partly based on their initial conditions. CDST has recently been applied to examine motivational development in various studies (e.g., Serafini, 2017; Waning, Dörnyei, & de Bot, 2014). As Dörnyei (2014) and de Bot (2015) concurred, L2 motivation can fluctuate over different timescales (e.g., days, weeks, months, etc.) since it is a dynamic construct that cannot be investigated through the stable and monolithic lens. In CDST, L2 development emerges from self-organization which is somehow unpredictable and depends on learners' internal and external resources. Learners' resources are constantly influenced by other factors including motivation, joy, anxiety, working memory (WM), time, etc. (de Bot, 2008). In addition to the significant contribution to L2 development, CDST helps understand individual differences (IDs).

The study of IDs illuminates theoretical, empirical and practical issues involved in L2 development. Among all the IDs' variables, motivation might have the largest share in L2 development (Roberts & Meyer, 2012). Dörnyei, MacIntyre, and Henry (2015) state that motivation has adapting and self-organizing properties and would lead to nonlinear variations in learners' motivated learning behavior. Dörnyei (2009) believes that examining motivation within the CDST framework reveals the ways L2 motivation

interacts with the contextual factors. Study of variations in L2 Motivational Self System (i.e., L2MSS; Dörnyei, 2005; Dörnyei & Ushioda, 2011) within the CDST framework forms one of the main underpinnings of the present study.

The importance of cognitive and affective factors in learning situations has also been taken into account by many scholars to-date (e.g., Piniel & Csizér, 2015; Safdari, 2021; Serafini, 2017). Nevertheless, it has remained largely unexplored how to account for the interaction of motivation, cognition and affect. As Dörnyei, MacIntyre, and Henry (2015) put forward, “possible solution lies in the use of conglomerates to refer to the integrated operation of several different forces such as emotion, cognition and motivation” (p.196). The contributing role of cognition in L2 development has been highlighted by many educational experts (Robinson, 2013; Skehan, 2012). Among the cognitive factors that might affect learners’ performance, aptitude has been taken into account in the study. Aptitude was originally explained by Carroll and Sapon (1959) as a general ability to learn other languages. It has recently been addressed under WM concept and refers to the limited mental work place that adjusts learners’ ability to code, store, and process data (Serafini, 2017). Similarly, affects are assumed to have a big role in the process of language development. The study of learners’ affect can help understand the bifurcation between different kinds of learners (Prior & Kasper, 2016). It can also help teachers develop strategies to keep learners motivated all through the educational course (Arnold, 1999). The inclusion of affect in L2 motivation studies has been affirmed by different researchers (Dörnyei & Ushioda, 2009). The trajectories of joy as a positive emotion that learners experience have been scrutinized in the study.

Despite previous attempts to address the link between foreign language motivation and motivated learning behavior, the role of positive emotions (i.e., joy) as well as cognitive factors (i.e., working memory) in promoting or limiting motivated learning behavior, especially among male and female Iranian EFL learners, has not received adequate attention to-date. Many scholars called for further studies that include positive emotions in L2 acquisition (e.g., Dewaele &

MacIntyre, 2016; Dörnyei & Ryan, 2015). Likewise, it is somehow surprising that little attention has been paid to cognitive variables contributing to learning in the motivational studies (Brooks & Shell, 2006). Cooper (1998) asserts that working memory is one of the cognitive features of the mind that activates learners' consciousness and enables them to solve problems and think creatively and rationally. Cognitive specialists believe that cognition (as one of the dynamic features of individuals) relies upon contextual factors and, it is usually manifested through notions like affect and emotions (Dai & Sternberg, 2004). Therefore, the present study sought to examine how the main variables (i.e., L2MSS and joy) might affect motivated learning behaviors of male and female L2 learners at varying WM levels. To this end, a CDST perspective was used to conceptualize the interaction between the variables under study over a semester of instruction.

LITERATURE REVIEW

Principles of Complex Dynamic System Theory (CDST)

The overall aim of CDST is to see “phenomena in a holistic and systemic manner by recognizing the interrelated links of the components within the system and the often non-linear manner of self-organization and emergence by which the system evolves and responds to both external and internal stimuli” (Waninge, Dörnyei, & de Bot, 2014, p. 705). Larsen-Freeman and Cameron (2008) specified CDST principles as five steps including 1. Identifying the system's components (e.g., agents, process, etc.). Within such a framework, system embodies the cases where learners interact with the environment. In the case of the present study, the system components consist of cognitive, affective, and motivational aspects of L2 learning which interact with each other and the context to regulate L2 learners' behaviors simultaneously, 2. Identifying timescales and levels of social and human organizations on which the system relies, 3. Describing the links between and within the systems' components, 4. Describing the interrelationship between the system and context, 5. Describing the way the components vary over time

(i.e., dynamics). A key principle of CDST is that the behavior of the whole arises as a result of the interactions of its subcomponents in a nonlinear fashion (Van Geert, 1994). In fact, each successive move in the system's development is seen as a function of the preceding move, and change is to take place as a matter of interactions amongst the system's components. Nonlinear variation and impromptu self-organization are other salient maxims of CDST which are directly related to fluctuations and attractor states (i.e., system's position at a given time). It implies that the system may show irregular behaviors at certain times and inconsistent ones at other times which display that the system is adjusting to the preferred attractor states (Larsen–Freeman, 2012). The present study attempted to investigate the L2 learners' intrinsic dynamics (i.e., the cognitive ability) by analyzing the participants' WM capacity in conjunction with their motivational and emotional factors as emphasized by Dörnyei (2009b), and the way their interrelationships might vary through a semester of instruction.

Variables of L2 Motivational Self-system (L2MSS)

Since the L2MSS was put forward by Dörnyei (2005, 2009), plenty of studies have been carried out by various researchers all around the world to examine the model and the way its subcomponents affect the language development (e.g., Csizér & Kormos, 2014; Papi & Teimouri, 2014; You & Dörnyei, 2014). The L2MSS hypothesizes that learners' motivated behaviors including their decisions, attempts, and insistence, would be mainly influenced by three variables: ideal L2 self, which refers to a “future- oriented vision of what a learner might like to be; ought-to L2 self, which refers to the attributes that one believes he ought to possess to meet expectations and to avoid possible negative outcomes” (Dörnyei, 2009, p. 29); and L2 learning experience (L2LE), which relates to learners' attitudes toward instructional settings (Dörnyei, 2005, 2009; Dörnyei & Ushioda, 2011). In all studies, the researchers confirm that the ideal L2 self is a significant predictor of learners' motivated behavior (e.g., Csizer & Dörnyei, 2005; Kim & Kim, 2014;

Taguchi, Magid, & Papi, 2009). On the contrary, the ought-to L2 self was found to be a weaker or secondary factor in explaining learners' motivated behavior (Lamb, 2012; Papi & Teimouri, 2012).

Papi et al. (2019) recently proposed the new version of the L2MSS entitled 2×2 model of self-guides based on a regulatory focus (Higgins, 1997) and the self-discrepancy theory (Higgins, 1987). They utilized regulatory distinctions and ramified ideal L2 self and ought-to L2 self by two standpoints of own and other. These distinctions led to two ideal L2 selves and two ought-to L2 selves (i.e., ideal L2 self_{own/other} and ought-to L2 self_{own/other}). Ideal L2 self_{own} depicts the person the learner ideally would like to be; ideal L2 self_{other} refers to the fact that how the significant people in learners' life would like them to be; ought L2 self_{own} relates to having some features in L2 to avoid negative consequences; and ought L2 self_{other} represents those attributes that the learners believe others expect them to possess. As Waninge, Dörnyei, and de Bot (2014) state, accounting for fluctuation is a prerequisite to any further advancement in comprehending L2 motivation due to the significance of the motivation variability over time. Several studies have been conducted to reveal dynamic conceptions of motivational change to-date. For example, Gardner et al. (2004) investigated motivational change and its relationship with the long-term L2 development over a year of university instruction for intermediate L2 French learners. Yanguas (2007) examined the motivational variability of Spanish learners over a semester of instruction. Both authors found that contextual factors including language and anxiety were the variables that significantly explained variation in learners' performance. Campbell and Storch (2011) explored motivational fluctuation and change amongst university students learning Chinese as a foreign language over a semester. They found that environment was the most important variable affecting motivation both in positive and negative senses (i.e., both motivating and demotivating). Poupore (2018) traced the motivational development of learners for the duration of several classroom hours and highlighted the dynamic nature of short-term motivation. Therefore, a dynamic systems approach seems more appropriate in that it can provide

explanations for both variability and stability without drawing on cause–effect relationships.

Gender and Working Memory (WM) as Moderating Variables

A number of studies have been carried out on gender and motivation in spite of gender differences in L2 motivation (e.g., Henry & Cliffordson, 2013). Most of the studies, however, showed that female students were more motivated towards the achievement of desirable learning goals as compared to male students (e.g., Shang, 1998; Schatt, 2011). Nevertheless, the levels of students' motivation vary on different subject matters. Different genders have different types of motivation (i.e., intrinsic and extrinsic). Clayton, Blumberg, and Auld (2010) state that learners' motivational beliefs in different subjects present their emotions, behaviors, and thoughts that may lead to their success in learning. Henry (2009) found an emerging gender gap at the end of secondary school students. He concluded that while the ideal L2 selves of girls increased in strength, those of boys decreased. The findings also suggested that students' ideal L2 self-guides were significant predictors of the amount of effort they put into L2 learning. Henry and Cliffordson (2013) believe that gender affects both current selves and future-oriented possible selves simultaneously. They also found that females were interested in interpersonal relationships more than their males' counterparts.

WM is defined as a cognitive system that accounts for storing information in a maximum state of accessibility in the learning process (Cowan, 2017). Brooks and Shell (2006) highlight that WM would not be treated as the stable trait, rather it functions in terms of the learning context and is closely related to the individuals' prior backgrounds. For adult learners, WM is assumed to play a more significant role in comprehension and language use (Miyake & Friedman, 1998). Among several theoretical models of WM proposed to date (e.g., Sagarra, 2013; Wen, Mota, & McNeill, 2015), Baddeley et al.'s (2010) multiple resource model remains distinct in that it encompasses an executive function which is a domain-general construct

relating to different attentional foci including inhibiting, switching, and retrieving information and two domain specific storage systems consisting of the phonological and the visuospatial features. The former deals with phonological and verbal and the latter refers to the visual and spatial information. Motivation has been demonstrated to impact WM processes including selective attention (Krawczyk et al., 2007), encoding (Taylor et al., 2004), and active maintenance (Gilbert & Fiez, 2004). Previous studies on the relationship between WM and motivation indicate that cognitive efficiency (i.e., WM) and performance level (i.e., motivated behavior in our case) are affected by motivation. Krawczyk and D'Esposito (2013) showed that incentive motivation could modulate performance on WM tasks. Grogan, Randhawa, Kim, and Manohar (2022) showed in their study that motivation can reinforce WM in most cases.

Learners' Enjoyment from the CDST Perspective

Motivation is directly related to individuals' emotions (Saito et al., 2018; Teimouri, 2017). Through the CDST lens, individuals' motivation and enjoyment can function adaptively. As Fathi, Mohammaddokht, and Nourzadeh (2021) asserted, the affective filter may hinder students' achievement when it is high and can reversely enhance it when it is low. Recently, scholars put more emphasis on enjoyment as a positive emotion (e.g., Dewaele & MacIntyre, 2014; MacIntyre & Gregersen, 2012). Dewaele and Alfawzan (2018) believe that those who enjoy language learning are often better at developing L2 processes. Different variables including learners' motivation and enjoyment would interact closely with each other and jointly lead to language development according to the CDST perspective (Larsen-Freeman & Cameron, 2008). Through self-organization, learners' motivation and enjoyment would increase and give rise to a balanced behavior (Jirsa & Kelso, 2004). This motivation–enjoyment harmony provides a good representation for learners' motivated behavior (Lowie & Verspoor, 2019), and “illustrates how simplicity arises from the adaptive behavior of

interrelated and interacting components” (Papi & Hiver, 2020, p. 213).

Teimouri (2017) examined how learners’ enjoyment related to their L2 selves under the L2MSS framework and found a positive path from enjoyment to motivation. Pan and Zhang (2021) conducted a longitudinal study to explore how the motivation–enjoyment relation changed over time. The findings indicated that enjoyment was a less stable variable compared to other emotional variables, like anxiety, over time. Further, the findings confirmed that some motivational factors including ideal L2 self and ought-to L2 self were closely related to the changes in the learners’ enjoyment. L2MSS accounts for the fact that learners with a greater interest in English are expected to enjoy learning English more, compared to other students (Ryan & Deci, 2017). Accordingly, those who enjoy L2 learning more than others do often possess a more vivid ideal L2 self-image (Dörnyei, 2009; Nishida, 2013) and similarly acquire positive emotions during their language learning process (Dewaele et al., 2018). On the contrary, students motivated to learn English via the ought-to L2 self often have higher levels of extrinsic motivation (i.e., lower levels of of enjoyment, Dörnyei, 2009). Recent studies have confirmed that those students motivated by exams’ grades are usually extrinsically motivated and, thereby, show a stronger ought-to L2 self (Ryan & Deci, 2017).

Learners’ L2 learning experience at home, school, or different context as well as the financial situation and socioeconomic status of their family (Ansong et al., 2018) can also impact their enjoyment according to the L2MSS theory (Dörnyei, 2009). As Boudreau, MacIntyre, and Dewaele (2018) affirm, learners’ enjoyment varies over time since it might take place as reactions to various events. In fact, learners’ enjoyment can be affected by a number of internal and external factors (e.g., interpersonal/social relationships, contextual factors, personality traits, motivational constructs, etc.). In sum, the CDST framework is characterized by a clear perception of change and variability, with the subsequent sense of enjoyment. Nevertheless, this enjoyment is not necessarily intrinsic in nature. Rather, “the enjoyment is projected from the overall emotional loading of the target vision; it is as if

each step along the way reproduces some of the joy linked to the overall journey” (Dörnyei, Ibrahim & Muir, 2015, p. 101). In the present study, the researchers used the CDST principles to investigate fluctuations in learners’ enjoyment in given time scales within a semester of instruction.

Motivated Learning Behavior: Definitions and Limitations

Motivated learning behavior (i.e., intended effort) is often used as a criterion examining the level of effort that students intend to put into learning. Several studies have emphasized the significance of students’ motivated learning behavior and its strong correlation with the L2MSS components to-date (e.g., Csizér & Kormos, 2009; Taguchi et al., 2009). Motivated learning behavior is quite salient in determining students’ learning achievements. Winardi (2011) highlights that students’ behavior is generally motivated by an aspiration to meet certain objectives. Nevertheless, there are two problems associated with intended effort measures.

The first deals with the regulatory focus theory (Higgins, 1997) consisting of two general strategic inclinations when an individual struggles toward specific goals: eagerness and vigilance strategies. Learners having tendencies (i.e., promotion-focused) depend on an “eagerness” strategy to raise gains and decrease non-gains by taking advantage of any options that may generate positive results. However, individuals possessing a prevention-focused inclination take a “vigilance” strategy to reduce losses and increase non-losses by avoiding opportunities that may lead to negative consequences. The second problem of intended effort relates to the hypothetical nature and non-applicability to the present time. While some items of this measure are associated with the actual motivated behaviors of L2 learners (e.g., “I am working hard at learning English,” Ryan, 2009), some other items measure the amount of energy and time that learners intend to expend on L2 learning (e.g., “I would like to spend lots of time studying English,” Taguchi, Magid & Papi, 2009), which may not necessarily be similar to their actual language learning behavior (Sheppard, Hartwick & Warshaw, 1988).

Evaluating individuals' real-time behavior might best predict their achievements compared to their future intended efforts. These problems have been jointly accounted for the development of the ought-to and ideal L2 self-guides as weak and strong predictors of intended effort. Therefore, in the current research, it has been attempted to avoid these problems by using an improved measure of respondents' actual motivated behavior in real time without any regulatory focus issues.

PURPOSE OF THE STUDY

Based on the CDST perspective that L2 learning is complex, dynamic and unpredictable, the current study attempted to understand the emerging patterns in L2 learners' motivated behavior by examining the interplay of other variables considered important predictors of motivated learning behavior. Most previous studies focused on the significance of L2 motivation and anxiety for affecting language learning outcomes, while few of them have probed the interplay of motivation and joy emphasizing L2 self-guides within a CDST perspective and by means of two important moderating variables (i.e., gender and WM). Thus, more investigation is required in this area to determine how and to what extent L2 joy and L2 self-guides interact with one another to affect the motivated learning behavior of learners. The present study, conducted in an Iranian context, tried to examine the dynamic interrelationship between L2 joy and L2 self-guides in relation to their interactive effect on the motivated learning behavior of EFL learners with the inclusion of gender and WM levels as moderating variables. Therefore, the following research questions were articulated:

- 1) Is there any fluctuation in female EFL learners' motivational, emotional and behavioral variables during a semester of instruction at increasing WM levels?
- 2) Is there any fluctuation in male EFL learners' motivational, emotional and behavioral variables during a semester of instruction

at increasing WM levels?

- 3) Are intergroup and within-group fluctuations significant with respect to WM and gender?

METHOD

Participants

The sample consisted of 445 Iranian students (205 female and 240 male students) with different subject fields, who were studying English for specific purpose (ESP) at Islamic Azad University (IAU) East Tehran Branch. Their age range was between 18 to 25 years old (their mean age was 22.67, SD= 2.26). Students' level of English language proficiency was largely pre-intermediate as determined by the English proficiency test. Table 1 summarizes the demographic data of the participants:

Table 1: Demographic Background of the Participants

No. of Students	445
Gender	Males (53.9%) and Females (46.1%)
Native Language	Persian
Major	ESP (Different Majors)
University	IAU
Academic Year	2021-2022

Instrumentation

To fulfill the objectives of the study, the researchers used the following research instruments:

Preliminary English Test (PET)

To homogenize the participants and specify their levels of English language proficiency, the PET (exam updates 2020) was administered at the beginning of the study. This test is appropriate for learners of a pre-intermediate level, who are able to deal with everyday written and spoken communication. The

PET was organized into 4 parts of reading, writing, listening, and speaking. The total mark for each part was estimated as 25%. The reading section included 6 parts and 23 questions, the writing had 2 parts and 2 questions, the listening composed of 4 parts and 25 questions, and the speaking part consisted of 4 parts. The participants had one hour and 30 minutes to complete this test.

The Motivation Questionnaire

The 2×2 L2 Motivational Self System Questionnaire (i.e., self-guide scales; Papi et al., 2019; Papi & Khajavi, 2021) comprising four components was administered to the participants. Five items were used to measure ideal L2 self_{own}, three items for ideal L2 self_{other}, four items for ought-to L2 self_{own}, and four items for ought-to L2 self_{other}. Evidence for the validity of the 2×2 model was provided by Papi et al. (2019) and Tseng, Cheng, and Gao (2020). Furthermore, four items of the Motivational Factors Questionnaire (MFQ) by Ryan (2009) were administered to the participants to measure their motivated learning behavior.

The responses to the questions were collected on a six-point Likert scale with 1 showing strongly disagree and 6 showing strongly agree. The motivation questionnaires went through multiple stages of translation (into Persian), back translation (to English), and piloting. Two EFL experts examined the consistency and accuracy of the translated copies, then they were administered to 45 students who were similar to the participants of the study in every aspect. Items measuring the variables along with their reliability coefficients and means and standard deviations are presented in Table 2.

Table 2: Cronbach's alpha measures and descriptive statistics for the variables used

Variables	M	SD	α
Ideal L2 Self _{own}	3.85	1.32	0.94
Ideal L2 Self _{other}	3.81	0.89	0.88
Ought-to L2 Self _{own}	3.77	1.15	0.92
Ought-to L2 Self _{other}			

Motivated behavior	3.37	1.18	0.91
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The items relating to the purposes of this study were attached in Appendix.

The L2 Enjoyment Scale

To measure learners' enjoyment, the L2 Enjoyment Scale, which had been originally developed by Dewaele and MacIntyre (2014) and subsequently adapted and administered by Jiang and Dewaele (2019), including 10 items, was used to assess L2 enjoyment in an Iranian context. Considering the salient role that teachers play in creating the positive atmosphere, two subscales of the enjoyment scale, that is, L2 Enjoyment-self (including six items) and L2 Enjoyment-teacher (consisting of four items) were adopted in the present study (See Appendix). The responses to the questions were collected on a five-point Likert scale with 1 showing strongly disagree and 5 showing strongly agree. The L2 Enjoyment Scale went through multiple stages of translation (into Persian), back translation (to English), and piloting. Two EFL experts examined the consistency and accuracy of the translated copies, and subsequently, it was administered to 45 students who were similar to the participants of the study in every aspect. Items measuring the variables along with their reliability coefficients, means, and standard deviations are presented in Table 3.

Table 3: Cronbach's alpha measures and descriptive statistics for the variables used

Variables	M	SD	α
L2 Enjoyment-Self	3.86	1.32	0.88
L2 Enjoyment-teacher	3.74	0.96	0.92

The Working Memory Scale

Working memory capacity (WMC) was measured by the Operation Span task (OSpan; Unsworth et al., 2005) and Digit Span task (Wechsler, 1997). The former dealt with the functional WM and the latter related to phonological

WM. Both measures were nonverbal and required learners to complete them in their L1 independent of their L2 proficiency levels (Sagarra, 2013). In OSpan tasks, participants were required to solve simple arithmetic problems (e.g., “Is $(4 \times 2) + 1 = 9$ ”) by reading them aloud (e.g., “Is four times two plus one equal to nine ... Yes ... No”); i.e., processing component). The participants were asked to write down all of the letters at the end of each set, so that they could recollect them in the accurate order on the answer sheet (i.e., storage component). There were 12 sets with different levels of difficulty (from two to five mathematical operations). The participants were then asked to complete three similar examples before the test to check whether they understood the task’s directions. Learners’ scores showed both processing and storage accuracy (42 points each, 84 points total). The participants’ storage score was rated as high, medium, and low similar to what was suggested by Conway et al. (2005) and Serafini and Sanz (2016) as abstract, total, and lenient. The OSpan was individually administered and took up to 20 minutes to be completed. In the Digit Span task (Noort, Bosch, & Hugdahl, 2006), the participants heard different sets including two to nine numbers, and they were asked to repeat the numbers in the same order as they heard. There were eight sets of numbers. Every correct recalling (i.e., each set of numbers) had one point. If they were unable to repeat two sets of numbers accurately in the same order they heard, the task would be finished, and they would miss its point. Participants’ phonological WM scores revealed the number of sets correctly repeated (maximum 16 points possible). The digit span task was also individually administered and took up to 10 minutes to complete.

Data Collection Procedure

Participants answered the motivation questionnaire validated by Papi and associates (Papi et al., 2019; Papi & Khajavi, 2021) and the L2 Enjoyment Scale (Jiang & Dewaele, 2019). They were asked to do the WM tasks as well. Afterward, the progression of students’ motivational and emotional changes was tracked over a period of a semester (i.e., four months). Measurements of

the variables of the study (i.e., motivation, enjoyment, and motivated learning behavior) were taken at one-month intervals during the term. In fact, it was once administered at the outset of the research process, once at the end of it, and twice with one-month interval after the first and before the last administrations. There was no time limit and the participants were requested to answer the questionnaires at their own pace. They were allowed to ask for any ambiguities while completing the questionnaires. All the participants were requested to sign an ethics consent form. Ethical considerations were met by the researchers during data collection procedures. The reason for conducting the research and procedures for data collection were explained to the participants before the study. The participants were assured that the information they provided would be kept confidential, and the findings would be reported anonymously.

Data Analysis

Once all the required data were collected, they were transformed into codes and then entered into SPSS v. 24 program. Then, average scores were computed, and subsequently, the trajectory diagrams were drawn by Excel to investigate the degree of changes in participants' motivation, joy, and motivated learning behavior. In particular, the use of line graphs enabled the researchers to depict the temporal variation and/or stability of the variables of the study. Tables were also presented to indicate the significance (the two-sided test of equality for column means was run) of variations over an instructional semester. Moreover, learners' gender (as specified by participants on top of the questionnaire) and WM levels were included in the analyses to systematically investigate their moderating effects on the interplay of the main variables.

RESULTS

Variability in Female Participants' Motivation, Emotion, and Behavior with respect to Working Memory

In an attempt to address the first research question of the study, Figure 1 illustrates the variations in the variables under investigation. According to the figure, all the female participants at varying WM (i.e., high, mid, and low) showed relatively high levels of ideal L2 self_{own/other}, and motivated learning behavior with small fluctuations during the four months. Their enjoyment followed a similar trajectory (i.e., decrease-increase-decrease). The mean score of the participants' motivated learning behavior seems to be directly affected by the direction of their ideal L2 self_{own/other} and enjoyment. However, it is inversely related to their ought-to L2 self_{own/other}. The key emotional trajectory observed in Figure 1 is a steady decrease from a relatively higher level to a moderately lower level and then an increase and finally a slight decline. The level of ought-to L2 self_{own/other} participants was relatively lower than their ideal L2 self_{own/other} and followed an inverse trajectory (i.e., increase-decrease-increase) during the four months.

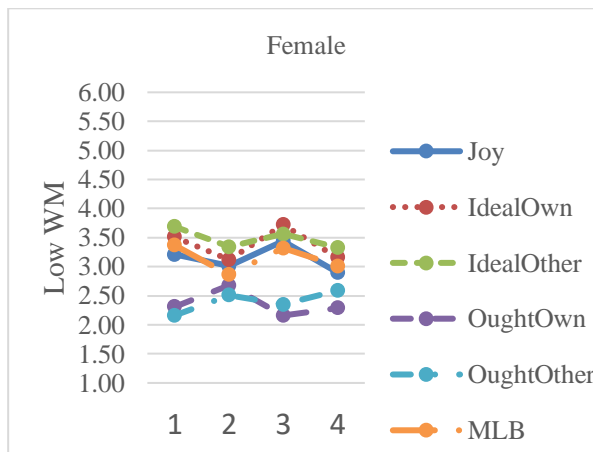




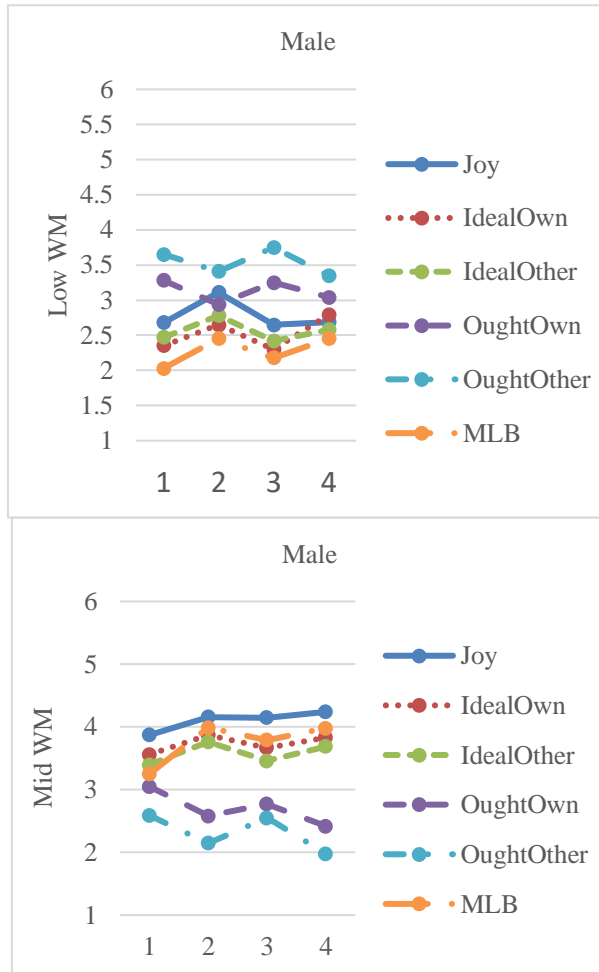
Figure 1: The progression of Female Participants’ Motivation, Emotion, & Behavior during a semester at varying Working Memory
**Note: MLB is the motivated learning behavior in all Graphs*

Variability in Male Participants’ Motivation, Emotion, and Behavior with respect to Working Memory

To deal with the second research question of the study, Figure 2 represents the variation in the variables under examination. According to the figure, the male participants with low and medium levels of WM showed relatively low and high levels of ideal L2 self _{own/other} and motivated learning behavior

respectively in the beginning of the semester. The ideal L2 self_{own/other} and behavioral trajectory indicated a steady increase and then a decrease and finally a slight increase. The enjoyment of the male participant with a low level of WM followed a similar trajectory (i.e., increase-decrease-increase). The enjoyment of the male participants with a medium level of WM shows the same trend, yet in a very slight and negligible degree. The mean score of the participants' motivated learning behavior seems to be directly affected by the direction of their ideal L2 self_{own/other} and enjoyment. However, it is inversely related to their ought-to L2 self_{own/other} (See Figure 2). The level of participants' ought-to L2 self_{own/other} was relatively higher than their ideal L2 self_{own/other} in low WM participants and lower than the same in medium WM students and followed an inverse trajectory (i.e., decrease-increase-decrease) during the four months.

With respect to participants with a high level of WM, there was a relatively high level of ideal L2 self_{own/other}, enjoyment, and motivated learning behavior in the beginning of the semester. The key ideal L2 self_{own/other} and behavioral trajectory indicated a steady decrease, then an increase, and finally a slight decline. Their enjoyment followed a similar trajectory (i.e., decrease-increase-decrease). The mean score of the participants' motivated learning behavior seems to be directly affected by the direction of their ideal L2 self_{own/other} and enjoyment. However, it is inversely related to their ought-to L2 self_{own/other} (illustrated in Figure 2). The level of participants' ought-to L2 self_{own/other} was relatively lower than their ideal L2 self_{own/other} at the outset of the term and followed a different trajectory (i.e., increase-increase-decrease) during the four months.



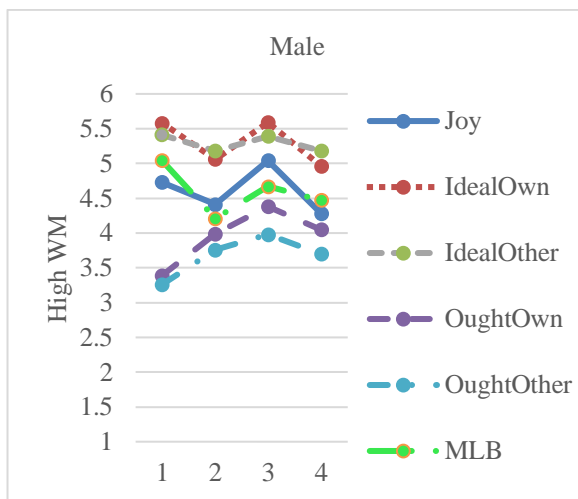


Figure 2: The progression of Male Participants' Motivation, Emotion, & Behavior during a semester at varying Working Memory

Variability in Participants' Motivation, Emotion, and Behavior with respect to Working Memory and Gender in terms of Statistical Significance

Ideal L2 self_{own/other}

This section and the related subsections attempt to address the third research question of the study. Each table in this section presents a separate variable which is additionally moderated based on participants' gender and WM. Values in the same row (and subtable), not sharing the same subscript, are significantly different at $p < .05$ in the two-sided test of equality for column means. Additionally, tests are adjusted for all pairwise comparisons within a row of each innermost subtable using the Bonferroni correction. As displayed in Tables 4 and 5, variations in terms of ideal L2 self_{own/other} for example at the first rows were statistically significant (2.35_a 3.56_b 5.58_c; 2.47_a 3.4_b → 5.41_c) while most of within group variations were not significant in spite of the meaningful trend and fluctuation observed in the progression. As

highlighted in Tables 4 and 5, as the level of participants' WM increased, their ideal L2 self_{own/other} increased as well.

Table 4: Mean Score of Participants' Ideal L2 self_{own} based on Gender & Working Memory

			Working Memory		
			Low	Mid	High
			Mean	Mean	Mean
Gender	male	IdealOwn1	2.35 _a	3.56 _b	5.58 _c
		IdealOwn2	2.65 _a	3.87 _b	5.06 _c
		IdealOwn3	2.30 _a	3.67 _b	5.59 _c
		IdealOwn4	2.79 _a	3.83 _b	4.96 _c
	female	IdealOwn1	3.51 _b	3.79 _b	5.61 _c
		IdealOwn2	3.12 _b	3.28 _b	5.20 _c
		IdealOwn3	3.72 _b	3.89 _b	5.68 _c
		IdealOwn4	3.16 _b	3.35 _b	5.09 _c

**Note:* Values not sharing the same subscript in the same row, are significantly different at $p < .05$ in the two-tailed test of equality for column means.

Table 5: Mean Score of Participants' Ideal L2 self_{other} based on Gender & Working Memory

			Working Memory		
			Low	Mid	High
			Mean	Mean	Mean
Gender	male	IdealOther1	2.47 _a	3.4 _b	5.41 _c
		IdealOther2	2.78 _a	3.76 _b	5.18 _c
		IdealOther3	2.42 _a	3.46 _b	5.39 _c
		IdealOther4	3.58 _b	3.69 _b	5.18 _c
	female	IdealOther1	3.69 _b	3.12 _a	5.39 _c
		IdealOther2	3.34 _b	2.79 _a	5.03 _c
		IdealOther3	3.56 _b	3.05 _a	5.46 _c
		IdealOther4	3.33 _b	2.58 _a	5.27 _c

Ought-to L2 self_{own/other}

As shown in Tables 6 and 7, some of intergroup variations with regard to ought-to L2 self_{own/other} were statistically significant while most of within group variations were not significant in spite of the meaningful trend and fluctuation observed in the progression. As illustrated in Tables 6 and 7, as the level of participants' WM increased, their ought-to L2 self_{own/other} increased as well.

Table 6: Mean Score of Learners' Ought-to L2 self_{own} based on Gender & Working Memory

			Working Memory		
			Low	Mid	High
			Mean	Mean	Mean
Gender	Male	OughtOwn1	3.28 _a	3.05 _a	3.39 _a
		OughtOwn2	2.94 _a	2.58 _a	3.99 _b
		OughtOwn3	3.25 _a	2.77 _a	4.38 _b
		OughtOwn4	3.04 _a	2.42 _a	4.05 _b
	Female	OughtOwn1	2.31 _a	2.74 _a	4.39 _b
		OughtOwn2	2.68 _a	3.08 _a	4.67 _b
		OughtOwn3	2.16 _a	2.80 _a	4.12 _b
		OughtOwn4	2.29 _a	3.04 _a	4.48 _b

Table 7: Mean Score of Learners' Ought-to L2 self_{other} based on Gender & Working Memory

			Working Memory		
			Low	Mid	High
			Mean	Mean	Mean
Gender	male	OughtOther1	3.65 _a		
		OughtOther2	3.41 _a	2.59 _b	3.26 _a
		OughtOther3	3.75 _a	2.15 _b	3.76 _a
		OughtOther4	3.35 _a	2.55 _b	3.98 _a
	female	OughtOther1		1.98 _b	3.7 _a
		OughtOther2	2.16 _b	1.95 _b	4.25 _c
		OughtOther3	2.51 _b	2.56 _b	4.52 _c
		OughtOther4	2.35 _b	2.18 _b	4.26 _c
		2.59 _b	2.74 _b	4.3 _c	

Enjoyment and Motivated Learning Behavior

As exhibited in Tables 8 and 9, intergroup variations in terms of participants' enjoyment and motivated learning behavior, for example, at the first rows were statistically significant ($2.68_a \rightarrow 3.87_b \rightarrow 4.73_c$; $2.03_a \rightarrow 3.25_b \rightarrow 5.04_c$) while most of within group variations were not significant in spite of the meaningful trend and fluctuation observed in the progression. As depicted in Tables 8 and 9, as the level of participants' WM increased, their enjoyment and motivated learning behavior increased as well.

Table 8: Mean Score of Learners' Enjoyment based on Gender & Working Memory

			Working Memory		
			Low	Mid	High
			Mean	Mean	Mean
Gender	male	joy1	2.68 _a	3.87 _b	4.73 _c
		joy2	3.11 _a	4.16 _b	4.42 _c
		joy3	2.65 _a	4.15 _b	5.04 _c
		joy4	2.69 _a	4.23 _b	4.29 _c
	female	joy1	3.21 _a	4.02 _b	4.52 _c
		joy2	3.01 _a	3.81 _b	4.16 _c
		joy3	3.44 _a	4.25 _b	4.64 _c
		joy4	2.90 _a	3.74 _b	4.11 _c

Table 9: Mean Score of Learners' Motivated Learning Behavior based on Gender & Working Memory

			Working Memory		
			Low	Mid	High
			Mean	Mean	Mean
Gender	male	MLB1	2.03 _a		
		MLB2	2.45 _a	3.25 _b	5.04 _c
		MLB3	2.18 _a	3.99 _b	4.21 _c
		MLB4	2.45 _a	3.79 _b	4.67 _c
				3.98 _b	4.47 _c
	female	MLB1	3.37 _b	3.68 _b	5.14 _c
		MLB2	2.88 _b	3.44 _b	4.86 _c
		MLB3	3.32 _b	3.75 _b	5.33 _c
MLB4		3.01 _b	3.22 _b	4.79 _c	

DISCUSSION

In line with Verspoor, de Bot, and Lowie's (2011) view that all facets in L2 development are interdependent and any variability in each facet will have an influence on others, the current research sought to scrutinize the dynamic patterns of change of male and female participants' motivation, emotion, and behavior at different levels of working memory over a semester of instruction. In addition to the components of L2 Motivational Self-System (i.e., ideal L2 self_{own/other}, ought-to L2 self_{own/other}), students' motivated learning behavior (intended effort) and L2 enjoyment were also taken into account. These data were collected and analyzed to recognize the participants' motivational, emotional, and behavioral trajectories at different working memory levels. As our findings displayed, there was a noticeable degree of variability in participants' motivation, emotion, and behavior.

The first and second research questions examined the variability in male and female EFL learners' motivational, emotional, and behavioral constructs during a semester of instruction at increasing WM levels. To discuss the findings related to aforementioned questions, the following patterns are worth noticing: 1) As far as the ideal L2 self_{own/other} were concerned, the results indicated when the level of female participants' ideal L2 self_{own/other} decreased in three levels of WM, their intended effort and enjoyment decreased as well in the first month. As the level of participants' ideal L2 self_{own/other} increased their intended effort and enjoyment also increased in the second month. While the level of participants' ideal L2 self_{own/other} decreased, their level of intended effort and enjoyment decreased in the third month as well. These findings confirm the fact that there is a direct relationship between female students' ideal L2 self_{own/other} and their intended effort and enjoyment. 2) With respect to the male participants' ideal L2 self_{own/other}, the results showed that when the level of male participants' ideal L2 self_{own/other} increased with low and medium levels of WM, their intended effort and enjoyment increased as well in the first month. As the level of participants' ideal L2 self_{own/other} decreased, their intended effort and

enjoyment also decreased in the second month. While the level of participants' ideal L2 self_{own/other} increased, their level of intended effort and enjoyment increased in the third month.

The trajectory for male participants' ideal L2 self_{own/other} with high level of WM would show the same trend as intended effort and enjoyment. The finding that ideal L2 self (regardless of two standpoints of own/other), intended effort, and enjoyment are positively correlated is in conformity with the results of previous studies (e.g., MacIntyre & Serroul, 2015; Papi, 2010; Lamb, 2012; Teimouri, 2017). 3) Regarding ought-to L2 self_{own/other}, the findings showed negative correlations between this variable and participants' ideal L2 self_{own/other}, enjoyment, and intended effort in all three levels of WM. The inverse correlation between ought-to L2 self_{other} and ideal L2 self_{other} might be related to the participants' misunderstanding of the questionnaire's items, when they are, for example, unable to make a distinction between their own desire to make their family proud (ideal L2 self_{other}) and the necessity to meet their aspirations (ought-to L2 self_{other}, Papi & Khajavy, 2021). Likewise, participants' worries about other significant people's decisions, judgments, or estimation of their abilities might lead to feeling of embarrassment. This may be the reason that ought-to L2 self_{own/other} failed to correlate with L2 enjoyment (Papi & Khajavy, 2021).

The third research question took the intergroup and within group variations of each construct into account (i.e., motivation including ideal L2 self_{own/other/ought-to L2 self_{own/other}}, enjoyment, and motivated learning behavior). In line with the raised research question, the following outcomes were obtained; 1) The intergroup variations were statistically significant, 2) Within-group variations were not statistically significant despite the presence of some sort of variations, and 3) There was a direct link between the level of participants' WM and their motivation, emotion, and behavior. These results are consistent with those of Waninge, Dörnyei, and de Bot' (2014). They found a considerable amount of variability between students' motivation as well. Similar findings were reported in the research carried out by Boudreau, MacIntyre, and Dewaele (2018) in terms of enjoyment. Results from

Serafini's (2017) study also showed that there was a direct relationship between students' motivation and WM, similar to what the researchers found in the current study. These results imply that cognitive and psycholinguistic features underlying the L2 development do not operate in isolation; they go hand in hand and form part of the interrelated structure underlying the learner's internal cognitive system (van Geert, 1995).

As the findings revealed, CDST views learning as a multifaceted and unpredictable phenomenon which is assumed to emerge through self-organizing process. In spite of variability in students' learning, there is some consistency in the way individuals perceive and process information. The main underlying feature causing emergence of a particular behavior is amalgamation of motivation, cognition, affection, and contextual features (Waninge, 2014). These parameters which are somehow inseparable in nature (Ushioda, 2015) constantly interact and reinforce one another and thus make it difficult to isolate their impacts and highlight any clear-cut causal relationships (Dai & Sternberg, 2004; Swain, 2013; Waninge, 2014). Our findings illuminated these factors (i.e., motivation, cognition, and affection) under the umbrella term of conglomerates, helping participants' build and sustain interest throughout the educational semester. They function in conjunction with one another and with the immediate environment in which learning takes place.

CONCLUSION AND IMPLICATIONS

This study examined learners' motivation, affect, and learning behavior mediated by WM and gender at one-month intervals. The results provided a clear illustration that participants' motivation, affect, and accordingly motivated learning behavior are susceptible to change over a semester. The findings showed noticeable ebbs and flows and variability over a term. Further, the results of the data analysis showed cases when almost all the participants followed the same trajectory implying that the existence of vigorous attractor states. As Waninge, Dörnyei, and de Bot (2014) highlight,

“certain contextual factors constituted a strong enough force to regulate disparate system behavior” (p. 718). Identifying these attractor states (including patterns, solutions, outcomes, etc. towards which a system approaches or settles down in the course of time; Newman, 2009) and recognizing the most contributing ones might be useful for teachers to raise and sustain students’ motivation and enjoyment. Learners’ prior experience is quite influential and contributes to the trajectory of the system as well. For example, when there is a negative correlation between ought to L2 self_{own/other} and ideal L2 self_{own/other}, it could be explained by the initial motivational level with which the learners entered a particular setting. In fact, the events prior to an instructional semester can impact the learners’ initial motivation, enjoyment, and therefore, the emerged behavior during the semester. In consideration of above, it is necessary for teachers to invest in the beginning of a term by either introducing interesting/novel warm-up activities, or merely by making a point of sustaining every learner’s attention. Furthermore, some robust regulating forces like creative tasks and a nice teacher might not have a good impact on all the learners in every context, stipulating the CDST maxim of nonlinearity in the system behavior. Therefore, a combination of motivation, affection, cognition, and context can potentially account for learners’ variability.

The present study has shown that CDST presents a comprehensive framework for explaining the interrelationships of different variables in an instructed setting. It may possibly broaden teachers’ understanding of motivation, cognition, and affect in an EFL context. According to Dörnyei (2010), the holistic view adopted in this study might contribute to an understanding of the novel patterns of the emergent language behavior as stated by Larsen-Freeman and Cameron (2008). An important implication of the study is that teachers must be aware of the contributing factors to learners’ development as much as they could, especially due to the fact these factors can lead to positive/negative motivation, high/low enjoyment, and subsequent appropriate/inappropriate behaviors. Teachers should also keep in mind that motivation and affect are not treated as stable traits under any circumstances,

and they are always susceptible to change and variation. Even the highly motivated and joyous learners may lose their enthusiasm in ten minutes by teachers' neglect, and the reverse is the case.

Further research would be essential to examine various principles of the CDST framework and their interrelationships with EFL development in different context. Other affective (e.g., shame, guilt, etc.) and cognitive (e.g., self-efficacy, attention, etc.) factors are recommended to be taken into account in future studies. Moreover, one academic semester and one-month intervals could not be possibly long enough to see the evolution of learners' L2 enjoyment, motivation, and subsequent behavior. Lastly, collecting data on learners from different academic settings and different levels of educational backgrounds both in and out of their hometown would probably present a more vivid picture.

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Appendix

Items of 2 × 2 L2 Motivational Self System

Ideal L2 Self_{own}

- 1- On day I will be able to speak English very easily and fluently.
- 2- I can imagine a day when I speak English like a native speaker of English.
- 3- I can imagine a day when I speak English fluently with international friends/colleagues.
- 4- I can imagine a day when I write effectively and read fluently in English.
- 5- I can imagine a day when I use English effectively to communicate with people from all around the world.

Ideal L2 Self_{other}

- 1- If I master the English language, the people who are important in my life will be proud.
- 2- My family will be proud of me if one day I master the English language.
- 3- I want to learn to speak English fluently to make the people who are important in life proud.

Ought to L2 Self_{own}

- 1- If I don't improve my English, I will risk my professional/academic position.
- 2- If I don't work on my English, I will have problems in my professional/academic life.
- 3- If I don't work on my English, it will negatively affect my social status.
- 4- If I don't work on my English, I will fail in my future career.

Ought to L2 Self_{other}

- 1- I will disappoint those who are important to me if I fail to master the English language.
- 2- If I don't improve my English, I will have to face my family's blames and criticisms.
- 3- If I don't improve my English, my family/teachers will lose confidence in me.
- 4- If I don't improve my English, people who are important in my life may think poorly of me.

Motivated Learning Behavior

1. I work hard at studying English.
2. I spend a lot of time studying English.
3. I put a lot of effort in studying English.
4. I constantly think about my English learning activities.
5. Studying English is very important to me these days

L2 Enjoyment**L2 Enjoyment-self**

1. I don't get bored with English.
2. I enjoy learning English.
3. I can express myself better in English.

4. I am a worthy member of my English class.
5. I have learned interesting things in English class.
6. In English class I feel proud of my accomplishments.

L2 Enjoyment-teacher

7. The English teacher is encouraging.
8. The English teacher is friendly.
9. The English teacher is supportive.
10. There is a good atmosphere in my English class.