

Article

Technology-Mediated Individual and Collaborative L2 Academic Writing on Learner Autonomy

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How To Cite: Wang, Z. Y., Chen, Q. H., & Hong, W. C. H. (2026). Technology-Mediated Individual and Collaborative L2 Academic Writing on Learner Autonomy. *Journal of Educational Technology and Innovation*, 8(3), 20–34. <https://doi.org/10.61414/h26xme36>

Received: 16 April 2026

Revised: 31 August 2026

Accepted: 14 September 2026

Published: 30 September 2026

Abstract: This study investigates the impact of individual and collaborative writing approaches on learner autonomy within technology-mediated L2 academic writing contexts. Through thematic analysis of semi-structured interviews conducted with 20 English-major undergraduate students in Macau, we examined how these writing modes—and their intersection with digital tools—influence key dimensions of autonomy: goal setting, self-monitoring, and self-evaluation. Our findings reveal that collaborative writing fostered greater peer support, digital skill complementarity, and reduced writing anxiety. Conversely, individual writing facilitated consistent planning and eliminated interpersonal stress, with students increasingly relying on AI as a “digital peer” for ideation and advanced software for digital workflow management. Notably, while collaborative students demonstrated enhanced peer-mediated self-evaluation, individual writers exhibited autonomy through strategic technological restraint and tech-mediated troubleshooting. A significant finding was the emergence of “complementary autonomy”, where alternating between individual and collaborative approaches—augmented by human-machine interaction—enhanced overall autonomy development more effectively than exclusive reliance on either mode. This study extends sociocultural theory by demonstrating that the quality of interaction—whether with human peers or digital tools—determines its value for autonomy development. The findings challenge dichotomous conceptualizations of learner autonomy, suggesting instead a dynamic interplay between personal agency, social interdependence, and technological mediation. Pedagogical implications include offering students’ flexibility in choosing writing modes while providing appropriate scaffolding for both digital literacy and human collaboration. This research contributes to a more refined understanding of how writing instruction can be designed to foster digital learner autonomy in modern L2 academic contexts.

Keywords: educational technology; collaborative writing; self-regulation; goal setting; self-monitoring

1. Introduction

Over the past decade, the rapid digital transformation of higher education has fundamentally reshaped English language instruction, transitioning from traditional classroom settings to technology-mediated learning environments. This pedagogical evolution, accelerated by the integration of cloud-based collaborative platforms and artificial intelligence (AI), has created unprecedented opportunities for students to exercise agency and make



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decisions during their learning process (Hong, 2023). At the core of this transformation is the concept of learner autonomy, which has evolved to encompass digital literacy and the strategic use of educational technologies (Sakai et al., 2008; Wang & Ren, 2024).

Learner autonomy refers to a student's capacity to take charge of their own learning (Holec, 1981; Winne, 2001). In the contemporary domain of English writing, autonomous writers are characterized not only by their ability to set clear goals and independently manage the learning process but also by their proficiency in leveraging digital tools—such as AI writing assistants and collaborative word processors—to support themselves in achieving those goals. Building on this foundation, previous studies have examined various factors affecting learner autonomy in L2 academic writing, including different teaching methods and learning strategies such as individual versus collaborative writing approaches (Sulistiyo & Kamil, 2022).

While much scholarly discussion has focused on conceptualizing learner autonomy and identifying factors that influence it, the advent of generative AI and advanced collaborative software has introduced new variables. There remains a significant gap in our understanding of how different *technology-mediated* learning arrangements—specifically digital individual and collaborative work—impact learner autonomy in L2 academic writing. This gap is particularly noteworthy given that L2 academic writing courses are standard requirements for university EFL learners, and both individual (often AI-assisted) and collaborative (often cloud-mediated) learning approaches are commonly employed in these contexts. The challenges that L2 academic writing poses for students (Paltridge, 2004) further underscore the importance of understanding how different digital learning arrangements might support the development of learner autonomy.

To bridge this gap, this study qualitatively investigates students' perceptions of technology-mediated individual and collaborative work in L2 academic writing, examining how these different approaches, supported by digital tools, affect the development of learner autonomy.

2. Literature Review

2.1. Defining Learner Autonomy

The concept of learner autonomy has evolved significantly since its introduction in language education. Trim's (1978) declaration captured the origins of learner autonomy as a conceptual tool for teachers to plan, structure, and deliver curriculum according to learners' needs, motivations, and characteristics, enabling them to direct and control their learning processes. Holec (1981) further developed this concept in adult education, characterizing it as a shift from "directed teaching" to "self-directed learning". Similarly, Winne (2001) defined learner autonomy as students taking ownership of their learning process, which now heavily involves actively controlling their digital learning environment, managing screen time, and selecting appropriate technological methods (Xu, Hong, et al., 2024; Xu, Li, et al., 2024; Xu, Su, et al., 2024).

More recent conceptualizations emphasize that learner autonomy in digital spaces aims to balance power dynamics by respecting learners' right to participate in decision-making about their learning process, including which digital tools to employ (Balcikanli, 2010; Xu, Hong, et al., 2024). Learner autonomy also encompasses learners' involvement in planning, monitoring, and assessing their learning (Mickwitz, 2020). For the purposes of this study, we define students with high learner autonomy as those who can independently guide and evaluate their academic writing process, confidently share their work with teachers and peers via digital platforms, and effectively apply technological learning strategies (such as AI-assisted or cloud-based co-authoring) to achieve their writing goals.

2.2. Learner Autonomy in L2 Academic Writing

In the specific domain of L2 academic writing, research has consistently demonstrated the significant demand for L2 academic writing skills among university students across disciplines. Academic writing presents unique challenges as it requires learning and following complex rules that vary across disciplines, with each writing context having different audiences and purposes (Paltridge, 2004). Students in the social sciences and humanities frequently need to produce substantial research papers that demonstrate disciplinary knowledge and rhetorical awareness (Hale et al., 1995). These challenges are particularly pronounced for non-native speakers, whose prior writing experiences may differ substantially from the expectations in their current academic environments (Hong, 2021; Zhang et al., 2025).

The development of academic writing skills involves more than just acquiring discipline-specific language; it requires induction into academic discourse communities and their practices (Starfield, 2001). In this challenging context, learner autonomy becomes particularly important for L2 writers who must independently navigate these disciplinary expectations while developing their writing skills (Lin, 2013; Liu & Qi, 2017). Recent studies have

emphasized that successful academic writers must develop self-regulation skills and autonomy to meet the demands of academic writing tasks (Leeming, 2024; Suwannaphima & Vibulphol, 2023). This necessity for autonomy is operationalized through a set of distinct abilities.

Autonomous writers demonstrate distinct characteristics that can enhance L2 learners' writing performance, including determining objectives, defining content and progression, selecting appropriate methods and techniques, monitoring the acquisition process, and evaluating what has been acquired (Holec, 1981, p. 3). More specifically, autonomous writers engage in processes such as goal setting, planning, making decisions about what and how to learn, self-monitoring, and self-evaluation (Mickwitz, 2020). Emotionally, they feel ownership of their writing process and maintain positive attitudes toward taking charge of their education by establishing learning objectives, selecting suitable learning techniques, and assessing their own progress (Head et al., 2014; Mondahl et al., 2009).

While the importance of autonomy in L2 writing is well-established (Cotterall, 1995; Little, 2022), there remains limited research on how different learning arrangements—specifically individual versus collaborative work, especially under technological assistance—impact learner autonomy in L2 academic writing contexts (Mahapatra, 2024; Parnrod & Darasawang, 2018; Wigglesworth & Storch, 2012).

2.3. *The Influences of Individual and Collaborative Work*

2.3.1. Individual and Collaborative Work in L2 Academic Writing

Different teaching methods or learning strategies significantly impact learner autonomy in L2 academic writing (Sulistiyo & Kamil, 2022). Among these approaches, individual and pair work represent two prominent approaches in this domain (Alastuey & de Lizarrondo Larumbe, 2017; Storch, 2002). Research has consistently demonstrated that the impact of these writing arrangements on learner autonomy cannot be overlooked. From a theoretical perspective, Littlewood (1999) emphasized that autonomy should be considered within cultural contexts, noting that East Asian educational traditions may foster different forms of autonomy than Western contexts. His framework distinguishes between proactive autonomy (learners taking charge of their own learning) and reactive autonomy (learners organizing resources autonomously once a direction has been initiated). Similarly, Storch (2002) identified distinct patterns of dyadic interaction in ESL pair work, with collaborative and expert/novice patterns showing the most promise for language development through effective scaffolding and co-construction of knowledge. More recent studies have expanded on these foundations, with Liu et al. (2018) revealing that in digital storytelling, cooperative work yields superior learning outcomes, including higher learner autonomy, compared to individual work. For L2 academic writing specifically, which constitutes a significant component of language learning (Ivanič & Simpson, 2014; Paltridge, 2004), both individual and collaborative approaches play crucial roles in students' development of autonomy (Dobao, 2012; Kaweera et al., 2019; Zabihi & Bayan, 2020). These studies collectively provide important context for understanding how different writing arrangements might influence learner autonomy development in various cultural and educational settings.

Social constructivist theory, based on Vygotsky (1978), provides a foundation for understanding how collaboration enhances autonomy. According to this theory, learning is fundamentally a social process where knowledge is co-constructed through interaction with others. When learners collaborate, they engage in dialogic interactions that help them construct knowledge together, gradually internalizing strategies and skills that they can later apply independently. This process of internalization is central to the development of autonomy, as learners move from other-regulation to self-regulation (Thorne & Lantolf, 2006).

2.3.2. Individual and Pair Work on Learner Autonomy in L2 Academic Writing

Researchers paid more attention to the positive effects that collaborative learning provides on learner autonomy in different portions in language learning. One of the topics Şener and Mede (2023) explored was the role of collaborative learning in promoting learner autonomy. The result indicated that collaborative learning has an enhanced effect on learner autonomy, and learners have positive attitudes towards this learning mode. Through collaboration, students can move from dependence towards independence, thus developing their autonomy (Geary, 1998; Harmer, 2008; Wijaya, 2021). In oral learning, pair work is a significantly useful strategy to promote learners' speaking skills and will enhance learners' independent learning ability, thus increasing learner autonomy (Azam, 2024). Similarly, in the reading field, which is also considered to be essential in language learning (Burt et al., 2003), Timothy et al. (2023) investigated the effect of collaborative strategy on reading ability and reading autonomy of middle school students. This study demonstrated that collaborative work would increase students' independence.

Regarding the field of writing, Tanyeli Zeki and Kuter (2018) analyzed the independence shown by students in different stages of writing, thus concluded that collaborative writing stimulates students to have better manifestations in their autonomy. In addition, collaborative writing in L2 promotes learner autonomy in the context of student

groups, and most students support this activity (Shehadeh, 2011). Wigglesworth and Storch (2012) further demonstrated that collaborative writing can lead to better text quality and language learning opportunities through pooled knowledge and mutual scaffolding. This aligns with Storch's (2002) earlier findings on the benefits of collaborative patterns of interaction, where learners engage in joint problem-solving and knowledge construction.

However, these studies have focused primarily on the impact of cooperation or pair work on learner autonomy. Few studies make a comparative analysis on individual and pair work for a similar task, seldom focusing on the performance of learner autonomy in L2 academic writing.

2.3.3. Technology-Assisted Writing and Digital Autonomy

As higher education increasingly transitions into digital spaces, the mediums through which students engage in both individual and collaborative writing have fundamentally changed. Cloud-based collaborative platforms (e.g., Google Docs, Wikis) have revolutionized pair work by enabling synchronous and asynchronous co-regulation, allowing learners to document iterative revisions and engage in continuous peer-to-peer interactions (Wang & Ren, 2024). In these digital environments, collaborative writing not only enhances language acquisition but also cultivates digital literacy and shared autonomy.

Simultaneously, individual writing has been transformed by the advent of generative AI. AI tools provide immediate, personalized formative feedback, assist in idea generation, and offer linguistic scaffolding (Mahapatra, 2024). Recent research highlights that AI functions as a highly effective “More Knowledgeable Other”, operationalizing the Zone of Proximal Development at scale by providing adaptive scaffolding that allows students to overcome creative blocks and self-edit with unprecedented autonomy (Hong, 2026). Furthermore, for EFL students specifically, AI tools have proven invaluable for structural organization, information management, and language enhancement, effectively reducing the cognitive load associated with writing in a non-native language (Hong & Litwin, 2025). Consequently, individual writers are no longer working in complete isolation; they are exercising a new form of digital autonomy where they must critically evaluate and integrate AI-generated assistance while maintaining their authentic authorial voice.

However, these studies have focused primarily on the impact of the isolated use of specific digital tools. Few studies make a comparative analysis of individual and pair work for a similar task within a modern, technology-mediated environment, seldom focusing on how the integration of digital tools (like AI and cloud platforms) influences the performance of learner autonomy in L2 academic writing. The present study aims to address this gap by investigating both technology-mediated individual and collaborative approaches to L2 academic writing and their respective impacts on learner autonomy.

Specifically, the present study addresses the following research questions:

- (1) What are students' perspectives about individual and pair work in technology-mediated L2 academic writing?
- (2) How do students who have exclusively and recently experienced either individual or pair work perceive the development of their learner autonomy in L2 academic writing?

3. Methods

This study employed a qualitative approach to investigate learner autonomy through the experiences of students who had recently been engaged in L2 academic writing around the period of the investigation. To gain deep insights into students' perceptions and experiences, we adopted a semi-structured interview methodology, which offers the advantage of being “reasonably objective while still permitting a more thorough understanding of the respondent's opinions” (Borg & Gall, 1983, p. 442). This approach enabled us to explore the underlying reasons behind students' responses in ways that would not be possible using quantitative methods such as questionnaires. Our research instruments included semi-structured interviews for data collection and thematic analysis for data analysis.

3.1. Research Context & Participants

The study was conducted at a university in Macau with 20 third-year English majors aged 20–21 years. Prior to data collection, we consulted with the program coordinator and reviewed the curriculum to ensure participants had comparable academic backgrounds. We also verbally confirmed with all participants that this was their first course involving lengthy academic writing projects, ensuring similar prior experience with this type of extended academic writing task. All participants were enrolled in the same L2 academic writing course, receiving identical teaching content, methods, and materials. As a cohort, they were admitted under the same language proficiency requirement,

received the same duration of formal classroom instruction, and also completed a comparable volume and type of academic writing exercises, which allowed for natural control for academic writing experience and proficiency level.

Two groups of participants—10 students who just finished working individually to draft a full-length research proposal and 10 students who worked collaboratively in pairs—were interviewed right after their respective writing activities. With informed consent, the participation was voluntary, and students self-selected their preferred writing approach (individual or collaborative) based on personal preference, which happened to be of exactly equal with both approaches. Throughout the course, all students had access to standard digital writing technologies, including cloud-based word processors (e.g., Google Docs, Microsoft Word Online) for drafting and sharing, as well as generative AI tools (e.g., ChatGPT, Grammarly) which they were permitted to use as supplementary writing aids.

3.2. Measures

Semi-Structured Interview Questions

After the students' writing activity, semi-structured interviews were employed to investigate their individual and collaborative writing processes in depth through self-reflection. This approach allowed for open-ended questions that did not constrain participants' responses (Karatsareas, 2022). The interview questions were initially developed based on an extensive review of literature on learner autonomy and subsequently adapted from Shen et al.'s (2020) questionnaire. The final interview protocol addressed five key dimensions of learner autonomy: (1) learners' expected role of the teacher (5 questions), (2) learners' independence (5 questions), (3) learners' confidence in study ability (3 questions), (4) learners' ability to evaluate the learning process (3 questions), and (5) learning strategies used (4 questions). Crucially, within the "learning strategies used" dimension, specific probes were included to explore how students utilized digital tools, collaborative software, and AI applications to support their writing process. Additional follow-up questions emerged during the interview process. This structured yet flexible approach allowed us to gather comprehensive details and personal narratives while ensuring consistency across responses. All interviews were audio-recorded and later transcribed for analysis. The interviews lasted for 30 to 60 min.

3.3. Data Collection & Analysis

3.3.1. Data Collection

We conducted both online and face-to-face interviews with participants, recording all sessions. To create a comfortable environment and elicit authentic responses, participants were permitted to respond in either Chinese or English according to their preference. Theoretical saturation was found to be reached at the 7–8th participant for each group. Following data collection, we transcribed the audio recordings using iFLYTEK software and carefully reviewed the transcripts to correct any transcription errors.

Initially, we imported the data into NVivo for analysis; however, due to the nuanced nature of our data and the limitations of NVivo's keyword-frequency-based classification (Woolf & Silver, 2017), we determined that manual coding using Excel and Word would provide more detailed and contextually sensitive analysis.

3.3.2. Data Analysis–Thematic Analysis

Thematic analysis is widely employed by qualitative researchers for analyzing rich descriptive data (Naeem et al., 2023). We selected this method to identify common and unique perspectives on learner autonomy in L2 academic writing and to examine themes related to the effects of individual and collaborative approaches. Thematic analysis enabled us to interpret structured, sequential research data, contributing to a comprehensive understanding of participants' experiences.

Our manual coding process followed Naeem et al.'s (2023) six-step framework for conceptual model development in qualitative research. The coding was conducted by three researchers, with any differences in coding resolved through deliberation and consensus-building to ensure consistency (>90%). First, we read the transcripts multiple times to develop a holistic understanding of all responses. Next, we identified recurring words and meanings as keywords. We then transformed these keywords into codes relevant to our research questions. Subsequently, we categorized and organized these codes into groups to identify patterns that provided insights into our research questions, forming preliminary themes. During the conceptualization stage, we refined these themes based on our operational definition of learner autonomy, focusing particularly on goal setting, self-monitoring, and self-evaluation, etc. Open coding was done to identify main themes, sub-themes and code examples. Axial coding was then performed to find relationships among the themes. These collectively address our research questions.

4. Findings

4.1. Themes and Sub-Themes

The open coding of the interview data revealed distinct patterns in how students perceive and experience individual and collaborative approaches to L2 academic writing. Students across both writing conditions recognized that collaborative writing offers increased companionship and idea stimulation during the writing process, while individual writing provides more consistent planning opportunities and reduces interpersonal pressure (see Table 1). Importantly, our findings indicate that collaborative work enhances specific dimensions of learner autonomy in L2 academic writing, particularly in the areas of goal setting, self-monitoring, and self-evaluation.

Table 1. Open coding results.

Theme	Sub-themes	Representative Quotes	Interpretation
Autonomy in Individual Work	Freedom of decision-making	<i>Because individual writing is more conducive to the divergence of my own thinking, that is, I don't need to communicate with others, I can organize the directions I'm interested in myself (HY)</i>	Individual work allows students complete control over their writing direction and interests
	Control over pace and schedule	<i>If I were to do pair collaboration, I might find that the communication between the two of us could delay things in terms of time (XD)</i>	Individual writers can better control their own schedule and pace
	Self-directed learning	<i>I think I am someone who can better control my rhythm for these kinds of tasks. But if you make me do pair writing, I would feel my rhythm being disrupted (XD)</i>	Individual writers feel more in control of their learning process
Autonomy in Collaborative Work	Shared decision-making	<i>I choose pair work because one person's thinking is definitely limited. If it's two people, through discussion, there can be some collisions of ideas (JN)</i>	Collaborative work enables shared decision-making and diverse perspectives
	Mutual support	<i>I think it's also motivation, that is, if two people do it together, the efficiency will be higher (JM)</i>	Partners provide motivation and support to each other
	Complementary skills	<i>I think [my partner] is more technical, I feel he is much more flexible in using such software than me... He very well compensates for my disadvantage of not being familiar with computer operations (LY)</i>	Partners can complement each other's skills and knowledge
Self-regulation	Time management	<i>Formulated, it's not really a plan, writing the outline took about 4 h (PS)</i>	Students develop strategies for managing their time
	Goal setting	<i>My goal is to complete the exploration of a certain issue, that is, I will first search for materials, then in these works or other people's writings, understand the points I'm interested in (HY)</i>	Students set specific goals for their writing
	Self-monitoring	<i>I have changed my strategies, and I find a new method in this time, it is much more suitable for me (PS)</i>	Students reflect on and adjust their strategies
Challenges in Individual Work	Limited perspectives	<i>I think the only benefit is that between us two, there might be more different viewpoints emerging, some of which are parts I hadn't thought of (XD)</i>	Individual writers recognize the limitation of having only one perspective
	Emotional pressure	<i>My disadvantage is that I easily get internally consumed, that is, if I get stuck on this problem, I will panic, I will worry (HY)</i>	Individual writers may experience more emotional pressure when facing challenges
	Technical limitations	<i>First, many professional terms I don't know, some research methods although heard in class, but implementing myself is still difficult (QX)</i>	Individual writers may face technical limitations without partner support
Challenges in Collaborative Work	Coordination difficulties	<i>We might need to revise many versions, to create the final version that both of us agree on (XD)</i>	Collaborative writers need to coordinate and reach consensus
	Interpersonal tensions	<i>Because in group cooperation, you inevitably will have closer interactions with classmates or group members who were originally at a certain distance. And closer interactions actually bring many conflicts that everyone doesn't want (DR)</i>	Collaborative work can lead to interpersonal tensions
	Pace synchronization	<i>Because it's two people, there might be times when the pace is not consistent during writing (DR)</i>	Partners may have different working paces

Table 1. Cont.

Theme	Sub-themes	Representative Quotes	Interpretation
Tech-Assistance	Generating ideas/arguments	<i>That is, now we all have this AI software and such. If you say you want to propose viewpoints, actually AI can also provide them to you (XD)</i>	AI-assisted brainstorming and ideation
	Problem solving	<i>If I really can't find [data/materials], AI can help a bit. (QX)</i>	AI-mediated troubleshooting
	Managing writing	<i>Directly used Mendeley and EndNote to annotate everything... making it easier to match. (PS)</i>	Digital workflow and reference organization
	Avoiding over-reliance	<i>English writing emphasizes logic more... so I will not use a lot of translation or various tools to assist my writing. (YY)</i>	Strategic technological restraint
Teacher's Role	Guidance	<i>Helped me slightly modify my topic (XD)</i>	Teachers provide guidance on topic selection and direction
	Feedback	<i>Then check materials myself, then the teacher can modify my first draft, second draft and such, then gradually perfect it (QX)</i>	Teachers provide feedback on drafts
	Emotional support	<i>Then he will also often care about our emotions, that is, in terms of writing, whether we encountered any problems (HY)</i>	Teachers provide emotional support
Learning Strategies	Seeking help	<i>I will seek help from my mentor, because my mentor in this aspect, many of his previously written papers or published journals are beneficial to my thinking. (HY)</i>	Students seek help from teachers or peers when facing challenges
	Self-help	<i>I would go to YouTube or Bilibili to watch SPSS videos... my partner is not as quick to pick up computer applications as I am. (DR)</i>	Students solve problems on his/her own
	Comparative analysis	<i>That should be the comparative method, um, because my topic is mainly under the comparative perspectives, so I often encounter various opinions. (HY)</i>	Students use specific analytical methods
Peer Influence	Idea generation	<i>Because at the beginning of writing, you actually need many new ideas, regardless of whether they are feasible or not, but you need ideas anyway. So among my partner's many different new ideas, I will also be inspired (DR)</i>	Peers inspire new ideas and perspectives
	Emotional support	<i>Then I think my companion very well compensates for my disadvantage of not being familiar with computer operations (LY)</i>	Peers provide emotional support
	Skill complementarity	<i>I think I might provide more ideas... Then he will be precise to the transition between each sentence, whether it's natural, or whether the logic is smooth like that (DR)</i>	Peers complement each other's skills
Preference Factors	Prior experience	<i>I think now we have ground to a state where both sides feel quite comfortable. So if pairing with a new person, might have to go through such a process again (DR)</i>	Prior experience with partners influences preferences
	Personal traits	<i>I don't hope others urge me, except teachers. Because I am a person with my own rhythm. If you urge me, I will feel annoyed (XD)</i>	Personal traits influence preferences for individual or collaborative work
	Task complexity	<i>At that time, after knowing, we were thinking, because you said this time we also need to collect data, or we feel that one person handling these things would be a large amount, then want to find someone to share (DR)</i>	Task complexity influences preferences

Notes: Individual condition = LV, HY, XD, QX, PS, LJ, PB, YE, YH, YX; Group condition = DR, LY, JN, JM, ZZ, WL, WT, EC, ZE, ZA.

4.2. Relationships between Themes

4.2.1. The Autonomy-Collaboration Spectrum

The analysis reveals a complex relationship between autonomy and collaboration in academic writing. Rather than being opposites, they represent different manifestations of learner autonomy. Individual work offers direct

autonomy through complete control over decisions, pace, and content. In contrast, collaborative work offers a form of “distributed autonomy” where students exercise autonomy through negotiation, mutual decision-making, and complementary contributions.

Students who prefer individual work often value the freedom to follow their own schedule and make independent decisions without compromise. As one student (XD) noted, “因为一个人写的话，他就可以想写你自己选择的主题，而不是需要去迎合别人的这个想法” (Because when writing alone, you can write about your chosen topic without having to accommodate others’ ideas). Interestingly, the integration of technology has expanded this spectrum. For individual writers, AI often acts as a surrogate collaborator for AI-assisted brainstorming and ideation, allowing them to experience the benefits of a sounding board without the interpersonal friction of human collaboration. XD further explained, “因为现在我们都这个 AI 软件什么的。如果你说你要提观点的话，其实 AI 也能给你提供... 就是不需要同伴” (Because now we all have this AI software and such. If you say you want to propose viewpoints, actually AI can also provide them to you... so you don’t need a partner).

Conversely, students who prefer collaborative work recognize the limitations of individual perspectives and value the “intellectual collision” that occurs through collaboration. They see autonomy as enhanced rather than diminished through collaboration, as expressed by JN: “通过讨论可以进行一些思维上的碰撞，你就可以有更好的一些点子去构思你的写作” (Through discussion, you can have intellectual collisions that give you better ideas for your writing).

4.2.2. Self-Regulation as a Core Component of Autonomy

Regardless of writing mode, self-regulation emerges as a core component of learner autonomy. Both individual and collaborative writers demonstrate self-regulation through time management, goal setting, and self-monitoring. However, the manifestation differs, particularly in how they manage their digital workflow:

Individual writers tend to develop more independent self-regulation strategies, often relying on internal motivation, deadlines, and specialized software to manage their writing. For instance, PS highlighted the use of reference management tools to maintain control over the writing process: “直接用 medaling [Mendeley] 和那个 end note 就把所有该批注的地方都批注了，然后就比较匹配这样子” (Directly used Mendeley and EndNote to annotate everything... making it easier to match). Furthermore, autonomous self-regulation also involves strategic technological restraint. Students actively monitor their reliance on tools to preserve their authorial voice. YY noted, “感觉英文写作会更加重逻辑性... 所以说我不会运用大量的。比如说翻译，或者说各种各样的工具去辅助自己写作业” (English writing emphasizes logic more... so I will not use a lot of translation or various tools to assist my writing).

Collaborative writers develop co-regulation strategies, where partners help regulate each other’s learning. LY described how her partner would provide emotional regulation: “然后有时候比如说我很焦虑...他当时就很及时的劝我” (When I was anxious... he promptly advised me). This suggests that both writing modes can foster autonomy, but they develop different aspects of self-regulation, ranging from digital discernment to interpersonal emotional management.

4.2.3. The Role of External Support in Autonomous Learning

The analysis reveals that autonomous learning does not mean learning in isolation. Both individual and collaborative writers seek external support, but in different ways:

Individual writers tend to seek more targeted support from teachers or engage in tech-mediated troubleshooting for specific problems. XD mentioned, “如果遇到问题的话，我就会觉得有点问题...如果那个时候我正好 writing 有问题，并且没有找老师解决，我就会觉得有点问题” (If I encounter problems and haven’t consulted the teacher, I feel troubled). When traditional resources fail, technology serves as a critical fallback. QX noted how AI acts as a safety net for problem-solving: “实在找不了的话可以可以说 AI 可以帮助一下” (If I really can’t find [data/materials], AI can help a bit).

Collaborative writers have built-in support systems through their partners, creating a “first line of support” before seeking teacher assistance. LY explained her problem-solving approach: “我会先自己想...但是如果我实在是想不到了，我就会问他...如果是我们两个实在都没有办法解决，我们才会求助老师” (I’ll think about it myself first... if I really can’t figure it out, I’ll ask him... only if both of us can’t solve it will we seek help from the teacher). This suggests that autonomy is not about complete independence but about making strategic decisions about when and how to seek support, whether human or digital.

4.2.4. The Influence of Personal Traits and Task Complexity

The preference for individual or collaborative writing is strongly influenced by personal traits and task complexity:

Students with strong preferences for controlling their own pace and schedule tend to prefer individual writing. XD stated, “我觉得我是一个比较能掌控我的节奏的这些这种任务。但是如果你让我觉得是双人写作的话, 我就我会我就会觉得我的节奏被打过来” (I feel I can control my own pace for these tasks. If it were pair writing, I would feel my rhythm being disrupted).

Task complexity also influences preferences, particularly when digital literacy is required. For complex tasks involving data collection, software analysis, or formatting, students often opt for collaboration to achieve digital skill complementarity. DR explained the need for shared workload: “因为你有说这次还要收集数据还要收集数据, 或者我们觉得一个人可能就是要处理这些东西的话量很大, 然后想找一个人分担” (Because this time we needed to collect data, we felt it would be too much for one person to handle, so we wanted to find someone to share the workload). Similarly, LY highlighted how her partner scaffolded her technical skills: “一开始是 EndNote... 就很很不熟, 然后也是 Rick 一直在帮着... 他完美的弥补了我对电脑操作不熟悉的这个短板” (At first, I was very unfamiliar with EndNote... and Rick [partner] kept helping... he perfectly made up for my shortcoming of being unfamiliar with computer operations). This suggests that autonomy in academic writing is not just about personal preference but also about making strategic choices based on task demands and technological proficiency.

4.2.5. The Development of Autonomy through Experience

The analysis indicates that autonomy develops through experience with both individual and collaborative writing, as well as through the mastery of digital tools:

Students who have had successful collaborative experiences tend to develop confidence in their ability to negotiate, co-construct knowledge, and share technical burdens. DR mentioned wanting to continue with the same partner because “我们已经磨合到了一个两边都觉得还挺舒服的一个状态” (we’ve already adjusted to a state where both sides feel quite comfortable).

Individual writers develop confidence in their independent problem-solving abilities and digital workflows. PS noted, “I’m not a cautious writer, so sometimes I mistakenly take some unnecessary message into molecule, but luckily I’m working individually so I can just delete it or simply replace it.” This suggests that both writing modes can contribute to the development of autonomy, but in different ways and potentially at different stages of learning, ultimately shaping a more resilient and digitally adaptable learner.

5. Discussion

5.1. Students’ Perspectives on Individual and Collaborative Work

Regarding the first research question, our thematic analysis revealed mixed perspectives on both writing approaches, significantly shaped by the integration of modern digital tools. Participants valued individual writing for the complete control it afforded over content, pace, and style. This aligns with Holec’s (1981) conceptualization of autonomy as the ability to take charge of one’s learning. Participants appreciated the freedom to make independent decisions without negotiation or compromise, reflecting Winne’s (2001) emphasis on students taking ownership of their learning process. Interestingly, the traditional challenge of isolation in individual writing was notably mitigated by the use of AI tools, which served as “digital peers” for brainstorming and ideation, allowing students to experience collaborative benefits without interpersonal friction.

However, participants also identified significant challenges in individual writing, including uncertainty, emotional pressure, and technical limitations. These findings resonate with the idea that learner autonomy encompasses planning, monitoring, and assessing learning, which can be difficult to accomplish alone (Mickwitz, 2020). The absence of immediate human feedback often led to anxiety about the quality of work, supporting the notion that confidence is a crucial prerequisite for autonomous learning (Cotterall, 1995).

Collaborative writing elicited equally complex perspectives. On one hand, participants valued the social support, diverse ideas, and immediate feedback that peer collaboration provided. Furthermore, collaboration offered crucial digital skill complementarity, where peers scaffolded each other’s technical shortcomings (e.g., navigating data analysis software or reference managers). This appreciation for collaborative learning supports Vygotsky’s (1978) sociocultural theory and extends Storch’s (2002) findings on the benefits of collaborative patterns of interaction in ESL pair work. The emotional support and reduced anxiety reported by participants suggested that collaborative learning has an enhanced psychological effect on learner autonomy (Şener & Mede, 2023).

On the other hand, participants identified challenges in collaborative writing, including interpersonal conflicts, uneven workload distribution, pace synchronization, and compromised personal voice. These findings echo concerns raised by Wigglesworth and Storch (2012) about the potential complexities of collaborative writing. The frustration expressed by some participants regarding the need to compromise on ideas indicates the importance of learner agency in autonomous learning environments.

Interestingly, our findings revealed that preferences were not static but highly contextualized, influenced by factors such as task complexity, time constraints, and technological proficiency. This contextual nature of preferences supports earlier findings that autonomy should be considered within cultural and environmental contexts (Littlewood, 1999), noting that modern educational environments foster new, digitally-mediated forms of autonomy.

5.2. Impact on Learner Autonomy

Addressing our second research question, the analysis revealed distinct patterns in how individual and collaborative work influenced different dimensions of learner autonomy. In goal setting, individual writing promoted “proactive autonomy”, where learners independently established their objectives (Littlewood, 1999). Collaborative writing, however, facilitated what might be called “reactive autonomy”, where learners organize resources autonomously once a direction has been initiated through social interaction.

For self-monitoring, individual writing necessitated learners’ involvement in monitoring their learning (Mickwitz, 2020). In our study, this was frequently operationalized through digital workflow management (e.g., using Mendeley or EndNote to organize literature) and strategic technological restraint (e.g., deliberately limiting the use of translation tools to preserve logical flow and authorial voice). Collaborative writing introduced peer-mediated regulation, aligning with Vygotsky’s (1978) principles of social learning, where knowledge and technical skills are co-constructed through interaction with others. This supports the concept that learners move from other-regulation to self-regulation through social interaction (Thorne & Lantolf, 2006).

In self-evaluation, individual writing often led to uncertainty, where learners struggled to objectively assess their work, frequently relying on tech-mediated troubleshooting as a fallback before consulting teachers. Collaborative writing provided opportunities for peer assessment, offering multiple perspectives on quality and appropriateness (Tanyeli Zeki & Kuter, 2018). This finding extends research on how collaborative writing stimulates students to have better autonomy manifestations particularly in the evaluation stage of writing.

Our analysis also revealed a phenomenon of “complementary autonomy”, where individual and collaborative approaches mutually reinforced different aspects of learner autonomy. This concept builds upon Littlewood’s (1999) distinction between proactive and reactive autonomy, suggesting that these dimensions are not merely distinct but can be synergistic when appropriately combined. Furthermore, this synergy now extends beyond human interaction to include human-machine collaboration. The benefits of collaborative writing clearly demonstrate the principle that learning is fundamentally a social process (Vygotsky, 1978); however, our study shows that the quality of collaboration—whether with a human peer or an AI tool—significantly impacts autonomy development.

5.3. Theoretical Contributions and Pedagogical Implications

Our research innovates beyond previous studies in several significant ways. While existing literature has primarily focused on text quality and language learning outcomes in collaborative writing (Wigglesworth & Storch, 2012), our study explicitly connects interaction patterns to autonomy development across multiple dimensions. Furthermore, our study expands traditional sociocultural frameworks by highlighting how digital tools and AI act as non-human mediators in the zone of proximal development, fostering a new dimension of “digital autonomy” (Hong, 2026). Previous research has often examined collaborative writing’s general impact on learner autonomy (Shehadeh, 2011), but our findings provide deeper insights into the psychological and technological processes underlying autonomy in both individual and collaborative contexts.

Perhaps most significantly, this research challenges the dichotomous thinking that often characterizes discussions of learner autonomy. Rather than positioning autonomy as either individually or socially constructed, our findings suggest a dynamic interplay between personal agency, social interdependence, and technological mediation (Balcikanli, 2010). This reconceptualization has important implications for L2 writing pedagogy, suggesting that fostering learner autonomy requires a balanced approach that strategically incorporates individual work, collaborative experiences, and digital literacy training tailored to learners’ developmental needs.

By illuminating the complex relationship between writing modes, digital tools, and autonomy development, this study contributes to a more refined understanding of how pedagogical approaches can be optimized to support

learner autonomy in modern L2 academic writing contexts. Previous research has suggested that collaboration can help students move from dependence toward independence (Geary, 1998; Harmer, 2008; Wijaya, 2021). However, our findings indicate that this process is neither linear nor universal. Instead, the development of autonomy in L2 academic writing appears to benefit from a thoughtful integration of both individual and collaborative approaches, augmented by technology.

Hence, at earlier stages of conceptualization, planning, and idea drafting, L2 writers would benefit more from collaborative efforts and AI-assisted ideation. Then, the mid-stages of literature and methodological review, and sectional write-ups would benefit more from individual work supported by digital workflow tools and reference managers. In the later stage, where writers need to put everything together and perform final editing, a collective effort and peer-assisted technical troubleshooting may once again show advantages.

5.4. Limitations

This study has several limitations that should be acknowledged. First, our reliance on semi-structured interviews as the primary data collection method, while theoretically justified for exploring the psychological dimensions of learner autonomy, may limit the comprehensiveness of our findings. Although interviews provided rich insights into students' subjective experiences and perceptions—which are central to understanding autonomy as an internal psychological construct (Holec, 1981)—the absence of triangulation with other data sources represents a methodological limitation. Future research would benefit from a mixed-methods approach that combines interview data with: (a) analysis of actual writing products to examine textual evidence of autonomous behaviors such as goal-setting strategies, self-correction patterns, and evidence of self-monitoring; (b) classroom observation protocols to document real-time collaborative interactions and individual writing behaviors; (c) pre- and post-task questionnaires measuring learner autonomy orientations; and (d) learning analytics data from digital writing platforms to track revision patterns, time allocation, and help-seeking behaviors. Such triangulation would provide a more comprehensive understanding of how different writing arrangements influence both the subjective experience and objective manifestations of learner autonomy.

Second, while the cohort design allowed for natural control over formal academic writing training, former academic writing experience, and language proficiency, we did not formally assess individual differences in communication styles and interpersonal skills that could affect collaborative writing effectiveness, as well as baseline autonomy orientations or learning style preferences that may predispose students toward certain writing arrangements. As stated, future studies could employ pre-task assessments to measure these unmeasured variables and either control for them statistically or examine them as moderating factors in the analysis. Relatedly, the self-selection of writing arrangements (individual or collaborative) introduces potential bias, as students may have chosen approaches that aligned with their pre-existing preferences or autonomy orientations. Future studies might employ random assignment to writing conditions to address this limitation.

Third, while our data analysis involved three researchers with differences resolved through deliberation and consensus-building, we acknowledge that we did not formally calculate inter-coder reliability coefficients or provide comprehensive documentation of our complete coding procedures. This limitation affects the transparency and reproducibility of our analysis process. Future research should implement more systematic reliability verification procedures, including formal inter-coder reliability calculations and detailed documentation of coding manuals and procedures to enhance methodological rigor and reproducibility. Furthermore, our study focused on a specific context—English majors at a university in Macau—which may limit the generalizability of our findings to other educational contexts, disciplines, or cultural settings. Additional research across diverse contexts would enhance our understanding of how individual and collaborative approaches influence learner autonomy in L2 academic writing.

6. Conclusions

This study provides a comparative analysis of how individual and collaborative approaches influence learner autonomy in technology-mediated L2 academic writing, addressing an important gap in the research literature. Our findings reveal that both approaches offer distinct advantages and challenges in shaping students' writing experiences, autonomous behaviors, and digital practices.

Collaborative writing demonstrates significant positive effects on key dimensions of learner autonomy, particularly self-monitoring and self-evaluation. The partnership creates a natural scaffolding environment where students can solve problems, exchange ideas, leverage digital skill complementarity, and critically reflect on their own and each other's performance. Through this process, they mutually explain and internalize writing criteria to achieve their goals. Conversely, individual writing fosters autonomy through consistent personal planning and

freedom from the potential stresses of interpersonal communication and workload negotiation. Crucially, our findings show that the traditional isolation of individual work is increasingly mitigated by the use of AI as a “digital peer” for ideation and advanced software for digital workflow management. This allows solo students to exercise complete control over their time and resources—an important aspect of modern self-direction.

However, rather than advocating for one approach over the other, we suggest that instructors should understand the unique dynamics and benefits of each writing arrangement and provide students with options based on their needs, preferences, and the specific requirements of writing tasks. Additionally, educators should offer appropriate support tailored to each context, such as clear guidelines for human collaboration, training in digital discernment and strategic technological restraint, and strategic feedback for individual writers navigating AI and digital tools.

By recognizing the complementary strengths of individual and collaborative approaches—and the transformative role of digital mediation within them—L2 writing instructors can create learning environments that effectively foster learner autonomy while accommodating diverse student needs and preferences. Future research should continue to explore the complex interplay between writing arrangements, learner characteristics, technological integration, and the development of autonomy in modern L2 academic writing contexts.

Author Contributions

Z.W.: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing—original draft, Writing—review & editing; Q.C.: Conceptualization, Methodology, Investigation, Data curation, Formal analysis, Writing—original draft; W.C.H.H.: Formal analysis, Validation, Writing—original draft, Writing—review & editing, Supervision. All authors have read and agreed to the published version of the manuscript.

Funding

This research received no external funding.

Institutional Review Board Statement

Ethical approval was obtained from the City University of Macau with ethical approval reference number 2024-RE-31.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Data will be available upon request.

Conflicts of Interest

The authors declare no conflict of interest.

Use of AI and AI-Assisted Technologies

During the preparation of this work, the authors used ABACUS.AI to identify literature sources, refine the language and compile the reference list. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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