



Expanding the collaborative writing research framework: A longitudinal analysis of how collaborative and independent writers orient to writing spaces

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ABSTRACT

Recent reviews of the L2 collaborative writing (CW) literature have highlighted a propensity for researchers to rely on learner and task-related variables to explore CW phenomena. However, this focus limits how scholars conceptualize CW by overlooking the wider educational context that accompanies CW activities and how writers orient to said spaces. Investigating how writers perceive the CW landscape is important as their perceptions are known to impact writing development. Engaging a systems orientation to writing spaces, this study examined how students in different writing conditions perceive the writing landscape. This work followed two intact university classes (one engaged in CW, and one not) over one semester, and collected data from five iterations of a system mapping task and interviews with students. The CW group perceived a more nuanced and complex perspective of the writing space, comparatively. Cluster analyses also revealed that both groups oriented similarly to two variable sets: task and environmental factors, and learner and environmental variables. This study demonstrates how CW positively impacts writers' perceptions of the writing space and encourages instructors to help CW students realize and take advantage of the wider context that CW is embedded in. This work also expands the CW research framework.

1. Introduction

The benefit of collaborative work (i.e., multiple agents working collectively toward an end goal) on subsequent individual performance has long been recognized in disparate educational contexts, including the learning sciences (Laughlin et al., 2008), mathematics (Ellis, 2011), and preservice teacher education (Watters & Ginns, 2000). Research on L2 collaborative writing (CW) has also demonstrated positive learner outcomes, with studies regularly documenting how language learning from CW activities (in dyads or small groups) transfers to individual collaborators in subsequent writing tasks (for an overview, see Elabdali, 2021). As recent reviews and commentary on the CW literature have suggested (Li & Zhang, 2021; Storch, 2019; Zhang & Plonsky, 2020), related research has focused primarily on linguistic output (e.g., Bikowski & Vithanage, 2016; Storch, 2002) or on interaction features informing CW dialogues and activities (e.g., Li & Kim, 2016; Storch, 1998; Wang, 2019).

Moreover, such studies have typically examined interactions related to learner (e.g., proficiency level, L1) and task-related variables (e.g., task type or task setting) (see Zhang & Plonsky, 2020, for an overview). Insightful in their findings and principled in their

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approaches, these studies—with few exceptions ([Cho, 2017](#); [Storch, 2004](#); [Wang, 2019](#), reviewed later)—are limited as such variable sets frequently restrict CW investigations to those focused on interactions between collaborators. Subsequently, there is little account of how the wider educational context informing CW might impact related writing processes.

To understand a broader account of the CW landscape, researchers rely on limited studies that investigate learner perceptions of CW. These studies have predominantly examined student satisfaction relative to the CW experience, generally observed to be supportive ([Bikowski & Vithanage, 2016](#); [Shehadeh, 2011](#)), or learners' perceptions of the task itself, commonly found to be positive ([Kessler, 2009](#); [Storch, 2005](#)). However, these studies do not address how writers perceive to orient themselves inside the CW space. That is, little is known about how students adapt to CW tasks when a wider lens is cast on the CW context.

Exploring the wider educational landscape informing CW is important because how learners identify, reflect upon, and interact with their writing spaces can influence the composing strategies they develop and the quality of their writing output ([Majchrzak, 2018](#); [Nitta, 2020](#)). Moreover, without expanding the CW research framework researchers are left to guide writing pedagogy with a limiting understanding of the environment CW occurs in and how students orient to said contexts. Not having access to this information is problematic because of the situational nature of writing: learner, task and environmental variables (the latter defined subsequently) all press upon it. Given that writing is a located, spatial activity, understanding how writers orient accordingly can provide useful feedback about CW composing processes and can lend support to instructors and administrators coordinating such spaces.

2. Defining key terms: collaborative writing spaces and environmental variables

To develop further insights into the CW landscape, the present study expands the definition of the CW space by adding previously unexamined factors to the conventional focus on individual and task related variables. This approach explores, for instance, how instructor-classroom dynamics and classroom-wide discussions impact CW. Doing so extends the research lens beyond dyadic or small group CW interactions. In redefining the CW space, research also moves outside the classroom, tapping into the personal and professional interactions and engagements of instructors and students. Doing so can account for, for example, how writing center tutors and previous writing instruction impact CW.

One way to activate this expanded definition of the CW space is by attending to environmental variables. Environmental variables are defined as those factors beyond the conventional fold that potentially inform CW processes. Such variables include, for example, professional development workshops for instructors, students' previous writing teachers, and students' peers outside of class—items typically disassociated with CW studies. Environmental variables further differ from learner and task variables as they facilitate studies into the educational landscape CW occurs in, rather than just examining the CW interaction itself. That is, exploring such variables pushes research beyond its standard focus on learner and task-related variables and motivates researchers to stretch the CW research boundary. In the present work, environmental features are examined alongside those factors often linked with CW research (i.e., learner and task variables) to explore how learners perceive the interaction of these three variable sets on their English writing development. In doing so, this paper takes up calls by [Li & Zhang \(2021\)](#) and [Storch \(2019\)](#) to expand the research framework informing CW studies.

3. An expanding collaborative writing research landscape

The work of [Storch \(2004\)](#), [Cho \(2017\)](#), and [Wang \(2019\)](#) provide important insights into, and can help chart the later evolution of, variables conventionally associated with CW research (for thorough overviews, see [Li & Zhang, 2021](#); [Storch, 2019](#); [Zhang & Plonsky, 2020](#)). Although related studies predate these publications (e.g., [Villamil & De Guerrero, 1996](#)), these three selections demonstrate notable increases in the scope of variables investigated in CW research. As their publication dates correspond with an increase in the breadth of coverage, they are presented chronologically, with overlapping features highlighted when necessary.

[Storch's \(2004\)](#) classroom-based study followed approximately 16 dyads across one semester of university studies. Her work, framed by activity theory, documented unique interaction patterns that mirrored learners' underlying ambitions, showing how learner variables such as collaborators' aims, motivations, experiences, and beliefs contributed to CW interaction patterns. Exploring this variable set developed the research space considerably by moving beyond conventional attention to group-level exchanges. Storch's work provided useful preliminary insights into how additional factors (e.g., learner variables such as motivations and experiences) inform our interpretation of dyadic behavior in CW contexts.

[Cho \(2017\)](#) and [Wang \(2019\)](#) broadened [Storch \(2004\)](#)'s exploratory landscape by employing [Engeström's \(1999, 2015\)](#) extended activity theory model—described by Storch as “presenting a more complex activity system” (p. 475)—to track other factors informing CW. The extended activity theory model typically accounts for the following variable set: instruments (e.g., online writing tools), objects (e.g., participants' goals), division of labor (e.g., collaborative roles), community (e.g., the group members), rules (e.g., task instructions), and subjects (e.g., the group members). As the model's constituent parts suggest, this framework moves the research context beyond a focus on learner and task-related variables. With this model as a guide, Cho's work—a case study of three learners engaged in computer-mediated CW—documented how the quality and variance of collaborations could be attributed to, for example, the rules, division of labor, and instruments informing the CW tasks. Cho's findings expanded [Storch's \(2004\)](#) earlier focus on learners' motivations and experiences. Like Wang, however (described subsequently), her work focused on computer-mediated CW. What remains unclear is how well these findings transfer to face-to-face or classroom settings. Nonetheless, Cho's work underscored the promise of investigating a wider CW landscape.

Like [Cho \(2017\)](#), [Wang's \(2019\)](#) study of web-based CW used [Engeström's \(1999, 2015\)](#) extended activity theory to focus on interaction patterns among collaborative writers. Wang explored how regulatory activities (e.g., establishing a personal goal and

evaluating group progress) impacted learners and facilitated different interaction types. Through analyses of, for example, individual roles, writing strategies, agency, and time and team management, Wang found patterns of web-based CW to be dynamic within and across groups and essay tasks, and demonstrated how regulation activities functioned as a powerful influence on behavioral patterns. Her work highlighted, in ways similar to Storch (2004), how goal-directed activities have a wide-ranging influence on learner behavior in CW contexts.

Collectively, these studies demonstrate how expanding the research landscape to include environmental variables facilitates knowledge of CW processes. Although these studies helped develop our understanding of different modes of CW (in particular, computer-mediated or web-based CW), there remains much to learn about classroom-based CW, the focus of the present work. For instance, little is known about how writers orient to classroom collaborative spaces when we broaden the exploratory lens to include environmental factors atypical of CW research. Nor do we know how, if at all, such orientations shift over time.

To address these issues, this study examines how CW spaces are perceived to interact, develop, and change across one university semester in CW and independent writing (IW) students. In doing so, this work differentiates itself from conventional comparative studies between CW and IW that typically attend to differences in linguistic output (e.g., Shehadeh, 2011; Storch & Wigglesworth, 2007; Strobl, 2014) and instead focuses on how both sets of writers orient to their writing spaces. To assist with this comparative interest, the following question supports this study: How do CW and IW students orient similarly and differently to writing spaces over one semester? The subsequent questions help guide this larger aim:

1. What are the differences in the two groups, if any, regarding how many and to what degree variables are seen to influence L2 writing development over one semester?
2. What patterns of relations with the writing space appear, if any, with students engaged in CW and those engaged in IW?
3. How did learners in CW and IW conditions orient themselves to the writing space, and did such orientations change over time?

One manner of pursuing answers to these questions is through a systems account (von Bertalanffy, 1969; Arrow, et al., 2000) of the writing space that enables researchers to push variables of interest even beyond those seen in recent CW studies employing activity theory.

4. Theoretical framework: a systems account of collaborative writing spaces

To examine a broad CW space, a perspective that foregrounds a measured degree of system-wide behavior is called for. A simplex systems approach, embedded within a complex dynamic systems theory orientation, provides a useful framework here. van Geert and Steenbeek (2014) define such systems as a “*connected whole of beliefs, representations, values, emotions, habits, practices and material tools that serve as a simplifying representation of the overarching complex system* [emphasis in original]” (p. 23). Interpreted as a series of nested features, the emergence of simplex systems is a result of repeated efforts to engage with the complex, expansive, and frequently unwieldy nature of educational landscapes (Koopmans, 2020; van Geert & Steenbeek, 2014). In this way, a simplex systems approach responds to calls to generate research spaces that can be meaningfully and feasibly explored while maintaining the inherent complexity of the larger educational context a phenomenon is embedded in—what van Geert and Steenbeek call “praxis-based forms of representing complexity” (p. 22). As we redefine the CW space to move beyond interactions at the dyad or small group level, a simplex systems approach may prove fruitful.

A simplex systems perspective affords researchers an analytic framework that can furnish stakeholders (e.g., administrators, teachers, and students) with a broad view of the learning space that can assist with curricular and pedagogical decisions. For example, via a simplex systems analysis of how L2 writing is managed in a Thai university actuary science program, Fogal (2020) demonstrated how the program’s different stakeholders and structures helped maintain its stability and quality, and noted how small-scale curricular changes (e.g., instilling in new faculty the value of a writing-across-the-curriculum approach) could advance the educational environment. As Fogal demonstrated (see too Fogal, 2022, 2023; Ludlow et al., 2017), a simplex systems framework focuses on knowledge producing systems (e.g., the space one learns in) rather than the knowledge (e.g., the learning that occurs) said systems generate (Davis & Sumara, 2006)—a key feature that complements existing CW interaction studies.

Documenting insights into expanded CW spaces via a simplex systems approach may contribute to the literature by revealing (a) how writers reflecting upon and interacting with learner, task, and environmental variables facilitates writing development, (b) how, when captured longitudinally, such perspectives shift over time, if at all, and (c) how similar learning spaces may be enacted in analogous educational contexts. Capturing these perspectives and developing these insights has become increasingly important as CW tasks find their way into progressively more academic writing classes (Chen & Hapgood, 2021; Li & Zhang, 2021). To explore the CW space as a simplex system, system mapping can be effective.

5. System mapping

Having emerged as a research tool to operationalize simplex systems thinking, system mapping is predicated on the belief, one shared across epistemological boundaries, that educational systems (e.g., classrooms) are themselves complex and dynamic environments nested in more complex and larger institutions, including local school boards, college faculties, and governmental agencies (Davis & Sumara, 2006; van Geert & Steenbeek, 2014). System mapping maintains this wide view of the educational landscape by recognizing its interconnected nature and so attempts to capture the teaching-learning space across a wide range of relevant components. In doing so, as Ferreira & Ryan (2012) note, system mapping supports researchers by highlighting interdependencies,

detecting occasions for improvement, describing how stakeholders are influenced, and outlining system borders and their permeability. Through these opportunities, system mapping identifies leverage points and tables evidence “for proposals aimed at how, where, and when educational spaces may benefit from change” (Fogal, 2022, p. 2). As the L2 literature aims to better understand CW, system mapping may serve to address questions about how best, under what conditions, and with what learners CW may facilitate learning.

As a research tool, system mapping addresses calls to expand conventional approaches to CW research (Li & Zhang, 2021; Storch, 2019) and to examine the wide ecosystem associated with teaching and learning. To do so, system mapping operationalizes simplex systems in ways that are pedagogically meaningful and researchable across space and time (Fogal, 2020). System mapping thus enables research to investigate a learner generated, introspective look at the learning landscape that extends beyond the standard classroom setting—a reflective perspective seldom accounted for in CW research (Li & Zhang, 2021).

6. The present study

The present work distinguishes itself from CW interaction studies as it does not focus on group-work dynamics at the dyad or small group level—a shift that pairs with Li and Zhang's (2021) call to generate new avenues for investigating CW. In addition to exploring the wider CW context, this work also addresses two further invitations in the literature. The first is the longstanding and repeated call to explore classroom writing research in ways that account for its situatedness (Cumming, 2016; Leki et al., 2008)—that is, in the present context, to move beyond the group or dyad as the primary phenomenon of inquiry. The second, more recent but no less important and related call, expands the first by highlighting a further need to adopt a curricular lens that extends L2 writing research beyond the classroom (Byrnes, 2020; Norris & Manchón, 2012). This call is particularly noteworthy here as recent descriptions of face-to-face CW research limit such endeavors to a “classroom-based domain of research” (Zhang & Plonsky, 2020, p. 1). The present work thus presents an opportunity to expand this domain by exploring classroom-based CW that is itself embedded in a larger curricular (i.e., a university undergraduate program of study) and social (e.g., learners' peers and previous writing instructors) ecosystem. The focus of this study, therefore, is not CW per se, but on CW as it is perceived to unfold relative to learners' complex writing spaces and how such perceptions may differ between writers composing collaboratively and those writing independently. In this way, this study identifies and compares system (rather than dyadic or group) interactions and perceptions between CW and IW students.

6.1. Context and participants

This study is embedded in parallel and intact sections of a university course taught by the same instructor and follows two sets of learners: those engaged in CW (Section A) and those engaged in IW (Section B). The study ran over a single semester at a private university in Japan. Both the course and the liberal arts program the course is situated in is delivered in English. Generally, students in the program identify as bi- or multilingual and relate closely with at least English and Chinese, Japanese, or Korean languages. The mean TOEFL score of students in Section A was 106.35 ($SD = 7.48$). In Section B the mean score was 108.29 ($SD = 9.76$). There was no statistically meaningful difference in TOEFL scores between the two groups. The students followed in this study also provide a rare look into CW among learners with advanced proficiency—a relatively unique perspective in CW studies (Zhang & Plonsky, 2020).

The course informing this study (Thinking & Writing [TW]) is required of all students in the faculty, and students typically enroll in TW in their second semester. The course aims to develop students' critical thinking and writing abilities and moves learners through an extensive series of academic reading and writing tasks. Students compose approximately 15,000 words over a 14-week semester, comprised of a series of near twice-weekly writing tasks (500 words each) and a lengthier midterm (2000 words) and final paper (3000 words). The twice-weekly writing tasks (22 in total) require students to write a response paper by synthesizing their reading of required texts (e.g., selections from Nietzsche's *Thus Spoke Zarathustra*) with notes derived from a professor's lecture and discussions at the group and classroom level. Students were typically allotted approximately 72 hours to complete each response paper. Students starting the course are aware of its reputation (i.e., as intellectually demanding and time intensive), and so typically begin TW motivated for a rigorous course of study.

The two parallel sections of TW met twice weekly for 100-minutes per session and were taught in consecutive periods of the day. With the exception of the first and last response paper, as well as the midterm and final essay, students in Section A ($n = 15$, forming five triads) were required to engage in CW to complete the twice-weekly writing assignments. Students in Section B ($n = 18$, forming six triads, primarily used for in-class group discussions) did not complete any CW tasks. The selection of Section A for CW was random, and the two sections of the course were largely pedagogically matched. For example, both class sections had the same opportunities and allotted time to engage in small group discussions and received the same lectures and writing assignments. In addition, both sets of learners frequently had the last fifteen minutes of class to begin to consider the writing task. However, the CW students also typically met outside of class, working on their essays face to face (e.g., at the university library or a local coffee shop) and online using a video communication platform (e.g., Zoom). In this regard, collaboration was computer-mediated and face to face, with individual CW groups fluctuating between time spent in each of the two modes depending on group members' schedules.

Aside from the CW condition, the primary pedagogical difference between the groups was that on day one of the semester students in Section A received instructions for operationalizing CW. Presenting learners with some direction followed suggestions for best practice (Chen & Hapgood, 2021; Li & Zhang, 2021; Zhang, 2019) and was deemed necessary as no students had written collaboratively before. The suggestions emphasized that students collaborate across the writing process, discuss the writing task in real time when possible, and employ one of a series of online writing platforms (e.g., Microsoft OneDrive) that facilitate CW.

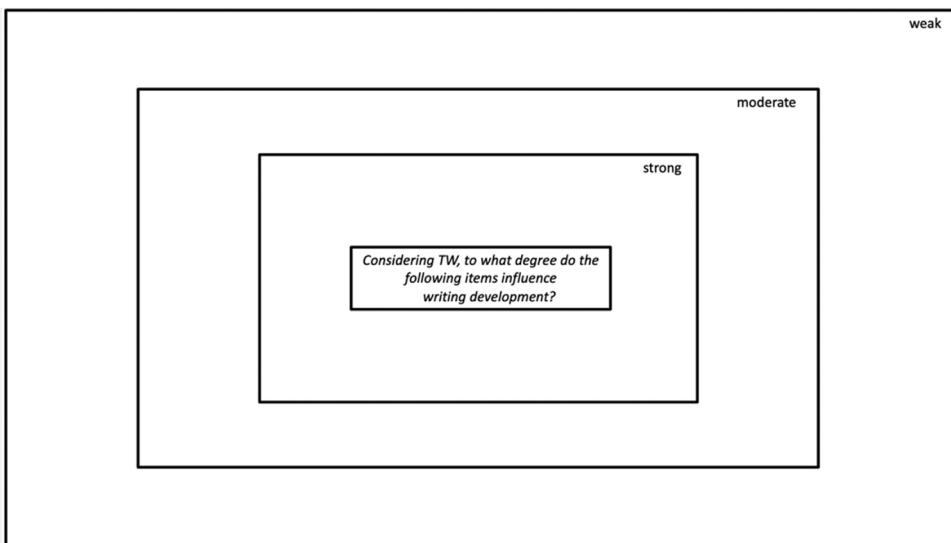
Table 1

Writing Space Variables, Derived from Fogal, 2020, 2022.

Related to the course	Related to the program curriculum	Related to agents	Related to students' motivations & experiences
v ^a 1-learning content knowledge	v7-lexico-grammatical forms	v16-course professor	v28-grade-point average*
v2-learning to think critically	v8-text structures	v17-other faculty professor(s)*	v29-ambition to be an effective writer
v3-learning about effective writing	v9-writing process	v18-administration	v30-interest in study material
v4-writing assignments	v10-writing feedback	v19-writing center tutor(s)	v31-secondary school writing experiences
v5-classroom discussions	v11-writing genres	v20-high school or cram school instructor*	v32-secondary school experiences*
v6-professor's professional activities	v12-course readings	v21-professor-class dynamics	v33-prior general life experiences*
	v13-external resources	v22-general group dynamics among students	v34-extra-curricular activities
	v14-critical engagement	v23-small group dynamics	v35-personal beliefs
	v15-using sources (research skills)	v24-students' peers outside the class*	v36-language(s) other than English
		v25-professor's peers outside the classroom	
		v26-personal relationships of students*	
		v27-other non-university individuals*	

^a Variable number.

* Indicates variables sourced exclusively from students in pilot studies.

**Fig. 1.** Sample System Mapping Board.

Over the semester, students in the CW class wrote in four different groups. Following the teacher's instructions, students self-selected into triads with the caveat that they work with new group members each time. Students changed groups in week 5, 9, and 12. Rather than ensure that each group work together for the same period of time, following Ushioda (2021) and aiming to capture the CW space in a naturalistic setting, classroom parameters guided the research space, and so changes in groups occurred at pedagogically meaningful points in the semester. According to the instructor, changes in group membership were made to expose students to potentially different perspectives on the study material. The IW students changed groups in the same weeks.

6.2. Data collection

System mapping (Fogal, 2022; Ludlow et al., 2017) was employed to capture how students interacted with a wide set of variables thought to influence writing development. The system mapping activity involved three stages. First, students in both groups were asked to consider the degree of influence (strong, moderate, weak) that a set of variables (Table 1, derived from Fogal, 2020, 2022) known to impact L2 writing development had relative to a guiding question (*Considering TW, to what degree do the following items influence writing development?*).

The items in Table 1 respond to calls in the literature to envision writing development over the lifespan (e.g., considering the impact

Table 2

Writing and system mapping activities across the semester and course sections.

Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Response paper	1 ^a , 2, 3	4, 5	6	7, 8	9 ^b	10	11, 12		13 ^b	14, 15	16, 17	18 ^b , 19	20, 21	22 ^a	
Midterm paper								1 ^a							1 ^a
Final paper															
Mapping activity	1 ^c				2				3			4			5

^a Denotes assignments composed independently by students in both sections.

^b Denotes when students in both sections changed groups.

^c Completed before writing assignment 1 was assigned.

of secondary school studies on tertiary-level writing), as a community-embedded exercise (e.g., including the influence of tutors at local writing centers), and as situated inside a wider curricular framework (e.g., accounting for the impact of other instructors in the faculty) that reaches beyond the conventional classroom space (Byrnes, 2020; Leki et al., 2008). In addition to consulting the literature (see, for example, Hyland's (2019) knowledge types required for effective writing), the variables were selected with input from L2 writing instructors and scholars, and was piloted across four groups of learners and two proficiency levels (see Fogal, 2020, 2022). While many of the variables in Table 1 appear readily in the L2 writing literature (e.g., v3-learning about effective writing; v7-lexico-grammatical forms) and/or are familiar to writing instructors (e.g., v9-writing process; v19-writing center tutor), those marked with an asterisk were derived exclusively from the pilot study and so provide learners' insights on the topic of variables thought to inform their writing spaces. In addition to task and learner-related factors, the variables in the table were deemed particularly useful for the present study as they include environmental variables that have received minimal attention in the CW literature (Zhang & Plonsky, 2020).

Each of the 36 variables in Table 1 was listed on a card that students mapped onto a physical board (see Fig. 1) arranged on a desk, placing them relative to their degree of influence. A brief definition of each variable was noted on the back of the cards to assist learners. Students received the cards in randomized order, completed the task individually, and were told to exclude cards considered insignificant.

After this first phase, students were asked to consider their completed system map holistically, instead of as a collection of discrete items, and were invited to make changes to the placement of their cards, if need be. In this way, students could visualize interactions and engage with relationships while completing the task in ways that rating scales do not allow for (Fogal, 2022, 2023). The final phase asked students to draw lines that linked together variables thought to have a meaningful relationship (variables could be linked more than once to demonstrate a multiplicity of interactions stemming from the same variable).

Learners in both sections participated in five system mapping activities across the semester: at the start and finish to the term, and at the end of three different thematic units of the course, in weeks five, nine, and twelve. As noted earlier, shifts in thematic units also corresponded with changes in group membership. Table 2 provides an overview of the timing of the writing and mapping tasks students in both sections engaged in over the semester.

Finally, to gain deeper insights into decisions students made with their system maps and to better appreciate the growing understanding of their writing development and their orientation to the writing space, at the conclusion of the semester follow-up, semi-structured interviews were conducted with an equal number of students ($n = 8$) from each section who volunteered to discuss their learning experiences. As more students volunteered than was deemed feasible to interview, the interview students were randomly selected. In total, the dataset comprised sixteen interviews and 165 system maps.

6.3. Data analysis

To identify differences in how learners oriented to variables thought to impact writing development (RQ1) and patterns of perceived engagement with the writing space (RQ2), system maps were coded using a framework developed by Ludlow et al. (2017) and employed by Fogal (2020, 2022). Items that learners considered *strong* were coded 3, those considered *moderate* were coded 2, while items considered *weak* were coded 1. Items that were not employed were coded 0. To determine differences between the two sections, mean scores were calculated for each item. In addition, cut-off scores determined differences in degrees of influence: 2.5–3 (strong), 1.9–2.4 (moderate), and 1–1.8 (weak). The results served to reveal patterns and differences of perceived influences on writing across the two sections.

To determine what component parts informed each section (RQ3), a hierarchical cluster analysis (HCA) was employed using SPSS (version 28) to allow for different orientation types to the writing space to emerge. For each section, Ward's method determined the squared Euclidean distance between items in an agglomerative process that iteratively combines the closest relationships in the mapping data. The resulting dendograms demonstrate which items were clustered and at what step (see Staples & Biber, 2015 for a discussion of cluster analysis in applied linguistics research).

A cluster analysis is particularly useful here as it facilitates the exploration and interpretation of multidimensional relationships (Ludlow et al., 2017) capable of highlighting differences and similarities concerning interactions and variables learners may have relied on (overtly or not) as they reflected on their writing development (Fogal, 2022). Considering the extensive amount of CW conducted by Section A, thus engaging a diverse set of learning experiences compared to Section B, it was surmised that such analyses

Table 3

Descriptive statistics: summary of number and degree of influential variables distributed across learners' system maps over time.

CW group (Section A; n = 15)						IW group (Section B; n = 18)					
DI ^a	Strong	M	Moderate	SD	Weak	Strong	M	Moderate	SD	Weak	SD
Week	Strong	M	Moderate	SD	Weak	Strong	M	Moderate	SD	Weak	SD
1	11.73	4.27	11.67	2.23	9.40	3.33	11.82	1.55	10.53	2.90	9.59
5	16.53	2.56	9.87	2.13	7.73	3.69	12.06	1.56	10.53	3.08	9.12
9	18.13	2.83	8.87	2.47	6.27	2.66	16.18	3.32	7.88	2.62	7.29
12	16.93	2.63	9.80	2.27	6.53	2.53	10.88	3.39	10.12	2.93	8.18
15	18.73	4.06	8.27	3.26	6.47	2.75	13.12	4.15	9.24	3.05	7.82

^a Degree of influence.**Table 4**

Variables deemed strongly influential across groups and time.

Week 1		Week 5		Week 9		Week 12		Week 15		
CW ^a	IW ^d	CW	IW	CW	IW	CW	IW	CW	IW	
v ^b 2-learning to think critically ^c v10-writing feedback v8-text structures v9-writing process v16-TW professor	v2-learning to think critically v10-writing feedback v3-learning effective writing v16-TW professor v4-writing assignments	v2-learning to think critically v3-learning effective writing v10-writing feedback v16-TW professor v1-learning content knowledge v5-class discussions v8-text structures v9-writing process v21-prof.-class dynamics v22-general dynamics among Ss v23-small group dynamics v28-GPA v29-ambition to write effectively v30-interest in study material v31-high school writing	cv2-learning to think critically v3-learning effective writing v10-writing feedback v16-TW professor v1-learning content knowledge v5-class discussions v8-text structures v9-writing process v21-course readings v16-TW professor v21-prof.-class dynamics v22-general dynamics among Ss v23-small group dynamics v28-GPA v29-ambition to write effectively v30-interest in study material v31-high school writing v35-personal beliefs	v1-learning content knowledge v2-learning to think critically v3-learning effective writing v10-writing feedback v14-critical engagement v22-general dynamics among Ss v9-writing process v10-writing feedback v14-critical engagement v16-TW professor v21-course readings v16-TW professor v21-prof.-class dynamics v22-general dynamics among Ss v23-small group dynamics v28-GPA v29-ambition to write effectively v30-interest in study material v31-high school writing v35-personal beliefs	v1-learning content knowledge v2-learning to think critically v3-learning effective writing v10-writing feedback v14-critical engagement v22-general dynamics among Ss v9-writing process v10-writing feedback v14-critical engagement v16-TW professor v21-course readings v16-TW professor v21-prof.-class dynamics v22-general dynamics among Ss v23-small group dynamics v19-writing center tutor(s)	v3-learning effective writing v16-TW professor v19-Writing Center tutor(s) v15-using sources v19-Writing Center tutor(s) v10-writing feedback v14-critical engagement v16-TW professor v21-course readings v16-TW professor v21-prof.-class dynamics v22-general dynamics among Ss v23-small group dynamics v19-writing center tutor(s)	v5-class discussions v16-TW professor v21-prof.-class dynamics v22-general dynamics among Ss v23-small group dynamics v19-writing center tutor(s)	v5-class discussions v16-TW professor v21-prof.-class dynamics v22-general dynamics among Ss v23-small group dynamics v19-writing center tutor(s)	v5-class discussions v16-TW professor v21-prof.-class dynamics v22-general dynamics among Ss v23-small group dynamics v19-writing center tutor(s)	v5-class discussions v16-TW professor v21-prof.-class dynamics v22-general dynamics among Ss v23-small group dynamics v19-writing center tutor(s)

^a Collaborative writing group. ^b Variable number. ^c Shaded cells represent variables perceived as strongly influential by both groups in that week.^d Independent writing group.

could lead to novel interpretations of the writing space (Bruce & Bruce, 2017).

At present there is no consensus regarding an appropriate sample size for cluster analyses (Crowther et al., 2021; Sarstedt & Mooi, 2011). However, there is agreement that HCA is the most suitable approach for smaller samples (Crowther et al., 2021; Henry et al., 2015) with the caveat that researchers "take appropriate steps to validate their cluster solutions" (Crowther et al., 2021, p. 106). As Crowther and colleagues note, this concern is all the more relevant with small sample sizes. To address this concern, and given the interpretive nature of cluster analyses (e.g., determining the number of cluster solutions), consultations with two L2 writing scholars familiar with the research context, CW, and cluster analyses were also conducted. The consultations included two online meetings with both scholars, three weeks apart, to collectively review the dataset and the SPSS output, including the agglomeration schedule (known to help guide with interpretation—Staples & Bibel, 2015), and to discuss the relevance of different cluster solutions concerning the

Table 5

Themes and corresponding samples from interviews with collaborative and independent writers.

Section A (CW)	
Theme	Interview samples
awareness about writing thus far unrealized	I could see how I was getting ideas to write better from many different places. ^a (What kind of different places?) ^b Like, things my high school English teacher said about starting sentences with 'because'. Then someone in my group would say something they remembered, and then we would all learn that or remember a small little grammatical point or something. (Interview with Rik, week 16.) These group writings that we did, like, I know the writing process. But I always thought of it, like, for just one paper. Like brainstorm, outline, draft. That kind of process. But now I see it differently. (How so? What's different?) It's more spread out. Or a longer process. Like from learning the alphabet when I was in elementary school all the way to higher level like thesis statements or a synthesis essay. (Interview with Emma, week 16.)
stable perception of writing development over time	After a few response papers, even after changing groups, it felt like everyone was moving together. We all had the same goal of finishing the paper, and we all did the same things to finish it. So, I kind of saw the same process happening over and over. (Interview with Mia, week 16.) I could see how the writing process changed at the beginning. Like it was involving trying to synthesize more people's ideas. But there was a lot of synthesizing. That was almost always the main task, right. So even though the essay topic was different, I think what we had to do was pretty similar, so I could see this same process, even when I was in different groups. (Interview with Hiro, week 16.)
breadth of coverage of writing influences	After we did the first mapping activity... I mean before we did it, I didn't give this much thought. But afterwards, working in groups and talking about the essays, I could see so many variables working to help us compose. I think I just had a few on my first map, but once we started writing together I could see that more, more than I thought, was happening. (Interview with Sato, week 16.) Once I wrote collectively [i.e., collaboratively], I mean after we did some essays in the first group, I knew right away that more was part of the writing process than I thought. Working together with others really helped that. I could think about different influences that really mattered, but that I never paid attention to before. (Interview with Hiro, week 16.)
Section B (IW)	
writing center	The [writing center tutor] was asking questions about things like genre so that I could understand what I was doing with things like structure. (Anything else?) Yea, uhm... she was asking if I did something like peer review or any other feedback I got on my draft. It made me think about those maps we did. I mean, I was thinking more about other variables on the maps. At least the ones I didn't really think about before. (Interview with Mika at week 16.) The tutor was really helpful about getting me to think... to connect my essay to other things we were doing in class. (Such as?) Like the readings, and then what the professor said, like the lecture part, and then what about my other courses could relate to the essay. (Interview with Nao at week 16.)
agents and classroom dynamics	We all seemed to be working nicely at the end of term. (Who is we?) Everyone, I guess. In my group and the whole class. The discussions were... lively. Or livelier. The professor was in the group more too. And everyone seemed to give more ideas. And the ideas all seemed to fit better with what we were talking about for the essay. It's like the ideas were always just growing. (Interview with Mika at week 16.) I could see how the different conversations I was having with classmates was getting really helpful. It was like I was listening better. Or maybe those around me had better things to say. (Interview with Kit at week 16.)

^a Bold font denotes specific examples from the transcripts that inform the related theme.^b Interviewer discourse in parentheses.

writing context. That is, as cluster analysis is highly interpretive, decisions regarding cluster solutions did not rely solely on the SPSS output. For example, solutions with more clusters may serve to initiate further study (Kane & Trochim, 2007) and are valuable when exploring novel contexts. In addition, this study did not select the number of desired clusters in advance—consistent with HCA. Rather, to assist with selecting appropriate cluster solutions, alongside the interpretive assistance of two consultants, information gained or lost by adding or subtracting clusters (using the distance between fusion coefficients, derived from information in the agglomeration schedule) was examined to ensure that the clusters were sufficiently different. The meetings thus helped with decision making and ensured that different possible cluster solutions were engaged and discussed before determining the best possible outcome.

The interview data were transcribed verbatim and then coded using an open coding framework (Braun & Clarke, 2006). After two sessions of rater training, the interviews were coded separately by the author and a research assistant (rater reliability was measured using Cohen's kappa: $\kappa = 0.87$). Following common practice (Fogal & Koyama, 2022; Hafner & Ho, 2020), differences in coding results were discussed until a resolution was reached. The ensuing analysis aimed at eliciting thematic accounts of different categories in the interview data (Pavlenko, 2007) that could complement or further explain learners' perceptions and decisions regarding the mapping task. For example, after a close review of the transcripts the members of the CW group appeared to express new ideas about their writing processes. After this concept was initially identified in the dataset, the transcripts were then reviewed closely by the author and research assistant to check whether this idea constituted a theme in the interview data. This process was repeated with a series of potential themes in the transcripts.

6.4. Findings

RQ1. : *What are the differences in the two groups, if any, regarding how many and to what degree variables are seen to influence L2 writing development over one semester?*

Table 3 documents changes in the number of variables and the degree of influence such variables had on learners across five data-collection points over one semester.

As **Table 3** shows, at the start of the semester both sets of writers identified nearly the same number of variables as strongly influencing their writing. However, as the semester progressed, the two sections diverged, with the CW group consistently having identified more variables as having a strong influence on writing development than did the IW group. Moreover, as the number of variables listed as strongly influential remained comparatively high and stable in the CW group from week five onwards, the number of strongly influential variables fluctuated throughout the term for the IW group, with week nine showing a noticeable increase—a change that is not sustained. The results of RQ1 demonstrate that after initially similar interpretations of the writing space, the CW group consistently identified more variables over time as having a strong impact on writing development in comparison to the IW group.

RQ2. : What, if any, patterns of relations with the writing space appear with students engaged in CW and those engaged in IW?

Research question two provides a more nuanced perspective of the findings derived from RQ1. **Table 4** was designed to emphasize which variables appeared to strongly influence learners' writing, across both groups, and how these perspectives shifted over time.

Table 4 documents notable differences and similarities in how the two groups interpreted the meaningfulness of the variables. For example, across groups variable 2 and 10 (*learning to think critically* and *writing feedback*, respectively) are shared in weeks 1, 5, and 9, and then variable 3 (*learning about effective writing*) across weeks 5, 9, and 12. Variables.

21, 22, and 23 (*professor-class dynamics*, *general dynamics among students*, and *small group dynamics*, respectively) are consistently present in the CW group in the last four iterations of the mapping task, although these only appear in week 15 of the IW group—unsurprising, given that the IW group had much less exposure, comparatively, to intense work with peers and so had less opportunities to engage with agent-agent dynamics.

Within groups, among the collaborative writers there is a consistent set of variables perceived as strong across the semester (v2-*learning to think critically*, v9-*writing process*, v10-*writing feedback*, and v16-*TW professor*), whereas variables 5 (*class discussions*), 21 (*professor-class dynamics*), 22 (*general dynamics among students*), 23 (*small group dynamics*), 28 (GPA), and 29 (*ambition to be an effective writer*) appear in all weeks except week one. The independent writers do not share this consistency. In addition, in week 15 the IW group emphasizes agents and interactions with them (v16-*TW professor*, v19-*writing center tutor(s)*, v21-*professor-class dynamics*, v22-*general dynamics among students*, and v23-*small group dynamics*).

Although difficult to infer precisely what is driving these similarities and differences, the interview data provide some insights. Space precludes extensive reporting, but **Table 5** documents themes that emerged from the interview data and related samples.

As **Table 5** notes, the unfolding semester and frequent CW tasks triggered a degree of reflection and awareness about writing that was thus far unrealized among the CW group. Moreover, as RQ1 indicates, that awareness stabilized. The interview data attribute this stability to the iterative nature of the writing task (i.e., consistently asking students to synthesize data). The interview data also revealed patterns wherein learners highlighted the breadth of possibilities for engagement that informed their writing, and that said possibilities covered a wider set of variables than interview participants had initially thought meaningful.

Concerning the IW group, **Table 5** shows that learners' interactions with tutors in the university writing center (visited to seek assistance for the mid-term paper) provided perspective on a wider set of variables thought to impact their writing, providing some evidence for the spike in strongly influential variables seen in week nine (see **Table 3**). Moreover, the theme of *agents and dynamics* also helps explain an inclination toward relationships and engagement with others that informs perceptions of the learning space in the closing weeks of the semester (see **Table 4**, week 15).

The results of RQ2 show that collaborative writers emphasized multiple group dynamics (among peers in small and large groups, and with the instructor) and a wide set of strongly influential variables early in the semester (week 5) and maintained this perspective. The CW group also had a more holistic perspective of the writing experience and articulated a more complex view of their writing processes. Comparatively (and in contrast), the IW group deemed group dynamics important only toward the end of the fifteen-week semester and was generally less stable in its interpretation of the writing space, with extra attention given to writing center tutors in widening their perspectives on writing development. The CW group was also more acute to the potential impact of different sets of dynamics on their writing when explored across a wide educational landscape, comparatively, and underscored that the practice of writing collaboratively helped influence how these learners oriented to the writing space in ways that reflected a more nuanced view of composing processes. The IW group eventually came to appreciate some of these dynamics, but only late in the semester.

RQ3. : How did learners in CW and IW conditions orient themselves to the writing space, and did such orientations change over time?

As noted, a cluster analysis was conducted to allow different orientation types to emerge from the dataset. The dendograms for the CW (Appendix A) and the IW group (Appendix B) reveal two distinct patterns of orientation across both groups and across time that help define the clusters: (a) course and curriculum (defined as the combination of task and environmental variables) and (b) agents and students' personal experiences (defined as the pairing of learner and environmental factors). These definitions stem from the variables informing the clusters. For example, the orientation to course and curriculum includes variables such as learning about effective writing (v3), writing assignments (v4), writing feedback (v10), and critical engagement (v14) that underscore attention to pedagogical decisions and course content. Further, an orientation toward agents and students' personal experiences comprises variables that include, among others, course professor (v16), small group dynamics (v23), ambition to be an effective writer (v29), and secondary school writing experiences (v32), all of which emphasize attention to individuals (including a focus on oneself) and interactions with others and their experiences.

Limited exceptions to these orienting patterns include, in the CW group, in cluster one of week 12, (Appendix A, **Fig. A4**) and

clusters one and three and in week fifteen (Appendix A, Fig. A5), places where only limited variables depart from these orienting patterns. Similarly, in the IW group minimal changes appear in cluster two of weeks one and fifteen (Appendix B, Fig. B1 and Fig. B5, respectively). However, despite these exceptions, both groups overwhelmingly maintained a consistent and similar orientation to their writing spaces across the semester, demonstrating little change in how they perceive groups of variables interacting over time. The results of RQ3 revealed that learners in both groups oriented themselves to the writing space similarly across time, despite writing under different conditions for fifteen weeks.

A summary of the primary findings of this study suggest that notwithstanding similarities early on in their perspectives of the writing space, the CW group discerned notably more variables as having a strong influence on academic writing over time (RQ1), that the CW group linked said variables more consistently to group dynamics and the interpretation of the writing space as nuanced and complex (RQ2), and that despite these differences, both groups oriented themselves similarly across time to two distinct sets of influential variables: those focused on the course and curriculum (i.e., task and environmental factors), and those concentrated on agents and learners' experiences (i.e., learner and environmental variables) (RQ3).

7. Discussion

This study explores how collaborative writers and independent writers orient to writing spaces over time. Results from RQ1 and RQ2 showed that the CW group, comparatively, developed a more nuanced interpretation of the writing landscape by emphasizing a consistent and broader perspective from week five onwards. Although increased awareness of the writing space is known to improve linguistic performance (Fogal, 2023; Negretti & McGrath, 2018), the present study highlights the utility of both promoting that awareness inside a larger CW environment and the ability of CW to facilitate that reflection. For instance, this awareness may encourage writers to attend to unexpected forms and sources of input and to engage with underexplored learning opportunities (e.g., pursuing extensive out-of-class discussions with peers or writing center tutors). This study thus contributes to better realizing how CW experiences can help trigger such awareness and helps to recognize and conceptualize L2 writing across a broader curricular landscape (Byrnes, 2020; Fogal, 2020)—one that locates CW and CW research inside that wider curricular sphere.

Despite showing that CW can raise awareness of the writing space, the findings also demonstrate a limit to said awareness. Although the CW group perceived more variables as strongly impacting their writing development (RQ1), the understanding of how those variables interacted to serve development was limited across groups to within similar cluster types (RQ3). This representation is concerning, as the writing space appears centralized and restricted to defined sets of variable types interacting. In both CW and IW contexts, this constraint is problematic as centralized environments (those that curb possibilities for activity) provide minimal opportunities for emergent behavior and experimentation (e.g., seeking out new writing strategies) that could help learners with problem solving and writing (Fogal, 2020; Majchrzak, 2018). This finding was particularly surprising in the CW group, given the expectation—based on findings in other domains of collaborative work (e.g., social systems, Aminpour et al., 2021, and the behavioral sciences, Sulik et al., 2022)—that working with multiple group members on repeated, problem-solving tasks (responding to essay prompts) would expose students to various ways of thinking that would translate into diverse perceptions of the writing space. The present study suggests that such collaborative opportunities did not advantage the CW group in this way. Rather, such noticing opportunities were limited to features of the writing landscape, but not to how those features interacted. This work thus contributes to discussions (e.g., Elabdali, 2021; Shehadeh, 2011) about the beneficial limit or boundary of CW—at least in the context of the present study (i.e., advanced learners in an EFL university setting).

When considering the CW research framework, this work expands this context in two ways. First, system mapping provides a new method for exploring CW. As the literature suggests (Fogal, 2020, 2022; Ludlow et al., 2017), this technique allows stakeholders to reflect upon their engagement with the educational landscape in an effort, for one, to assist with learning and interventions. For example, in the present study system mapping exposed centralized or limited views of interactions that may hamper writing and problem solving. To address this concern, this work invites instructors to lead CW students through exercises that expose them to different ways of thinking about their writing development (e.g., what contributions have students' past L2 writing studies made to their present writing experience)—an invitation akin to calls in the literature for explicit classroom instruction on how best to operationalize CW (Chen & Hapgood, 2021; Li & Zhu, 2017). As a relatively new research method for L2 writing studies, system mapping appears poised to assist CW researchers to understand the wide landscape CW activities occur in. Accordingly, system mapping can function as a macro-analytic tool that complements studies focused on the dyad or small group.

Second, the findings emphasize the utility of including environmental factors in CW research. Students from both sections recognized environmental features as closely related to learner and task-related variables (RQ3), emphasizing how learners in both writing conditions appreciated, although to different degrees (RQs 1 and 2), the interrelated and complex nature of L2 writing and how this awareness, at least with the CW group, could trigger opportunities for engagement otherwise untapped, as previously noted. Considering environmental variables also provides an additional layer of understanding to CW phenomena by unpacking system components and operations at different levels of granularity. This study, and those of Cho (2017) and Wang (2019), represent very early glances into how CW research may benefit from operationalizing a larger variable set across a wider research landscape. Both of these contributions, then, address calls in the literature (Li & Zhang, 2021; Storch, 2019) to broaden the scope and context of CW research and allow scholars to probe how stakeholders perceive and interact with the dynamic and complex ecosystem CW writing is embedded in.

In summary, the findings and related discussion expand the CW research framework in numerous ways. First, this study demonstrates how examining an unconventionally broad CW space can reveal the utility of students reflecting on said spaces to stimulate their situational awareness in ways that may serve language learning. Second, accessing learners' perspectives of expansive writing

spaces enables researchers to appreciate how learners relate to said environments, signifying to researchers the potential limits of CW among advanced learners. Third, this study introduces a novel research tool (i.e., system mapping) capable of capturing and examining a wide educational landscape, thus complementing CW research on, for instance, small groups. This complement is made possible by including a wider variable set (i.e., environmental variables) that studies of dyads, for example, typically do not account for. Expanding the CW research agenda in these ways provides researchers with a principled method for exploring CW at different levels of granularity, thus exposing researchers to unique, system-wide perspectives on CW that can guide understanding and praxis.

In this vein and based on the findings discussed and summarized thus far, this work also presents opportunities to advance classroom practice. That is, understanding learner's perceptions of the wider writing space may help writing instructors and program directors to facilitate opportunities for students to see, reflect upon, and take advantage of the wider educational context that CW is embedded in. For example, instructors may encourage writing center visits or consultations with professors as extensions of the CW experience. Moreover, instructors can also employ system mapping—shown by [Fogal \(2023\)](#) to enhance learners' language awareness in service of writing development—to raise awareness of the wider context informing learners' writing practice. Such an approach would enable instructors to address classroom issues at the local level, given the highly contextualized nature of system mapping. This work also suggests that instructors engage CW students in activities (e.g., system mapping, group or classroom-wide discussions that point beyond the conventional classroom, or journaling about their past writing experiences) that reveal to learners diverse perspectives about advancing their writing. In these ways, instructors can provide CW students with explicit access to experiences beyond the classroom that may serve their writing needs.

Finally, this study is not without limitations, some of which may guide future research. This work did not examine linguistic output via learners' compositions. However, such an analysis could address the utility of CW to advance different writing constructs among advanced learners participating in repeated CW tasks. In addition, there is some chance that learners were underprepared for the third step in the system mapping activity (the synthesizing of variable interactions), despite relevant controls like guided assistance and samples for students to examine. Although previous studies employing system mapping reported no such concerns, synthesizing is widely considered a higher-order thinking process and may require further guidance than what was delivered here. Similar to recommendations for approaching CW in the classroom (i.e., including guidance on best practice), future studies employing system mapping may consider more guidance for learners regarding the final step in the synthesis task.

8. Conclusion

This study examined how writers in CW and IW conditions orient to the writing space while considering their writing development. Related findings make contributions to theory, pedagogy, and research methods. This work documents how collaborative writers move from limited to expansive and stable modes of interpreting the writing space in ways that highlight a nuanced and complex understanding of the CW landscape. Conversely, despite these new perspectives, learners in both conditions were restricted in their thinking about how variables interact to support L2 writing. Both groups characterized their writing environments as centralized systems—notable for their potential to constrain student access to novel approaches to dealing with their writing. This highlights a potential limit to what can be expected of advanced learners engaged in CW that requires further investigation. Pedagogically, this work confirms earlier claims about the importance of providing learners with initial classroom support for operationalizing CW and addresses instructors' needs to recognize and facilitate writer engagement with the wide landscape CW is embedded in. Finally, this work expands the CW research framework by introducing system mapping as a meaningful technique for exploring CW spaces and expanding the variable set conventionally associated with CW studies. In addition to the contributions thus noted, this work invites researchers to consider a systems approach to CW studies as a meaningful and worthwhile complement to previous and ongoing projects in this research domain.

Conflict of interest

None.

CRediT authorship contribution statement

Fogal Gary G.: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Data Availability

The authors do not have permission to share data.

Appendix A

Dendograms for CW Group

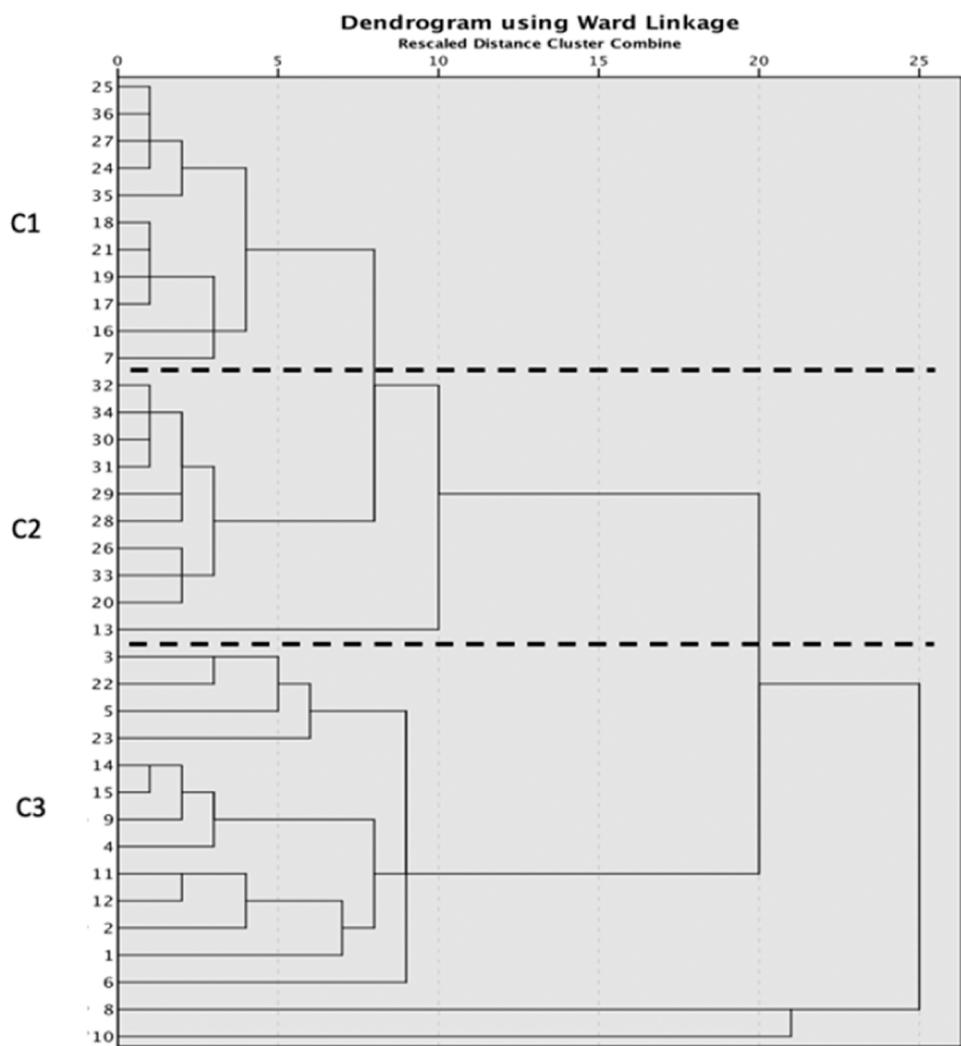


Fig. A1. Dendrogram highlighting links and clusters for CW group, week 1.

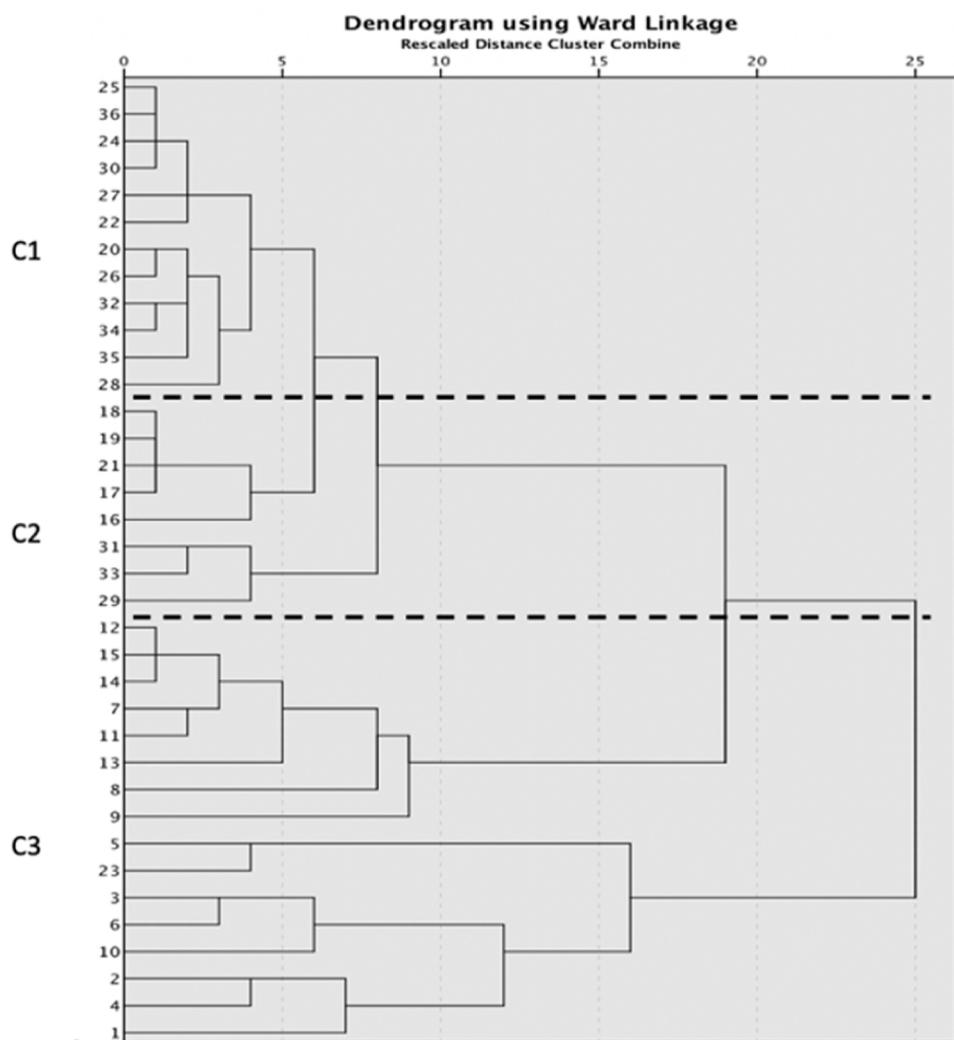


Fig. A2. Dendrogram highlighting links and clusters for CW group, week 5.

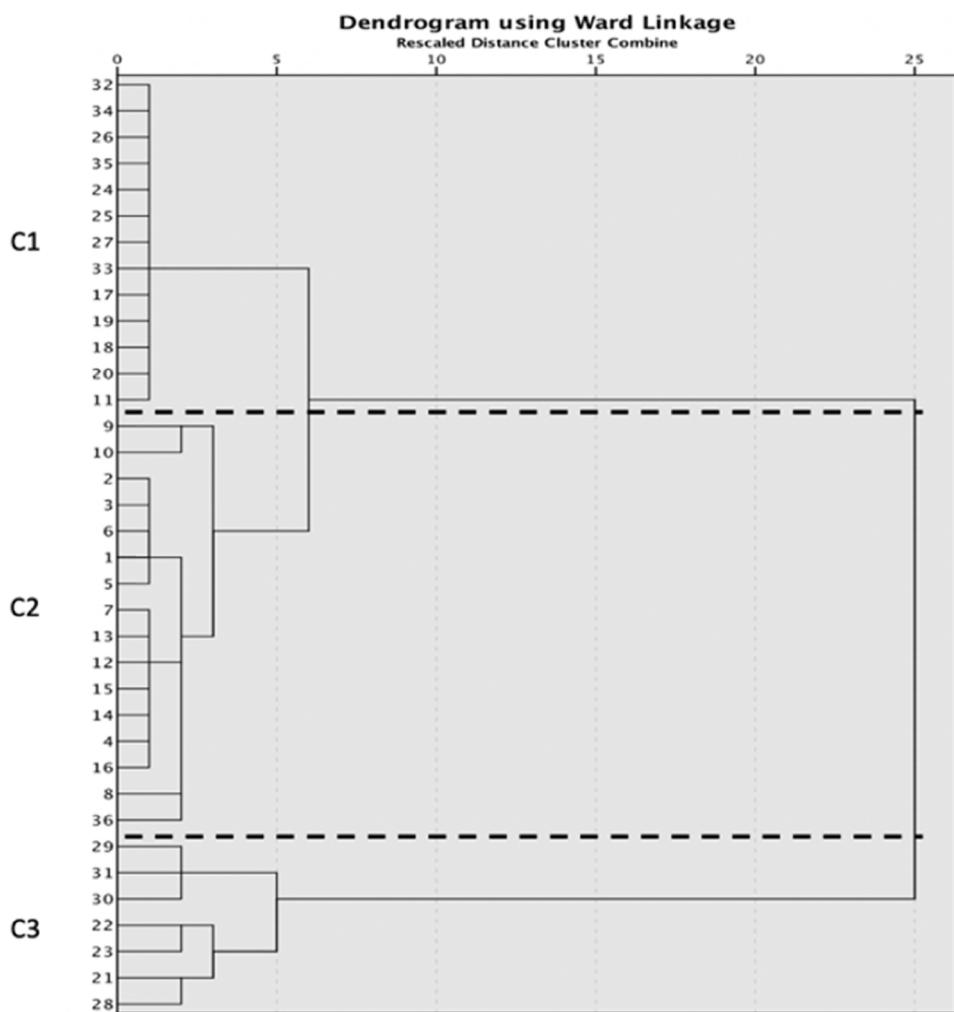


Fig. A3. Dendrogram highlighting links and clusters for CW group, week 9.

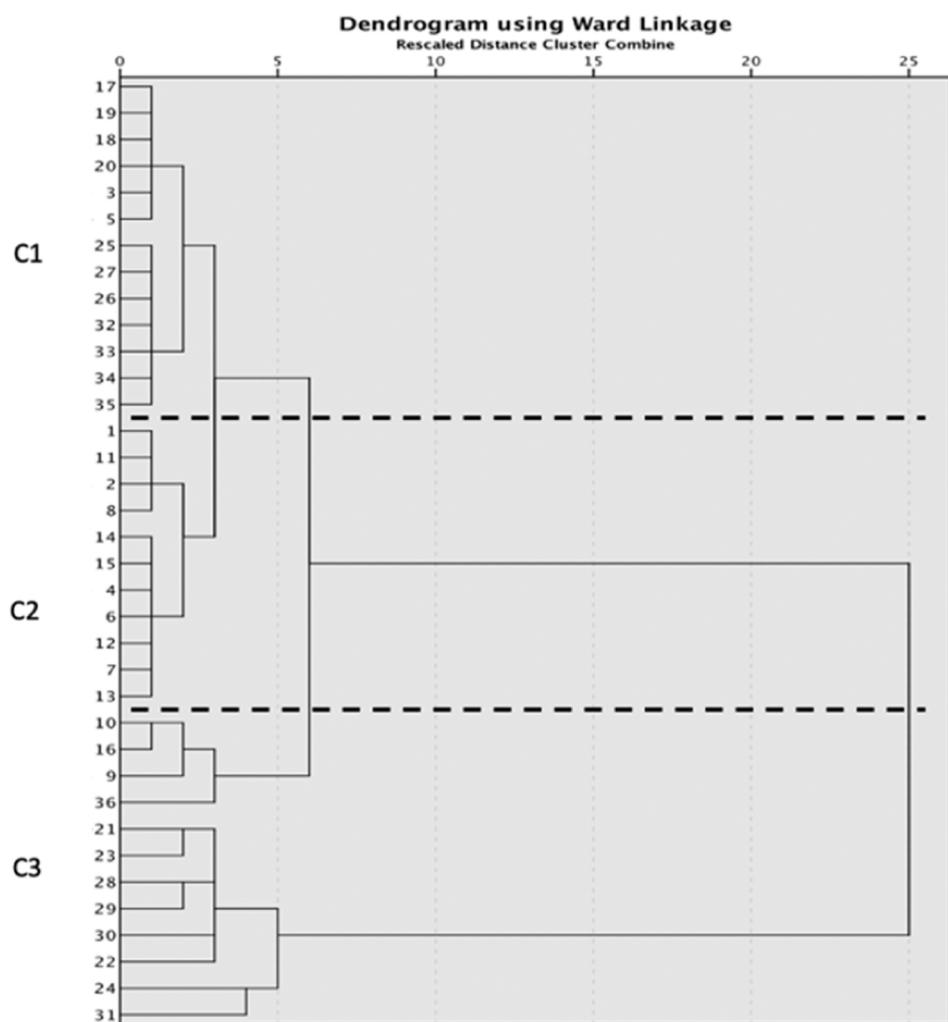


Fig. A4. Dendrogram highlighting links and clusters for CW group, week 12.

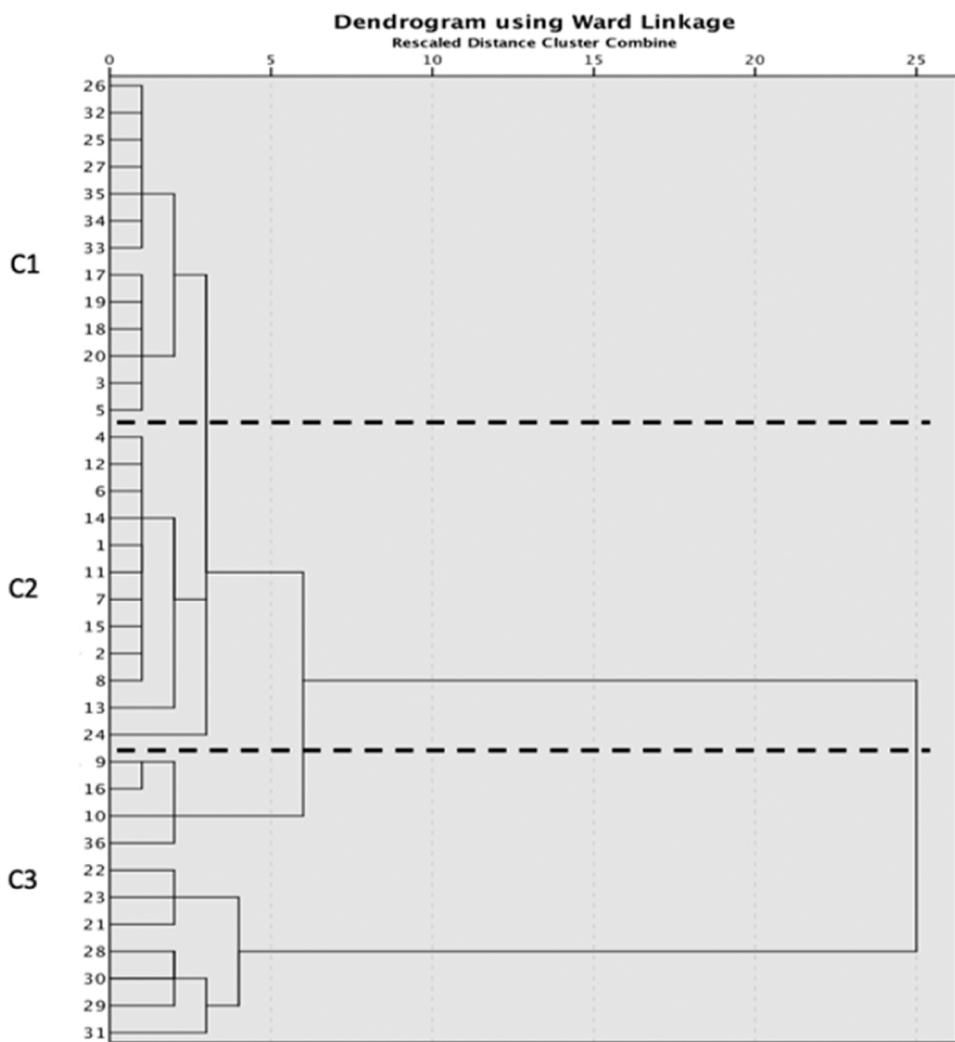


Fig. A5. Dendrogram highlighting links and clusters for CW group, week 15.

Appendix B

Dendrograms for IW Group

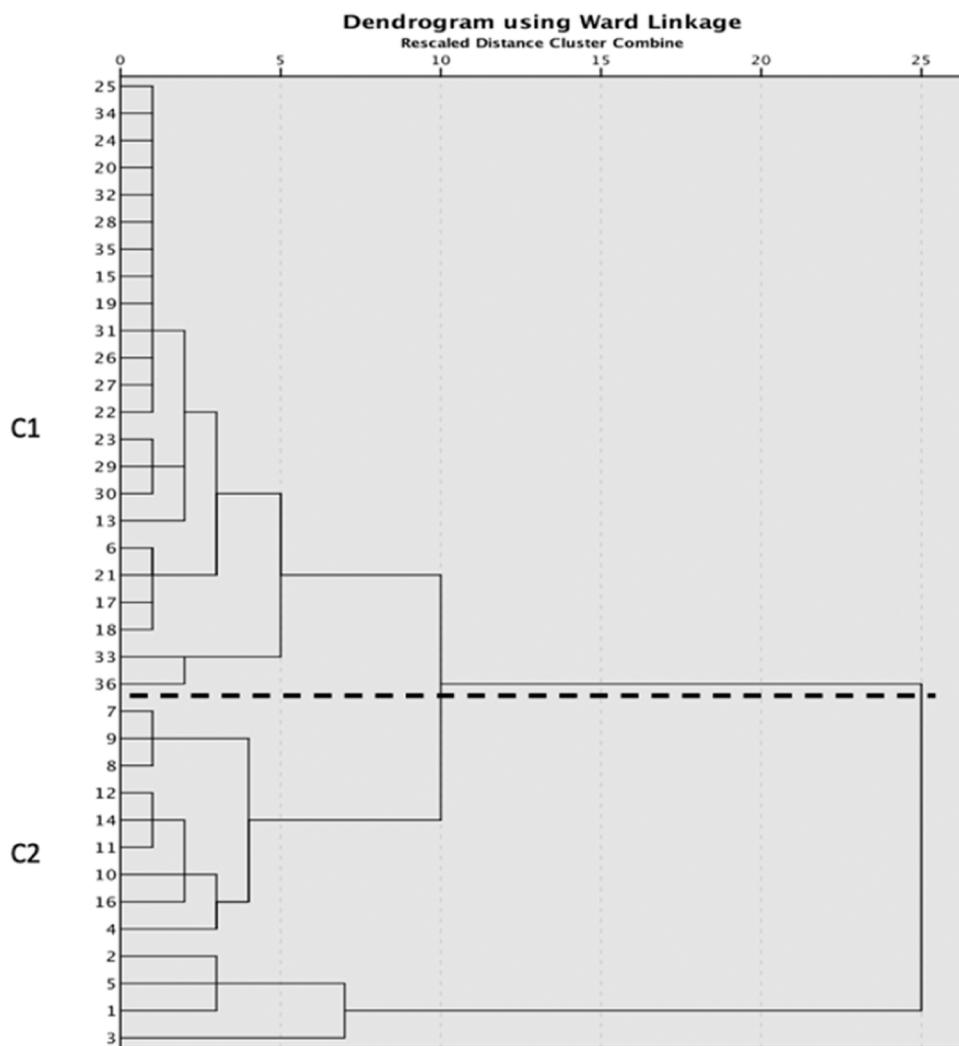


Fig. B1. Dendrogram highlighting links and clusters for IW group, week 1.

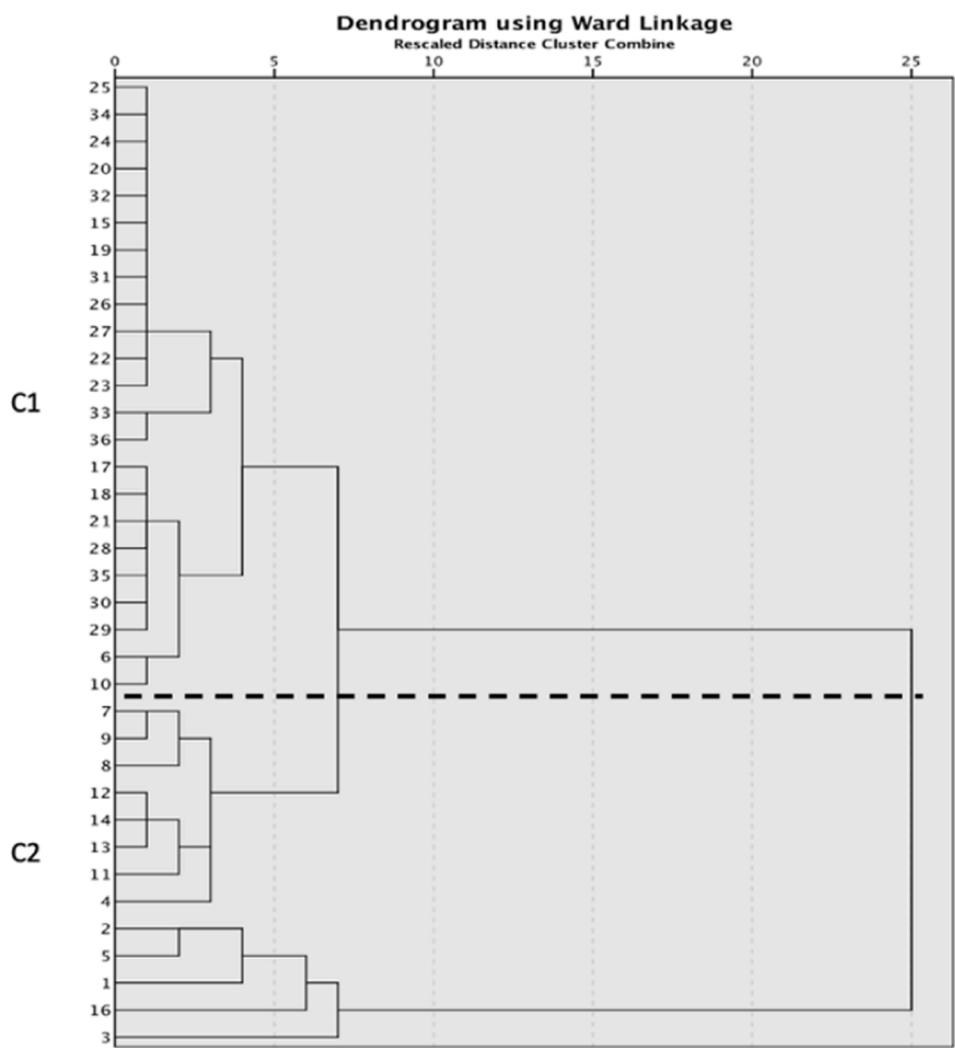


Fig. B2. Dendrogram highlighting links and clusters for IW group, week 5.

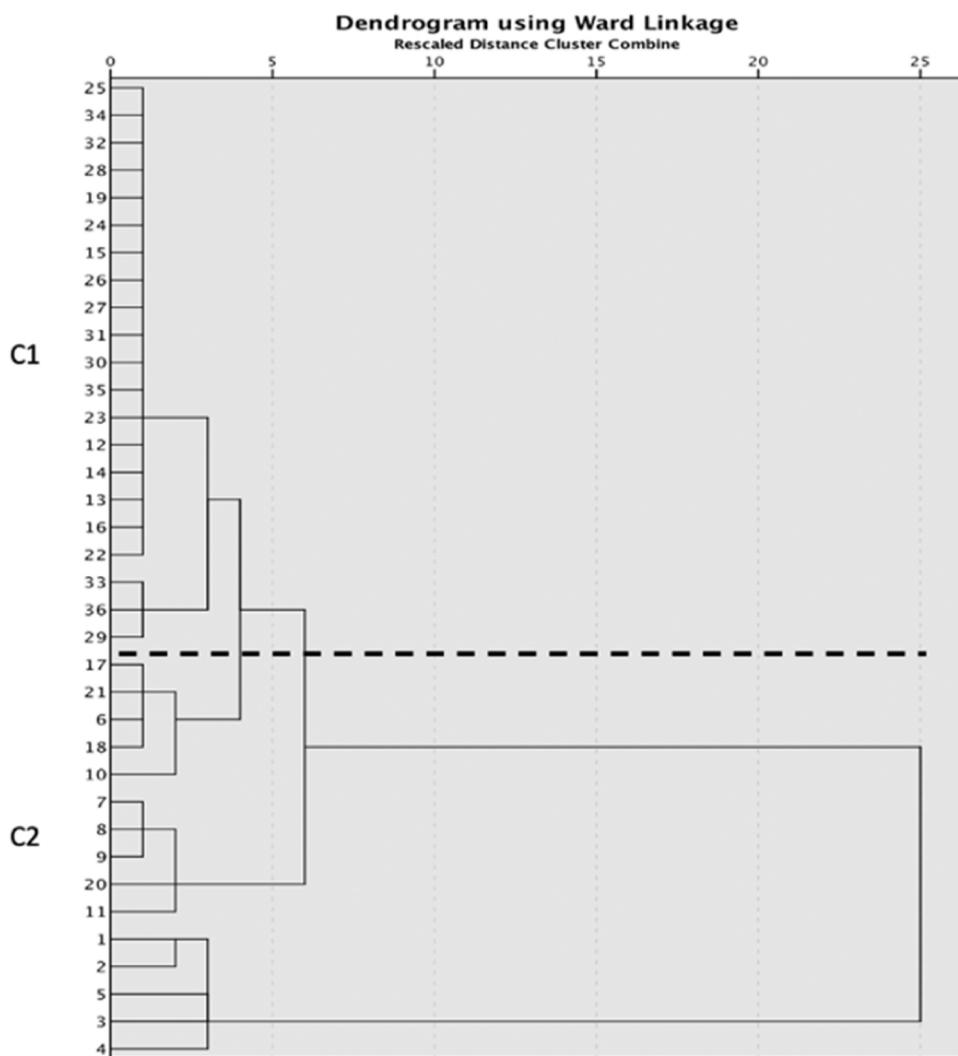


Fig. B3. Dendrogram highlighting links and clusters for IW group, week 9.

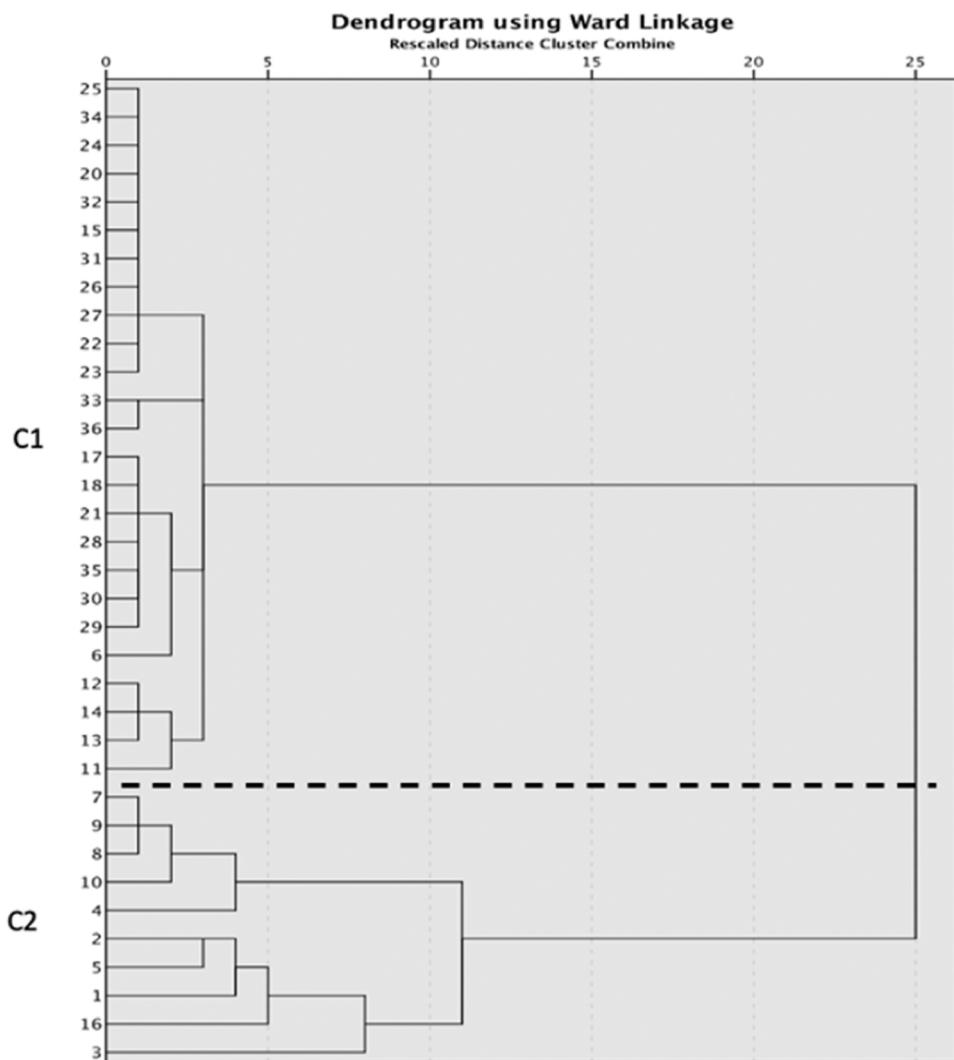


Fig. B4. Dendrogram highlighting links and clusters for IW group, week 12.

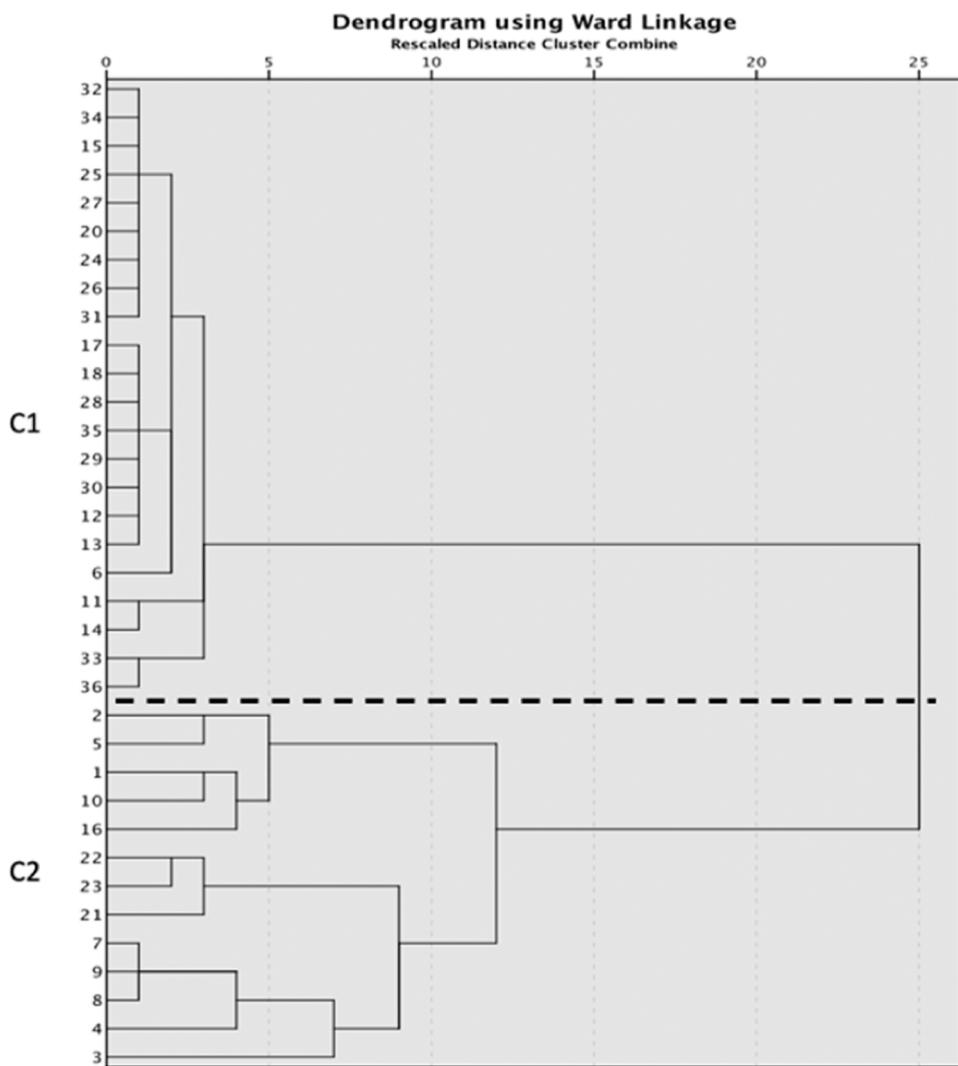


Fig. B5. Dendrogram highlighting links and clusters for IW group, week 15.

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