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ARTICLE

Learner interactions in face-to-face collaborative writing with the support of online resources

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Abstract

This study explores interactions among language learners with the support of online resources in a collaborative writing task and how online resources assisted collaborating learners in the meaning-making process. The study was conducted in the freshman English course at a national university in Taiwan. Fifty-six students constructed an essay in pairs firstly *without* the support of online resources, and subsequently constructed another essay *with* the support of online resources. Each pair's interactional patterns and dynamics of peer scaffolding across the two settings were examined. The findings show that the availability of online resources fosters a variety of interaction characteristics among learners with varied collaboration orientation. Results also suggest that learners' collaboration predisposition at the onset plays a critical role in influencing the way they used online resources to support their interaction. This study thus suggests that learners' collaborative patterns and their use of online resources have mutual impact, which may inform teachers seeking to integrate online resources to enhance their students' collaborative learning.

Keywords: learner interactions; collaborative learning; collaborative writing; computer-supported collaborative language learning (CSCLL); online resources; L2 writing

1. Introduction

Collaborative learning has been gaining popularity for several affordances considered conducive to student learning, including encouraging engagement, promoting higher-order thinking skills, and improving the retention of knowledge (Brown, 2008; Johnson, Johnson & Smith, 1998). It involves the joint intellectual efforts of learners as they mutually search for understanding, explore available information, produce meaning, and create a product. Deeply rooted in the sociocultural theory of learning (Vygotsky, 1978), collaboration allows learners to construct knowledge through interactions in social contexts. Language-learning research has consistently shown that tasks that involve collaborative work encourage learners to reflect on their language use and provide opportunities for learners' mutual feedback and knowledge construction to emerge (Dobao & Blum, 2013; Kim & McDonough, 2008; Watanabe & Swain, 2007).

Another rising trend in education is the integration of technological applications into learning environments. The multiplicity of technology attributes as well as the various ways of integrating them into collaborative work have presented wide possibilities for interplay between learning and technology. The research area of computer-supported collaborative learning (CSCL) has emerged during the past two decades to explore the extent to which technology integration assists collaborative learning and the meaning-making process (Stahl, Koschmann & Suthers, 2006). The scope of CSCL research spans from online to on-site settings, including the potential of the Internet to connect geographically remote people in innovative ways synchronously and asynchronously

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(Stahl *et al.*, 2006) and the way software applications support face-to-face collaborative learning (Crook, 1994; Gutiérrez, 2006; Lin, Chan & Hsiao, 2011). CSCL has also explored the availability of Internet resources to facilitate collaborative discussions between learners (Stahl *et al.*, 2006). However, studies on such Internet-based collaborative pedagogy are mostly situated in science classrooms (Kuiper, Volman & Terwel, 2009; Petra, Jaidin, Perera & Linn, 2016; Raes, Schellens, De Wever & Vanderhoven, 2012). Limited attention has been paid to how Internet resources can enrich language learners' face-to-face collaborative learning experiences.

The current study addresses the gaps in CSCL research by exploring the role of Internet support in collaboration between language learners and the extent to which online resources assist them in the meaning-making process. As this study is situated in a language-learning setting, online resources refer to any website or online tool that learners may find useful in support of their writing process, concept understanding, and language use (e.g. online dictionaries, discussion forums, etc.). To see possible impacts of Internet resources on learner interaction patterns, participants worked on a task in pairs in both conditions, *with* and *without* Internet support. Their collaborative discourse was examined. Currently, around 70% of CSCL studies have focused on the analysis of textual data in asynchronous or synchronous online settings (Jeong, Hmelo-Silver & Yu, 2014); less research has focused on the analysis of face-to-face interactional data. This study also addresses this gap by focusing on learners' face-to-face interactions in terms of the dynamics of scaffolding and their collaborative discourse. The two concepts will be elaborated upon in the literature review.

2. Literature review

2.1 Scaffolding

Scaffolding was first defined by Wood, Bruner and Ross (1976) as a "process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts" (p. 90). The assistance a teacher or an expert gives to a student or a novice is critical for their accomplishment, and it has the potential to facilitate learners to progress in their zone of proximal development (ZPD). ZPD was conceptualized by Vygotsky (1978) as the learning space in which an individual obtains assistance and support from others to move to a higher level of performance. The six features of scaffolding include drawing learners' attention to the desired version of a task, reducing the complexity of a task, motivating and engaging learners, highlighting critical features of a task, reducing the chance of failure, and providing learners with ideal models of required actions. By offering leading questions, showing how a problem can be solved, initiating the solution, or providing necessary hints, teachers or experts can help learners reach a higher level of performance when they encounter difficulties. On the other hand, many have argued that scaffolding also occurs among peers in collaboration (Bull *et al.*, 1999; Crook, 1994; Donato, 1994). Peer interaction provides a venue for learners to engage in dialogue and create scaffolding when they have difficulties or differing perspectives. Crook (1994) also stated that collaborations typically involve "equitable levels of expertise among the participants" (p. 150), so members in a pair are both non-experts who need to work together and provide mutual assistance to discover ways of completing a task or solving a problem. Conflicts and negotiation may result in the construction of new conceptual structures and knowledge. Therefore, working collaboratively provides a forum in which peer-to-peer scaffolding can emerge.

In addition, as stated in Hannafin and Land (1997), "Scaffolding ... is not limited solely to student-student and teacher-student interactions. Rather, technology-enhanced environments often provide the conceptual scaffolding and means (resources, tools) to promote personal and individual reflection" (p. 194), so the construct of scaffolding can be further expanded to include technological applications, including educational software and Internet resources (Bruce, 1997; Mavrou, Lewis & Douglas, 2010; Peters, Weinberg, Sarma, & Frankoff, 2011). Technological scaffolding can be seen in features of computer technologies that serve as mediational tools among face-to-face collaborating

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learners (Gutiérrez, 2006; Lund, 2008). For example, in language learning settings, Mavrou *et al.* (2010) and Gutiérrez (2006) acknowledged that the presence of notification cues and hints in educational software encourages collaborating learners' language discussions and negotiations as well as helping behaviors such as providing explanations, which help learners co-construct language-related knowledge. Researchers also found that the design of collaborative-oriented digital systems, such as a shared display screen that shows collaborating learners' integrated work during a joint task, promotes mutual interactions and discussions, contributing to more effective knowledge construction in collaborations (Chung, Lee & Liu, 2013; Nussbaum *et al.*, 2009). Contextualized in a technology-supported learning setting, this study focuses on peer scaffolding as well as technology scaffolding (particularly Internet sources) during collaboration. The concept of scaffolding is closely related to collaborative discourse.

2.2 The structure of collaborative discourse

Effective collaboration involves the joint intellectual efforts of learners as they explore available information. Researchers have indicated that the most significant indication of effective collaboration is learners' attempts to establish mutual understanding and shared knowledge (Crook, 1994; Roschelle & Teasley, 1995). Such mutual understanding can be achieved through several discourse patterns such as turn-taking, collaborative completion, repairs, narration of intentions, elaboration of ideas, and knowledge convergence upon a solution. Studies in language learning collaboration suggest that mutual understanding can be achieved through collective scaffolding, which include collective co-construction (incorporation of each other's utterances), requests for assistance, questioning competing forms, jointly managing components of the problem, and other- or self-correction (de Guerrero & Villamil, 2000; Donato, 1994; Foster & Ohta, 2005). Studies on collaborative writing tasks also documented learners' several collaborative patterns that support their shared tasks. De Guerrero and Villamil (2000) found that learners supported their joint task with "scaffolding mechanism" (p. 64) through mutual engagement, discussions on differing opinions, explanation, modeling, and the establishment of shared focus and intention.

With a micro-level analysis of learner interactive discourse, Storch (2001) identified certain linguistic features as collaborative discourse such as first-person plural pronouns (e.g. we, us) and the presence of metatalk, which is learners' metalinguistic discussion about grammatical and lexical choices (Swain, 1995). The metalinguistic understanding of how language shapes and creates meaning in written and spoken contexts has proven to be a pedagogical tool that greatly facilitates language learning (Swain, 2006). It can include language definitions (e.g. word choices and collocations) and function of features (e.g. personal pronouns, tense, and prepositions). Studies have adopted the construct of metatalk to analyze teachers' talk to understand how they help learners explore language meanings in writing (Myhill & Newman, 2016) and peer-to-peer talk to investigate learners' verbalized strategies to solve problems in language-focused tasks (Ishii, 2011).

Apart from collaborative discourse, Storch (2002a, 2002b) also documented other patterns of interaction when examining pair interaction patterns among English-as-a-second-language (ESL) adult learners who worked on writing tasks. The study focused on equality (the degree of control or authority over a task), mutuality (the level of collaborators' engagement with each other's contributions), as well as linguistic features to analyze learners' interaction. Four patterns of interaction were identified: collaborative (high equality, high mutuality), dominant/dominant (high equality, low mutuality), dominant/passive (low equality, low mutuality), and expert/novice (low equality, high mutuality) (see Figure 1; Storch 2002a). Table 2 explicates the distinctive interactional characteristics of each pattern with studies reviewed in the literature; the patterns are used as the analytical tool in this study. Among the four patterns, collaborative and expert/novice patterns were identified as "collaborative-oriented" and considered conducive to language learning and knowledge transfer (Storch, 2001, 2002a, 2002b; Watanabe & Swain, 2007).

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The dominant/dominant and dominant/passive situations, in which over-authoritarian stance was observed, were considered harmful to effective collaboration.

2.3 Internet resources as a support for meaning-making processes

The multiplicity and diversity of online information create a powerful learning environment (Chang *et al.*, 2011; Greene & Azevedo, 2010). Internet resources have been acknowledged as an important source of scaffolding for their potential to assist learning and knowledge construction in learners' immediate environments (Kim & Hannafin, 2011; Larson-Guenette, 2013; She *et al.*, 2012). For instance, in a language learning setting, online resources such as online dictionaries and language learning websites help language learners expand knowledge, improve accuracy (Hughes, 2013; Peters *et al.*, 2011), be exposed to other cultures (Larson-Guenette, 2013), and broaden the scope of their learning through alternative ways of learning (Bruce, 1997). Situated in a collaborative learning context, online resources allow learners to engage in interactive talk in the meaning-making process through exploring diverse resources online to interpret and compare different concepts (Kuiper *et al.*, 2009; Stahl *et al.*, 2006; Suthers, 2005). Hannafin and Land (1997) also noted that this meaning-making process evolves as learners reflect on their understanding and express their agreement or disagreement on certain online information. Currently, most studies on the benefits of online resources for language learning focused on individual (Hughes, 2013; Larson-Guenette, 2013; Peters *et al.*, 2011) rather than collaborative learning settings. Empirical studies on interaction patterns among collaborating language learners and Internet resources are scant, leaving a research gap in the field. Therefore, the main research question in this study is, what is the nature of language learner interactions with Internet resources and how can Internet resources assist collaborating learners in the meaning-making process?

3. The present study

3.1 Research design

This classroom-based case study was conducted in two classes enrolled in a freshman English course at a national university in southern Taiwan. In accordance with Storch (2002a, 2002b), this case study focuses on an in-depth analysis of learner dialogic interactions to examine their collaborative patterns. This is a one-semester compulsory course, aiming to improve intermediate English-as-a-foreign-language (EFL) students' language proficiency. Students meet for a two-hour session and a one-hour session each week for a total of three hours. The study was conducted over three sessions for each class during normal class time in the middle of the semester, during which the researcher assumed the role of instructor. This study explores how learners interact with each other with the support of online resources. Learners' interactions were examined as they engaged in a collaborative writing activity in pairs in two settings: they first constructed a text in English *without* Internet support, and in the next session they constructed another text *with* Internet support. In the Internet-supported setting, students could use any online resources available (e.g. online dictionaries, public forums, or online mind-mapping tools) to support their language use and help organize their ideas. The comparative nature of the methodology allowed the researcher to identify changes in interaction patterns and the dynamics of scaffolding that might be impacted by Internet support. The writing task in the study was integrated into their regular curriculum as a writing assignment. The primary data set was the video recordings of learners' interactions across the two settings and a stimulated recall interview with each pair.

3.2 Participants

Two freshman English classes, a total of 56 students (28 pairs), participated in this study. The class instructor indicated that the two classes had comparable intermediate-level English proficiency.

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Table 1. Time frame of the data collection procedure

Session	Tasks	Data collected
1	Introduction (40 minutes)	
(2 hours)	Practice session (50 minutes)	
2	Task I: Text construction in pairs *without* Internet support (1 hour)	Video recordings of interaction patterns
(1 hour)		
3	Task II: Text construction in pairs *with* Internet support (1 hour)	Video recordings of interaction patterns
(1 hour)		
Out of class time	Stimulated recall interview with each pair (20 minutes each pair)	Learners' perceptions

The participants were male (65%) and female (35%) native speakers of Mandarin. Among them, around 80% majored in science (primarily engineering and medical studies) and the rest in humanities (history, economics, and politics). Following previous studies exploring learner interaction patterns (Gutiérrez, 2006; Storch, 2002a), this study adopted a self-selected pairing arrangement based on participants' familiarity with each other.

3.3 Data collection

Table 1 shows the time frame of the data collection procedure. In session 1, the researcher introduced the collaborative writing task to familiarize students with such a writing mode. The introductory session was followed by a practice session, in which students practiced writing a 150-word essay in pairs. The actual writing tasks began in session 2. Students co-constructed a 150-word essay in pairs in response to a prompt (see Appendix A[1]) *without* the support of online resources. In session 3, students co-constructed another 150-word essay to another prompt (see Appendix B[2]) *with* the support of online resources in a computer lab, where two students in a pair shared a computer for online search. The prompts were adopted from a global English test (IELTS), which is also the English graduation benchmark in this university. Students were asked to analyze the information in a chart and interpret it. The language difficulty of the two prompts is intermediate level according to the Flesch–Kincaid readability test. In both settings, students wrote in paper-and-pencil mode, following their usual in-class writing mode in this course. Each pair's writing process in both settings was video-recorded with individual devices. A follow-up 20-minute stimulated recall interview was conducted with each pair out of class time. In the interview, their writing product and video recordings were used as stimuli for them to further elaborate their experiences and the challenges they encountered. The participants viewed particular moments chosen by the researcher and answered questions about their thinking processes and intentions during those moments. Sample questions included, "In what way do you think the online information helped you when you constructed this sentence?" and "What made you change the word use?"

[1]Adapted from IELTS practice test retrieved from IELTS-Exam.net (n.d.) in August 2013.
[2]Adapted from IELTS practice test retrieved from IELTS-Exam.net (n.d.) in August 2013.

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Table 2. Distinctive characteristics of each pattern of interaction

Patterns of interaction	Characteristics
Collaborative (Quadrant 1)	• Mutually build shared understanding • Both learners show high equality and high mutuality: equal degree of control over the task and engagement of each other's contribution (reciprocal feedback) • Frequent use of first-person plural pronoun (we) • Text co-construction: both learners repeat, incorporate, extend, or complete each other's utterances • Metatalk – metalinguistic discussion about grammar and lexical choices • Elaboration – both learners discuss and elaborate on what they will write together
Dominant/dominant (Quadrant 2)	• Both learners contribute to the task (moderate to high equality) • Disputational talk – insisting on their own language use • Show unwillingness to fully engage with each other's contribution • High levels of disagreement and are often unable to reach consensus (moderate to low mutuality)
Dominant/passive (Quadrant 3)	• One learner takes an authoritarian stance over the task, while the other adopts a more passive role (low equality) • Self-repaired, non-interactive turns, long monologues • Little negotiation
Expert/novice (Quadrant 4)	• One takes control of the task (moderate to low equality) • The dominant one tries to provide assistance, encourages the other learner to offer ideas, and provides suggestions (moderate to high mutuality)

3.4 Data analysis

The transcripts of the participants' interactions in the two settings were the main sources of data. The video recordings allowed the researcher to note down students' contextual/behavioral information (e.g. writing, checking online, pauses). Storch's (2002a) framework of learners' patterns of interaction was used to identify and examine participants' interaction patterns. The data analysis procedures comprised three steps: identifying patterns of interaction, identifying emerging interactional characteristics, and documenting impact of Internet use.

First, based on distinctive interactional characteristics identified in the literature (Crook, 1994; Donato, 1994; Foster & Ohta, 2005; Roschelle & Teasley, 1995; Storch, 2001, 2002a; Wegerif & Mercer, 1996), and summarized in Table 2, the researcher identified the participants' patterns of interaction in both settings as collaborative, dominant/dominant, dominant/passive, and expert/novice, visualized as Figure 1. A second reviewer, also professionally trained in data coding, was given randomly selected transcripts to identify the pairs' patterns of interaction. To ensure the reliability of coding, disagreements were identified and discussed until 100% agreement was reached. In a second step, the researcher documented emerging interactional characteristics in the second setting (with Internet support) for each pair. This step helped to understand the differences in the way the participants built shared understandings across the two settings. Third, the researcher conducted a member-checking technique in the post-task stimulated recall interview with each pair to confirm the causes of the changes in their interaction characteristics (e.g. the scope of language discussions). The process thus documented changes that may have been caused by the support of the Internet.

4. Results

This study explores the nature of collaborating learners' interactions with the support of online resources and how the resources can assist the learners in the meaning-making process.

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Table 3. Shifts in interaction patterns across the two settings among the 28 pairs

Patterns	Non-Internet-supported	Internet-supported	Number of pairs	%	Group
1	Collaborative	Collaborative	9	32%	(H)
2	Mostly: Collaborative Occasionally: Expert/Novice	Collaborative	7	25%	(H)
3	Mostly: Collaborative Occasionally: Expert/Novice, Dominant/Dominant	Collaborative	2	7%	(H)
4	Mostly: Dominant/Passive Occasionally: Collaborative	Mostly: Dominant/Passive increased Collaborative	6	21%	(M)
5	Mostly: Expert/Novice Occasionally: Dominant/Passive	Expert/Novice Dominant/Passive	4	14%	(L)

Note. H = high collaboration group; M = moderate collaboration group; L = low collaboration group.

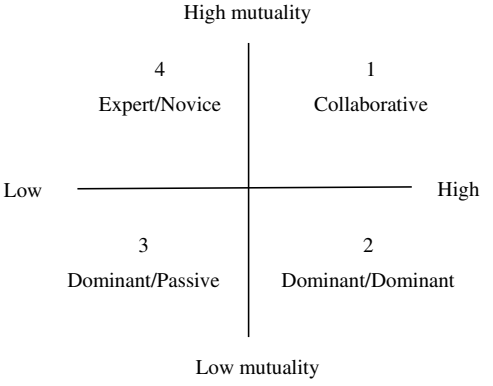


Figure 1. Storch's framework of four patterns of interaction (Storch, 2002a)

The results present changes in the participants' overall interaction patterns across the two settings and emerging characteristics with the support of the Internet.

4.1 Shifts in interaction patterns across the two settings

Five distinctive shifts in patterns of interaction were identified among the 28 pairs across the two settings, as shown in Table 3. They are arranged in accordance with the degree of collaborative orientation displayed (pattern 1 the most collaborative and pattern 5 the least). Over half of the pairs displayed collaborative patterns in both settings. In pattern 1 (nine pairs) and pattern 2 (seven pairs), the participants were predominantly collaborative in both settings. In pattern 3 (two pairs), they were predominantly collaborative with occasional non-/less collaborative scenarios and became fully collaborative with Internet support. Pairs in these patterns were further categorized as the "high collaboration group (H)," in which collaborative orientation was demonstrated predominantly compared to those in other patterns. In the less collaborative pattern, pattern 4, six pairs primarily exhibited a dominant/passive pattern but grew more collaborative subsequently and were labelled as the "moderate collaboration group (M)." The four pairs in pattern 5, who started with a mainly expert/novice and dominant/passive pattern and became even more non-collaborative, were labelled as the "low collaboration group (L)."

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Table 4. Collaborative characteristics that emerged with Internet support

Groups	Emerging characteristics in the Internet-supported setting
High collaboration	• Expanded discussion and different interaction dynamics in metatalk • Elaboration • Internet-supported text co-construction
Moderate collaboration	• Interactive turns in metatalk • Negotiation of meanings • Engagement
Low collaboration	• Non-interactive turns related to the use of the Internet • More scenarios of working individually

An overview of the primary pattern of interaction across two settings shows that most of the pairs either maintained or grew more collaborative-oriented with Internet support except for the L group. Observed themes are discussed and illustrated with representative excerpts (Chinese is translated into English in italics).

4.2 Emerging collaborative characteristics

Table 4 summarizes the collaborative characteristics that emerged when they had Internet support for the three groups. The changes in the participants' collaboration characteristics caused by Internet use are discussed in detail as follows.

4.2.1 High collaboration group

These 18 pairs demonstrated a highly collaborative pattern of interaction with several collaborative characteristics displayed repeatedly in both settings: text co-construction, metatalk, reciprocal feedback, narration of intention, and elaboration of ideas. They were actively engaged and showed high equality and mutuality, except for occasional non-collaborative patterns in pattern 2 and 3. There was considerable metatalk that focused on lexical knowledge, such as meanings, spellings and uses. With Internet support, the learners engaged in a wider range of activities, such as expanded metatalk, elaboration, and Internet-supported text co-construction.

Expanded metatalk. Among the collaborative characteristics, metatalk made up the largest proportion of each pair's conversation. Therefore, the most evident differences in learners' interaction across the two settings were observed in metatalk. The differences included (1) the scope of the content, (2) the dynamics of the peers' scaffolding and interactions, and (3) the effectiveness of discussion. Table 5 summarizes the differences in the scope of metatalk across the two settings.

In the setting without Internet support, learners' metatalk mostly focused on lexical and grammatical discussion. Unsuccessful attempts to solve language difficulties led to breakdowns in their conversation. However, when they had access to online resources such as dictionaries and public discussion forums, the content of metatalk became extensive. Apart from lexical and grammatical discussion, the most frequently observed theme was the attempt to learn to use synonyms found in online dictionaries to avoid word repetition (see Excerpt 1). Hua and Fen managed to find a synonym for "abilities" online to complete the sentence.

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Table 5. The differences in the scope of metatalk across the two settings

1st setting (Non-Internet-supported)	2nd setting (Internet-supported)
• Requesting lexical help • Requesting grammar help • Creating shared understanding	• Requesting lexical and grammar help • Learning to use synonyms • Extending reflections on a word/phrase, including word choice, word use, comparisons, collocations • Relating second language to first language • Discussing sample sentences • Verifying lexical knowledge • Reviewing background knowledge • Engaging actively in lexical discussions prompted by the verification process • Creating shared understanding

Excerpt 1. Learning to use synonyms

10	Hua:	They would lose their job
11	Fen:	Yeah, and they have dream so they have to strength … um, strength, their … their …
12	Hua:	Still using abilities? … haha.
13	Fen:	我們來口一下*(Let's check online)* … ok
14	Hua:	Capacity?
15	Fen:	Yeah, capacity! So … they still dream about the future …

Also, extended reflections on synonyms, antonyms, collocations, pronunciations, and even L1–L2 relation were observed as they tried to use them in their writing (see Excerpt 2). Provided with sample sentences in the dictionaries, learners were also engaged in the analysis of sentence structure as they tried to apply it in their writing. In addition, when learners verified their linguistic knowledge with online resources, they indicated that the process effectively helped them review what they had learned before (see Excerpt 3) and prompted active brainstorming on proper word choices and use (see Excerpt 4).

Excerpt 3 shows how their background knowledge was activated. Mu-Fan searched for a synonym for "city" (line 55) and found the word "urban," and Yang gave affirmative feedback. Immediately afterwards he noticed its antonym in the dictionary and recalled the word "rural" (line 56) by saying *rural is the countryside, yeah*. With the Internet information as scaffolding, Yang was able to extend his reflection on a word and recall a related word. In Excerpt 4, when Mu-Fan and Yang verified their knowledge of the word "affect" with the dictionary, they were engaged in brainstorming (affect, influent, effect, and influence) as they attempted to reach accuracy. In this setting, learners had access to multiple sources of scaffolding – their peers and the Internet. The two types of scaffolding became blended and mutually strengthened as their interactions progressed. Figure 2 illustrates the mutual scaffolding between peers in the first setting. Figure 3 presents the scaffolding in the second setting, where Internet resources scaffolded the learners and prompted more collaborative characteristics, encouraging greater interaction between the peers.

Also, language difficulties were more effectively solved. With the Internet, when learners encountered difficulty solving language problems, the unsuccessful attempts yielded misunderstandings, inaccurate language decisions, or unanswered metatalk. Breakdowns in conversations

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Excerpt 2. Extended reflections on words/phrases (L1–L2 relation)

52	Lin:	我看一下愛面子 (*Let me check how people say "love their face."*) (Checking online) 好奇怪 ... (*So strange ...*) "be sensitive about one's reputation ... be keen to face-saving."
53	Yu-Jie:	Face-saving? 真的假的? (*Really?*) Hahaha!
54	Lin:	有可能阿! 挽救 ... 好就寫這個 (*Yeah it makes sense! Like Chinese, to "save" our "face" right? Ok, we'll use this.*)
55	Yu-Jie:	(Writing) Because they are keen on face-saving ...
56	Lin:	好好笑他挽救了他的臉 (*So funny he "saves" his face ...*)

Excerpt 3. Review of background knowledge

55	Mu-Fan:	忙碌的城市生活 *(Busy city life)* Busy city ... (Checking online) busy "urban" life ...
56	Yang:	對 urban 是城市 ... rural 是口村 *(Yeah "urban" is city ... and "rural" is the countryside ... yeah.)*

occurred. With the support of Internet resources, most of the requests in metatalk discussion were more effectively addressed. Online search and elaborated discussions on language use helped the learners obtain satisfactory answers to their questions. There were also fewer long pauses caused by language difficulty in the conversation.

Elaboration. Elaboration is a form of discussion in which learners extend their ideas on what they will write together. The participants reported that the access to online resources stimulated brainstorming, contributing to the elaboration of ideas in writing. They searched for related information when they brainstormed for ideas. Although most of them could elaborate on their ideas together in both settings, some contributed to this process more actively with the support of online resources. In Excerpt 5, Shu-Hao and Shi-Yu were brainstorming about "income and family." The phrase "make ends meet" that they found online stimulated the elaboration of ideas as they tried to incorporate them into their writing (lines 14, 15).

Internet-supported text co-construction. Text co-construction is where both learners repeat, incorporate, extend, or complete each other's utterances. It occurred in both settings, but more frequently when they had Internet support. In Excerpt 6, Fen and Hua obtained useful information in a public discussion forum *Yahoo Answers* (line 39) to complete a sentence (line 40). Provided with rich information, both learners were more willing to try to use alternative words and complex sentence structures.

4.2.2 Moderate collaboration group

The six pairs in the moderate collaboration group primarily exhibited a dominant/passive pattern across the two settings with plentiful monologues and self-directed turns. However, more collaborative activities were observed when they had Internet support, which signified their emerging collaborative pattern. Those activities included interactive turns in metatalk, negotiation of meanings, and learner engagement.

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Excerpt 4. Active brainstorming prompted by the verification of lexical knowledge

25	Mu-Fan:	Factors … 影響 … (“*affect*”…)
26	Yang:	Affect, effect, influence?
27	Mu-Fan:	可是動詞耶 *(But I need a verb.)*
28	Yang:	Influent? 是嗎 *(Influent, is it)*？動詞 *(verb)*？I-n-f-l-u-e-n-t?
29	Mu-Fan:	Let me see … (Checking online) 不是耶, 那就 … effect … *(No … Then try “effect”…)* (Checking online)
30	Yang:	也不對, 看有沒有相似字 *(Not that either … See if there are similar words.)*
31	Mu-Fan:	有阿，不對，意思不一樣 … 還有什麼？… 我知道用influence 當名詞就好了 … which are major factors that have influence on … on work … influence 的用法是 … (Checking online) have influence on … *(Yes … but the meaning is not right … What else can we think of …? I know! Let’s use the noun “influence.” … which are major factor that have influence … on work … influence … how do I use “influence?”* (Check online) (*Ok, have influence on …*)

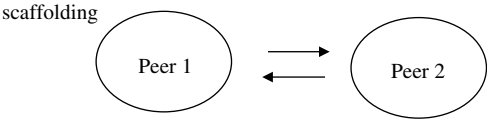


Figure 2. The dynamics of scaffolding of collaborative pairs without Internet support

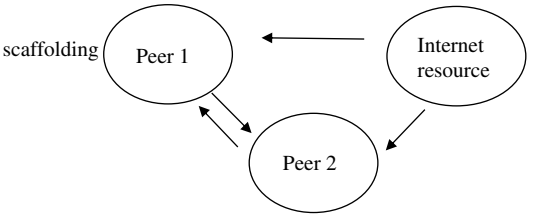


Figure 3. The dynamics of scaffolding of collaborative pairs with Internet support

Interactive turns in metatalk. When the dominant peer took control of the Internet search, the conversation remained non-interactive and authoritarian and the passive peer remained passive. As Lin *et al.* (2011) noted, when learners are not given the chance to operate the computer, some tend to withdraw their attention from a task, especially for passive or less proficient peers. However, this pattern was countered when the passive peer was in charge of online information search. As they became the information provider, they assumed a more active role in their

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Excerpt 5. Elaboration of ideas prompted by online resources

12	Shu-Hao:	(Checking online) See, there is a phrase ... "make ends meet"...
13	Shi-Yu:	Oh make ends meet ...
14	Shu-Hao:	Maybe we can use this.
15	Shi-Yu:	Okay let's see ... Make ends meet ... if the money is not enough, then he would barely make ends meet. But if he has more money, he can make his family's life more better.... He would have a better life ...

Excerpt 6. Internet-supported text co-construction

35	Fen:	They don't, they are more 務實 (*realistic, down to earth*) they think money is more useful so they will do their best to work better to ...
36	Hua:	Earn more money.
37	Fen:	So I write they ... uh ...
38	Hua:	務實? *(realistic, down to earth?)*...
39	Fen:	(Checking online dictionary) Ok.... no good words ... 知識家看看 *(Let's check Yahoo Answers)* (Checking Yahoo Answers)
40	Hua:	(Studying the results) They become more "pragmatic?"
41	Fen:	Ok, they become more pragmatic.

conversation, as exemplified in Excerpt 7. Lee appeared passive while Ding dominated the discussion, leaving little space for interactive conversation. With Internet support, a two-way discussion pattern was observed, signified by higher turn interactivity and shared control of the task. In lines 34, 36, 42, Lee became more active when he adopted the role of information provider to help Ding complete the sentence (line 43). Their metatalk became interactive with reciprocal turns (request-answer). Lee became more involved by contributing to the text construction.

Negotiation of meanings. For this group, the occurrence of negotiation of meaning was initially rare. With the emergence of interactive turns, negotiation of meaning was more likely to occur as the passive/less proficient peer was able to verify his lexical knowledge with online resources and contribute to the language discussions. Excerpt 8 shows their discussion of the phrase "promotion prospect," which Ding mistakenly interpreted as "winning people's respect." Lee challenged Ding's idea in lines 46, 48 and 50, but was uncertain about its exact meaning. He then verified his knowledge and was able to negotiate the meaning with Ding (line 52), which helped Ding reach a clearer understanding.

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Excerpt 7. Interactive turns

33	Ding:	Mm, they have more 動力? (*motivation?*) 去追求? (*pursue?*)
34	Lee:	Motivate ... m-o-t-i-v-a-t-e (checked online) 是動詞 (*yeah ... and it's a verb*).
35	Ding:	Motivation ... "to"?
36	Lee:	(Checked online) Yes.
37	Ding:	More motivation to 追求? (*pursue?*)
38	Lee:	Pursue, yes.
39	Ding:	Motivation to pursue? 這樣嗎 (*Is it correct?*)
40	Lee:	Mm.
41	Ding:	Then 中年人 (*"Middle-aged people"... um*)
42	Lee:	Let me see. (Checked online) *Middle-aged, yes*.
43	Ding:	The middle-aged people ... and on this table ... they always want to 展現自己 (*show their talent*) show themselves ...

Learner engagement. With the unbalanced equality over a task, the passive peers in the moderate collaboration group usually appeared disengaged. Their role seemed to be limited so they either kept silent or gave phatic utterances (e.g. "mm" or "yeah") in response to the dominant peers' ideas. With the development of collaborative characteristics shown in interactive turns and negotiation of meanings, the participants grew more engaged in the task. As they reported, the role as the information provider enabled them to feel "active" and engaged in metatalk. The engagement was also observed during information search, when both peers focused on the computer display and studied the information together.

4.2.3 Low collaboration group

The low collaboration group was the smallest of the three groups (four pairs). They primarily displayed less/non-collaborative patterns across the two settings. Their non-interactive pattern can perhaps be explained by the individual's personality or their large language proficiency gap, which held them back from making contributions to language discussions. The characteristics displayed in the two settings included the expert/novice pattern, difficulties in mutual understanding, non-interactive turns and individual working pattern, which occurred sequentially. As the passive/lower proficient peers were usually not confident speaking English, initially, the dominant/higher proficient peers would attempt to involve their partner by asking questions and eliciting ideas (expert/novice pattern). When interaction seemed difficult, the non-interactive turns took over and finally developed into an individual rather than a collaborative working mode. Access to the Internet did not seem to change this pattern; instead, they were engaged in individual online search without sharing information with each other. Internet support in this case seemed to function as a personal language support tool, rather than to encourage interactive metatalk or collaboration. In Excerpt 9, Chang-Yi (passive, lower proficient) looked up some words in a dictionary without sharing any information with Kao (dominant, higher proficient), who was fully engaged in his own online search and writing. Kao's self-directed one-way conversation left Chang-Yi out of the conversation and the task.

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Excerpt 8. Negotiation of meanings

44	Lee:	Promotion prospect ... 這是什麼 (*What is this?*)
45	Ding:	提升尊重阿 (*To win people's respect.*)
46	Lee:	是嗎？這個呢？ (*Is it? Then what's "prospect?"*)
47	Ding:	Prospect ...
48	Lee:	這不是指望嗎 (*Isn't this "possibility?"*)
49	Ding:	(Checked online) 盼望阿 (*Yeah it means "expectation"...*)
50	Lee:	提升的期望 ... 那不是升職的意思嗎 (*To raise expectation? I think "promote" means "getting promoted."*)
51	Ding:	那不然這句是什麼意思 (*Then what do you think it means?*)
52	Lee:	(Checked online) 不是講升職的機會嗎 (*I think the phrase means "the possibility of getting promoted."*)
53	Ding:	是升職嗎 (*Is it really?*) ？ (Checked online) Oh ... ok.

5. Discussion

Overall, most of the pairs either maintained or grew more collaborative oriented with the support of online resources except for the low collaboration group, which maintained their low interactive pattern. The results indicate that the access to Internet support might possibly foster certain collaborative characteristics among learners of varied collaboration orientation; on the other hand, learners' collaboration predisposition may also play a role in influencing their interactions with Internet support. These are elaborated as follows.

5.1 Collaborative characteristics among learners of varied collaboration orientation

For the high collaboration group, the interactions with online resources prompted learners' active thinking in several areas such as lexical discussion, idea elaboration, knowledge review, knowledge verification, and the application of knowledge. These active thinking activities demonstrate learners' "IPS [information problem solving] skill" (Brand-Gruwel, Wopereis & Walraven, 2009: 1207). With such skill, learners integrate and elaborate online information to build relevance with their prior knowledge, so that they can reach a deeper understanding of the information. The current study shows that this skill developed as learners navigated online resources, as reported by the participants that the access of online resources facilitated their higher-order thinking. Also, some participants' extensive online searches demonstrated a good command of new literacy skills, or Web literacy (Chang *et al.*, 2011; Leu, Kinzer, Coiro & Cammack, 2004), with which they effectively located, synthesized, and communicated online information to create a shared understanding. The quality of their collaboration was thus further enhanced by the presence of such problem-solving skill and Web literacy in their expanded metatalk. On the other hand, the expanded scope of metatalk is the result of multiple scaffolding, where learners had access to multiple sources of scaffolding from peers and online resources. The dynamic flow among peer-to-peer and peer-to-computer interactions produced interconnected scaffolding. As Bull *et al.* (1999) observed, a well-functioning collaborating group in a computer-mediated setting is maintained by mutual scaffolding involving peers and computers. The participants in the study interacted vibrantly with multiple online resources and their peers to build shared understanding and elaborate their ideas. This finding is also consistent with a previous study that focuses on language learners' dynamic mutual interactions among peers and online resources as they engaged

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Excerpt 9. Non-interactive pattern

9	Chang-Yi:	(Checked online for vocabulary)
10	Kao:	The young ages ... ok ... (Talking to himself. Checked online)
11	Chang-Yi:	(Checked online for vocabulary)
12	Kao:	To progress ... um ... to progress.... (Talking to himself)

in the meaning-making process in writing, termed as "multi-directional scaffolding" (Hsieh, 2017: 126). This type of interaction facilitates learners to co-construct a shared understanding during problem-solving. The current study goes beyond the scope to discuss learners' changes in collaborative orientation and highlights that learners' collaborative predisposition can influence their use of online resources to support their interactions.

For the moderate collaboration group, the unbalanced weight of authority seemed to be countered to varied extents by the availability of online resources, depending on the extent to which they utilized the Internet as a mediational and engaging tool. Passive peers adopted a more active role in discussion, making the dominant peers less authoritarian. The online language support mediated learners' negotiation of language decisions and reduced the dominant/passive or dominant/dominant scenarios that might have derived from language proficiency gaps or language decision conflicts. Consistent with previous studies, online resources could be a mediational tool, particularly for less proficient peers in collaborative learning (Lund, 2008; Mavrou *et al.*, 2010). The shifts in interaction pattern in this study illustrated the value of Internet support. Moreover, reading and discussing information together helped the participants, especially passive peers, stay engaged in their task, which was crucial in their movement toward a more collaborative pattern. For instance, one pair's use of a mind-mapping tool, "XMind" (see Figure 4), enhanced their engagement in building shared understanding as they visualized their elaboration of ideas. Group members stay "task-engaged" (Crook, 1994: 162) when they are attentive to the computer display, and, according to Chung *et al.* (2013), this is when they are more likely to generate higher levels of discussion.

Another value of online support is the promotion of learner autonomy (Greene & Azevedo, 2010). The access to multiple representations of information (e.g. visualization) could potentially accommodate different learning needs and facilitate learners to progress in their ZPD. Hobrom (2004) noted that learners' ability to navigate online resources to accommodate their specific needs reinforces learner autonomy. In this study, the participants reported that they greatly benefited from using online resources because they could find resources to address their individual inquiries at all stages in the process (brainstorming, negotiating, writing, etc.). This allowed them to follow their own pace and develop their own ways of collaborating with each other, which enabled them to develop ownership of their joint work.

As for the low collaboration group, the issue of the imbalance between computer–learner and learner–learner interaction (Dillenbourg, Baker, Blaye & O'Malley, 1996) was always a concern. Learners may depend heavily on the Internet for immediate feedback rather than seeking input from their partner, greatly impeding learner–learner mutual interactions. In this group, online resources supported each peer individually, without promoting interactive turns and discussions. Thus, Internet support seemed to play a minimal role in fostering learner interactions; rather, it triggered more non-collaborative behaviors and an individual working pattern. Such a scenario

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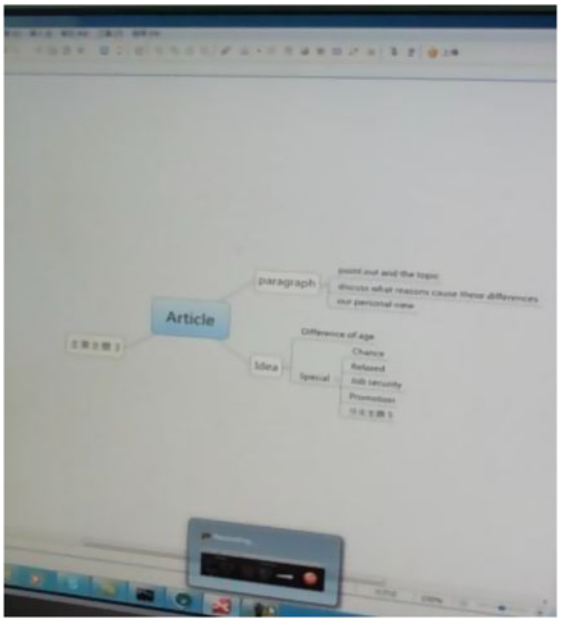


Figure 4. Visualization of ideas: XMind

can be attributed to the lack of peers' modeling and coaching (Brown, Collins & Duguid, 1989) in an expert/novice pair configuration. The "expert" peer in a collaboration could be encouraged to actively provide explicit modeling to encourage the "novice" peer to be more involved in problem-solving. In the current study, although the expert peers attempted to elicit ideas from the novice peers, they failed to provide scaffolding by modeling idea construction (e.g. by verbalizing how they constructed the outline of the writing) and information searching strategy (e.g. by explicitly sharing where to locate useful information and how to use it in writing). However, the "scaffolding provision" ability among learners does not form naturally. Instead, it entails the development of learners' self-regulatory skills, which is the ability to strategically adjust their own as well as their peer's learning and cognitive process in a problem-solving context (Järvelä *et al.*, 2015). This is a critical skill in an ideal collaborative setting where group members "regulate their collective activity" (Järvelä *et al.*, 2015: 128), which is known as shared regulation. Group members would have the awareness of their collective knowledge, how the shared group work is functioning, as well as cognitive strategies that help group members understand difficulties or solve problems in a shared task. Undeniably, such development of shared regulation needs to be facilitated in collaborative activity design and assisted by an instructor.

5.2 Collaboration predisposition is indicative of interaction patterns in the Internet-supported setting

Research advocating the benefits of technology has suggested that the integration of computer use in the classroom helps increase collaborative patterns in group work (Bradley, Lindström & Rystedt, 2010; Gutiérrez, 2006; Lund, 2008). The results of the study suggested a mixed result in terms of integrating the Internet in support of learners' interactions. The extent to which Internet access supported collaborative patterns could be influenced by learners' collaboration predisposition. The highly interactive nature of high collaboration pairs allowed them to

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effectively use online resources to support their mutual scaffolding and discussions. Therefore, Internet support made them even more collaborative. On the contrary, Internet support may have had a more limited role in encouraging collaborative behavior in the low collaboration group. The lack of interaction between participants in this group (which could possibly be explained by their language proficiency) kept them from having effective mutual discussions at the onset, which in turn caused their individual use of the Internet, reducing their interactions.

6. Conclusion

This study explored the nature of learner interactions with Internet support and how access to online resources can assist collaborating learners in the meaning-making process in the context of a collaborative writing activity. The findings show that access to online resources may foster a variety of interaction characteristics among learners of varied collaboration orientation. Online resources provided a source of scaffolding that promoted active thinking. In addition, the access to multiple sources of scaffolding enabled their dynamic flow of scaffolding for highly collaborative learners. For less collaborative learners, online resources functioned as a mediational tool that assisted learners' language discussions and negotiations. Online information presented in varied modalities also sustained learners' engagement, encouraging the emergence of a collaborative pattern. Among non-collaborative learners, on the contrary, online resources may decrease peer interactions. Therefore, the findings also suggest that learners' collaboration predisposition may influence the way they used online resources to support their interaction. The more collaborative they were, the greater extent to which they may utilize online resources to support their interaction and collaboration, and vice versa.

The current study has some limitations that should be acknowledged. First, the study was situated in a specific instructional context, a college-level writing class, so the findings might not be directly applicable to other learning contexts. Also, the study did not explore other possible variables that may come into play when the Internet is integrated into collaborative learning. For example, learners' Web literacy (Web searching, reading, and evaluating skills) (Kuiper *et al.*, 2009) was not critically examined. Learners are more likely to effectively construct knowledge through Web search when they have adequate Web literacy, and vice versa. Other variables such as learners' language proficiency and task design were not examined in the study. In addition, although the study exclusively focuses on any interaction pattern changes caused by the use of the Internet, the findings might still be influenced by the order in which the learners worked in a *non*-Internet-supported and an Internet-supported setting (effect of practice). Future studies could explore the differences in their interactions across the two settings when learners work in an Internet-supported setting prior to the *non*-Internet-supported setting. The alternation of the order allows the researcher to see if the effects of practice impact their collaborative patterns in the second setting. The interplay shown in the study, therefore, should not be seen as a rigid causal link, but as one piece of the big picture of the relation between learner interaction and Internet support.

Pedagogically, the interplay between learners' collaborative patterns and their use of online resources may inform teachers seeking to integrate the Internet to enhance their students' collaborative learning. Given that learners' collaborative predisposition is critical in affecting the efficacy of the integration of Internet support, teachers can help learners establish collaborative interaction patterns prior to assigning them to the Internet-supported collaborative work. According to Kim and McDonough (2008), engaging students in discussions about the advantages of group work is the foremost step to the development of their collaborative pattern. The provision of modeling of interactions and collaborative dialogues (Bull *et al.*, 1999) is also an essential element to prime learners for a collaborative learning mode. During collaborative work, teachers should monitor

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the occurrence of non-collaborative patterns so that necessary adjustments to learners' pairing or intervention could be made. Besides the establishment of collaborative orientation, to maximize the benefits of online resources to students' learning, Hughes (2013) suggested that formal information literacy instruction should be provided to equip students with the skills to effectively locate and critically synthesize useful information to help their writing process. Teachers can demonstrate how online resources can potentially help to mediate their language discussions and establish a shared understanding.

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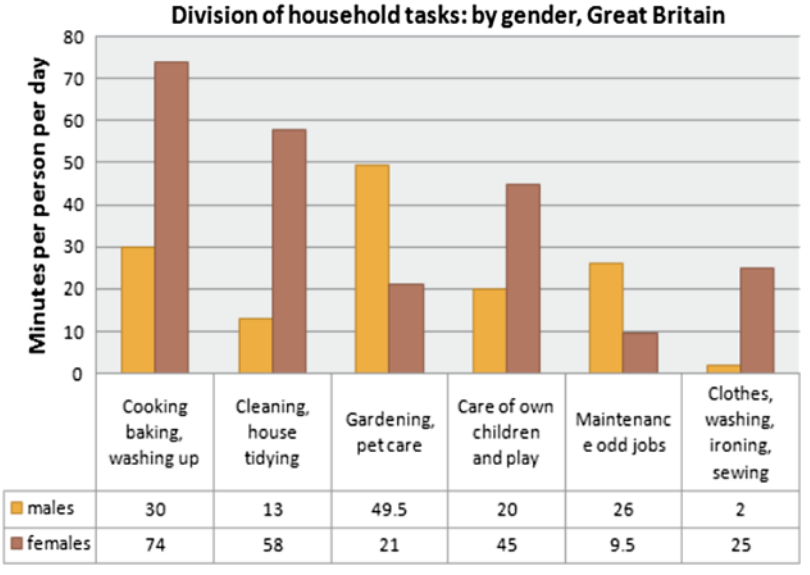
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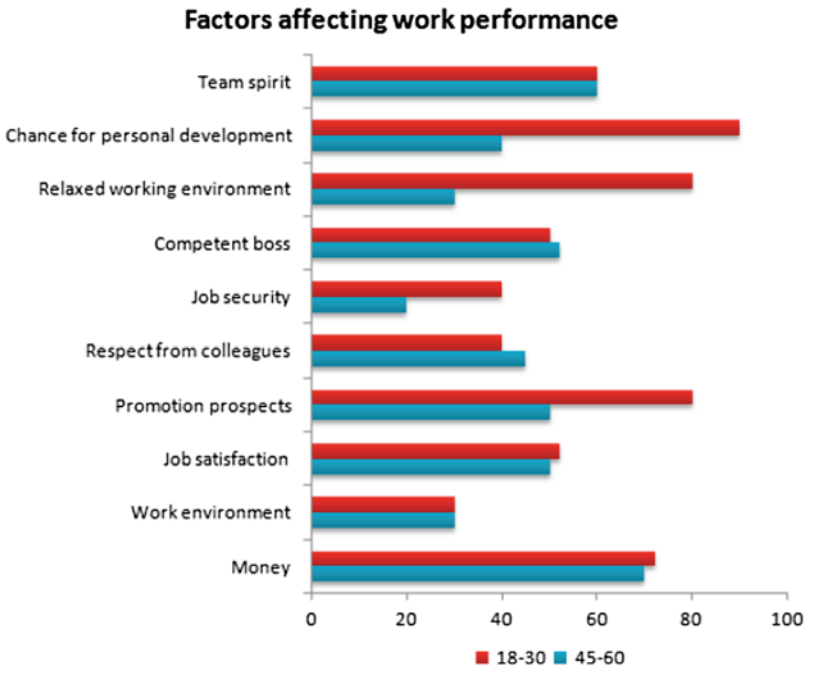
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Appendix A



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Appendix B



About the author

Dr Yi Chin Hsieh is a lecturer in the Language and Communication Centre at Nanyang Technological University, Singapore. Her current research focuses on knowledge construction and scaffolding dynamics among learners, technology incorporation into language classroom, and peer feedback in an English-for-specific-academic-purposes (ESAP) course.

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