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Research into Individual Differences in SLA and CALL: Looking for Intersections¹

Miroslaw Pawlak

Adam Mickiewicz University, Kalisz, Poland

University of Applied Sciences, Konin, Poland

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Abstract

Research into the role of individual difference (ID) factors in the process of second and foreign language (L2) learning and teaching has been one of the most robust lines of inquiry in the field of second language acquisition (SLA; Dörnyei & Ryan, 2015; Griffiths & Soruç, 2020; Pawlak & Kruk, 2022). Most of these empirical investigations have concerned L2 learning in general contexts while empirical inquiry targeting specific instructional settings has been quite limited in terms of both quantity and scope. One such context is computer-assisted language learning (CALL), which involves numerous applications, devices and environments that can be drawn upon to enhance and support L2 learning and teaching. While many studies have been carried out in this area, there have been very few comprehensive attempts to synthesize such empirical evidence and such research has largely lagged behind the developments in the broader domain of SLA. The aim of this paper is to synthesize and critically evaluate research into ID factors in CALL against the backdrop of such advances in SLA and consider future directions of such empirical investigations.

Keywords: *Individual Differences in L2 Learning, Computer-Assisted Language Learning, Macro-Perspective, Micro-Perspective*

Introduction

The role of individual difference (ID) factors in second language acquisition (SLA) has long been acknowledged, and there is a general consensus that such factors affect both the process of

¹ The present paper is broadly based on Pawlak and Kruk (2022). However, thanks to extensive changes to the length, structure, and content as well as the inclusion of new insights and interpretations, the article constitutes an original contribution to the field.

second (L2) and foreign language (FL) learning (e.g., the way in which learners respond to instruction) and its product (e.g., levels of attainment, however, they may be operationalized) (cf. Cohen & Henry, 2020; Pawlak, 2020a). It is thus not surprising that the last several decades have witnessed a huge number of studies that have sought to offer insights into the role of individual variation in learning additional languages, whether quantitative, qualitative or mixed-methods in nature (see Dörnyei & Ryan, 2015; Gregersen & Macintyre, 2014; Gregersen & Mercer, 2021; Griffiths & Soruç, 2020; Li et al., 2022; Pawlak, 2017a, 2020a; Pawlak & Kruk, 2022). While these empirical investigations have been undertaken in many instructional contexts, most of them have concerned L2 learning in a general manner, without specifically addressing the role of ID factors in specific settings. This does not mean, however, that research into ID variables in specific contexts, such as English-medium instruction (EMI; Macaro, 2018) or English for specific purposes (ESP; Anthony, 2018), has not been undertaken but, rather, that it has been limited in scope and volume.

One such area is computer-assisted language learning (CALL), which can be regarded as a subdomain of SLA and which can broadly be understood as the use of new technologies with the aim of enhancing and supporting the process of L2 learning and teaching, regardless of whether this involves reliance on specific applications, devices, environments or settings. In fact, CALL has undergone a major evolution since stand-alone devices were introduced in the 1980s, branching out in many directions and relying increasingly on portable devices (e.g., smartphones) and multimedia (Chun, 2011; Kessler, 2017; Reinders & Stockwell, 2017; Ziegler & González-Lloret, 2022). As a result, L2 teachers, at least in theory, can avail themselves of a range of technological advances, such as interactive whiteboards, social networking platforms (e.g., Facebook), corpora, mobile devices, virtual worlds (e.g., Second Life), digital games, computer-mediated communication (CMC) or even extended reality (cf. Pawlak & Kruk, 2022). This remarkable diversity of CALL-based options in L2 learning and teaching as well as a high degree of flexibility in how they can be employed indicate that their efficacy might be moderated by various constellations of ID factors to a much greater extent than in any other instructional setting. It is thus surprising that this issue has been given scarce attention in state-of-the-art overviews of CALL (e.g., Chun, 2011; Kessler, 2017; Ziegler & González-Lloret, 2022), and when IDs are considered, this is primarily done from a pedagogical perspective with a focus on how computer-assisted instruction can be adjusted to learners' needs (e.g., Reinders & Stockwell, 2017). In rare cases, when syntheses of research on IDs in CALL do get written, only some variables are taken into account, the latest developments in SLA are not considered, and emphasis is placed on specific national contexts (e.g., Rahimi, 2015).

With this in mind, the paper provides a succinct overview of research on ID factors in CALL, adopting as a point of reference the most recent advances in research in the broader field of SLA. Several important caveats are in order at this juncture. First, to set the scene, the overview will be preceded by a brief discussion of current tendencies in research into ID factors in SLA. Second, the choice of the ID variables is selective and reflective of the research interests of the present author. Third, the selected variables are arranged in terms of growing malleability or susceptibility to pedagogic interventions. Fourth, given space limitations, the latest research

developments can only be signaled, and no attempt is made to offer an exhaustive synthesis of existing studies. Fifth, in the case of research in CALL, in most cases, only the latest studies, those that have been published in the last fifteen years, are taken into account. Sixth, given the considerable volume of empirical investigations in some areas (e.g., motivation), emphasis is placed on the most representative ones.

Evolution of Research into ID Factors in SLA

For several decades following the advent of good language learner studies (e.g., Rubin, 1975) intended to identify the characteristics and behaviors of individuals who succeeded in L2 learning, investigations of ID variables drew on the classic perspective of the construct. Thus, such factors were viewed as clearly definable psychological attributes that were relatively stable, largely independent of one another, and internal to the learner rather than shaped by the environment (cf. Dörnyei, 2009a; Dörnyei & Ryan, 2015). This resulted in a proliferation of attempts to divide IDs into categories in the hope of identifying variables that play the most important role in determining the outcomes of L2 learning (e.g., Ellis, 2008; Skehan, 1989; Pawlak, 2012). In other words, as Dewaele (2009) vividly characterized it, SLA researchers embark on “a quest for the holy grail.” It should be stressed that although the field has witnessed a major transformation in recent years and some of the changes will be outlined below, this traditional view has never been abandoned. In fact, not only does this stance continue to inform numerous studies, but it has also been responsible for most existing insights into the role of individual variation in L2 learning. It would thus be imprudent to ignore this body of empirical evidence and discount the research tradition that has allowed us to generate such evidence in the first place.

This said, it is undeniable that the last few decades have brought about major changes in how ID factors are perceived and examined with far-reaching consequences for the field (cf. Gregersen & Macintyre, 2014; Griffiths & Soruç, 2020; Pawlak, 2020a). Perhaps the most consequential development has been increasing reliance on complex dynamic systems theory (CDST; Larsen-Freeman & Cameron, 2008; Larsen-Freeman, 2016) and sociocultural theory (Storch, 2017) as theoretical frameworks for research into individual variation. In simple terms, the former posits that ID factors are characterized by periods of change and stability as a result of the constant interaction with each other and the environment, while the latter highlights the contribution of the social and ecological context in determining how ID variables operate and impact L2 learning. In effect, ID variables have ceased to be seen as monolithic, stable, and self-contained entities and now tend to be regarded as interconnected, subject to temporal variation, and malleable, either as a result of complex interactions or in response to external influences, such as teaching procedures. Unsurprisingly, such fundamental conceptual change must have sparked major modifications to the way in which IDs are investigated, an issue that will be addressed at the end of this section.

Apart from this key transformation at the theoretical level, several other clear-cut trends have become apparent (cf. Pawlak, 2012, 2020a; Pawlak & Kruk, 2022). One of them is almost total abandonment of attempts to squeeze IDs into categories, perhaps in recognition of the fact that

most of them are the result of an intricate interplay of cognition, affect, and social influences, and authors have become more selective in the choice of variables considered (e.g., Dörnyei, 2005; Dörnyei & Ryan, 2015; Griffiths & Soruç, 2020). Moreover, while some ID factors have never lost their appeal and are constantly being explored from diverse theoretical perspectives (e.g., motivation), others have been to some extent sidelined, or their overall relevance has even been questioned (e.g., learning styles). In this connection, some new variables have captured the attention of SLA researchers, typically those that have been examined in educational psychology, such as boredom (e.g., Pawlak et al., 2020b), grit (e.g., Teimouri et al., 2020) or curiosity (e.g., Mahmoodzadeh & Khajavy, 2019). It is also noteworthy that some ID factors have been reconceptualized, and their current theoretical underpinnings differ dramatically from what they used to be when the factors started to be explored, good examples being aptitude or motivation. Equally important, there is a growing understanding that the effects of isolated factors are superseded by the joint impact of constellations of such factors (cf. Ryan, 2020). This has become evident in studies seeking to illuminate such joint effects (e.g., Piniel & Csizér, 2013; Pawlak et al., 2022), although we are a long way from identifying clusters of variables as a basis for identifying a limited number of distinct learner profiles. At the same time, there are two areas where research into IDs has been lacking basically from the get-go. First, researchers have a tendency to focus on variables that are of relatively little relevance to everyday teaching practice, such as working memory or personality (Biedroń & Pawlak, 2016). Second, there is still little research that examines the mediating effects of IDs in relation to various instructional options, such as different corrective feedback (CF) moves (Loewen, 2020; Pawlak, 2017b, 2021a, 2021b), and most available studies in this respect yet again focus on variables that cannot truly be manipulated in classrooms (e.g., aptitude). In fact, one can get the impression that many scholars interested in IDs have limited understanding of research on teaching grammar, vocabulary, and pragmatics, with the effect that the paths followed by the two lines of inquiry cross only very infrequently.

The evolution of research into individual variation has had serious consequences for the methodology of such research. Traditionally, empirical investigations in this area have adopted a *macro perspective*, where data are collected from a large number of participants with the purpose of uncovering general patterns, such as factors underpinning a particular construct (e.g., motivation), the way a given variable is experienced in different contexts (e.g., boredom) or links between ID factors (e.g., grit, emotions and motivated behavior). Although such research is typically quantitative and is associated with the use of meticulously designed questionnaires and advanced statistical procedures, qualitative studies also fall into this category as long as respectable samples are used and some general tendencies are sought (e.g., perceptions of boredom tapped into by means of open-ended items; e.g., Pawlak et al., 2021). In contrast, the adoption of CDST has amplified the role of the *micro-perspective*. When this stance is embraced, the focus is on smaller groups with the aim of exploring a given ID factor or several factors in a context dependent, situated manner, often looking at their temporal variation as well as the causes of this variation. In such studies, small sample size is compensated for by a rich, multi-faceted description of the attribute under investigation, with the effect that mixed methods are

usually employed, and data are gathered by means of various tools such as, for example, self-ratings, questionnaires, interviews, immediate reports, narratives or stimulated recall. It needs to be underscored that to fully understand the contribution of IDs to SLA, it is necessary to adeptly combine insights afforded by the macro- and micro-perspective. As the present author has highlighted when outlining a research agenda for grammar learning strategies (GLS), “(...) future research into GLS should strive to adeptly combine the old and the new, judiciously capitalizing on the benefits of a macro- and micro-perspective” (Pawlak, 2020b, p. 368). Finally, a different set of methodological choices is required in the case of intervention-based studies, which aim to determine how specific ID factors mediate the efficacy of various instructional procedures (e.g., deduction vs induction in teaching grammar). In such studies, which often follow quasi-experimental designs, there is a need for experimental and control groups, pretests, immediate and preferably delayed tests to be included, and the treatments should be of sufficient length to effect changes in the mastery of the targeted feature (cf. Pawlak, 2014; Pawlak & Kruk, 2022). This line of inquiry presents researchers with at least two key dilemmas: (1) how a specific ID factor should be operationalized (e.g., motivation can be approached from different theoretical angles) and (2) what measures of attainment should be employed (e.g., tapping into explicit knowledge, which allows the use of a feature when sufficient time is provided, or implicit, automatized knowledge that can be drawn on in real-time communication; cf. DeKeyser, 2017; Ellis, 2009). Needless to say, the choices made in these areas are crucial and can affect the findings.

Aptitude and Working Memory

The importance of language aptitude (LA), which can simply be defined as “a special talent for learning languages” (Doughty, 2019, p. 109), is recognized by both SLA researchers and practitioners. This said, as noted above, it is doubtful whether LA and the related construct of working memory (WM) can be of much relevance to L2 pedagogy for the simple reason that teachers lack the necessary expertise and tools to tap into these attributes and, even if they did not, it is unclear how such knowledge could be capitalized on in the classroom (Biedroń & Pawlak, 2016; Pawlak, 2017a, 2021a). It should also be emphasized that although higher levels of L2 or WM can indeed accelerate the process of L2 learning, they do not determine its outcomes because deficits in this respect can be compensated for by other aspects of individual learner profiles, in particular motivation (Cohen & Henry, 2020). Although there is currently a consensus that L2 consists of several components rather than being unitary, there is less agreement concerning its stability and its relevance in different learning conditions (Biedroń & Pawlak, 2016; Gregersen & Macintyre, 2014; Singleton, 2017).

The understanding of LA has changed considerably since Carroll (1962) conceptualized it in terms of phonetic coding ability, grammatical sensitivity, inductive learning ability, and associative memory, a model that provided a basis for the *Modern Language Aptitude Test* (MLAT, Carroll & Sapon, 1959). Even though a detailed discussion of such developments goes beyond the scope of this paper, some new accounts of LA include the linguistic differences coding hypothesis (Sparks & Ganschow, 1991), which stresses the role of first language

knowledge, the attempt to relate aptitude to Sternberg's (1997) triadic theory of intelligence (Grigorenko et al., 2000), the assumption that LA should be linked to the stages of L2 acquisition (Skehan, 1998, 2016), the aptitude complex hypothesis (Robinson, 2005), which argues that different human abilities come into play during the performance of specific tasks, and the development of new LA tests, such as the LLAMA test battery (Meara, 2005) or the *High Level Language Aptitude Battery* (Hi-LAB; Doughty et al., 2010). The most consequential, however, has been the reconceptualization of the LA construct from a WM perspective, where WM is responsible for "temporary storage and manipulation of information that is assumed to be necessary for a wide range of complex cognitive activities" (Baddeley, 2003, p. 189). In fact, WM is now viewed as a distinct cognitive factor that affects SLA achievement for different learner groups (Biedroń & Pawlak, 2016; DeKeyser & Koeth, 2011; Doughty, 2019; Li, 2017; Wen, 2016, 2021; Wen et al., 2017). Research has, for the most part, focused on two verbal components of WM, that is, *phonological short-term memory* (PSTM), also known as *phonological working memory* (PWM), and *working memory capacity* (WMC), also called *executive working memory* (EWM). In particular, Wen (2016, 2019) proposed the phonological/executive hypothesis, which strives to explain the memory-SLA nexus. As he explains, "The two key working memory components (...) are purported to subserve to varying degrees specific domains of L2 acquisition (e.g., phonology, lexis, formulaic chunks, morpho-syntactic and sub-skills (bilingual) processing (e.g., listening, speaking, reading, writing, and interpreting, etc.)" (Wen, 2021, p. 396).

Moving on to research into LA and WM in CALL, the main and somewhat surprising conclusion is that it is relatively scant. Several observations can be made with respect to such research. First, the main focus has been on WM rather than LA as such, which perhaps can be attributed to the fact that the concept of LA was introduced into the field in the 1960s when technology-enhanced L2 learning was yet to emerge and, when it finally took off, WM understandably became the main object of investigation (Wen, 2016, 2021). Second, aptitude has sometimes been interpreted in a broad way in CALL research being equated with TL proficiency or mastery of specific skills (e.g., Jin, 2018; Mekheimer, 2012), which runs counter to the approach embraced by SLA researchers. Third, this line of inquiry has been for the most part confined to very distinctive instructional modes, such as the use of glosses or interaction in communication tasks. Fourth, research of this kind has treated technology in diverse ways, either in relation to instructional conditions or the way in which learning outcomes are gauged. Such empirical investigations have had two main foci. One of them is the contribution of WM to the utility of captions in L2 learning, as evidenced by studies undertaken, for example, by Gass et al. (2019) or Kam et al. (2020), with the findings being somewhat mixed. Another strand, grounded in the cognitive-interactionist approach (Kim, 2017), has zoomed in on the role of WM in affecting face-to-face and synchronous CMC, showing that learners with low WM can benefit more from the latter (Payne & Whitney, 2002). Some studies have also focused on specific instructional conditions, such as Ruiz et al. (2021), who examined the acquisition of English phrasal verbs through reading web-based tests in meaning-based and form-based conditions. In this case, regression analysis showed that WM predicted the acquisition of the instructional

targets in the form-focused condition, while declarative memory was associated with learning irrespective of the conditions under which learning took place.

Personality

Personality has been conceptualized in a diversity of ways but is currently regarded as “a patterning of dispositional traits, characteristic adaptations and integrative life stories set in culture and shaped by human nature” (McAdams, 2018, p. 18). This indicates that while the construct represents an enduring and stable characteristic (Ellis, 2008; Griffiths & Soruç, 2020), it is also subject to change in response to external influences, such as culture, family, or various situations. In general, personality has not been given due attention in SLA studies, and the empirical evidence that has been yielded thus far has fallen short of the expectations of specialists (cf. Dörnyei & Ryan, 2015; Ellis, 2008; Piechurska-Kuciel, 2020). In the words of Dewaele (2021), “The fact that findings have been relatively modest is probably linked to expectations that were (or are) unrealistic, the difficulty of carrying out solid interdisciplinary research between personality psychology and SLA, and the fact that SLA is a volitional activity that implies that learners with specific personality profiles may behave atypically (...)” (p. 115). Nevertheless, a number of studies have sought to shed light on the contribution of personality to L2 learning, and this line of inquiry is gaining popularity. While earlier research mainly drew upon the *Myers–Briggs Type Indicator* (MBTI; Myers, 1962) or the *Eysenck Personality Questionnaire* (EPQ, Eysenck & Eysenck, 1975), recent empirical investigations have embraced the Big Five model (Costa & McCrea, 1986; McCrea & Costa, 2003), which includes five basic dimensions: openness to experience, consciousness, extraversion, agreeableness and neuroticism, each with a larger number of lower-order personality traits. Personality has typically been treated as an independent variable, and the main emphasis has been placed on the distinction between extroversion and introversion, with the findings indicating that their role is context-dependent (e.g., Dewaele & Furnham, 2000; Ożańska-Ponikwia, 2018; Piechurska-Kuciel, 2020). Some studies have also focused on other dimensions of the Big Five (e.g., Ożańska-Ponikwia & Dewaele, 2012), looked at their links with other ID variables (e.g., Piechurska-Kuciel, 2018), explored the contribution of lower-order personality traits such as ambiguity tolerance (e.g., Dewaele & Shan Ip, 2013), examined the impact of personality on the use of learning strategies (e.g., Liyanage & Bartlett, 2013), and explored the extent to which this construct itself is affected by multilingualism and multiculturalism (cf. Dewaele & Botes, 2020).

Generally, personality has seldom become the focus of empirical inquiry in CALL. Similar to the broader domain of SLA, earlier empirical investigations mainly tapped into this attribute by means of the MBTI and examined the role of this factor in the development of TL proficiency (e.g., Chapelle & Jamieson, 1986; Grace, 1998). With time, the contribution of personality began to be explored in relation to various aspects of L2 learning, and the Big Five started to be adopted as a point of reference. For example, Hwu (2007) conducted a case study that explored the use of language learning strategies (LLS) when using a grammar application in L2 Spanish in connection with personality, operationalized as scores on the MBTI and TL proficiency. Quite a few recent studies have examined the way in which personality shapes participation in online

exchanges or CMC. For example, the research projects by Jones and Holland (2013), and Kao and Craigie (2014) employed the personality traits established on the basis of the Big Five to establish the frequency of online exchanges. The former found openness and conscientiousness to be the strongest predictors of blogging about cultural issues. The latter corroborated the positive role of conscientiousness with respect to the frequency of Facebook use, which was accompanied by extraversion, whereas neuroticism was negatively associated with such activity. Online intercultural exchanges through Facebook were also examined by Kelsen and Flowers (2017). Using the HEXACO Personality Inventory Revised (Lee & Ashton, 2004), which gauges honesty-humility, emotionality, extraversion, agreeableness, conscientiousness, and openness to experience, they failed to uncover meaningful relationships with any of these traits but revealed positive links for items representing sincerity and organization. Additionally, of relevance is the study by Hsu (2021), who showed that the way in which learners of English perceived certain aspects of language massive open online courses (i.e., system, service, and information quality) depended on their degree of openness to experience.

Grit

Grit, understood as “perseverance and passion for long-term goals” (Duckworth et al., 2007, p. 1087), is a newcomer to the field of SLA but has been investigated thoroughly in educational psychology. While the concept is related to personality, it does not fit neatly into any of the categories in the Big Five as a result of its preoccupation with an enduring commitment to pursuing the goals set, which is why it has been viewed as an ID factor in its own right (Credé et al., 2017; Teimouri et al., 2020). Grit is conceptualized in terms of two lower-order components: *perseverance of effort* (i.e., ability to keep going despite adversities) and *consistency of interest* (i.e., capacity for maintaining one’s involvement over time) (Duckworth et al. 2007). SLA research has tapped grit either by means of generic tools, such as the 12-item Grit Scale (Grit-O; Duckworth et al., 2007) or the abbreviated 8-item Grit Scale (Grit-S; Duckworth & Quinn, 2009), or the L2 grit scale developed by Teimouri et al. (2020). Among others, researchers have explored levels of grit and its temporal variation (e.g., Zawodniak et al., 2021) and its relationship to other IDs, such as curiosity, motivation, willingness to communicate, emotions or engagement (e.g., Khajavy, 2021; Lee, 2020; Pawlak et al, 2022; Resnik et al., 2021), links to achievement (e.g., Pawlak et al., 2022; Teimouri et al., 2020) and teachers’ grit (e.g., Sudina et al., 2021). Even though this line of inquiry is not without its share of problems, related, for example, to the conceptualization and measurement of the construct (Credé & Tynan, 2021), research into grit holds much potential, as it can illuminate yet another piece of the puzzle in terms of the role of individual variation in L2 learning.

In view of the fact that L2 grit has only recently found itself in the crosshairs of SLA researchers, it is not surprising that empirical investigations of this factor in CALL are few and far between. In fact, the concept has mostly been examined as an independent variable mediating the contribution of other IDs rather than an attribute worthy of exploration in its own right. In particular, L2 grit was investigated as a predictor of L2 willingness to communicate in in-class, out-of-class, and digital settings. While this factor proved to affect readiness to speak in the three

settings in the study by Lee and Hsieh (2019) in the Taiwanese context, this was only the case for digital settings in the research project undertaken by Lee and Lee (2020) in the Korean context. The predictive role of L2 grit was also examined with respect to anxiety and enjoyment manifested by learners of English during emergency online classes together with trait emotional intelligence (TEI) in the study carried out by Resnik et al. (2021). L2 grit proved to be a predictor of all three variables, with students characterized by greater grit and TEI being more likely to enjoy their classes and those less gritty being more likely to succumb to anxiety.

Learning Styles

Learning styles, which can be defined as “the characteristic ways in which individuals orient to problem solving” (Ellis, 2008, p. 660), are intuitively appealing not only to researchers but also to L2 learners and teachers. This is because, as Griffiths and Soruç (2020) write, the construct “(...) offers the potential to make learning more enjoyable and successful; it acknowledges individual differences, rather than adopting a ‘one size fits all’ approach” (p. 97). In other words, when teachers have time and are willing to invest the necessary effort, they can tailor techniques, materials, and resources used so that they match predominant learning styles, thus increasing the likelihood that instruction will be more effective. At the same time, SLA specialists are not overly enthusiastic about the potential of the concept, which may help explain why research in this area has lost momentum over the last decade or so. The main reason for this situation is that learning styles are hard to define, they are often confused with similar notions (e.g., learning strategies), and different labels are employed to refer to similar dimensions (cf. Dörnyei, 2005). In addition, a number of classifications together with related instruments are available, some of which come from educational psychology (e.g., Riding, 2002), while others have been designed to probe learning styles in L2 learning, such as the *Perceptual Learning Style Preference Questionnaire* (PLSPQ; Reid, 1995), the *Learning Style Questionnaire* (LSQ; Willing, 1987) or the *Learning Style Survey* (LSS; Cohen et al., 2001). There is also the question concerning the extent to which learning styles are fixed, with some specialists arguing that it is possible to engage in *style stretching*, whereby an alternative approach to handling a specific task is encouraged (Cohen & Henry, 2020; Gregersen & MacIntyre, 2014). Such problems notwithstanding, there is copious empirical evidence linking learning styles to SLA. For example, researchers have given considerable attention to the distinction between *field dependence* (FD) and *field independence* (FI), showing that although greater FI may predict more successful L2 learning in formal and informal conditions (e.g., Baran-Łucarz, 2012; Chapelle & Roberts, 1986), FD can be more advantageous in communicative contexts (e.g., Nel, 2008). There have also been attempts to explore the role of perceptual preferences (e.g., Chen, 2009) and to determine the extent to which learning styles affect LLS use (e.g., Littlemore, 2001), the performance of specific tasks (e.g., Pawlak, 2018a) or the efficacy of various instructional options, in particular with respect to the provision of CF (e.g., Kim & Nassaji, 2018).

Shifting the focus of CALL settings, even though the contribution of learning styles has unsurprisingly been the focus of numerous empirical investigations, such research has been less

frequent than in the broader field of SLA. The main emphasis has been placed on the contribution of perceptual learning styles in relation to different technology-enhanced applications or environments. For example, Aliweh (2012) revealed that more favorable attitudes toward web-based activities were positively associated with kinesthetic, tactile, and visual learning styles, while Lee et al. (2016) demonstrated that new technologies were more likely to be taken advantage of by learners characterized by visual and kinesthetic learning styles than those with auditory and tactile learning styles, irrespective of age or gender. Some studies have also focused on very selected dichotomies of learning styles and their effects on specific areas of TL attainment. In one study, Chapelle and Heift (2009) found little evidence for the role of the FI/FD dimension in predicting the use of technology, while in another, Chen and Tseng (2019) showed that the cognitive style of holism and serialism (Pask, 1987) did not influence the perceptions of scaffolding English e-assessment learning but affected actual learning of grammatical concepts. Sato et al. (2021), in turn, examined whether verbalizers and imagers, established on the basis of the *Style of Processing Questionnaire* (Childers et al., 1985), were more likely to benefit from the use of static and dynamic visual aids in the acquisition of English spatial prepositions. Not overly surprisingly, it was imagers who proved to have an edge under both instructional conditions.

Learning Strategies and Self-Regulation

Research on LLS has witnessed considerable evolution since the concept gained recognition thanks to good language learner studies (e.g., Rubin, 1975). Oxford (1990) defined the construct as “specific actions taken by the learner to make learning easier, faster, more enjoyable, more self-directed, and more transferable to new situations” (p. 8). She also developed an influential classification, where LLS were divided into *direct* (i.e., memory, cognitive, and compensation) and *indirect* (i.e., metacognitive, affective, and social). This taxonomy provided a basis for the *Strategy Inventory for Language Learning* (SILL), which has been used in a large number of studies and remains an instrument of choice in empirical investigations of strategic learning (Amerstorfer, 2018). Over the years, other definitions have been proposed (e.g., Cohen, 1998; Griffiths, 2018), but although they may have stressed some aspects more than others, all of them have perceived LLS as actions and thoughts in which individuals deliberately engage to enhance the process of L2 learning and use in various contexts. Understood in this way, the construct came in for severe criticism on theoretical and methodological grounds (cf. Grenfell & Macaro, 2007), which culminated in appeals that it should be abandoned in favor of the notion of self-regulation (e.g., Dörnyei, 2005). Self-regulation, defined as an internal ability to actively foster and manage various aspects of the learning process (Zimmerman, 2000), was simply believed to be a more inclusive, manageable, and useful concept.

Despite all the criticism, research on LLS has never been discontinued; it has managed to reinvent itself, and judging by the spate of recent publications (e.g., Chamot & Harris, 2019; Griffiths, 2018; Oxford, 2017; Oxford & Amerstorfer, 2018; Pawlak, 2021c; Pawlak & Oxford, 2018), it keeps flourishing and continues to be extended to different instructional contexts. In particular, it has been recognized that LLS and self-regulation are complementary rather than

mutually exclusive (Thomas & Rose, 2019; Teng & Zhang, 2021), and attempts have been made to integrate the two concepts, as evident in Oxford's (2017) model of strategic self-regulation (S2R). In addition, it is now stressed that strategies are not applied in isolation but in clusters or chains, their use is mediated by an intricate combination of learner-internal (e.g., anxiety) and learner-external (e.g., task demands) factors, and these factors are responsible for their dynamism. All these features have been acknowledged in the recent, all-inclusive definition proposed by Oxford (2017). The foci and methodology of research into LLS have changed in line with such developments. Initially, the primary thrust was on repertoires of strategies employed in different contexts, variables moderating strategy use (e.g., gender), links of such use to attainment, and the effects of strategy-based instruction (cf. Griffiths, 2018; Griffiths & Soruç, 2020; Pawlak, 2021c; Takeuchi et al, 2007). More recently, attention has been given to examining reliance on LLS in learning specific TL skills and subsystems, such as grammar (e.g., Pawlak, 2018b, 2020b; Pawlak & Csizér, 2022) and, less frequently, to exploring the construct through the prism of self-regulation (e.g., Pawlak et al., 2020; Seker, 2016) or investigating strategy use in the performance of specific tasks (e.g., Cohen & Wang, 2018).

In regard to research on LLS in CALL-related environments, it should first be pointed out that the concept is often understood here more broadly than in SLA because it also includes communication strategies (i.e., devices employed to get messages across despite lacking TL resources) or negotiation of meaning (i.e., interactive efforts to ward off or overcome communication breakdowns). Another important observation is that such studies tend to focus to a much greater extent on LLS use in specific areas of TL (e.g., reading or vocabulary), they are conducted to gauge the utility of specific technology-enhanced solutions, and they sometimes focus on selected types of strategies (cf. Zhou & Wei, 2018). For example, Rahimi and Katal (2012) explored the use of listening strategies, showing that metacognitive LLS were predictors of podcast use. Hung (2016) looked at the use of speaking strategies in response to multimodal video feedback and text-based feedback, whereas Lee (2020) investigated writing strategies employed when working with an automated content feedback program. Empirical evidence concerning TL subsystems is relatively scant, with the main emphasis on vocabulary learning strategies (e.g., Li, 2009) and other areas being neglected, which is reflective of the situation in SLA. Worth mentioning here are studies by Cohen et al. (2011), who evaluated the website for learning Spanish grammar, and Hwu (2007), who set out to determine how a specifically designed application aided the acquisition of Spanish past tense forms. There are also studies that have tapped into the employment of LLS in distinct CALL-based environments, such as Shih and Huang (2020), who examined the use of metacognitive strategies in a flipped university classroom, and Chen et al. (2021), who investigated the application of social strategies in three contexts: self-directed learning outside synchronous online classes, assessment task completion online, and participation in synchronous online classes. Attempts have also been made to gauge the effects of instruction in the use of LLS, although this has seldom involved following specific models (Gu, 2019). Relevant studies include Chang and Chang (2014), who trained college students in listening comprehension strategies for 16 weeks, and Bai et al. (2021), who instructed learners in the use of writing strategies in a blended mode, also looking at writing motivation and

acceptance of e-learning. Finally, researchers have also targeted L2 learners' ability to self-regulate their learning in CALL environments (e.g., Lai & Gu, 2011; Rahimi & Fathi, 2021).

Beliefs

Learner beliefs can be described as assumptions about L2 learning that individuals hold that have the potential to impact the ways in which they approach learning tasks (Ellis, 2008; Gregersen & Macintyre, 2014). As Ellis (2008) aptly comments, "(...) learners do vary considerably in their beliefs about language and language learning and it is reasonable to assume that their beliefs influence both the process and product of learning" (p. 699). A seminal attempt to examine learner beliefs was made by Horwitz (1985), who viewed the construct as a combination of preconceived notions or misconceptions. She developed the *Beliefs About Language Learning Inventory* (BALLI), which has been used in numerous empirical investigations. Since then, there have been many endeavors to reconceptualize the concept, which, among others, have stressed its link to metacognition (Wenden, 1999), epistemological beliefs (Mori, 1999), metaphors (Kramsch, 2003) or emotions (Barcelos, 2015), as well as emphasizing the complexity and dynamism of beliefs (Barcelos & Kalaja, 2011). Such modifications have not in the least diminished scholars' conviction that beliefs are important contributors to success or failure in L2 learning or discouraged research in this area. Empirical studies have investigated, for example, beliefs about different skills and subsystems (e.g., grammar, e.g., Pawlak, 2018b), the ways in which CF should be provided (e.g., Ha et al., 2021), content-based instruction (e.g., Briggs et al., 2018), classroom experiences (e.g., Nilsson, 2020) or the use of the first language (e.g., Wach & Monroy, 2019). There has also been empirical interest in self-efficacy beliefs referring to "(...) a self-evaluation of how able you feel to carry out a specific task in a specific situation successfully" (Irie, 2021, p. 100). Empirical evidence has shown that such beliefs are predictors of attainment (e.g., Chao et al., 2019), they interact with other ID factors (e.g., Sardegna et al., 2018), and they are relevant in various contexts, including study abroad (e.g., Pawlak et al., 2020).

Given that beliefs can influence learning processes, it should not come as a surprise that they have been quite frequently investigated in CALL. In many cases, learner beliefs were examined in a very general manner, sometimes also with the intention of determining whether they translate into the use of new technologies. In one such study, Lai and Gu (2011) provided evidence that positive beliefs about CALL facilitated access to different resources, although participants were less optimistic about the potential of technology to instigate more frequent opportunities for communication. Sydorenko et al. (2017) revealed that more frequent use of CALL brought about more positive beliefs, while Alhamami (2018) found that the intention to attend L2 classes and to learn in face-to-face and online settings hinged on attitudes toward the mode of learning. There are also studies that have examined L2 beliefs in relation to specific types of CALL or TL areas. Olejarczuk (2018), for example, probed the beliefs of ESP students about a blended language course in which in-person instruction was combined with Moodle, while García-Gómez (2020) carried out a cross-cultural study that explored university students' beliefs about using WhatsApp to perform group tasks outside the classroom and the effect of

these beliefs on the nature of interactions. Some studies, typically quasi-experimental in nature, have also focused on self-efficacy beliefs typically designated as an outcome variable. One relevant study is Rahimi and Fathi (2021), who examined the effects of wiki-mediated collaborative writing in relation to self-regulation and self-efficacy, and L2 performance. Another was conducted by Sanchez-Castro and Strambi (2017), who looked at discourse roles in face-to-face and synchronous CMC by learners with low and high self-efficacy.

Motivation

There is a general consensus that motivation is a major determinant of L2 learning. Dörnyei and Ryan (2015) make the following comment: “Without sufficient motivation, even individuals with the most remarkable abilities cannot accomplish long-term goals, and neither are appropriate curricula or good teaching enough” (p. 72). It is thus not surprising that L2 motivation has never ceased to capture the attention of SLA researchers, and the intensity of empirical inquiry in this area has never abated (Lamb et al., 2020). At the same time, new theoretical accounts of how this ID factor affects L2 learning have emerged, and the field has gone a long way since the *socio-psychological stage*, where the main emphasis was placed on the role of attitudes and the concept of integrativeness (Gardner, 1985). In fact, the subsequent stages have included the *cognitive-situated phase*, which built on theories of motivation in educational psychology, such as self-determination theory (Deci & Ryan, 1985), and related research on L2 motivation to classroom learning, and the *process-oriented phase*, which laid store by changes in the nature and intensity of motivation (e.g., Dörnyei & Ottó, 1998), and, finally, the *socio-dynamic period*, which is grounded in CDST (Larsen-Freeman & Cameron, 2008). Importantly, the onset of new phases did not cancel out previous theoretical accounts; therefore, investigations of motivation continue to draw on a diversity of perspectives.

The bulk of research on L2 motivation is currently informed by the theory of the L2 motivational self-system (L2MSS), which encompasses three dimensions: *the ideal L2 self*, related to learners’ future vision of themselves as L2 users, *the ought to L2 self*, concerning the pressure coming from external forces (e.g., parents) and the fear of adverse consequences (e.g., dropping out), and the *L2 learning experience*, linked to the impact of the immediate environment (e.g., nature of classroom instruction). In this model, motivation arises from the tension between the current and future selves as well as learners’ efforts to reduce the distance between the two (Csizér, 2020; Dörnyei, 2009b). The L2MSS has provided an impetus for a large number of quantitative studies (e.g., Busse, 2013; Csizér & Lukács, 2010; Taguchi et al., 2009) and qualitative studies (e.g., Kim, 2009; Miyahara, 2014). Al-Hoorie’s (2018) meta-analysis showed that the three components are positive predictors of motivated learning behavior, with the ideal L2 self-playing the most important role, even though methodological issues were also highlighted. There are also other promising lines of inquiry, only some of which have been inspired by the L2MSS. These include directed motivational currents (DCMs), or surges of motivation triggered by personally important goals (e.g., Dörnyei et al., 2016; Muir, 2020), unconscious motivation (e.g., Al-Hoorie, 2016), group motivation (e.g., Fukada et al.,

2020), demotivation (e.g., Kikuchi, 2019), motivation to learn languages other than English (LOTEs; Dörnyei & Al-Hoorie, 2017) or the use of motivational strategies (e.g., Lamb, 2020).

Research into the role of motivation in technology-enhanced L2 learning has been extensive, which is understandable given the decisive role attributed to this variable. This said, there are two crucial issues concerning such investigations: (1) many of the studies can be considered atheoretical as no attempt is made to specify the model in which they are grounded; moreover, even when this happens, there are issues related to the validity and reliability of the instruments employed, and (2) in contrast to SLA research, many studies have sought to investigate changes in motivation as a result of the application of new technologies, which is their undeniable strength. Regarding specific studies, Wehner et al. (2011) revealed that the use of the virtual world Second Life had a beneficial impact on motivation, measured by means of a survey based on Gardner's (1985) *Attitude/Motivation Test Battery*. Chen and Brown (2012) showed a positive impact of authentic task-based CMC instruction on motivation, even though this construct was not properly operationalized. Lamb and Arisandy (2020) revealed that online informal learning of English was positively associated with high motivation to develop TL proficiency, with the L2MSS being adopted as a point of reference. There are also some intervention-based studies that have included motivation as either a mediating or outcome variable. Kelley (2010), for example, showed that the use of social networking sites had a positive impact on motivation, which, however, was tapped through a questionnaire including items taken at random from other data collection tools. Similar results were reported by Ebrahimzadeh and Alavi (2017) in a study that examined the impact of video games on motivation, with the caveat that it was watching the game rather than playing it that did the trick. More recently, positive effects of CALL on motivation have been uncovered by Canals (2020) in the case of virtual language exchanges, and Rivera-Trigueros and Sánchez-Pérez (2020) for gamification. Worth mentioning is also the study by Alamer and Al-Khateeb (2021), who explored the impact of teachers' informal use of WhatsApp on motivation, conceptualized in terms of self-determination theory (Deci & Ryan, 1985). It was found that autonomous motivation increased only among learners who were invited to use the application.

Willingness to Communicate

The construct of willingness to communicate (WTC) was initially investigated in communication studies in the first language and was perceived as a stable personality-based trait (McCroskey & Richmond, 1987). Since interaction is viewed as one of the necessary conditions for L2 acquisition (Loewen & Sato, 2018), the concept made its way into SLA and is defined as the "readiness to enter into discourse at a particular time with a specific person or persons, using an L2" (MacIntyre et al., 1998, p. 547). In this context, it was necessary to go beyond personality and to recognize that, even for proficient learners, readiness to contribute to interaction depends on an array of psychological, linguistic, and contextual factors (cf. Dörnyei & Ryan, 2015; Yashima, 2021). This stance found its reflection in the pyramid model put forward by MacIntyre et al. (1998), where L2 WTC is portrayed in terms of six layers of variables, with the more permanent (e.g., intergroup climate) being placed at the bottom and the more transient (e.g.,

desire to communicate with a specific person) closer to the top. Initial research into L2 WTC drew on the macro-perspective and attempted to identify antecedents of readiness to speak in different settings. Among others, it was revealed that high levels of self-perceived communicative competence enhance WTC while increased anxiety hampers it (e.g., Khajavy et al., 2016; Liu & Jackson, 2008; Peng, 2007) and that the attribute is directly and indirectly impacted by motivation (e.g., Munezane, 2013; Wu & Lin, 2014), international posture (e.g., Yashima, 2002), extraversion (e.g., Cetinkaya, 2005), teaching style (e.g., Chen et al., 2022), or gender and age (e.g., Baker & MacIntyre, 2000). The last two decades have seen a shift to empirical investigations grounded in the micro-perspective with a focus on WTC in specific situations and its fluctuations over time. Such research has generated insights into a number of variables underpinning readiness to speak, such as classroom organization, mode, interlocutor familiarity and involvement, topics and tasks, planning, classroom atmosphere, teacher-related factors and culture (e.g., Cao, 2011; Cao & Philip, 2006; Kruk, 2021a; MacIntyre & Legatto, 2011; Pawlak & Mystkowska-Wiertelak, 2015; Pawlak et al., 2016; Peng, 2014; Weaver, 2007; Zarrinabadi, 2014). There are also innovations in investigations into L2 WTC with respect to their foci and methodology. For example, attempts have been made to link the construct to TL subsystems, such as pronunciation (e.g., Baran-Łucarz, 2014), as well as to other ID factors, such as grit and engagement (Khajavy, 2021).

Most research into L2 WTC in CALL environments has focused on establishing whether the use of new technologies enhances readiness to speak and identifying potential mediating factors. The studies by Kissau et al. (2010) and Reinders and Wattana (2015) provided evidence that online learning environments lead to a greater readiness to interact, mainly by reducing the deleterious influence of affective factors such as anxiety. Lee (2019) showed that L2 WTC in digital extramural learning (i.e., unstructured learning outside the classroom) was affected by three types of factors (i.e., socio-political, contextual, and individual), while Al-Amrani and Harrington (2020) found that although CMC was likely to increase readiness to speak, this was not true for all students. Of particular relevance are quasi-experimental, intervention-based studies that have attempted to determine the impact of new technologies on WTC. Buckingham and Alpaslan (2017) uncovered that out-of-class asynchronous speaking practice in the form of prerecorded communicative exercises had a beneficial influence on readiness to speak and L2 oral performance. Mohammadi et al. (2019) demonstrated that the use of the flipped classroom model contributed to greater L2 WTC, also resulting in greater learning gains. However, another line of inquiry encompasses studies that have looked at the way in which other IDs influence readiness to speak. Lee and Hsieh (2019), for instance, found that L2 self-confidence and grit were important predictors of L2 WTC in in-class, out-of-class, and digital settings, but L2 anxiety played a part only in the first two of these. Lee et al. (2019), in turn, demonstrated that differences in WTC in various settings may be a function of educational context.

Engagement

Even though the concept of engagement has a relatively short history in educational psychology, it is often viewed as “the holy grail of learning” (Sinatra et al., 2015, p. 1). Mercer (2019)

explains that the construct refers to “the dynamic state when learners are actively thinking about, focusing on, and enjoying their language learning” (p. 643), thus ultimately determining the success or failure of any act of learning, including L2 learning. Specialists emphasize the actional element of engagement, which distinguishes it from the closely related notion of motivation (Hiver et al., 2021; Mercer, 2019; Mercer & Dörnyei, 2021). Another crucial feature is multidimensionality, and although disagreements abound, a distinction is made between *behavioral engagement* (e.g., participation in interactions), *cognitive engagement* (i.e., mental effort invested in learning), *affffective engagement* (i.e., emotions about L2 learning), and *social engagement* (i.e., interaction with others). Two additional features of engagement are that it is situated and context-dependent, and that it is malleable and subject to change over time (Hiver et al., 2021). Research into engagement in SLA is still in its infancy, but it is clearly gaining momentum. The construct was ushered into the field by Svalberg (2009), who introduced the concept of *engagement with language* (EWL) or the manifestation of the active construction of L2 knowledge. Most existing studies have focused on learners’ involvement in communicative task performance (e.g., Baralt et al., 2016), their attention to TL features through language-related episodes (e.g., Svalberg, 2021), or verbal and non-verbal behaviors (e.g., Michell, 2012). Some studies have examined fluctuations in engagement during the performance of tasks, operationalizing it in a variety of ways and opting for alternative labels, such as *interest*, *motivation*, or *WTC* (e.g., Aubrey, 2022; Guo et al, 2020; Pawlak, 2012b; Pawlak et al., 2016). There have also been attempts to trace temporal changes in engagement (e.g., Oga-Baldwin & Fryer, 2021) or to relate it to other IDs and attainment (e.g., Khajavy, 2021). A critical issue in all such studies is a valid and reliable measurement of various facets of engagement, a daunting challenge that can be facilitated by the use of technology (Reinders & Nakamura, 2021).

Indeed, as shown by existing research on engagement in CALL, the construct may be easier to track thanks to the use of technology, although mirroring the situation in SLA, it has been examined under different guises, and its facets have seldom been teased apart. One line of inquiry pertains to the performance of computer-mediated collaborative tasks and basically builds on the concept of EWL (Svalberg, 2009). For example, Elola and Oskoz (2010) demonstrated that collaborative wiki writing allowed L2 learners to construct and reconstruct their TL knowledge, while Lee (2010) showed that, in such tasks, the writing process was considerably aided by scaffolding through the provision of CF. More recent investigations have targeted the construct more directly, also giving attention to its specific dimensions. Lee (2020) demonstrated that cognitive engagement during technology-enhanced essay writing manifests itself through the use of distinct strategies linked to specific types of mental activity. Lui and Lai (2022) found that affective, cognitive, and behavioral engagement tended to change in response to feedback type, and Aubrey (2022) revealed that engagement, operationalized as focus and interest, was higher in video chat than text-based chat, although it had a tendency to fluctuate in both settings.

Emotions

Similar to many other concepts in psychology, emotions are complex and multidimensional, thus not lending themselves to straightforward characterizations (Oxford, 2021). This is evident in the definition offered by Reeve (2005), who describes them as “(...) short-lived, feeling-arousal purposive-expressive phenomena that help us adapt to the opportunities and challenges we face during important life events” (p. 294). The complexity of emotions has also been acknowledged in SLA, with Dörnyei (2009a) viewing them, alongside motivation and cognition, as a crucial element underlying the functioning of the human mind. The control-value theory of achievement emotions (Pekrun et al., 2007) posits that emotions should be considered along three dimensions: *valence* (i.e., pleasantness or unpleasantness), *activation* (i.e., the extent to which they generate involvement), and *focus* (i.e., on the performance of an activity or its outcome). Accordingly, positive and negative emotions come to the fore depending on the level of control over the activity and the value that is attributed to it. This said, such emotions do not simply represent the flip side of the same coin, and in line with broaden-and-build theory (Fredrickson, 2001), they perform different functions (MacIntyre & Gregersen, 2012). Moreover, the effects of these emotions may be unpredictable since, for example, anxiety or shame can under some circumstances provide a stimulus for action and, paradoxically, generate positive emotions (Teimouri, 2018).

For a long time, research on emotions in SLA was mainly confined to anxiety, or “a distinct complex of self-perceptions, beliefs, feelings, and behaviors related to classroom language learning arising from the uniqueness of the language learning process” (Horwitz et al., 1986, p. 128). Researchers have sought to identify the causes of this aversive emotion, shed light on its effects in relation to specific areas of the TL, relate it to other ID factors, or tap into its fluctuations over different time scales (e.g., Dörnyei & Ryan, 2015; MacIntyre, 2017). Only in the last several years have specialists set their sights on other emotions in L2 learning, mainly under the influence of positive psychology (MacIntyre & Mercer, 2014; MacIntyre et al., 2019). The positive emotion that has received the most attention is enjoyment, “a positive affective state that combines challenge, happiness, interest, fun, sense of pride, and sense of meaning” (Dewaele & Li, 2021), with the main focus on illuminating its link with anxiety (e.g., Boudreau et al., 2018; Dewaele et al., 2018). However, another emotion that has instigated vibrant research activity is boredom, or “a state of disengagement caused by lack of interest and involvement” (Kruk et al., 2021, p. 21). This attribute has been examined in quantitative, qualitative, and mixed-methods studies, which allowed the identification of its internal structure, variables accounting for its fluctuations, and links to other IDs (e.g., Kruk et al., 2021; Li, 2021; Nakamura et al., 2021; Pawlak et al., 2020a, 2020b, 2022). Research into other emotions has been limited and has focused on, among others, curiosity (Mahmoodzadeh & Khajavy, 2019), hope (Ross & Rivers, 2018), pride (Ross & Stracke, 2016), shame (Galmiche, 2017) and guilt (e.g., Teimouri, 2018).

What surely comes as a surprise, research into emotions in CALL is extensive and far exceeds the scope and volume of studies undertaken in traditional classrooms. One reason for this could be that some CALL researchers were quick to pick up on new ideas concerning the role of

emotions and test them in an area familiar to them. Another, probably a much more important one, was the transition to online education because of the COVID-19 pandemic, which left researchers with little choice but to conduct empirical investigations into emotions just introduced into the field in online settings. Following the trends in the field of SLA, for several decades, CALL researchers have mainly focused on anxiety, first looking at its occurrence and causes in connection with new technologies (Kessler, 2010; McNeil et al., 2014; Satar & Özden, 2008) and subsequently tapping into its fluctuations over time (Elahi Shirvan & Taherian, 2018; Melchor-Couto, 2017). As is the case with motivation and WTC, intervention studies have also sought to determine whether the use of technology can contribute to decreasing anxiety. A good example is a study by Yang et al. (2022), who showed that an online simulation game was more effective in reducing this aversive emotion than onsite learning. The bulk of the remaining empirical investigations has focused on boredom. Drawing on the macro- and micro-perspective, the majority of such studies have tracked fluctuations in boredom over time. For example, Kruk (2021b) showed in his case study of an English major in Poland that anxiety was prone to change as a result of contextual and individual factors, including learning styles. Derakhshan et al. (2021), in turn, identified a number of causes of boredom in online classes and strategies employed to cope with this negative emotion. Other emotions have been explored to a lesser extent, notable exceptions being the study by Hong et al. (2020), who examined the role of curiosity, as well as those undertaken by Yoshida (2020) and Frascini and Tao (2021), who looked at both positive and negative emotions. Invaluable insights come from investigations that have examined relationships among different emotions and other IDs. Kruk (2021c), for example, explored causes of and changes in anxiety, boredom, motivation, and WTC in Second Life, while Kruk and Pawlak (2022) focused on the interplay between the positive emotions of curiosity and enjoyment and the negative emotions of boredom and anxiety in the same setting.

Conclusion

The aim of the present paper has been to look for intersections between research on ID factors in SLA and CALL. On the one hand, it is undeniable that SLA researchers have been blazing the trail in studies on the role of such factors in L2 learning, and CALL specialists have been following in their footsteps, logically drawing guidance and inspiration from relevant empirical investigations. While research into LLS, engagement or emotions has kept up with the latest developments in SLA, the same cannot be said about aptitude, working memory, personality, grit, learning styles, motivation, and to some extent also WTC. It is not only the fact that such research has fallen behind with major advances in the field but also that sometimes it has not been underpinned by relevant theoretical models, which is most blatant in the case of the study of L2 motivation. In addition, the dynamicity of ID factors has rarely been examined, and methodological innovations have seldom been utilized for this purpose. On the other hand, there are also areas in which CALL-based research on IDs has been faring quite well, and it could in fact lay out the path that SLA studies should follow. What is particularly commendable is a large number of intervention-based studies or those in which the mediating effects of ID variables are probed (e.g., motivation, willingness to communicate, self-efficacy beliefs). One must also

appreciate highly innovative investigations of engagement that have succeeded at least to some extent in teasing apart its different dimensions. This testifies to the enormous potential of CALL functionalities in conducting research on IDs from a micro-perspective, especially when the aim is to capture the temporal variation of attributes under investigation (e.g., through experience-based sampling).

At the same time, it must be acknowledged that research on IDs in SLA and CALL is afflicted by similar limitations, which include (1) almost identical areas of neglect (e.g., GLS), (2) failure to illuminate the contribution of complexes of ID factors, and (3) few attempts to shed light on the moderating effects of ID variables on the efficacy of instructional options, in particular such that they would be the most relevant to practitioners. Such a situation is not overly surprising in view of the fact that a number of researchers wear two different hats and are active in both fields. In addition, as noted above, experts in research on ID factors often lack sufficient knowledge about form-focused instruction, which largely precludes designing and implementing successful interventionist studies where ID factors could be incorporated.

The key question that arises at this juncture is how the takeaways from the discussion in this paper can help push the empirical investigation of ID variables forward to align it with the advances in the field of SLA. Several concrete recommendations can be made: (1) there is a need for more balance with respect to the IDs being examined, (2) the conducted studies should be informed by specific theories concerning variables under investigation and draw on related data collection tools, (3) efforts should be made to take into account the most recent developments in SLA (e.g., emerging conceptualizations of some constructs, novel research procedures), (4) even greater emphasis should be placed on examining IDs in specific settings, both with respect to TL subsystems and skills, and in relation to concrete CALL applications and environments, (5) there is a need for more research rooted in the micro-perspective, particularly such that would tap into temporal variation of IDs, (6) attempts should be made to examine and identify complexes of individual differences, (7) the mediating effects of ID variables on diverse instructional options should be explored, and (8) constant exchange of ideas between SLA and CALL is indispensable. This last point is, indeed, of pivotal importance because, as has been demonstrated in this overview, the transmission of ideas and good practices is by no means always unidirectional. Thus, close cooperation between representatives of the two camps, some of whom are active in both, holds the promise of enhancing our understanding of individual variation in L2 learning and in fact capitalizing on such variation.

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