Katarzyna Rokoszewska
ORCID: 0000-0003-4479-0385
Institute of Linguistics
Jan Dlugosz University in Czestochowa, Poland
k.rokoszewska@ujd.edu.pl

Group and Individual Learning Profiles of Complexity, Accuracy, and Fluency in L2 English Writing at Secondary School

Abstract: According to Complex Dynamic Systems Theory (CDST), language development is an individually owned process. CDST studies should draw from both group-based and individual-based data since research results should not be generalized from the group to the individual and vice versa unless the group is an ergodic ensemble. This paper describes a part of a sequential mixed method (MM) study in which group-based data obtained in a panel study were further analysed with respect to all individual learners. The aim of the study was to examine the individual learners' development of syntactic complexity, accuracy, lexical complexity, and fluency (CALF) in L2 English writing at secondary school in comparison to the whole group. The study was based on *The Written English Developmental Corpus of Polish Learners* (WEDCPL), which includes 1,923 essays written by one hundred learners during twenty-one data waves organized over the period of three years at secondary school. The results of the study indicated that the individual learners rarely differed from the group in terms of the average CALF results, but in terms of progress over time, most learners represented different learning profiles than the group. The main implication for practitioners is to empower more individual learners to succeed in L2.

Keywords: Complex Dynamic Systems Theory (CDST), syntactic complexity, accuracy, lexical complexity, fluency (CALF), individual learning profiles, L2 writing, learner corpus, secondary school

1. Introduction

Complex Dynamic Systems Theory (CDST) is an alternative approach to second language development (Atkinson) which provides a new perspective on many constructs, including the CAF triad (Larsen-Freeman and Cameron; Verspoor, de Bot, and Lowie; de Bot). Complexity, accuracy, and fluency (CAF) function as measures of language performance, proficiency, and development. Initially, they were investi-

gated as dependent variables in studies which measured the effect of various factors, such as age, instruction, individual learner differences, task design, and learning context, on learners' proficiency and performance (Housen, Kuiken, and Vedder). Recently, CAF research has been criticized for varied operationalization of its constructs which might have led to inconsistent findings (Housen and Kuiken; Norris and Ortega; Robinson, Cadierno, and Shirai). Hence, Bulté and Housen ("Defining") highlight the need for meta-analyses of previous CAF studies. CAF research has also been criticized for its reductionist approach (Larsen-Freeman; Norris and Ortega; Pallotti; Wolfe-Quintero, Inagaki, and Kim) which neglects the fact that complexity, accuracy, and fluency are distinct, but complex and interrelated constructs whose interaction changes in the course of language development. Thus, they should be examined simultaneously and longitudinally from a broader conceptual framework provided by CDST (Larsen-Freeman and Cameron; Verspoor, de Bot, and Lowie). In this framework, complexity, accuracy, and fluency often function as independent variables whose development is examined its own right (Housen, Kuiken, and Vedder).

So far, the CAF triad has been investigated in a number of CDST-informed case studies which were based on longitudinal corpora of single learners (Verspoor, Lowie, and van Dijk; Caspi; Spoelman and Verspoor; Chan, Lowie, and de Bot; Lowie et al., Penris and Verspoor; Hou, Loerts, and Verspoor) and small groups (Kowal; Bulté and Housen, "Defining"; Verspoor, Lowie, and Wieling). However, CDST research has recently been criticized for a lack of quantitative studies verifying the main assumptions of this theory (Pallotti). Hiver and Al-Hoorie (72) explain that it is a common misunderstanding that "quantitative data elicitation and analyses are poorly situated to CDST-informed empirical research or that qualitative designs are inherently more compatible with dynamic change and interconnectedness". Following Molenaar and Cambell, Lowie and Verspoor argue that research results should not be generalized from the group to the individual and vice versa unless the group is an ergodic ensemble. Generalizing results from the group to the individual may lead to ecological fallacy, whereas generalizing them from the individual to the group may result in atomistic fallacy (Hiver and Al-Hoorie). Thus, it is recommended to combine findings from group-based and individual-based levels (Lowie and Verspoor). The present mixed-method study employs a quantitative method, compatible with CDST, which has been rarely used, namely panel design (Hiver and Al-Hoorie; Bülow and Pfenninger), followed by individual data analysis. Taking into consideration the fact that research on CAF has provided mixed results, the present study intends to contribute to this area of research within the CDST framework by analysing the development of syntactic complexity, accuracy, lexical complexity, and fluency (CALF) of many learners in comparison to the whole group in L2 English writing at secondary school on the basis of a big longitudinal corpus.

2. Complexity, accuracy, and fluency in CDST

From the CDST perspective, complexity, accuracy, and fluency are multidimensional constructs. Linguistic complexity, which refers to formal, semantic, and functional features of language items, comprises grammatical and lexical complexity (Housen, Kuiken, and Vedder). The former refers to the breadth and depth of L2 grammatical structures and involves syntactic and morphological complexity (Bulté and Housen, "Defining"). The latter pertains to the breadth and depth of the learner's repertoire of L2 lexical items (Bulté and Housen, "Defining"). It involves lexical density, which measures the amount of information in a text (Ure), lexical sophistication, which indicates the depth of lexis (Laufer and Nation; Read), lexical variation, which shows the range of vocabulary in a text (Malvern et al.), and lexical compositionality, which refers to formal and semantic components of lexical items (Bulté and Housen, "Defining"). Furthermore, accuracy denotes error-free use of language in accordance with L2 norms (Michel). It may be analysed either in a unitary way or in a non-unitary way when divided into grammatical and lexical accuracy (Polio). It may be measured with the use of holistic, global, or specific scales (Michel), but it should account for error gravity by means of weighted accuracy measure (Kuiken and Vedder; Foster and Wigglesworth) as opposed to the accurate-inaccurate grammaticality judgment. It should also accommodate appropriateness and acceptability (Housen, Kuiken, and Vedder). Finally, writing fluency involves smooth, rapid, and effortless text production (Kowal). It may be examined as a product in terms of the length-based or rate-based measures. Alternatively, with the use of the keystroke logging software (Leijten and van Waes), it may be measured as a process in terms of rapidity, which shows the amount of information provided in a given period of time, automaticity, which refers to retrieving language items from long-term memory, and smoothness, which shows pauses and self-corrections (Kowal).

As far as cognitive processes behind the CAF triad are concerned, it is said that complexity is determined by the degree to which L2 learners have transformed declarative knowledge into procedural knowledge (Towell and Hawkins; Wolfe-Quintero, Inagaki, and Kim). Accuracy is influenced by the degree to which the learners have adjusted their declarative knowledge to native-speaker norms and by the degree to which they are able to use it under processing limitations. Fluency depends on the learners' control over language reflected in the speed with which they can access and use L2 information to communicate in real time. Such control increases with the proceduralization and automatization of L2 knowledge. Thus, in terms of Levelt's speech production model, complexity and accuracy refer to the representation of L2 knowledge at the level of the conceptualizer and the formulator, whereas fluency, which refers to the control over L2 knowledge, depends on automaticity at the level of the formulator and the articulator (Housen,

Kuiken, and Vedder). Furthermore, cognitive mechanisms behind the CAF triad are differently explained by Skehan's Limited Attentional Capacity Model and Robinson's Multiple Resources Attentional Model. According to Skehan, L2 learners are not able to allocate their limited attentional resources to all aspects of language production. Increasing cognitive task complexity reduces the general attentional pool, which makes the learners focus on content so that their linguistic complexity and accuracy decrease. Thus, in line with this model, fluency competes for attentional resources with accuracy, which in turn competes with complexity. In contrast, according to Robinson, learners can access different attentional pools at the same time so that all three CAF components may increase or decrease depending on task conditions.

It has been assumed that an overall developmental sequence for the CAF triad, namely complexity > accuracy > fluency, follows three stages which indicate major changes in the language system (Housen, Kuiken, and Vedder). First, the internalization of new L2 items leads to greater complexity. Then, the modification of the internalized items results in greater accuracy. Finally, the consolidation and proceduralization of L2 knowledge ensure greater fluency. However, longitudinal CAF studies have provided mixed results on this developmental sequence in L2 writing. In a case study of four advanced learners of English which lasted one year, Caspi observed that the development of lexical and syntactic complexity preceded the development of accuracy in these areas. Polio and Shea reported that instructed L2 English learners made greater progress in complexity than in accuracy per one semester. However, Larsen-Freeman found that five Chinese learners of English made grater progress in accuracy as opposed to complexity and fluency. In the case of languages other than English (LOTE), Spoelman and Verspoor found that a Dutch learner who studied Finnish for three years increased not only syntactic and lexical complexity, but also accuracy in most aspects. Gunnarsson, who observed five Swedish L2 learners of French for thirty months, found that some learners progressed in accuracy as opposed to fluency, but others did exactly the opposite. In a three-year case study of fifteen Polish students of Swedish, Kowal found that the development of fluency and accuracy was ahead of complexity. As for quantitative studies, Storch and Tapper observed significant progress in accuracy and complexity at the cost of fluency in the case of postgraduate English students in Australia. However, in the case of undergraduate students in the same context, Knoch, Rouhshad, and Storch reported significant gains only in fluency.

With respect to syntactic complexity, Norris and Ortega proposed the developmental sequence consisting of coordination, subordination, and nominalization, which has been challenged by some studies (Inoue; Bulté and Housen, "Syntactic"). Concerning the development of lexical complexity, some studies reported progress in lexical sophistication and variation with regress in lexi-

cal density (Durán et al.; Storch and Tapper; Zheng), whereas others did not report significant progress in any of them (Bulté and Housen, "Conceptualizing"; Knoch, Rouhshad, and Storch). As for the co-development of these two types of complexity, some support has been provided for the claim that lexis develops before syntax (Caspi; Verspoor, Schmid, and Xu; Verspoor, Lowie, and Wieling). Notwithstanding, it is assumed that more synchronized development of different subsystems indicates automatic language use (van Geert and Verspoor; Kowal; Hou, Loerts, and Verspoor).

Generally speaking, complexity, accuracy, and fluency are multi-componential subsystems which may develop differently in different learners under different learning conditions (Housen, Kuiken, and Vedder). CDST research has highlighted both intra-individual and inter-individual variability in CAF development. With respect to the former, CDST studies reported significant peaks (Verspoor, Lowie, and van Dijk; Spoelman and Verspoor; Penris and Verspoor; Hou, Loerts, and Verspoor) and phase transitions (Baba and Nita; Wang and Tao) in CAF development. With respect to the latter, such studies emphasized differences between individual learners (Larsen-Freeman; Caspi; Gunnarsson; Kowal; Bulté and Housen, "Syntactic"; Pfenninger, "The Dynamic"; Baba), even in the case of identical twins (Lowie et al.). Since such differences are not always statistically significant, Vercellotti argued against the idea of separate developmental paths. Thus, the present study will compare the individual learners' learning profiles with the whole group in L2 English writing at the level of secondary school.

3. Method

3.1. Research aim and questions

The aim of the present study was to examine the individual learners' development of syntactic complexity, accuracy, lexical complexity, and fluency (CALF) in L2 English writing at secondary school in comparison to the whole group. The research questions were as follows:

RQ1. What progress did the whole group of learners make in the development of CALF variables in L2 English writing at secondary school?

RQ2. What group profiles can be distinguished with respect to progress in these measures?

RQ3. What progress did individual learners make in the development of the CALF measures in L2 English writing at secondary school in comparison to the whole group?

RQ4. What are individual learner profiles with respect to progress in these measures like?

3.2. Research method and variables

The present study was a sequential mixed method (MM) study (Johnson and Christensen; Hiver and Al-Hoorie) in which group-based data obtained in a panel study were further analysed with respect to all individual learners. A panel design is a study in which the same variables are measured repeatedly in the same individuals over a longer period of time (Dörnyei; Salkind; Hiver and Al-Hoorie). The study focused on eleven general and specific CALF variables whose operationalization is presented in Table 1 (Ellis and Barkhuizen; Larsen-Freeman; Lu, "Automatic"; Leech, Rayson, and Wilson; McKee, Malvern, and Richards). The main unit of analysis was a T-unit, defined as the main clause with subordinated clauses (Hunt).

Table 1: Research variables

Index	Symbol	Index description
Syntactic complexity	SC	Number of clauses per T-unit
Lexical complexity	LC	Complex TTR—word types per square root of two times the words
Accuracy	AC	Correct T-unit ratio—number of correct T-units per all T-units in a text
Fluency	FL	Average number of words per T-unit in a given text
Subordination	SB	Number of dependent clauses per T-unit
Coordination	CO	Number of coordinated phrases per T-unit
Nominalization	NM	Number of complex nominals per T-unit
Lexical density	LD	Number of lexical tokens per total number of tokens
Lexical sophistication	LS	Number of advanced tokens per total number of lexical tokens
Lexical variation	LV	Randomized type-token ratio
General language development	GLD	Weighted arithmetic mean from general and specific measures calculated on the basis of normalized data

3.3. Participants and setting

The study was carried out at secondary school in Poland in 2014–2017. The research sample consisted of one hundred secondary school learners, i.e., forty-five boys and fifty-five girls, aged sixteen to nineteen in grades 1–3, respectively. After around nine years of learning English at lower educational levels, the learners represented the B1 level in grade 1 and the B2 level in grades 2 and 3 at secondary school. They participated in an extended English programme, followed the same coursebook, and had four to six lessons per week depending on the grade. They were taught in seven language groups by five different teachers. The instruction, which was delivered mainly in L2, was based on the presentation, practice, and production sequence,

involved all language areas and skills, and entailed formal assessment. Around half of the learners had some extra-curricular classes in English. The learners' results on the final written exam in English (B1—91.8%; B2—72.1%) were better than the national results (B1—73.0%; B2—63.0%).

3.4. Data collection and analysis

The Written English Developmental Corpus of Polish Learners (WEDCPL) is a genuine longitudinal corpus (Granger) compiled on the basis of a multi-wave procedure within which the panel of the same one hundred learners was asked to compose essays on different topics during twenty-one data waves which spanned the period of three years at secondary school (Table 2). The corpus comprises 1,924 per total of 2,100 texts, the return rate being 91.6%. The size of the analysed corpus was 393,202 words, with the average text length of 204 words. The corpus compilation involved the following stages: asking learners to write essays on various topics without reference materials during English lessons once a month; checking the essays and giving feedback to the learners; converting hand-written essays into electronic transcripts with the use of the speech recognition program Dragon Naturally Speaking (Nuance®); verifying the transcripts with the original versions, including the learners' errors; and truncating the transcripts to a specified length. The accuracy of the transcripts was checked by an inter-rater ($r = 1.00$).

Table 2: Longitudinal corpus compilation

Time	Grade 1		Grade 2		Grade 3	
September	Organization		Organization		Organization	
October	Test 1	Fashion	Test 9	Books and films	Test 17	Love
November	Test 2	Internet	Test 10	Shopping	Test 18	TV
December	Test 3	Music	Test 11	Friendship	Test 19	Crime
January	Test 4	Education	Test 12	Christmas	Winter break	
February	Winter break		Winter break		Test 20	Terrorism
March	Test 5	Ecology	Test 13	Family	Test 21	Tolerance
April	Test 6	Pets	Test 14	Health	End of school-year	
May	Test 7	Work	Test 15	Fame	Final exams	
June	Test 8	Holidays	Test 16	Home and living	—	

The corpus was analysed by means of different computer programs. The analy-sis of accuracy, which was conducted manually in Microsoft Excel, involved marking T-units for spelling, lexical, grammatical, and discourse errors in British and American English on the basis of the 0–1 scale, with the inter-rater reliability

equalling 0.93. Fluency and syntactic complexity were computed by means of the L2 Syntactic Complexity Analyzer (L2SCA) (Lu, "Automatic"). The reliability of the T-unit count in the analyses of accuracy, syntax, and fluency was 0.99. Lexical density and sophistication were measured by means of the L2 Lexical Complexity Analyzer (L2LCA) (Lu, "The Relationship") while lexical variation by Text Inspector (*Text Inspector*). The reliability of the word count in the two programs was 1.00. The research samples were pre-processed for automated syntactic and lexical analyses. For the former, spelling, morphological, and morphosyntactic errors were corrected (James), whereas for the latter, minor spelling errors and morphosyntactic errors were corrected, but words with major spelling errors, morphological errors, and L1 or L3 words were excluded (Hemchua and Schmitt; James).

The panel data from these language programs were first analysed at the group level and then at the level of all individual learners. For this purpose, the missing data (8.4%) were forecast with the ETS function in Excel, which uses the Exponential Triple Smoothing (ETS) algorithm to predict future values on the basis of prior data in a time series taking into account peaks and lows. The differences between the group and individual results were checked by the Mann-Whitney U test for independent samples ($\alpha = 0.05$; $n = 21$). This non-parametric test was used because the Kolmogorov-Smirnov test of normality ($\alpha = 0.05$; $n = 21$) had not shown the normal distribution of scores in any of the CALF variables measured in the group with which the individual learners were compared. The relationships between CALF variables and time were calculated by means of Pearson's linear correlation coefficient (r), the critical value (r^*) being 0.43 ($n = 21$; $\alpha = 0.05$). The group and individual profiles were plotted on the basis of time correlations. Positive correlations indicated progress while negative correlations regress in a given variable, with insignificant correlations denoting lack of change.

4. Results

4.1. CALF development—group results and profiles

The results of the study (Table 3) indicated that, in terms of syntactic complexity, the whole group of learners, on average, produced 1.40 clauses per T-unit ($SD = 0.08$) while, in terms of lexical complexity, it obtained 5.26 points ($SD = 0.20$). In terms of accuracy, the group used 34.00% of correct T-units per all T-units in a given text ($SD = 0.05$) while, in terms of fluency, it produced 10.80 words per T-unit ($SD = 0.89$). As far as language progress is concerned, the correlations between the group results on all tests and time showed positive, moderate, and statistically significant relationships in the case of lexical complexity ($r = 0.59^*$) and fluency ($r = 0.56^*$), but insignificant relationships in the case of syntactic complexity ($r = 0.33$) and accuracy ($r = -0.05$) (Table 3). Thus, the group profile concerning

the general CALF measures consisted of progress in lexical complexity and fluency (LC/FL) (Figure 1).
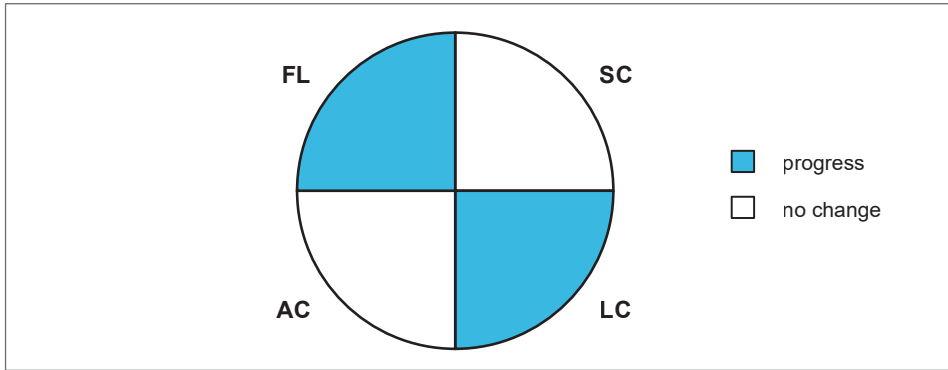

Figure 1: Progress in complexity, accuracy and fluency—group profile

Source: own data.

In terms of specific measures of syntactic complexity, the group, on average, produced 0.41 subordinated clauses ($SD = 0.08$), 0.30 coordinated phrases ($SD = 0.30$), and 1.11 complex nominals per T-unit (Table 3). Time correlations indicated a positive, moderate, and statistically significant relationship for nominalization ($r = 0.64^*$), but insignificant relationships for subordination ($r = 0.35$) and coordination ($r = 0.37$) (Table 3). Thus, the group profile of syntactic complexity involved progress only in nominalization (NM) (Figure 2).
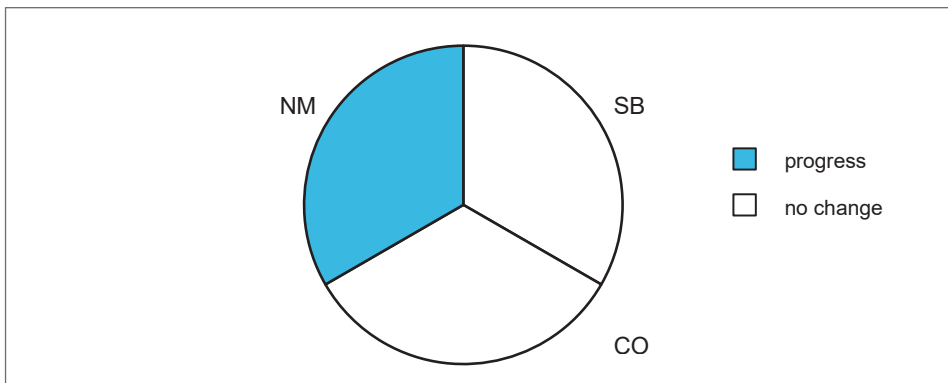

Figure 2: Progress in syntactic complexity—group profile

Source: own data.

As for specific lexical measures, the study showed that, in terms of lexical density, the group used 52.00% lexical items per all items in the text ($SD = 0.02$),

whereas in terms of lexical sophistication, it used 22.00% of words which went beyond the first two thousand most frequent words in English per text ($SD = 0.04$) (Table 3). For lexical variation, the group obtained 79.94 points ($SD = 7.36$). Time correlations revealed a positive, moderate, and statistically significant relationship for lexical variation ($r = 0.53*$), but insignificant relationships for lexical density ($r = 0.22$) and sophistication ($r = -0.32$) (Table 3). Hence, the group profile of lexical complexity entailed progress only in lexical variation (LV) (Figure 3).
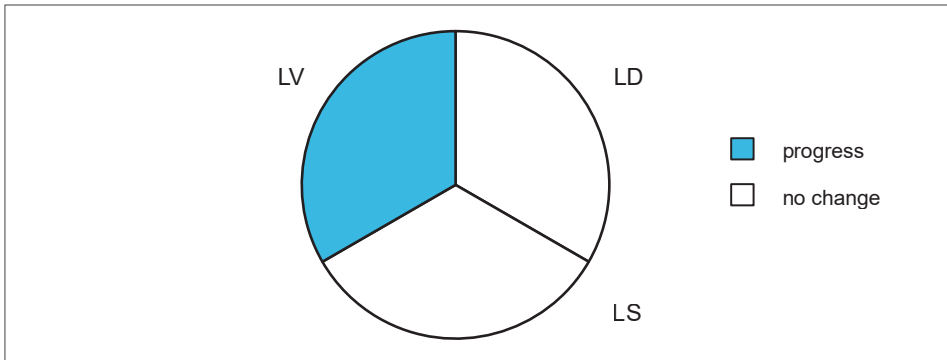

Figure 3: Progress in lexical complexity—group profile

Source: own data.

Finally, general language development of the whole group of learners was equal to 0.47 on the 0–1 scale (cf. 3.2) (Table 3). Its correlation with time was quite strong, positive, and statistically significant ($p = 0.73*$). Language progress in all areas is summarized in Figure 4.

Table 3: Group results and progress in language development

Data	SC	LC	AC	FL	SB	CO	NM	LD	LS	LV	GLD
M	1.40	5.26	0.34	10.80	0.41	0.30	1.11	0.52	0.22	79.94	—
M_N	0.32	0.50	0.48	0.55	0.35	0.44	0.48	0.51	0.67	0.45	0.47
SD	0.08	0.20	0.05	0.89	0.08	0.05	0.20	0.02	0.04	7.36	0.13
Min	1.29	4.96	0.26	9.21	0.30	0.23	0.78	0.47	0.13	66.68	0.22
Max	1.62	5.56	0.43	12.12	0.62	0.39	1.47	0.56	0.26	95.96	0.69
r	0.33	0.59*	−0.05	0.56*	0.35	0.37	0.64*	0.22	−0.32	0.53*	0.73*

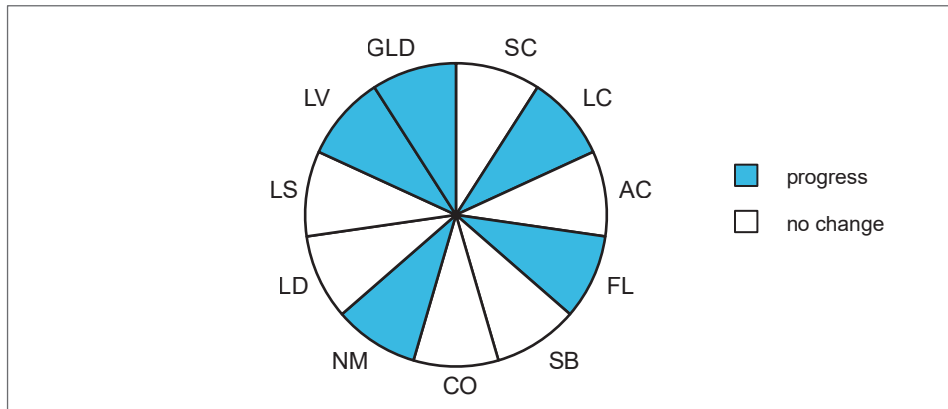Note: asterisk—statistically significant results (Pearson product, $\alpha = 0.05$, $n = 21$).

Figure 4: Language progress—group profile

Source: own data.

4.2. CALF development—individual results

The analysis of the differences between the group and individual learners' average results in the development of all CALF measures, conducted by means of the Mann-Whitney U test ($\alpha = 0.05$; $n = 21$), revealed that seventy-six per total of 1,100 results, i.e., 6.91%, obtained by individual learners differed from the group (Table 4). More precisely, twenty-four per 1,100 results, i.e., 2.18%, were significantly higher than the group's average score, whereas fifty-two per 1,100 results, i.e., 4.73%, were lower than this score on different CALF variables. The biggest number of differences was observed in lexical variation, with five per one hundred better results and thirty per one hundred worse results obtained by the individual learners.

As far as the individual learners' progress is concerned, the results of the study (Table 5, Figure 5) indicated that the correlation between syntactic complexity and time was positive and statistically significant for 22.00% and negative for 3.00% of the learners ($n = 100$), whereas the correlation between lexical complexity and time was positive for 28.00% of the learners. In terms of accuracy, the time correlation was positive for 8.00% and negative for 5.00% of the learners, whereas in terms of fluency, it was positive for 34.00% of the learners. Furthermore, positive time correlations for specific syntactic measures were as follows: subordination—23.00%, coordination—14.00%, nominalization—45.00%, whereas negative time correlations were: subordination—1.00% and coordination—1.00%. As for specific lexical measures, positive time correlations included: lexical density—16.00%, lexical variation—28.00%, whereas negative correlations were: lexical density—3.00% and lexical sophistication—23.00%. Finally, the relationship between general language development and time was

positive for 41.00% of the learners. In total, 295 per 1,100, i.e., 26.82%, time correlations were statistically significant, including 259 (23.55%) positive and thirty-six (3.27%) negative correlations.

Table 4: Differences between group and individual learners

| Data | Group | Individual learners | | | |
| | | Higher results | | Lower results | |
	M	n	$\%$	n	$\%$
SC	1.40	2	2.00	4	4.00
LC	5.26	2	2.00	2	2.00
AC	0.34	4	4.00	5	5.00
FL	10.80	3	3.00	3	3.00
SB	0.41	2	2.00	3	3.00
CO	0.30	3	3.00	4	4.00
NM	1.11	2	2.00	1	1.00
LD	0.52	1	1.00	0	0.00
LS	0.22	0	0.00	0	0.00
LV	79.94	5	5.00	30	30.00
GLD	0.47	0	0.00	0	0.00
Total	—	24	2.18	52	4.73

Table 5: Progress in language development—individual learners

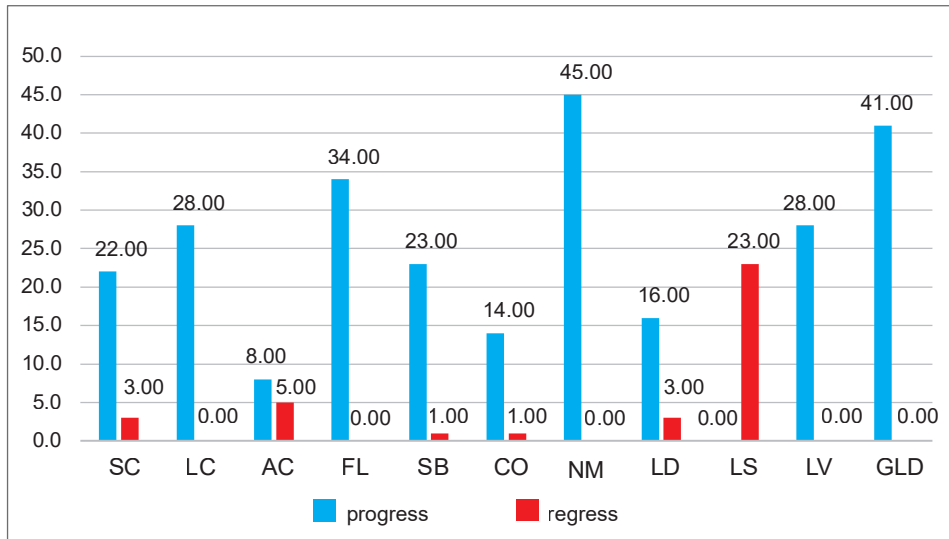| Data | Progress | | Regress | |
	n	$\%$	n	$\%$
SC	22	22.00	3	3.00
LC	28	28.00	0	0.00
AC	8	8.00	5	5.00
FL	34	34.00	0	0.00
SB	23	23.00	1	1.00
CO	14	14.00	1	1.00
NM	45	45.00	0	0.00
LD	16	16.00	3	3.00
LS	0	0.00	23	23.00
LV	28	28.00	0	0.00
GLD	41	41.00	0	0.00
Total	259	23.55	36	3.27

Figure 5: Progress in language development—individual learners

Source: own data.

4.3. CALF profiles—individual learners

Concerning individual CALF profiles, the study showed that, in the group of one hundred learners, most individuals made significant progress in the development of one general measure, namely lexical complexity—13.00%, syntactic complexity—4.00%, fluency—8.00%, and accuracy—5.00%, with one learner (1.00%) making regress in accuracy (Table 6, Figure 6). Some learners made progress in two general measures, namely SC/FL—12.00%, LC/FL—8.00%, and SC/LC—2.00%. However, three learners (3.00%) progressed in fluency at the cost of accuracy, with one learner (1.00%) making progress in syntactic complexity at the cost of accuracy and another one (1.00%) progressing in accuracy at the cost of syntactic complexity. Only three learners progressed in three general measures: SC/LC/FL—2.00% and SC/AC/FL—1.00%, with one learner developing syntactic and lexical complexity to the disadvantage of accuracy (1.00%) and another learner developing lexical complexity and accuracy to the disadvantage of syntactic complexity (1.00%). Still, for 37.00% of the learners, the CALF profile involved neither significant progress nor regress.

In terms of specific syntactic measures (Table 7, Figure 7), most learners made significant progress in the development of one measure: nominalization—25.00%, subordination—8.00%, and coordination—3.00%, with one learner making regress in coordination (1.00%). Some learners progressed in two measures, namely SB/NM—11.00%, CO/NM—5.00%, and SB/CO—1.00%. Only 4.00% of the learners

made progress in all three syntactic measures. Overall, the syntactic measures remained at the same level for 42.00% of the learners.

Table 6: Progress in complexity, accuracy, and fluency—individual profiles

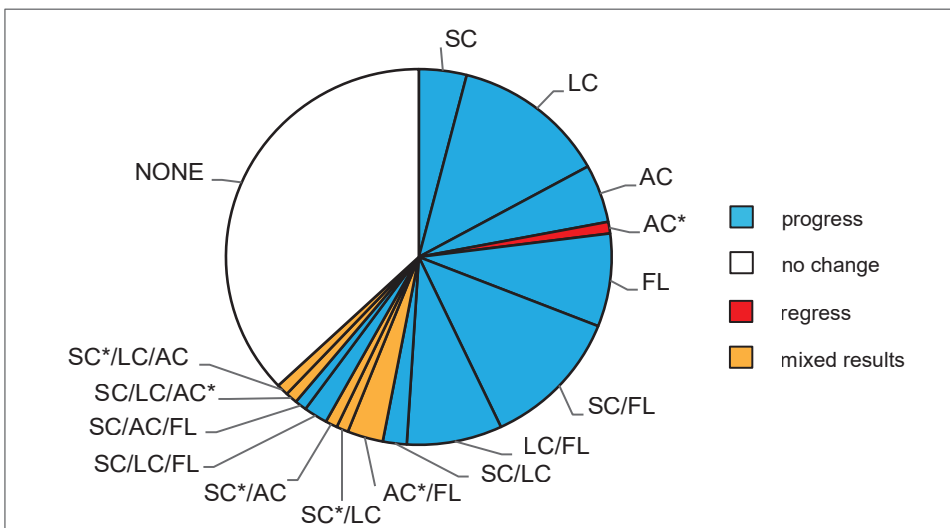| Profile	n	%
LC	13	13.00
FL	8	8.00
AC	5	5.00
SC	4	4.00
AC*	1	1.00
SC/FL	12	12.00
LC/FL	8	8.00
SC/LC	2	2.00
AC*/FL	3	3.00
SC*/LC	1	1.00
SC*/AC	1	1.00
SC/LC/FL	2	2.00
SC/AC/FL	1	1.00
SC/LC/AC*	1	1.00
SC*/LC/AC	1	1.00
None	37	37.00

Note: asterisk—regress.

Figure 6: Progress in complexity, accuracy, and fluency—individual profiles

Note: asterisk—regress.
Source: own data.

Table 7: Progress in syntactic complexity—individual profiles

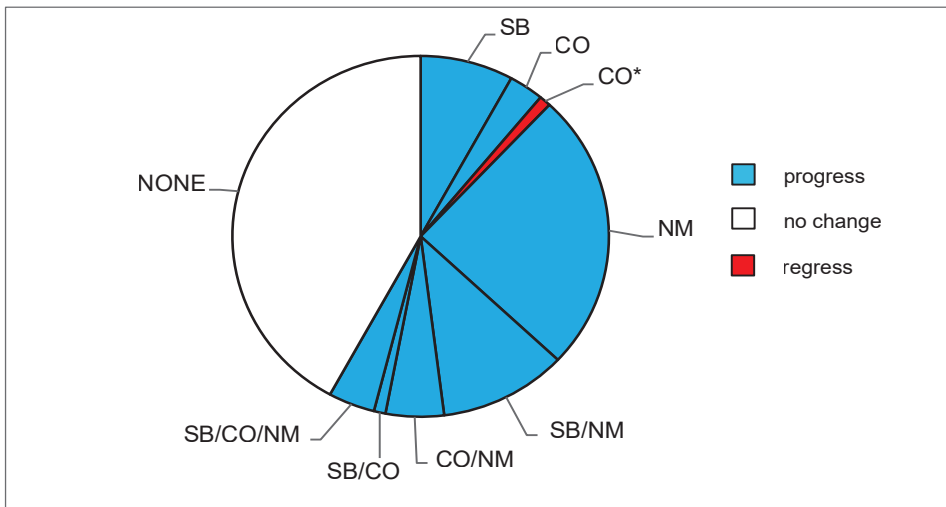| Profile	n	%
NM	25	25.00
SB	8	8.00
CO	3	3.00
CO*	1	1.00
SB/NM	11	11.00
CO/NM	5	5.00
SB/CO	1	1.00
SB/CO/NM	4	4.00
None	42	42.00

Note: asterisk—regress.

Figure 7: Progress in syntactic complexity—individual profiles

Note: asterisk—regress.
Source: own data.

As for specific lexical measures (Table 8, Figure 8), 15.00% and 8.00% of the learners progressed in lexical variation and density, respectively. However, 16.00% of them regressed in lexical sophistication, with one more learner (1.00%) regressing in lexical density. As for other profiles, 8.00% of the learners developed both lexical density and variation, while 5.00% of the learners developed lexical variation to the disadvantage of sophistication. In addition, two learners regressed in lexical density and sophistication, but one of them progressed in lexical variation. Still, for 45.00% of the learners, the lexical profile did not involve any significant changes.

Table 8. Progress in lexical complexity—individual profiles

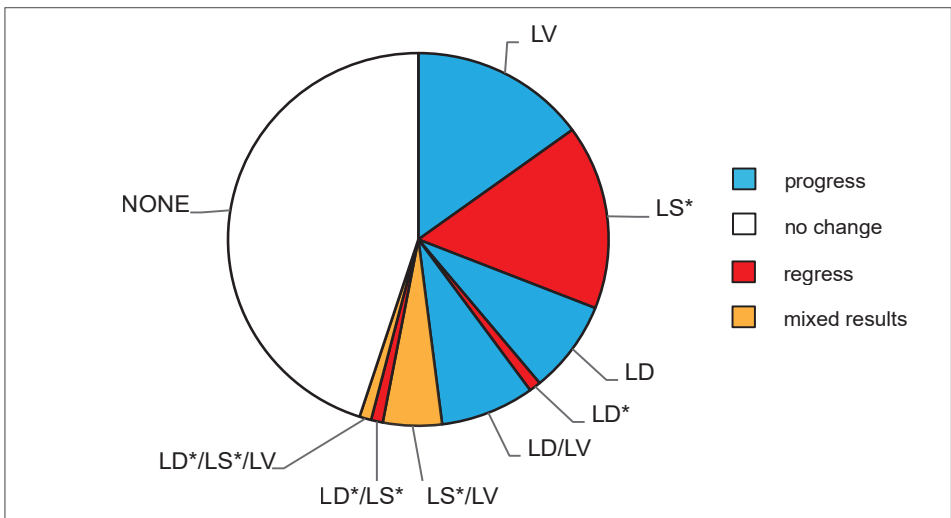| Profile	n	%
LS*	16	16.00
LV	15	15.00
LD	8	8.00
LD*	1	1.00
LD/LV	8	8.00
LS*/LV	5	5.00
LD*/LS*	1	1.00
LD*/LS*/LV	1	1.00
None	45	45.00

Note: asterisk—regress.

Figure 8: Progress in lexical complexity—individual profiles

Note: asterisk—regress.
Source: own data.

Finally, as already mentioned (Table 5), 41.00% of the individual learners in the group made significant progress in general language development, there being no change for the remaining 59.00% of the learners (Figure 9).
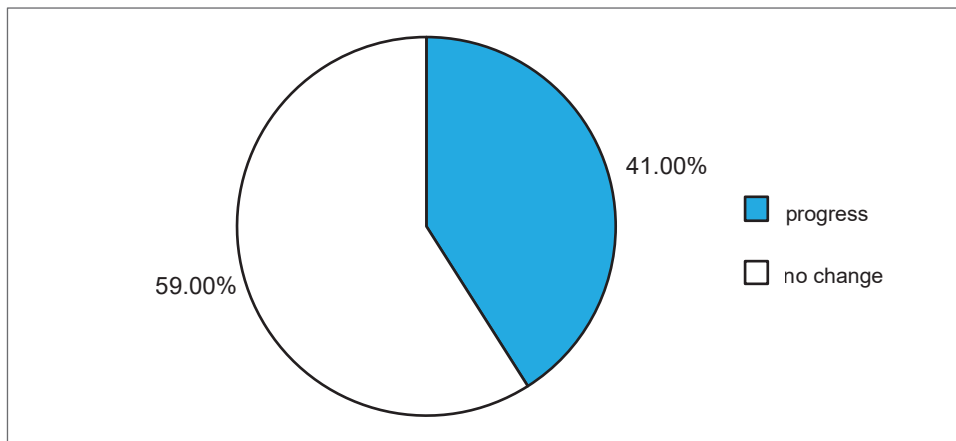
Figure 9: Progress in general language development—individual profiles

Source: own data.

5. Discussion

The aim of the present study was to compare the individual learners' development of syntactic complexity, accuracy, lexical complexity, and fluency (CALF) to the whole group in L2 English writing at secondary school (cf. 3.1). In reference to the first (RQ1) and second (RQ2) research questions, which focused on the group results and profiles in the development of CALF variables (cf. 3.1), the panel study indicated that the whole group of learners progressed in lexical complexity and fluency at the cost of syntactic complexity and accuracy. These findings overlap with other studies which point out that complexity precedes accuracy (Caspi; Polio and Shea) and that lexis precedes syntax (Caspi; Verspoor, Schmid, and Xu; Verspoor, Lowie, and Wieleing). Moreover, the group in the panel study made significant progress in nominalization as opposed to subordination and coordination, which contrasts with Norris and Ortega's developmental sequence, but supports the trade-off between subordination and nominalization (Bulté and Housen, "Syntactic"). Additionally, the group developed lexical variation to the disadvantage of lexical density and sophistication, which contrasts with studies that reported lack of progress in all three variables (Bulté and Housen, "Conceptualizing"; Knoch, Rouhshad, and Storch), but partly overlaps with studies that reported progress not only in lexical variation, but also in lexical sophistication at the cost of lexical density (Durán et al.; Storch and Tapper; Zheng). In total, despite the fact that the group developed some areas better than others, it made significant general language progress.

In relation to the third (RQ3) research question, which pertained to the individual learners' results in the development of CALF measures (cf. 3.1), the analysis of the panel data revealed that there were few statistically significant differences between the group and individual average results in CALF, one exception being lexical variation. As for language progress over time, the individual results reflected the group results in that more individuals progressed in fluency and lexical complexity than in syntactic complexity and accuracy. The same was true for nominalization as opposed to subordination and coordination as well as for lexical variation as opposed to density and sophistication, with some individuals actually regressing in the last measure. Nevertheless, it should be emphasized that around 40.00% of the learners did not undergo any significant progress in the general CALF measures (37.00%), as well as the specific syntactic (42.00%) and lexical measures (45.00%), leaving more than half of the learners with a lack of general progress (59.00%). Although the study does not provide the profile on all eleven measures, it was double-checked that only 15.00% of the learners did not undergo any change at all. In general, the study showed that making significant progress in many aspects of language was difficult for learners in the EFL context, the more so as the so-called plateau effect (Richards) is characteristic for intermediate learners who tend to believe that their language level is adequate for everyday life communication.

As for the last research question (RQ4), which concerned the learners' individual learning profiles (cf. 3.1), it was revealed that the majority of the individuals represented different learning profiles than the group. In terms of the general CALF measures, only 8.00% of the individual learners demonstrated the same learning profile as the whole group, consisting of progress in lexical complexity and fluency. As for syntactic complexity, 25.00% of the learners followed the group profile, which involved the development of nominalization. As for lexical complexity, 15.00% of the learners had the same learning profile as the whole group, which entailed the development of lexical variation. Finally, in terms of general language development the number of similar profiles amounted to 41.00%. The learners' profiles showed that different subsystems developed in different ways in individual learners (van Geert and van Dijk; Larsen-Freeman; Housen, Kuiken, and Vedder). The learners allocated their limited cognitive resources to the development of one subsystem to the disadvantage of other subsystems (Skehan). Not being able to synchronize different subsystems, they prioritized some subsystems over others (van Geert and Verspoor; Hou, Loerts, and Verspoor).

Generally, it may be said that in terms of the average CALF results, the L2 learners were not so different after all (Pfenninger, "Not So Individual"; Vercellotti). However, in terms of language progress over time, the learners' differing learning profiles indicated that language development might be an individually owned process (Larsen-Freeman and Cameron; Verspoor, de Bot, and Lowie). The study also showed that generalizing the research results from the group to the individual learners would have led to false conclusions as hardly any group is an ergodic

ensemble (Molenaar and Campbell; Penris and Verspoor) and hardly any learner is exactly average (Hiver and Al-Hoorie).

The study has some limitations which need to be addressed. Firstly, sequential mixed method studies have recently been criticized for a lack of integration between the primary and secondary method (Seawright; Hiver and Al-Hoorie). Secondly, although the study covered the whole educational level (Ortega and Iberri-Shea), the period of three years constituted merely a fragment of such a long process as foreign language development, with the plateau effect at the inter-mediate level (Richards). Thirdly, although the study involved a multi-wave research design, the granularity of measurement (Finkel) was rather low for process-oriented analyses ($n = 21$), irrespectively of the fact that each data wave involved one hundred learners. Finally, the learners' performance might have been influenced by the fact that within the iterative research procedure, the learners were provided with the same tasks in the same conditions, but with different topics. In addition, their performance might have been affected by instruction provided by different teachers with potentially different teaching styles.

Notwithstanding, the study offers important implications for English teachers in the secondary school EFL context in Poland. As the group data indicated, Polish teachers of English should work on learners' fluent use of complex and accurate language. In terms of syntactic complexity, they should focus on subordination while in terms of lexical complexity on lexical sophistication. However, the teachers should realize that individual learners may differ from the whole group as language development is not only a complex, dynamic, and variable, but also an individually owned process. As the individual data showed, learners whose average results are apparently similar may in fact follow different learning trajectories over the course of language development. Due to their limited linguistic and cognitive resources, they may progress in some areas, but regress in others. Hence, the teachers' task is to support the development of different subsystems in accordance with the learners' abilities and needs in order to cater for more coordinated language development which is said to characterize successful language learners. Moreover, it is a real challenge for the teachers to empower more learners to make significant progress in different aspects of language development in L2 English writing in an EFL context. Providing learners with extensive usage-based instruction should lead to the internalization, accommodation, and proceduralizing of complexified language which learners would be able to use automatically, accurately, and appropriately in free written communication.

6. Conclusions

The study examined language development along general and specific measures of complexity, accuracy, and fluency in L2 English writing at secondary school by

comparing this process between the group and individual learners. In the light of the data, a few conclusions can be drawn. Firstly, as a whole group, the learners made significant progress in lexical complexity and fluency at the cost of syntactic complexity and accuracy. Moreover, they progressed in nominalization at the cost of subordination and coordination, and in lexical variation at the cost of lexical density and sophistication. These results amounted to their progress in general language development. Secondly, the individual learners differed from the group not in terms of the average CALF results, but in terms of progress over time. In contrast to the group, many learners did not make significant progress in the clusters of the general and specific CALF measures, which was visible in the fact that less than half of the learners progressed in terms of general language development. Thirdly, the learners differed not only from the group, but also from one another in terms of the learning profiles which they followed. Thus, there arises the need to foster coordinated language development more efficiently in individual learners in the EFL context.

References

Atkinson, D. (ed.). 2011. *Alternative Approaches to Second Language Acquisition*. London: Routledge.

Baba, K. 2020. "Exploring Dynamic Developmental Trajectories of Writing Fluency: Who Benefited from the Writing Task?" In: Fogal, G. and M. Verspoor (eds.). *Complex Dynamic Systems Theory and L2 Writing Development*. Amsterdam: John Benjamins, 3–26. https://doi.org/10.1075/lllt.54.01bab.

Baba, K. and R. Nita. 2014. "Phase Transitions in the Development of Writing Fluency from a Complex Dynamic Systems Perspective." *Language Learning* 64.1. 1–35. https://doi.org/10.1111/lang.12033.

Bulté, B. and A. Housen. 2012. "Defining and Operationalizing L2 Complexity." In: Housen, A., F. Kuiken and I. Vedder (eds.). *Dimensions of L2 Performance and Proficiency: Complexity, Accuracy and Fluency in SLA*. Amsterdam: John Benjamins, 23–46. https://doi.org/10.1075/lllt.32.02bul.

—. 2014. "Conceptualizing and Measuring Short-Term Changes in L2 Writing Complexity." *Journal of Second Language Writing* 26.4. 42–65. https://doi.org/10.1016/j.jslw.2014.09.005.

—. 2018. "Syntactic Complexity in L2 Writing: Individual Pathways and Emerging Group Trends." *International Journal of Applied Linguistics* 28.1. 147–64. https://doi.org/10.1111/ijal.12196.

Bülow, L. and S. Pfenninger. 2021. "Introduction: Reconciling Approaches to Intra-Individual Variation in Psycholinguistics and Variationist Sociolinguistics." *Linguistics Vanguard* 7.2. 20200027. https://doi.org/10.1515/lingvan-2020-0027.

Caspi, T. 2010. "A Dynamic Perspective on Second Language Acquisition." Unpublished Diss. U of Groningen.

Chan, H. P., W. Lowie and K. de Bot. 2014. "A Case Study of Lexical Development of Writing and Speaking in Identical Twins." In: Gao, J. et al. (eds.). *Actes des 16`emes Rencontres Jeunes Chercheurs en Sciences du Langage: Mod`eles et Mod´elisation dans les Sciences du Langage*. Paris: HAL-SHS, 54–65.

de Bot, K. 2017. "Complexity Theory and Dynamic Systems Theory: Same or Different?" In: Ortega, L. and Z. Han (eds.). *Complexity Theory and Language development. In Celebra-*

tion of Diane Larsen-Freeman Amsterdam: John Benjamins, 51–58. https://doi.org/10.1075/lllt.48.03deb.

Dörnyei, Z. 2007. *Research Methods in Applied Linguistics. Quantitative, Qualitative, and Mixed Methodologies*. Oxford: Oxford UP.

Durán, P., et al. 2004. "Developmental Trends in Lexical Diversity." *Applied Linguistics* 25.2. 220–42. https://doi.org/10.1093/applin/25.2.220.

Ellis R. and G. Barkhuizen. 2005. *Analysing Learner Language.* Oxford: Oxford UP.

Finkel, S. E. 1995. *Causal Analysis with Panel Data*. Thousand Oaks: Sage. https://doi.org/10.4135/9781412983594.

Foster P. and G. Wigglesworth. 2016. "Capturing Accuracy in Second Language Performance: The Case for a Weighted Clause Ratio." *Annual Review of Applied Linguistics* 36. 98–116. https://doi.org/10.1017/S0267190515000082.

Granger, S. 2002. "A Bird's-Eye View of Learner Corpus Research." In: Granger, S., J. Hung and S. Petch-Tyson (eds.). *Computer Learner Corpora, Second Language Acquisition and Foreign Language Teaching.* Amsterdam: John Benjamins, 3–33.

Gunnarsson, C. 2012. "The Development of Complexity, Accuracy and Fluency in the Written Production of L2 French." In: Housen, A., F. Kuiken and I. Vedder (eds.). *Dimensions of L2 Performance and Proficiency: Complexity, Accuracy and Fluency in SLA.* Amsterdam: John Benjamins, 247–76. https://doi.org/10.1075/lllt.32.

Hemchua, S. and N. Schmitt. 2006. "An Analysis of Lexical Errors in the English Compositions of Thai Learners." *Prospect* 21.3. 3–25. Retrieved from https://api.semanticscholar.org/CorpusID:42846941. 16 Dec. 2021.

Hiver, P. and A. Al-Hoorie. 2020. *Research Methods for Complexity Theory in Applied Linguistics*. Bristol: Multilingual Matters. https://doi.org/10.21832/HIVER5747.

Hou, J., H. Loerts and M. Verspoor. 2020. "Coordination of Linguistic Subsystems as a Sign of Automatization?" In: Fogal, G. and M. Verspoor (eds.). *Complex Dynamic Systems Theory and L2 Writing Development.* Amsterdam: John Benjamins, 27–48. https://doi.org/10.1075/lllt.54.02hou.

Housen A. and F. Kuiken. 2009. "Complexity, Accuracy, and Fluency in Second Language Acquisition." *Applied Linguistics* 30.4. 461–73. https://doi.org/10.1075/lllt.32.01hou.

Housen, A., F. Kuiken and I. Vedder. 2012. "Complexity, Accuracy and Fluency: Definitions, Measurement and Research." In: Housen, A., F. Kuiken and I. Vedder (eds.). *Dimensions of L2 Performance and Proficiency: Complexity, Accuracy and Fluency in SLA.* Amsterdam: John Benjamins, 1–20.

Hunt, K. 1965. "Grammatical Structures Written at Three Grade Levels. NCTE Research Report, No. 3." Retrieved from https://files.eric.ed.gov/fulltext/ED113735.pdf. 25 Oct. 2019.

Inoue, Ch. 2016. "A Comparative Study of the Variables Used to Measure Syntactic Complexity and Accuracy in Task-Based Research." *The Language Learning Journal* 44.4. 487–505.

James, C. 1998. *Errors in Language Learning and Use: Exploring Error Analysis*. London: Longman.

Johnson, R. and L. Christensen. 2004. *Educational Research: Quantitative, Qualitative, and Mixed Approaches.* Boston: Allyn. Retrieved from https://www.researchgate.net/publication/264274753. 15 Nov. 2022.

Knoch, U., A. Rouhshad and N. Storch. 2014. "Does the Writing of Undergraduate ESL Students Develop after One Year of Study in an English-Medium University?" *Assessing Writing* 21.1. 1–17. https://doi.org/10.1016/j.asw.2014.01.001.

Kowal, I. 2016. *The Dynamics of Complexity, Accuracy and Fluency in Second Language Development.* Kraków: Jagiellonian UP. https://doi.org/10.4467/K9474.72/16.16.6986.

Kuiken, F. and I. Vedder. 2008. "Cognitive Task Complexity and Written Output in Italian and French as a Foreign Language." *Journal of Second Language Writing* 17.1. 48–60. https://doi.org/10.1016/j.jslw.2007.08.003.

Laufer, B. and P. Nation. 1995. "Vocabulary Size and Use: Lexical Richness in L2 Written Production." *Applied Linguistics* 16. 307–22. https://doi.org/10.1093/applin/16.3.307.

Larsen-Freeman, D. 2006. "The Emergence of Complexity, Fluency, and Accuracy in the Oral and Written Production of Five Chinese Learners of English." *Applied Linguistics* 27. 590–616. https://doi.org. 10.1093/applin/aml029.

Larsen-Freeman, D. and L. Cameron. 2008. *Complex Systems and Applied Linguistics.* Oxford: Oxford UP.

Leech, G., P. Rayson and A. Wilson. 2001. *Word Frequencies in Written and Spoken English: Based on the British National Corpus.* London: Longman.

Leijten, M. and L. van Waes. 2013. "Keystroke Logging in Writing Research: Using Inputlog to Analyse and Visualize Writing Processes." *Written Communication* 30.3. 358–92. https://doi.org/10.1177/0741088313491692.

Levelt, W. 1989. *Speaking: From Intention to Articulation.* Cambridge: MIT.

Lowie, W., et al. 2017. "Finding the Key to Successful L2 Learning in Groups and Individuals." *Studies in Second Language Learning and Teaching* 7.1. 127–48.

Lowie, W. and M. Verspoor. 2019. "Individual Differences and the Ergodicity Problem." *Language Learning* 69. 184–206. https://doi.org/10.1111/lang.12324.

Lu, X. 2010. "Automatic Analysis of Syntactic Complexity in Second Language Writing." *International Journal of Corpus Linguistics* 15.4. 474–96. https://doi.org/10.1075/ijcl.15.4.02lu.

—. 2012. "The Relationship of Lexical Richness to the Quality of ESL Learners' Oral Narratives." *The Modern Language Journal* 96. 190–208.

McKee, G., D. Malvern and B. Richards. 2000. "Measuring Vocabulary Diversity Using Dedicated Software." *Literary and Linguistic Computing* 15. 323–37.

Malvern, D., et al.2004. *Lexical Diversity and Language Development: Quantification and Assessment.* Basingstoke: MacMillan.

Michel M. 2017. "Complexity, Accuracy and Fluency in L2 Production." In: Loewen, S. and M. Sato (eds.). *The Routledge Handbook of Instructed Second Language Acquisition*. London: Routledge, 50–68.

Molenaar, P. and C. Campbell. 2009. "The New Person-Specific Paradigm in Psychology." *Current Directions in Psychological Science* 18.2. 112–17. https://doi.org/10.1111/j.1467-8721.2009.01619.x.

Norris, J. and L. Ortega. 2009. "Towards an Organic Approach to Investigating CAF in Instructed SLA: The Case of Complexity." *Applied Linguistics* 30.4. 555–78.

Nuance®. 2014. Dragon speech recognition software. Retrieved from https://www.nuance.com/dragon/support/dragon-naturallyspeaking.html. 15 Dec. 2014.

Ortega, L. and G. Iberri-Shea. 2005. "Longitudinal Research in Second Language Acquisition: Recent Trends and Future Directions." *Annual Review of Applied Linguistics* 25. 26–45. https://doi.org/10.1017/S0267190505000024.

Pallotti, G. 2022. "Cratylus' Silence: On the Philosophy and Methodology of Complex Dynamic Systems Theory in SLA." *Second Language Research* 38.3. 689–701. https://doi.org/10.1177/0267658321992451.

Penris, W. and M. Verspoor. 2017. "Academic Writing Development: A Complex, Dynamic Process." In: Pfenninger, S. and J. Navracsics (eds.). *Future Research Directions for Applied Linguistics*. Bristol: Multilingual Matters, 215–42.

Pfenninger, S. 2017. "Not So Individual after All: An Ecological Approach to Age as an Individual Difference Variable in a Classroom." *Studies in Second Language Learning and Teaching* 7.1. 19–46. https://doi.org/10.14746/ssllt.2017.7.1.2.

—. 2020. "The Dynamic Multicausality of Age of First Bilingual Language Exposure: Evidence from a Longitudinal Content and Language Integrated Learning Study with Dense Time

Serial Measurements." *The Modern Language Journal* 104.3. 662–86. https://doi.org/10.1111/modl.12666.

Polio, C. 1997. "Measures of Linguistic Accuracy in Second Language Writing Research." *Language Learning* 47. 101–43. https://doi.org/10.1111/0023-8333.31997003.

Polio, C. and M. Shea. 2014. "An Investigation into Current Measures of Linguistic Accuracy in Second Language Writing Research." *Journal of Second Language Writing* 26. 10–27. https://doi.org/10.1016/J.JSLW.2014.09.003.

Read, J. 2000. *Assessing Vocabulary*. Oxford: Oxford UP.

Richards, J. C. 2008. *Moving Beyond the Plateau: From Intermediate to Advanced Levels in Language Learning*. New York: Cambridge UP.

Robinson, P. 2001. "Task Complexity, Task Difficulty, and Task Production: Exploring Interactions in a Componential Framework", *Applied Linguistics*, 22. 27–57.

Robinson, P., T. Cadierno and Y. Shirai. 2009. "Time and Motion: Measuring the Effects of the Conceptual Demands of Tasks on Second Language Speech Production." *Applied Linguistics* 30. 533–54. https://doi.org/10.1093/applin/amp046.

Salkind, N. 2010. *Encyclopaedia of Research Design*. Thousand Oaks: Sage. https://doi.org/10.4135/9781412961288.

Seawright, J. 2016. "Better Multimethod Design: The Promise of Integrative Multimethod Research." *Security Studies* 25. 42-49. https://doi.org/10.1080/09636412.2016.1134187.

Skehan, P. 1998. *A Cognitive Approach to Language Learning*. Oxford: Oxford UP.

Spoelman, M. and M. Verspoor. 2010. "Dynamic Patterns in Development of Accuracy and Complexity: A Longitudinal Case Study in the Acquisition of Finnish." *Applied Linguistics* 31. 532–53. https://doi.org.10.1093/applin/amq001.

Storch, N. and J. Tapper. 2009. "The Impact of an EAP Course on Postgraduate Writing." *Journal of English for Academic Purposes* 8.3. 207–23. https://doi.org.10.1016/j.jeap.2009.03.001.

Towell, R. and R. Hawkins. 1994. *Approaches to Second Language Acquisition*. Bristol: Multilingual Matters.

Ure, J. 1971. "Lexical Density: A Computational Technique and Some Findings." In: Coulthard, M. (ed.). *Talking About Text*. Birmingham: English Language Research, 24–48.

van Geert, P. and M. van Dijk. 2002. "Focus on Variability: New Tools to Study Intra-Individual Variability in Developmental Data." *Infant Behaviour and Development* 25. 340–75. https://doi.org/10.1016/S0163-6383(02)00140-6.

van Geert, P. and M. Verspoor. 2015. "Dynamic Systems and Language Development." In: MacWhinney, B. and W. O'Grady (eds.). *The Handbook of Language Emergence*. New York: Wiley, 537–56. https://doi.org/10.1002/9781118346136.ch24.

Vercellotti, M. 2017. "The Development of Complexity, Accuracy, and Fluency in Second Language Performance: A Longitudinal Study." *Applied Linguistics* 38.1. 90–111. https://doi.org/10.1093/applin/amv002.

Verspoor, M., W. Lowie and M. van Dijk. 2008. "Variability in Second Language Development from a Dynamic Systems Perspective." *Modern Language Journal* 92. 214–31. https://doi.org.10.1111/j.1540-4781.2008.00715.x.

Verspoor, M., K. de Bot and W. Lowie. 2011. *A Dynamic Approach to Second Language Development*. Amsterdam: John Benjamins.

Verspoor, M., M. Schmid and X. Xu. 2012. "A Dynamic Usage Based Perspective on L2 Writing." *Journal of Second Language Writing* 21.3. 239–63. https://doi.org/10.1016/j.jslw.2012.03.007.

Verspoor, M., W. Lowie and M. Wieling. 2020. "L2 Developmental Measures from a Dynamic Perspective." In: Le Bruyn, B. and M. Paquot (eds.). *Learner Corpus Research Meets Second Language Acquisition*. Cambridge: Cambridge UP, 172–90. https://doi.org/10.1017/9781108674577.009.

Wang, Y. and S. Tao. 2020. "The Dynamic Co-Development of Linguistic and Discourse-Semantic Complexity in Advanced L2 Writing." In: Fogal, G. and M. Verspoor (eds.). *Complex Dynamic Systems Theory and L2 Writing Development*. Amsterdam: John Benjamins, 49–78. https://doi.org.10.1075/lllt.54.03wan.

Weblingua, Ltd. 2011. "Text Inspector. The Professional Web Tool for Analysing Texts". Retrieved from https://textinspector.com. 23 June 2020.

Wolfe-Quintero, K., S. Inagaki and H. Kim. 1998. *Second Language Development in Writing: Measures of Fluency, Accuracy and Complexity.* Honolulu: U of Hawaii.

Zheng, Y. 2016. "The Complex, Dynamic Development of L2 Lexical Use: A Longitudinal Study on Chinese Learners of English." *System* 56. 40–53. https:/doi.org.10.1016/j.system.2015.11.007.