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4 A Holistic Person-Centred Approach to Mobile-Assisted Language Learning

Hongying Peng, Sake Jager,
Steven L. Thorne and Wander Lowie

For many decades, quantitative second language (L2) researchers have been operating under the assumption that group averages reveal something about the individuals comprising the population on which they are based. This chapter constructively contests this assumption and offers an augmentative methodological and theoretical framework that emphasises person-centredness (Benson, 2019). Research has increasingly shown that L2 learning and use are essentially individually owned. This is perhaps especially the case in today's technologised world, where L2 learners have access to diverse and myriad learning resources that articulate with their personal goals, learning interests and preferences, prior knowledge and language and digital competencies. It is with this contemporary context in view that we present an ecological person-centred account of language learning. With a focus on individual learners, the person-centred approach views each individual as a relationally constituted whole, where intra- and extra-individual attributes and resources are understood to form an entangled system that jointly contributes to the process of language development. With a brief discussion of an empirical example of a clustering approach to analysing learning experiences mediated by mobile technologies, this chapter elucidates how the application of person-centred methods can help to advance our understanding of complex L2 phenomena. The conclusion discusses implications of the person-centred approach for L2 research and teaching.

Introduction

There is a growing acceptance of the view that language, as a complex and adaptive system, is interrelated with and embedded in our cultural, sociological and psychological lives (see Five Graces Group, 2009; Verspoor, 2017). In such a view, language learning is recognised as

a dynamic process that results from the interplay between a wide range of learner-internal and -external variables as well as their simultaneous interaction with the learning environment (e.g. de Bot *et al.*, 2007). Considering that the number of variables at play and the way they interact are usually different for different learners, each individual tends to show distinctive developmental trajectories (Verspoor *et al.*, 2017). Especially in today's globalised and technologised world, learners have available a multiplicity of language learning resources through which to explore personal goals, learning interests and preferences, and which potentially expand upon prior knowledge, language abilities and digital competencies (Kukulska-Hulme, 2016; Thorne, 2008).

Emerging technologies integrate diverse online resources with opportunities for interaction and communication with people from remote corners of the globe, creating conditions under which the boundaries between classroom-based guided learning and autonomous learning in learners' everyday lifeworlds are blurred (Thorne, 2013; Thorne *et al.*, 2015). Concomitant with global changes afforded by digital mediation are learners' pursuits of differentiated learning goals. That is, today's multilingual and technology-supported culture is redefining when, why and how languages are learned and used (Chinnery, 2006; Larsen-Freeman, 2017; The Douglas Fir Group, 2016). In direct application to our study, Kukulska-Hulme (2016) further recognises that digital language learning using mobile technologies offers an augmented potential for personalisation. To cope with the increasing complexity and diversity of language use in the 21st century, taking an ecological approach that simultaneously examines individual learners and their interdependence with a spatial-temporal context is warranted. This focus on the individual operating contingently in a spatial-temporal context redirects second language (L2) research to 'a more person-centred frame of reference' (Larsen-Freeman, 2017: 60).

It is from this perspective that we present an ecological and person-centred account of language learning in a technologised society. By focusing on individual learners, the person-centred approach views each individual as a functioning whole in interaction with components of larger systems that jointly contribute to the process of language development. Specifically, we pursue an integrative consideration of learners' attributes (e.g. motivation, emotion, autonomy) and the contexts through which they emerge and evolve. In providing this explication, we have two main aims: (a) to advance our understanding of language learning in an increasingly technologised world, with a specific emphasis on mobile technologies, and (b) to develop innovative means for addressing the complexity of L2 learning phenomena that adequately account for individual variability and differing developmental trajectories. As noted by Verspoor *et al.* (2009), aspects of the publicly available linguistic environment are not uniformly noticed or passively absorbed by groups or

communities. Rather, living persons variably interact with text, talk and other semiotic resources. This results in potentially divergent developmental processes where the ‘same’ input may be acted upon in different ways that are contingent upon a person’s immediate needs and goals. In this sense, the meaning-making experiences of persons in interaction with other persons form complex and adaptive systems that reorganise themselves based on the contingencies of the immediate goal-directed activity at hand.

The chapter begins with an overview of the nature of the person-centred approach, including provisional definitions at the theoretical and methodological level, and the situation in which this approach could be used as a complementary or alternative tool to the standard variable-centred approach in the field of L2 research. It then discusses the methodological decisions essential for conducting person-centred research and presents an empirical study as an illustration of this method. The chapter concludes by highlighting issues believed to have important implications for future L2 research.

Conceptual and Analytical Unit: From the Variable to the Person

There is consensus in the L2 field that learners exhibit differential success in their L2 learning. To elucidate why this is the case, abundant research has been conducted to investigate individual differences (ID) such as age, aptitude, motivation, emotion, learning belief and the use of learning strategies (see Dörnyei & Ryan, 2015). Studies have identified important factors that contribute to successful L2 learning, positively informing L2 research and pedagogy. However, quantitatively examining learners at the group level obscures learner diversity and can overshadow individual learning processes (Benson, 2019; Murakami, this volume). In addition, the dynamic nature of ID factors has gradually been acknowledged as non-stable, interconnected and contingent on context (Lowie & Verspoor, 2019), which problematises research methodologies that treat variables as inviolate conceptual and analytic units.

Recent studies that have adopted a dynamic systems perspective have shown that L2 learning and use are unique to each individual (Bulté & Housen, this volume; Verspoor *et al.*, 2017). Different learners, even those who appear highly similar in terms of the factors/variables under investigation, tend to present distinct learning trajectories over time (Lowie & Verspoor, 2019). These individualised learning trajectories have been largely sidelined in the second language acquisition (SLA) field’s search for causal language learning variables at the group level (Larsen-Freeman, 2001). Although group studies remain useful for identifying factors influential for L2 learning and use, research efforts should equally attend to individual learning processes which involve the intricate interplay of learners’ individual attributes (e.g. motivation, emotion,

aptitude and learning style) with the spatial-temporal contexts of human activity (e.g. Wind & Harding, this volume). This shift of focus from the variable to the individual ushers in a new person-centred era in L2 research (Benson, 2019; Larsen-Freeman, 2017).

Person-Centred Approach: Theoretical and Methodological Levels

The person-centred approach views each individual as a dynamic system, with interwoven components jointly contributing to the process of individual development. By ‘components’, we mean, for example, learning behaviours, learning motivation, learner emotion and learning contexts. They are traditionally viewed as distinct variables influential for L2 learning, but in the person-centred approach they are used to construct individuals’ learning patterns and should be interpreted as constituted in relation to each other. In other words, this indivisibility of components is core to a person-centred perspective. This view is related to Complex Dynamic System Theory (CDST) thinking that has gradually been embraced in the L2 field. Four basic tenets of this approach are presented:

- (1) *The process is partly specific to individuals.*
- (2) *The process is complex and is conceptualized as involving many factors that interact at various levels which may be mutually related in a complicated manner.*
- (3) *There is a meaningful coherence and structure (a) in individual growth and (b) in differences between individuals’ process characteristics.*
- (4) *Processes occur in a lawful way within structures that are organized and function as patterns of operating factors, where each factor derives its meaning from its relations to the others. Although there is, theoretically, an infinite variety of differences with regard to process characteristics and observed states at a detailed level, at a more global level there will often be a small number of more frequently observed patterns (‘common types’). (Bergman & Magnusson, 1997: 293)*

These four tenets describe a research focus on the individual and the associated phenomenal-experiential processes and practices associated with learning patterns. Specifically, each individual is seen as a functioning totality that can be studied by analysing his/her learning patterns. The identification of typically occurring patterns could reveal subgroups of learners who share those patterns. Searching for typical patterns has received considerable support from the study of language as a complex dynamic system. One characteristic of the language system is self-organisation, which refers to a process of spontaneous emergence of new patterns (van Geert, 2008) that arise from the interplay between learners’ internal and external attributes and resources. From this perspective, we could envision certain states (or what are called ‘attractors’) to occur

more frequently than others, corresponding to the aforementioned typical patterns.

Essentially, we could argue that understanding individual development, language development included, lies in a detailed examination at the individual level, with a focus on learning patterns. By way of classifying individuals with shared learning patterns into groups, distinct self-similar subgroups can be identified and a careful generalisation of individual cases can thus be made.

Classification and Person-Centred Methods

As the person-centred approach values learning patterns and recognises them as the basic unit of analysis and interpretation, a focal subject of this approach is to classify individuals who share similar typical patterns into different groups (Bergman *et al.*, 2003). Classification is a welcomed method in other fields, such as biology and psychology. For instance, individuals are often grouped into different personality types based on their shared traits (Csizér & Dörnyei, 2005).

With regard to classification issues, several methods are available, but their central concepts usually remain isomorphic. One of the concepts is similarity. To classify learners/patterns based on similarity, one could consider cluster analysis (CA). As a statistical technique, CA can ‘provide a bottom-up way’ (Staple & Bieber, 2015: 243) of identifying non-overlapping clusters/groups wherein the individuals have similar typical patterns. The clustered learner groups diverge largely from the learner groups targeted in traditional group studies. In traditional group studies, it is the researcher who selects or creates learner groups based on preconceived categorisations, while person-centred methods identify learner groups composed of similar learning patterns that emerge from the data (Bergman & Magnusson, 1997; Lee *et al.*, 2018; Papi & Teimouri, 2014). In this section, the initial focus is on the clustering in the cross-sectional dimension, which is later used as a building block for longitudinal clustering.

Cross-sectional clustering

L2 learning is a developmental phenomenon, and as we mentioned earlier, research should focus on the individual, the process and the learning pattern. It is also informative to analyse the learning patterns cross-sectionally. By way of grouping L2 learners into different types based on their shared learning patterns, cross-sectional clustering provides a nuanced picture of learner complexity and diversity in a systematic manner. For example, Papi and Teimouri (2014) conducted a CA of L2 motivation with a view to identifying learner groups with distinct motivational types. The clustering procedure yielded five self-similar groups that varied in terms of their motivational configurations. They further

identified how the five groups were different in their motivational, emotional and linguistic characteristics.

The establishment of different learner types provides an approach for researching complex L2 phenomena with practical implications for L2 instruction. By acknowledging the typical patterns specific to each learner group, adaptive and personalised instruction compatible with the characteristics and needs of different learner types can thus be tailored and employed to gain optimal learning outcomes. We suggest more studies that adopt a clustering technique in research on L2 development.

Longitudinal clustering

Although Papi and Teimouri's (2014) study convincingly illustrated the applicability of person-centred methods (e.g. the CA) in L2 motivation research, they collected data indicating L2 learners' motivational, emotional and linguistic states only at one time point, neglecting the fact that these learner attributes, from the dynamic perspective that their study took, may not be stable but rather fluctuate over time (Dörnyei *et al.*, 2014). The unstable nature of these attributes entails a process aspect to the person-centred approach, for example, the longitudinal CA.

Longitudinal CA is often incorporated in situations where multiple data gathering occurs across time (Bergman & Wangby, 2014). As mentioned earlier, if we adopt the person-centred approach, L2 learning trajectories for individuals show variability since interacting attributes and resources are contingent upon local conditions and hence differ across individuals (Lowie & Verspoor, 2019; Verspoor *et al.*, 2017). As such, the individual is at the core of understanding L2 learning and development and longitudinal case studies provide a significant source of insight into the L2 learning process (Lowie, 2017). Findings from cases that present shared longitudinal learning patterns can be aggregated and generalised. Ideally, a longitudinal data set with the same components measured at all time points would provide an accurate model of the individual's complete learning patterns. However, in practice, a comprehensive, fine-grained, longitudinal, person-centred analysis is not logistically feasible. Additionally, the results from numerous individual cases are often heterogeneous, hard to interpret and challenging to generalise from.

A remedy for this might be a cross-sectional pattern analysis followed by linking over time (Bergman & Magnusson, 1997). First, cross-sectional clustering of learning patterns could be carried out at each time point. What follows could be to link learner types/clusters at Time 1 to learner types/clusters at Time 2, and then a link between learner types/clusters at Time 2 to those at Time 3 and so on. Between each adjacent pair of time points, cluster membership should be cross-tabulated to give information about cluster membership combinations that occur more often than expected by chance (so-called developmental types) and

to look for individual stability (belongs to similar clusters at both time points) or dynamic changes.

A case in point would be Piniel and Csizér's (2015) examination of changes in motivation, anxiety and self-efficacy. By adopting a longitudinal clustering technique, they analysed whether persons in a given cluster remain in that group or jump to another cluster over time, the underlying idea being that 'development is not always gradual (but is not always a matter of qualitative shifts, either) and development is clearly different between individuals, but also shows general patterns or prototypical trajectories' (van Geert, 1994: 14). Therefore, the patterns of movement across clusters were called trajectories in their study. To capture the dynamic nature of the changes over time, Piniel and Csizér (2015) used the clustering results of the data collected at the first time point as the initial clusters for the second wave. In doing so, this study helped to unravel how interacting motivational, affective and cognitive factors shape learners' distinct learning patterns over a semester and how the learning patterns change over time. Diverging from prior work that revealed a negative correlation between motivation and anxiety, Piniel and Csizér (2015) found the existence of different motivation–anxiety relations for different learner types. Specifically, a trajectory with high motivation and low anxiety was more typical and less variable than another trajectory wherein learners showed both high motivation and high anxiety. Their findings disavowed the linear relationship between variables that had been long-held in L2 research and rather illustrated the power interrelationship dynamic among various attributes (Lowie *et al.*, 2017). This research suggests that a longer period of investigation with multiple points of data collection would yield a more intricate picture of developmental changes. Therefore, focusing on the learning process and applying longitudinal clustering analysis have the potential to provide insightful results, revealing the mechanism of multicausality and embedded and relationally constituted systems of L2 phenomena.

Empirical Study: Latent Profiles of Mobile Language Learners

Background

To elucidate how to apply an ecological person-centred perspective to L2 learning in today's globalised and technologised world, we present an empirical example of clustering learners' selective use of mobile technologies in their language learning. As a person-centred approach recognises language learning as a process of dynamic interactions between individuals' internal (e.g. motivation, emotion and aptitude) and external (e.g. learning context) attributes and resources, it logically follows that language knowledge is related to learners' everyday experience with goal-directed communication. With today's easy access to mobile technologies, learners' daily experience with language has expanded enormously.

By taking this into account, the current study focuses on L2 learning and use that are mediated by mobile technologies outside the classroom.

As emerging mobile technologies bring abundant opportunities for L2 learning and use, learners have immediate access to diversified and inexhaustible online resources that could serve to provide authentic language input, an essential element for L2 learning (Verspoor, 2017). Previous research has confirmed the effectiveness of mobile technologies in L2 learning (see Burston, 2015; Peng *et al.*, forthcoming; Sydorenko *et al.*, 2019; see Sung *et al.*, [2016] for meta-analyses), and examined the factors that moderate the effectiveness of mobile-assisted language learning (MALL) (e.g. Kim *et al.*, 2013; Xu & Peng, 2017). However, these explorations can only provide a partial and crude account of the nature of learners' language learning with mobile technology (Lai *et al.*, 2018). Examination of learners' selective appropriation of mobile learning resources (i.e. their lived experience with mobile technology resources) might help to better understand the nature and quality of learners' mobile language learning (Lai *et al.* 2018). Acknowledging learners' selective engagement with varied learning activities afforded by the mediation of mobile technology could also help teachers' better integrate learners' preferences with classroom instruction (Reinders & Benson, 2017).

Therefore, the current study targets the investigation of learners' engagement with learning activities that are mediated by mobile technologies. We applied Nation's (2007) four-strands principle to guide our interpretation of these mobile learning activities, as this principle can 'usefully be applied when learners take control of their own learning' (Nation & Yamamoto, 2012: 173). In their perspective, a good language learner should allocate an equal amount of time to activities representing meaning-focused input (MFI; e.g. reading and listening), meaning-focused output (MFO; e.g. speaking and writing), language-focused learning (LF; e.g. vocabulary, grammar, pronunciation) and fluency development (FD; e.g. activities involving the use of known language knowledge). We thus categorised the activities into MFI, MFO, LF and FD. Considering that the MFI and MFO activities somewhat overlap with the activities of the FD strand in the mobile learning context (Nation & Yamamoto, 2012), we discuss FD in reference to a combination of MFI and MFO activities. This study specifically examines whether, and how, L2 learners differ in their selective use of mobile technologies for language learning. According to the person-centred approach, though each learner has his/her own distinctive motives, attitudes and favoured ways of processing language information, there are likely learners who share common attributes in their learning patterns. Therefore, the current study endeavours to identify the number and composition of distinct learner types. The establishment of different learner types constitutes a major contribution to L2 learning research, positively informing future L2 theory, research and pedagogical practice.

Method

This is a two-stage study. In the first stage, by applying a clustering technique, we examined whether different homogeneous learner groups exist based on the similarity of their selective use of mobile technologies for language learning outside class, and uncovered the ways in which these clustered groups differ from each other. In the second stage, the group differences were further tested with measures indicating learners' linguistic, motivational and emotional characteristics. As suggested by Alexander and Murphy (1999), a good way to confirm the validity of group differences would be by comparing the groups in terms of other independent variables.

Sample and relationally constituted variables

This study was conducted at a university located in Southwest China, where learners have limited use of English for communication and the medium of class instruction is Chinese (i.e. their first language [L1]). A total of 238 learners participated in the study. They were all freshmen and averaged 19 years old, among whom 17 were English majors and the others were studying economics, horticulture, law, physics and veterinary medicine.

The data were collected via a questionnaire. In addition to the varied learning activities learners engaged in, the questionnaire also collected information regarding another three factors: learning motivation, L2 anxiety and L2 proficiency. The ecological perspective employed in this study recognises learners' mobile learning experience as a result of the interplay between different linguistic, affective and motivational factors, an idea which has been corroborated in Lai *et al.* (2018). Since it is impossible to examine all relevant factors in one study, our selection of variables is based on theoretical and empirical evidence in the MALL field (Bergman & Trost, 2006). Previous research on MALL has found that technology mediation is effective in boosting learners' motivation and alleviating their anxiety (González-Lloret, 2014; Lai *et al.*, 2018; Ma, 2017; Ushioda, 2013). Additionally, learners' L2 proficiency was also influential in their selective use of mobile technologies in language learning (Lai *et al.*, 2018). All the variables of interest in this study bear strong association with MALL effectiveness (Elgort, 2018; Ma, 2017). We agree that other variables (e.g. cognitive factors; social networks) are also relevant to MALL effectiveness. However, here we only included variables that had undergone wide investigation in the MALL field.

The questionnaire for data collection consists of three parts. Part 1 includes items regarding learners' background information such as gender, educational level and L2 proficiency. L2 proficiency, also an indicator of learners' linguistics state, was self-assessed by the participants based on a criterion-referenced, self-assessed checklist (Council of

Europe, 2001). The checklist (DIALANG) was developed for learners who want to know their level of language proficiency and who want to get feedback on the strengths and weaknesses of their language proficiency. In this study, descriptive statements concerning reading, writing and listening ability were explained to the participants prior to their self-evaluation of L2 proficiency. A 6-point Likert scale was used for learners' self-assessment, with 1 indicating *very poor* and 6 indicating *very good*.

Part 2 concerns participants' mobile learning experiences, encompassing all kinds of learning activities that are mediated by mobile technologies. Based on the aforementioned four strands principle, we categorised the activities into MFI (i.e. reading, listening), MFO (i.e. writing, speaking), language feature based (e.g. vocabulary, grammar, pronunciation) and FD (a combination of MFI and MFO).

Part 3 includes items that measure learners' motivational and emotional states. Motivation in the present study was operationalised in line with Dörnyei's (2009) L2 Motivational Self System. The variables indicative of learner motivation and emotion include ideal L2 self, ought-to L2 self, L2 learning experience, motivated learning behaviour and L2 anxiety.

- *Ideal L2 Self*: Indicating learners' aspiration and desire for language learning (5 items, $\alpha = 0.894$).
- *Ought-to L2 Self*: Measuring 'the attributes that one believes one ought to possess (i.e. various duties, obligations or responsibilities) in order to avoid possible negative outcomes' (Dörnyei & Ryan, 2015: 106; 6 items, $\alpha = 0.856$).
- *L2 Learning Experience*: Concerning the attitudes related to the immediate learning environment (here, mobile technologies; 6 items, $\alpha = 0.866$).
- *Motivated Learning Behaviour*: Examining the regulation of one's learning behaviour (8 items, $\alpha = 0.884$).
- *L2 Anxiety*: Measuring learners' uneasiness and discomfort with using English (8 items, $\alpha = 0.889$).

Items concerning the learning routine were constructed in reference to the current literature on L2 learners' MALL engagements (e.g. Lai *et al.*, 2018; Ma, 2017; Stockwell & Hubbard, 2013) and fine-tuned in consultation with experienced English teachers in China (e.g. Facebook, Twitter, YouTube, etc. can only be accessed via a VPN connection in Mainland China and hence are sidelined in the questionnaire). Participants were asked to select specific learning activities in relation to reading, listening, writing, speaking and language features (e.g. grammar, pronunciation and vocabulary) and to select the average time per day they engaged in these different aspects of mobile learning outside the classroom. Items indicative of participants' motivation and emotion were mostly adapted

from Papi and Teimouri (2014), and some were newly added, taking account of the mediation of mobile technologies (Stockwell & Hubbard, 2013). A 6-point Likert scale was used to measure the items, with 1 indicating *strongly disagree* or *not at all* and 6 indicating *strongly agree* or *very much*. The questionnaire version was fine-tuned with a pilot study.

Data analysis and findings

The data concerning participants' learning experience were cluster-analysed using R 3.5.0. From an ecological perspective, learners' learning experience is an outcome of the interaction between learners' individual attributes (e.g. motivation, emotion, language proficiency) and the spatial-temporal context (Lai *et al.*, 2018). CA is a multivariate exploratory technique used for identifying *new* groups in a bottom-up manner. It is useful in cases where there is extensive variation among individual cases (e.g. L2 learning processes) (Dörnyei, 2014; Staples & Biber, 2016). Two types of clustering are often employed: hierarchical CA (HCA) and disjoint CA. Disjoint clustering is conceptually simpler in that the researcher determines how many clusters he or she wants. HCA, in contrast, produces a hierarchical structure wherein distinct clusters emerge by themselves.

The current study applied the HCA procedure, which led to the emergence of self-similar groups without predetermining the group number. Six clusters emerged from the procedure (descriptive results are presented in Table 4.1). Significant differences between the clustered groups were checked using one-way analyses of variance (ANOVAs). The group differences were further tested on variables indicative of learners' motivational, emotional and linguistic characteristics (Alexander & Murphy, 1999), as shown in Table 4.2. Additionally, close examination of the specific activities each group engages in also revealed distinctive learning patterns. As a result, it was decided that the six clustered groups exhibited meaningful distinctions and the learners in each group were strongly self-similar.

Table 4.1 Descriptive results of the six clustered groups

Groups (n)	Group 1 (53) M (SD)	Group 2 (74) M (SD)	Group 3 (18) M (SD)	Group 4 (16) M (SD)	Group 5 (49) M (SD)	Group 6 (28) M (SD)
Reading	1.06 (0.23)	2.69 (0.93)	1.61 (0.77)	4.38 (0.95)	3.45 (0.58)	4.14 (0.80)
Listening	1.53 (0.69)	2.39 (0.77)	4.50 (1.09)	4.31 (0.87)	3.10 (0.62)	4.79 (0.63)
Speaking	1.23 (0.54)	1.72 (0.60)	2.67 (1.13)	1.69 (0.79)	3.04 (0.49)	3.82 (0.72)
Writing	1.15 (0.41)	1.62 (0.59)	2.33 (1.13)	2.31 (0.87)	3.16 (0.62)	3.54 (1.13)
Language features	1.28 (0.53)	2.08 (0.85)	2.11 (1.13)	3.25 (0.93)	3.43 (0.67)	4.32 (0.90)

Note: The value was based on a 6-point Likert scale, with 1 = no time spent; 2 = less than 10 minutes every day; 3 = 10 minutes to half an hour every day; 4 = half an hour to 1 hour every day; 5 = 1 to 2 hours every day; and 6 = more than 2 hours every day.

Table 4.2 Descriptive results of each group's linguistic, motivational and emotional states

Groups (n)	Group 1 (53) M (SD)	Group 2 (74) M (SD)	Group 3 (18) M (SD)	Group 4 (16) M (SD)	Group 5 (49) M (SD)	Group 6 (28) M (SD)
L2 proficiency	2.73 (0.79)	2.90 (0.79)	3.10 (0.65)	3.40 (0.96)	3.27 (0.66)	3.56 (0.62)
Ideal L2 self	3.47 (1.26)	3.52 (1.00)	3.72 (1.31)	4.32 (1.19)	3.74 (1.05)	4.14 (0.77)
Ought-to L2 self	2.82 (0.95)	3.02 (0.98)	2.92 (1.06)	3.17 (1.32)	3.00 (0.91)	2.86 (1.08)
Attitude	3.02 (0.90)	3.50 (0.72)	3.63 (1.09)	4.16 (0.67)	4.05 (0.88)	4.28 (0.84)
Motivated behaviour	3.46 (0.96)	3.87 (0.76)	4.02 (1.03)	4.16 (0.62)	4.31 (0.89)	4.20 (0.72)
L2 anxiety	3.97 (1.16)	3.75 (0.91)	3.77 (0.75)	3.42 (0.85)	3.53 (0.87)	3.14 (0.79)

Generally, learners in one of the clusters (Group 1) had the lowest scores in almost all language activities, which means that learners in this group spent little time learning English outside class. According to the four strands principle, to learn a new language well, learners should allocate equal and considerable amounts of time to MFI, MFO, LF and FD activities (Nation & Yamamoto, 2012). Since learners in Group 1 lacked adequate practice in all language aspects, this group was labelled the -MFI, -MFO, -LF and -FD group. This is also the group that presented the lowest levels of language proficiency and learning motivation, but showed the highest level of anxiety. One possible explanation is that learners in this group did not see the relevance of English in their daily life or in their future life, and they did not enjoy English learning but rather regarded it as a school obligation (McCarty *et al.*, 2017).

Another cluster (Group 2, henceforth the +MFI, +MFO, +FL and +FD group), though also spending little time practicing speaking and writing, was slightly different in that learners in this group devoted about half an hour every day to reading, listening and vocabulary learning, respectively. Of all the learners surveyed in this study, 31% belonged to this group, representing a large portion of English as a foreign language (EFL) learners in China. They had a relatively large amount of language exposure but limited use of English for communication. This receptive nature of language learning usually leads to a large observed gap between their comprehension and production (Wen, 2016). A similar learning pattern was found in another cluster (Group 4, henceforth the ++MFI, -MFO, +FL and ++FD group), except that learners in Group 4 engaged in MFI activities to a larger extent. That is, though they spent little time on speaking and writing, learners of this group practiced their reading and listening for one and a half hours every day, respectively, and then learned vocabulary, grammar and pronunciation for another half an hour. This learning pattern (i.e. with a particular focus on receptive skills and language features) might be ascribed to Chinese students' learning style. It is widely acknowledged that students from Confucian heritage

cultures such as China and Japan are often found compliant and receptive in their language learning (McCarty *et al.*, 2017).

Although learners in Groups 2 and 4 had a similarly high level of anxiety, they diverged in their language proficiency and learning motivation. It appears to be case that learners' engagement with learning activities is positively related to their proficiency and motivational levels, which mirrors Ma's (2017) findings in her multi-case study. Ma (2017) examined how mobile technologies mediate Hong Kong college students' L2 learning, and found that students' selective use of varied e-resources and tools was an outcome of the interaction of an array of factors, such as language proficiency, learner motivation, learning belief, study discipline, personal interests and goals (see also Lai & Zheng, 2018).

An ideal learning pattern (i.e. in line with the four strands principle) was found in another cluster (Group 5, henceforth the +MFI, +MFO, +FL and ++FD group). Learners of this group distributed comparable amounts of time (about half an hour every day) to learning each language aspect, which indicates that learners here have equally practiced their reading, listening, writing, speaking and language features, with the help of mobile technologies. Again, a similar pattern was observed in a related cluster (Group 6, henceforth the ++MFI, ++MFO, ++FL and +++FD group). Learners in this group performed all kinds of learning activities to a larger extent; that is, this is the group that committed the largest amount of time to practicing each strand of activities: about two hours every day on MFI (i.e. reading and listening), two hours on MFO (i.e. speaking and writing) and one and a half hours on LF (i.e. vocabulary, grammar and pronunciation).

Interestingly, the learners in Groups 5 and 6 were similar not only in their learning pattern, but also in their linguistic, motivational and emotional characteristics. The main difference between the two groups lay in their engagement with specific learning activities. Learners in Group 6 were more traditional and less creative in their selection of specific language learning activities. For instance, they relied very much on watching videos, listening to audio and searching e-news websites as efficient ways to improve their English. Learners in this group were also more goal oriented and conscious of 'what and how to learn' (Ma, 2017: 201), and sought out activities that could meet their needs and interests (Wrigglesworth & Harvor, 2018). Diverging from this, learners in Group 5 displayed a higher level of curiosity and awareness of the affordances of mobile technologies as well as the potential resources available (Demouy *et al.*, 2016). In other words, learners in Group 5 showed more dynamism in their choice of learning activities enabled by mobile technologies. For instance, they liked to practice writing via online forum discussion, and were willing to use WeChat Public Platforms to practice their reading, listening and language skills. As mobile technologies advance rapidly, this group might benefit more from the appearance of new resources and mobile activities. Previous

studies (e.g. Lai & Gu, 2011) revealed a limited use of web 2.0 technologies in language learning. According to our study, it makes sense to empower this group of learners with more meta-cognitive, self-regulating capabilities to embrace web 2.0 technologies. The distinction between Groups 6 and 5 also mirrors different views on language learning (a more conservative view versus a more open and socially integrated one). Although both are forms of language learning outside class, the former seems to reflect more how learners learn in class while the latter is more likely to be a form of social learning. Although it is not necessarily the teacher's responsibility to organise learners' mobile learning outside class, teachers may also be able to help learners develop a more integrated view of traditional learning and innovative learning, thus better exploiting the learning potential of emerging mobile technologies (Kashiwa & Benson, 2018).

One more cluster emerged in our data, Group 3 (henceforth the ++listening, +MFO, +FL and ++FD group). Learners in this group spent about half an hour every day on the MFO and LF strands. What surprised us was their overemphasis on listening. They had allocated about one and a half hours every day to listening to English materials. Looking closely at their preferred activities, listening to English songs stood out, which corroborated the view that 'learners have their preferred channels to receive and process learning resources, in the form of online reading (textual), videos (visual) or songs (auditory)' (Ma, 2017: 198). Students who listened primarily to music also illustrate the potential of popular culture resources for language learning (Dubreil & Thorne, 2017).

By adopting a clustering technique, this study revealed six distinct learner types whose learning patterns were mediated differently by their selective use of mobile technologies. It also presented how these differential learning patterns were related to their motivational, emotional and linguistic profiles. In doing so, we were able to extend previous general conclusions that mobile technologies can potentially facilitate learners' language learning (e.g. Burston, 2015), minimise their fear of embarrassment and raise their motivation for language learning (e.g. Ma, 2017). It further elucidated how learners' attributes (e.g. motivation, emotion and language proficiency) interact with different mobile technologies to give rise to differential learning patterns that are specific to each learner type. In other words, the application of clustering techniques can help to shed light on the latent learner types that can easily be overshadowed by the average-oriented data obtained at the group level.

There are also limitations to this study. The observation of six mobile learner types in the study was based on a sample of college EFL learners in China. More studies that adopt the clustering technique but target other socio-educational contexts are called for. In addition, although large-scale surveys and questionnaires have been considered valuable research tools to generate and test hypothesis, the data obtained are often self-reported and retrospective in nature, which may not accurately

reflect learners' attributes. Future research that integrates and triangulates the data from questionnaires with more objective measures of L2 proficiency would yield more robust results. Last but not least, this study adopted the HCA to cluster the participants into different groups. But there are weaknesses inherent in this technique (e.g. it does not work with missing data; it works poorly with mixed data types; it does not work well on very large data sets; and its main output, the dendrogram, is commonly misinterpreted). As such, future research dealing with mixed data types or very large data sets might consider applying better alternatives such as latent class analysis.

Implications

This empirical study has several implications for future L2 research and pedagogy. First, L2 learning, from a person-centred approach, should be understood at the individual level as a process of many interrelated components jointly contributing to, and co-evolving throughout, the developmental process. Research describing and explaining individual trajectories of observed sub-system components and the clustering procedure described in this study could also be applied to diachronic developmental processes, with a view to identifying ideal-typical trajectories and factors that account for the change or stability of these trajectories.

Second, we suggest that the clustering procedure we discussed above could complement standard variable-centred analysis of experimental data. Prior to an intervention or a treatment, researchers could first issue a series of pre-tests and questionnaires to collect data on IDs and could use clustering techniques to ascertain if the participants/learners can be clustered in meaningful ways (see Staples & Biber [2015] for similar suggestions). Researchers could then examine possible interaction effects between different learner types and the intervention, which could provide valuable findings regarding personalised instruction and the design of more effective learning materials, tools and task types.

Third, a person-centred study could also be appropriately viewed as a needs analysis for task-based language teaching (TBLT) and research (González-Lloret, 2014). The design of a TBLT curriculum, as proposed in Norris (2009), begins with an analysis, ideally multi-methodological, of learners' needs, wants and goals (see also Long, 2005). The clustering technique could potentially reveal learner types and their distribution, all profiled with distinct cognitive, motivational, emotional and linguistic characteristics, which together further lays the foundation for identifying pedagogical tasks L2 learners could perform to amplify their learning potential.

Fourth, as learners' use of mobile technologies in language learning potentially blurs the boundary of formal and informal learning, acknowledging the existence of different learner types with distinct mobile-assisted learning patterns could help L2 teachers design a better

integration between their in-class guidance and learners' autonomous learning outside class (Wong *et al.*, 2015), which mirrors Thorne and Reinhardt's (2008) call for bridging activities that incorporate learners' digital expertise, experience and curiosity with instructor guidance and hence helps educators to engineer optimal conditions for language learning (see also Reinhardt & Thorne, 2019). Collectively, a teacher's job is no longer to teach but to create environments that maximise learners' agentive role in language learning and which ecologically align with their personal interests and present as well as future needs (see Kassenberg *et al.*, this volume, for details on practice).

Future Directions and Conclusion

Theoretical implications of the 'person-centred' approach

To clarify the definition of person-centred, a clear distinction should be made between the theoretical and methodological aspects of the person-centred approach. Terms such as 'cluster analysis' (e.g. Papi & Teimouri, 2014) or 'clustering technique' (e.g. Lee *et al.*, 2018) only imply the person-centred approach by the method it uses, ignoring the theoretical dimension. The person-centred approach, as proposed in this chapter, is grounded in the ecological dynamic paradigm (de Bot *et al.*, 2007; Larsen-Freeman & Cameron, 2008), which recognises L2 learning as an individual learner's use of language in a spatial-temporal context (Larsen-Freeman, 2017).

This recent focus on individuals in context has been described as the era of 'person-centredness' by Benson (2019), which he contrasts with earlier eras such as 'the invisible learner' and 'learner-centredness'. A person-centred approach understands L2 learning, use and development at the individual level by regarding each learner as a functioning whole with its components (e.g. cognitive, affective, motivational and linguistic) jointly contributing to what happens in the developmental process. Given that the number of interacting components and the way they interact are usually different for different learners, L2 learning trajectories often differ across individuals (Lowie & Verspoor, 2019; Verspoor *et al.*, 2017).

Reconsidering issues of data aggregation

Conventional research on L2 learning is often based on group studies with an assumption that results obtained at the group level can be generalised to each individual. However, the person-centred perspective eschews the practice of overdetermined generalisation, as learning patterns are often found to differ across individuals and contexts. The proposed invalidity of generalising group findings to the individual is elaborated in Lowie and Verspoor's (2019) discussion on the ergodicity problem. Lowie and Verspoor (2019) argued that the generalisation of group observations across individuals can only be made under two

conditions: that the learner group is homogeneous and each individual's learning process remains stable. In view of the individualised nature of L2 learning, both conditions are likely to be violated, as 'a randomized group is most probably not homogenous and the data are not stable' (Lowie & Verspoor, 2019: 192).

Rather than using aggregated data with the whole group, our suggestion is to identify distinct and arguably self-similar subgroups. Molenaar and Campbell (2009: 116) similarly suggest that generalisation to the wider population can possibly be achieved 'through the identification of subsets of similar individuals'. This type of generalisation begins with identifying different learner types, with similar individuals in each type. As such, the findings of each identified subgroup could possibly be proximally generalised to the individual within it. However, this is not to say that a standard variable-centred study at the group level is inferior to the person-centred approach. While research efforts are still needed to identify new variables influential for successful L2 learning with group studies, research focus should also include examining the individual in context by taking a person-centred approach.

The need for intensive studies of individual development

When individual development is the focus, it is not evident that the conventional longitudinal approach, which is often characterised as group based and with relatively few measurement points, is adequate. To better illuminate details of individual development, it is necessary to study the dynamics of change in the developmental process. To achieve this, Lowie (2017) proposes longitudinal case studies with intensive (frequent) and temporally arrayed sampling. We acknowledge that intensive data collection with many measurement points is logistically difficult to obtain, which further restricts the learners who can be included in such research. A good compromise, as exemplified in Lowie and Verspoor (2019), would be to embed a small sample of intensively studied persons within a conventional group study. The group study could provide valuable information about the relative weight of individual variables that are influential for L2 development, while the longitudinal case studies shed light on the process of individual development, and potentially, can visualise relatively homogeneous ideal-typical subgroups.

The application of an ecological and person-centred approach means not rejecting but rather complementing the L2 frameworks developed in recent decades so as to optimally respond to the realities of our highly mobile, globalised and digitalised world, in which millions of people endeavour to learn new languages in different instructional settings and for different reasons. Ultimately, we hope to draw from descriptively oriented longitudinal case studies and cluster analyses in order to better engineer conditions for language learning, both within and outside of instructional settings.

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