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Collaborative Syntactic Priming Activities and EFL Learners' Production of *Wh*-questions

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Abstract: Syntactic priming is the tendency for a speaker to produce a structure that was encountered in recent discourse and is measured by calculating how frequently speakers use the modelled structures as opposed to alternatives. Recent lab-based studies have shown that carrying out syntactic priming activities with trained interlocutors positively affects Thai EFL learners' subsequent production of *wh*-questions. The current study explores whether carrying out priming activities with peers in a classroom context also facilitates subsequent production. In their integrated skills English course, Thai EFL learners ($N = 42$) either completed collaborative syntactic priming activities or followed the regular curriculum. Analysis of post-test data indicated that learners who carried out the priming activities subsequently produced significantly more *wh*-questions with supplied auxiliary verbs than learners who followed the regular curriculum. Pedagogical considerations for the use of collaborative syntactic priming activities in L2 classrooms are discussed.

Keywords: syntactic priming, collaborative activities, English questions, EFL learners

Résumé : L'amorçage syntaxique est la tendance pour un locuteur à produire une structure qui a été rencontrée dans le discours récent plutôt qu'une autre structure. De récentes études en laboratoire ont montré que la réalisation d'activités d'amorçage syntaxique avec des interlocuteurs formés à la tâche avait eu un impact positif sur la production ultérieure de questions en *wh*- chez des apprenants thaïlandais d'ALS. La présente étude cherche à savoir si la réalisation d'activités d'amorçage avec des pairs dans un contexte de classe facilite également la production ultérieure. Dans leur cours d'intégration des compétences en anglais, des apprenants thaïlandais d'ALS ($N = 42$) ont soit participé à des activités collaboratives d'amorçage syntaxique, soit suivi le programme régulier. L'analyse du post-test indique que les apprenants qui avaient participé aux activités d'amorçage ont produit par la suite un nombre significativement plus élevé de questions en *wh*- avec les verbes auxiliaires fournis que ceux qui avaient suivi le programme régulier. Des considérations

pédagogiques pour l'utilisation d'activités collaboratives d'amorçage syntaxique en classe de L2 sont abordées.

Mots clés : amorçage syntaxique, activités collaboratives, interrogatives en anglais, apprenants d'ALS

The use of collaborative activities to promote second language (L2) learning has been supported by various theoretical approaches to L2 acquisition. For example, the interaction hypothesis (Gass, 2003; Gass & Mackey, 2007; Long, 1996; Pica, 1994) states that collaboration facilitates L2 learning by bringing together input features such as interactional feedback, cognitive abilities such as noticing and working memory, and language production. Numerous interaction studies and several meta-analyses (Keck, Iberri-Shea, Tracy-Ventura, & Wa-Mbaleka, 2006; Li, 2010; Mackey & Goo, 2007; Russell & Spada, 2006) have concluded that interaction facilitates L2 learning when learners collaborate with native speakers as well as when they interact with peers in L2 classrooms. SLA researchers working from a socio-cultural perspective (e.g., Donato, 2000; Lantolf & Thorne, 2006; Swain, 2006; van Lier, 2000) have also suggested that collaborative activities contribute to mediated learning in which learners construct and co-construct language knowledge by interacting with peers and reflecting on their own language use. A variety of empirical studies have shown that collaborative activities that elicit these types of interaction also facilitate L2 learning (e.g., Kim, 2008; Swain, 1998; Swain & Lapkin, 2001; Tocalli-Beller & Swain, 2007).

Despite the overall positive findings for collaboration in both research paradigms, questions have been raised about the extent to which peer interaction is effective in generating learning opportunities in L2 classrooms, particularly in foreign language (FL) contexts (for a review of interaction research in FL contexts, see Philp & Tognini, 2009). Some researchers have suggested that learners rarely provide each other with interactional feedback or produce modified output during interaction (Foster, 1998; Foster & Ohta, 2005; Slimani-Rolls, 2005). And some collaborative dialogue studies have shown that learners, especially low-proficiency learners, may not remember or subsequently use the linguistic forms they have discussed (McDonough & Sunitham, 2009; Williams, 2001). In FL contexts, teachers and learners have questioned whether collaborative activities facilitate the acquisition of L2 grammatical or lexical forms (Carless, 2004;

McDonough, 2004; McDonough & Chaikitmongol, 2007). In these contexts, collaborative activities may be perceived as useful for promoting oral fluency or encouraging confidence in speaking the target language but not as beneficial for developing linguistic knowledge. Although first language (L1) use can support and encourage L2 learning (see Scott & de la Fuente, 2008, for a recent overview), some teachers in FL contexts in which learners share the same L1 do not consider that L1 use facilitates L2 learning (Carless, 2008). Finally, both researchers and teachers have speculated that collaborative activities may not provide or generate linguistic input that has new, complex, or accurate forms (Bruton, 2005; Carless, 2007; Swan, 2005).

An interesting question, then, is whether collaborative activities can be designed to promote L2 learning in ways that do not require learners to provide each other with interactional feedback or discuss language form yet still encourage the provision and use of developmentally beneficial language forms. One possibility is that collaborative syntactic priming activities might be useful for promoting L2 learning in classroom contexts. Syntactic priming (also referred to as structural priming) is the tendency for a speaker to produce a structure that was encountered in the recent discourse rather than an alternative structure. (For an overview of structural priming, see Pickering and Ferreira, 2008.) More simply, the presence of a specific structure in the prior discourse (referred to as a prime), encourages speakers to produce the same structure with different lexical items subsequently. Syntactic priming is believed to occur because structural and lexical information becomes activated when the prime is processed, and this activation facilitates subsequent production. The occurrence of syntactic priming is demonstrated when speakers use the structure modelled in the prime more frequently than alternative structures.

Collaborative syntactic priming activities are typically designed so that one interlocutor is provided with a sentence that models a particular syntactic structure, which is the prime, after which the other interlocutor is asked to generate an utterance from a prompt, which is often a single verb, a noun, or a subject-verb pairing. Throughout the communicative activity, one speaker articulates a complete sentence that has been provided (the prime), after which the other speaker generates a new sentence from a word or combination of words that has been provided (the prompt). Syntactic priming is demonstrated when the speaker with a prompt produces an utterance that has the structure of the preceding prime, even though the prompt could have been used to produce a variety of structures. The structures tested in L1 syntactic priming research involve alternation between two or more

target-like structures, such as the choice between dative constructions (*she gave the ball to her son* versus *she gave her son the ball*). Interestingly, the morphological features of lexical verbs do not appear to influence subsequent production. For example, a dative prime facilitates subsequent production of the same dative construction regardless of tense, number, or aspect (i.e., *will give, gave, has given, gives*, and so forth).

L2 syntactic priming research has similarly investigated alternation between two target-like structures but has also expanded the focus of priming research by testing alternation between target-like forms and interlanguage forms. For example, English L2 learners often alternate between two types of *wh*-questions: target-like *wh*-questions in which an obligatory auxiliary verb occurs after the question word (*What do cats and dogs shed?*) versus interlanguage forms in which the obligatory auxiliary verb is missing (*What cats and dogs shed?*). Because some *wh*-questions do not require auxiliary verbs, such as those with the copula (*What is an allergic reaction?*), alternation becomes apparent only when learners are asked to produce *wh*-questions that require auxiliary verbs. Syntactic priming activities may encourage learners who alternate between these two types of questions to produce the target-like *wh*-questions with supplied auxiliary verbs instead of the interlanguage questions with missing auxiliary verbs.

The segment of dialogue that follows illustrates the potential role of collaborative syntactic priming activities for modelling and eliciting target-like *wh*-questions. Two learners in the current study were asking each other questions about nutrition and vitamins based on the texts they each had read. Teerasak's materials provided him with six prime questions in the form of *wh*-questions with supplied auxiliary verbs (e.g., *How have scientists defined vegetables?*). His task was to ask his partner these questions and to make sure that her answers were correct. After his partner, Pranut, answered each question, she asked Teerasak questions about his text on vitamins. However, her materials provided prompts, such as subject-verb pairings like *people/get*, instead of complete questions. Consequently, she had to generate her own questions using the words provided, but she was not told what kind of question to ask. For example, she could have used the prompt *people/get* to ask a yes/no question (*Do people get scurvy?*) or produce an interlanguage *wh*-question (*What people get?*). The fact that she generated a question with the same syntactic structure as Teerasak's prime question rather than another type is taken as evidence of syntactic priming. Later in the task, the learners switched roles so

that Pranut's materials provided prime questions that she asked Teerasak, while he had to generate questions from prompts.

- Teerasak How have scientists defined vegetables? [prime question]
Pranut As seedless edibles.
Teerasak That's right. Okay, your turn.
Pranut How do people get scurvy? [prompt = people/get]
Teerasak Lack of vitamin C.
Pranut Yeah.

Syntactic priming activities may be useful for L2 development because the primes not only provide learners with target-like input but also elicit production of those target-like structures with a variety of lexical items. Interestingly, because syntactic priming appears to operate at the level of the presence/absence or order of constituents in an utterance, closed-class words and morphemes do not appear to influence subsequent production. Therefore, syntactic priming activities may help learners to produce *wh*-questions in which required constituents, such as auxiliary verbs, are supplied but may not affect the accuracy of tense, aspect, or number agreement.

Two recent studies have tested the effect of collaborative syntactic priming activities on EFL learners' subsequent production of *wh*-questions that require auxiliary verbs. The first (McDonough & Mackey, 2008) explored whether Thai EFL learners who carried out syntactic priming activities subsequently produced more target-like *wh*-questions with supplied auxiliary verbs than interlanguage questions with missing auxiliary verbs. The learners interacted with more advanced EFL learners who had been scripted with target-like *wh*-questions. The scripted interlocutors neither provided interactional feedback in response to the learners' non-target-like questions nor engaged in discussions about language form. Those learners who generated *wh*-questions from their prompts using lexical verbs and question words that had not been modelled by the scripted interlocutors showed greater subsequent production of the target *wh*-questions. The second study (McDonough & Kim, 2009) also reported that Thai EFL learners who produced *wh*-questions with a wide variety of lexical items during collaborative syntactic priming activities with native English speakers benefited more than learners who produced the same questions repeatedly.

The findings of these studies suggest that collaborative syntactic priming activities positively affect EFL learners' subsequent production

of *wh*-questions when they interact with trained interlocutors, either native speakers or more advanced L2 speakers. An important question, however, is whether collaborative syntactic priming activities are also beneficial when learners interact with their peers in L2 classroom contexts. As pointed out earlier, several questions have been raised about the contribution of collaborative activities to L2 development in such contexts. Therefore, the purpose of the current study was to determine whether collaborative syntactic priming activities facilitate Thai EFL learners' subsequent production of *wh*-questions. Because lab-based syntactic priming activities have been shown to facilitate subsequent production and peer collaboration in L2 classrooms has been associated with learning outcomes, it was predicted that the priming activities would have a positive impact on the learners' subsequent production of *wh*-questions with supplied auxiliary verbs.

Methodology

Participants

The participants were 42 Thai EFL learners, 25 women and 17 men, enrolled in an integrated skills English class at a public university in northern Thailand. The learners had a mean age of 18.64 years ($SD = 0.76$), and had studied English previously for a mean of 10.95 years ($SD = 2.85$). They were enrolled in bachelor degree programs in science (21), medical technology (8), agriculture (6), engineering (4), and social sciences (3), and were taking the English course as part of their degree requirements. The second author, Chaikitmongkol, was the instructor, and she taught one group of learners in the morning ($n = 21$) and one group in the afternoon ($n = 21$). There were no differences in the biographical and educational backgrounds of learners in the two sections. Learners who missed an oral test or more than one priming activity ($n = 13$) were not included in the analysis. In addition, three learners were excluded from the study because they consistently produced *wh*-questions with supplied auxiliary verbs on the pre-test and therefore did not alternate between target-like and interlanguage question forms.

Instructional context

The learners were enrolled in an integrated skills course whose goal was to develop their ability to use English for oral and written communication in academic and social contexts. It was organized into

three thematic units (travel, alternative medicine, and advertising) that emphasized skill development and cognitive and metacognitive learning strategies. The course included a self-access component that required learners to complete 20 hours of online learning activities throughout the semester. The course assessment was based on an oral and written task at the end of each thematic unit, the self-access activities, and a final examination. The study was carried out during the second thematic unit, which was about alternative medicine. The alternative medicine unit consisted of ten 75-minute class periods that targeted listening comprehension strategies, reading, note taking, and oral communication strategies related to decision making and reaching consensus. The learning strategies targeted in the unit included cognitive reading strategies (surveying and scanning), vocabulary strategies (guessing meaning from context), and metacognitive strategies (task analysis, peer review, self-evaluation, and reflection). The grammatical forms reviewed in the unit included questions, modals, and imperatives. The unit concluded with an oral presentation and written assignment in which learners described one type of alternative medicine (such as aromatherapy or reflexology) and designed and administered a quiz to their classmates.

Target structure

The target structure was *wh*-questions, which complemented the objectives and materials of the learners' integrated skills course. Initially, we planned to target a different structure in order to broaden the scope of collaborative syntactic priming research, but the timing of data collection coincided with the unit that focused on question formation. Although it was unfortunate that a different structure could not be selected, investigating *wh*-questions allowed for comparison with previous lab-based syntactic priming research (McDonough & Mackey, 2008; McDonough & Kim, 2009). More specifically, the *wh*-question form under investigation consisted of a question word followed by an obligatory auxiliary verb, subject, and lexical verb. For convenience, the term *wh*-question is used to refer to all questions of this type including questions in which the question word is *how*, *how much*, *how many*, *how often*, and so on. This type of *wh*-question was selected because Thai EFL learners often alternate between two variants: the target-like form in which the obligatory auxiliary verb is supplied (*Why do people count sheep?*) and an interlanguage form in which the auxiliary verb is missing (*Why people count sheep?*). Only *wh*-questions that require auxiliary verbs were considered because a missing auxiliary verb is

not ungrammatical for some question types, such as *wh*-questions with the copula (*What is dander?*) or questions in which the *wh*-word functions as a subject (*Who disagrees?*).

Materials

The materials consisted of oral tests and collaborative syntactic priming activities that complemented the course content. The oral test materials were information exchange activities that the learners carried out in pairs. The content of the pre-test and immediate post-test complemented the second unit theme of alternative medicine, including topics such as sleep, vitamins, exercise, and allergies. Because the delayed post-test occurred during the advertising unit, it targeted topics related to products and inventions, such as crayons and Styrofoam. Each test consisted of four short reading passages that were adapted from a resource book about science and nutrition (Strauss, 2005). For example, the pre-test provided learner A with texts about how much sleep people require and sweating during exercise, while learner B read texts about heart rates during exercise and sleep aids. A set of seven prompts, typically in the form of a noun and a verb such as *heart/pump* and *cells/need*, followed each text. Each learner generated questions using the words provided in the prompts in order to obtain information about the passages read by his or her partner. In sum, the oral tests provided learners with two texts to read and 14 prompts to use to ask their partners questions. The Appendix provides an example of one of the two information exchange activities used for the pre-test.

Four collaborative syntactic priming activities were created to complement the unit theme (alternative medicine), functional objectives (creating and administering a quiz), and grammar focus (questions) of the learners' integrated skills EFL course. The priming activities were carried out in pairs and each learner had a different set of information to exchange with a partner. The learners were provided with short reading passages or partially completed tables that were followed by a set of question primes and prompts. The question primes were target-like *wh*-questions with auxiliary and main verbs (e.g., *How do people damage their health?*), while the prompts were fragments consisting of one to three words (e.g., *how many/treatments*). The order of primes and prompts was manipulated so that one learner asked a prime *wh*-question immediately before the second learner generated a question using the words provided in a prompt. Each learner was given both primes and prompts but the order was reversed

so that learner A had primes followed by prompts, while learner B had prompts followed by primes.

The reading passages and tables provided in the four syntactic priming tasks were adapted from books, magazines, and news broadcast transcripts (Powell & Fischer, 2005; Strauss, 2005; Weil, 2007; and the Learning English section of the Voice of America News Web site). The first task targeted information about nutrition and provided short reading passages (147–160 words) about vitamins (learner A) or fruits and vegetables (learner B). The second task presented a table on health problems that was partially completed with short phrases about the causes, symptoms, outbreak areas, treatments, and prevention of different diseases. The third task provided two slightly longer reading passages on alternative treatments (273–279 words), one about reflexology (learner A) and the other about aromatherapy (learner B). And the final task provided short descriptions (50–65 words) of three massage therapies: reflexology, Thai massage, and Swedish massage for learner A; and shiatsu, tui na, and sports massage for learner B.

Design and procedure

The study used a pre-test/delayed post-test design to investigate the impact of collaborative syntactic priming activities on EFL learners' subsequent production of *wh*-questions. One class was randomly selected to carry out the collaborative syntactic priming activities (priming group), and the other class followed the regular curriculum (comparison group). Learners in both classes completed three oral tests: pre-test, immediate post-test, and delayed post-test. The dependent variable was their production of *wh*-questions that require auxiliary verbs, which was analyzed in terms of whether the auxiliary verbs were supplied or missing.

The data collection was carried out over an eight-week period within a 15-week semester in which the learners attended two 75-minute classes per week. As shown in Table 1, data collection began in the second class of week 5, when the pre-test was administered to both groups. The priming group completed two syntactic priming activities in week 6 and two syntactic priming activities in week 7, while the comparison group carried out speaking activities in the course textbook, such as discussing answers to a health quiz or comparing answers to comprehension questions about a homeopathy listening text. The course textbook activities did not specifically target *wh*-questions, and they were not designed to create

TABLE 1
Experimental procedure

Week	Class	Priming group	Comparison group
5	2	Pre-test: Sleep and exercise	
6	1	Priming activity: Nutrition quiz	Compare answers to health quiz in textbook
6	2	Priming activity: Health problems	Discuss answers to health questions in textbook
7	1	Priming activity: Alternative treatments	Report answers about homeopathy listening activity
7	2	Priming activity: Massage therapies	Compare answers to another health quiz in textbook
8	1	Reading activity	
8	2	Immediate post-test: Food and allergies	
9	1 and 2	No classes: Mid-term week	
10	1 and 2	Reading and listening activities, peer editing	
11	1 and 2	Oral presentations	
12	1	Delayed post-test: Products and inventions	

opportunities for syntactic priming. Both groups carried out the immediate post-test in the second class of week 8, and the delayed post-test in the first class of week 12.

All priming activities and oral tests were carried out during the learners' regularly scheduled classes and were administered by the course instructor following the same procedure. First, she distributed the materials, explained the communicative goal of the activity, and reviewed the instructions provided on the materials. Then each learner selected a partner who had different materials (i.e., a learner who received materials A found a partner who had materials B). Each pair was then given an MP3 digital recorder and instructed to begin recording. While the learners were interacting, the instructor walked around the classroom to clarify the instructions, explain vocabulary, answer questions, and make sure that the learners had turned on the recording equipment. Each priming activity and oral test took approximately 10–15 minutes to complete.

Analysis

The recordings of the collaborative syntactic priming activities and oral tests were transcribed by a research assistant and checked by the researchers. All transcripts were analyzed in terms of the learners'

production of *wh*-questions during the oral tests (both groups) and the syntactic priming activities (priming group only). For the syntactic priming data, each question was identified as either a prime question, which had been provided in the task materials, or a prompt-generated question, which learners had created using the words in their prompts. All of the *wh*-questions produced during the tests and priming activities were classified in the following categories:

1. *wh*-questions with auxiliary verbs supplied in the appropriate location between the question word and the subject. Examples: *How do we classify tubers? Where can I find vitamins? Why do you need vitamins?*
2. *wh*-questions in which required auxiliary verbs were missing. Examples: *Why we need vitamins? What benefit vitamins have? Why the body need vitamins?* Thai EFL learners often alternate between these interlanguage questions and the target-like *wh*-questions classified in category (1).
3. *wh*-questions that did not require auxiliary verbs and therefore did not indicate either the target-like form or the interlanguage form. In other words, these *wh*-questions were not ungrammatical in terms of the linguistic features associated with question formation even though they did not have auxiliary verbs. This category included (a) *wh*-questions with the present singular and plural forms of the copula, such as *What is category of tomato? Which vegetables are tubers?* and (b) *wh*-questions in which the *wh*-word acted as the subject, such as *Who found the disease?* These questions sometimes have auxiliary verbs to express tense or aspect distinctions (e.g., *Who will disagree? Who is disagreeing?*), but an auxiliary verb is not required.

Morphological errors involving number, tense, and aspect agreement as well as errors unrelated to question formation (such as article use) were not considered when the learners' questions were classified into the three categories. For example, the questions *How do we classify tubers?* and *How are we classify tubers?* were both identified as category (1), even though the latter had an agreement error. The total number of questions in each category was summed. For the syntactic priming data, prime questions and prompt-generated questions were summed separately. Proportion scores were obtained by dividing the total number of questions in each category by the total number of questions in all three categories. An independent rater analyzed a subset of the data (25%) and classified the questions into the three categories.

Simple percentage agreement between the researcher and the independent rater was 93% (Cohen's kappa = 0.87). Alpha was set at 0.01 in order to minimize the potential risk of Type I error created when multiple statistical tests are carried out on a small data set.

Results

Preliminary analysis

Prior to comparing the learners' production of *wh*-questions on the post-tests, preliminary analyses were carried out to ensure that (a) the priming and comparison groups were comparable at the pre-test, and (b) the learners in the priming group had carried out the activities as intended. In terms of their pre-test production, learners in the priming group produced a mean of 1.62 ($SD = 0.67$) *wh*-questions with supplied auxiliary verbs while the comparison group produced a mean of 1.52 ($SD = 0.93$) questions in that category, as shown in Table 2. When calculated as a proportion of their total questions (proportion scores were rounded), the groups' production of *wh*-questions with supplied auxiliary verbs was similar (0.17 and 0.16, respectively). The comparison group produced more *wh*-questions with missing auxiliary verbs ($M = 5.05$, $SD = 2.04$) than did the priming group ($M = 4.05$, $SD = 1.91$). Finally, the priming group produced more other *wh*-questions ($M = 4.05$, $SD = 1.80$) than the comparison group ($M = 3.05$, $SD = 2.01$). In sum, the learners in both groups produced interlanguage *wh*-questions with missing auxiliary verbs most frequently, followed by other *wh*-question types, and rarely produced target-like *wh*-questions with supplied auxiliary verbs. Independent-samples *t*-tests, also shown in Table 2, revealed

TABLE 2
Pre-test production of *wh*-questions by type and group

	Priming group			Comparison group			<i>t</i>	<i>p</i>
	Sum	<i>M</i>	Proportion	Sum	<i>M</i>	Proportion		
<i>Wh</i> -questions with supplied auxiliary verbs	34	1.62	0.17	32	1.52	0.16	0.38	0.71
<i>Wh</i> -questions with missing auxiliary verbs	85	4.05	0.42	106	5.05	0.52	1.64	0.11
Other <i>wh</i> -questions	85	4.05	0.42	64	3.05	0.32	1.70	0.10

that there were no significant differences in the number of questions in each category produced by the two groups.

Next, the syntactic priming data was checked to ensure that the learners in the priming group had carried out the activities as intended. As described, the syntactic priming materials provided (a) question primes in the form of *wh*-questions with supplied auxiliary verbs, and (b) prompts consisting of one to three words that the learners used to generate their own questions. However, because learners do not always implement activities as intended, their interaction was checked to (a) ensure that they actually asked their partners the prime questions that had been provided, and (b) determine whether the prompts elicited *wh*-questions with supplied auxiliary verbs more frequently than other question forms. As shown in Table 3, the learners consistently asked the prime questions that had been provided in the materials. They changed the form of the prime questions for only 20 out of 507 primes. In terms of the questions generated from the prompts, over half (299/508) of the learners' questions were *wh*-questions with supplied auxiliary verbs, which accounts for 0.59 of all the questions they generated. Their remaining prompt-generated questions were interlanguage *wh*-questions with missing auxiliary verbs (64/508 or 0.12) and other *wh*-questions (145/508 or 0.29).

To summarize the preliminary analyses, there were no pre-existing differences between the two groups at the pre-test in terms of the types of *wh*-questions they produced. Next, learners in the priming group asked their partners the prime questions that had been provided in the materials and rarely changed them into other question types. Finally, when asked to generate questions from prompts, learners in the priming group produced *wh*-questions with supplied auxiliary verbs more frequently than other *wh*-question forms.

TABLE 3
Prime and prompt-generated questions produced by priming group

	Primes			Prompts		
	Sum	<i>M</i>	<i>SD</i>	Sum	<i>M</i>	<i>SD</i>
<i>Wh</i> -questions with supplied auxiliary verbs	487	23.19	2.98	299	14.24	4.16
<i>Wh</i> -questions with missing auxiliary verbs	20	0.95	1.47	64	3.05	2.27
Other <i>wh</i> -questions	0	0	0	145	6.90	4.32
Total	507			508		

Subsequent production of wh-questions

In terms of the main analysis, the research question asked whether carrying out collaborative syntactic priming activities with peers facilitates the subsequent production of *wh*-questions with supplied auxiliary verbs. On the immediate post-test, learners in the priming group produced more *wh*-questions with supplied auxiliary verbs (124) than *wh*-questions with missing auxiliary verbs (42) or other *wh*-questions (61), as shown in Table 4. In contrast, learners in the comparison group produce more interlanguage *wh*-questions with missing auxiliary verbs (120) than other *wh*-questions (66) or *wh*-questions with supplied auxiliary verbs (52). When calculated as a proportion score, the learners' production of *wh*-questions with supplied auxiliary verbs was 0.54 for the priming group but only 0.22 for the comparison group. An independent-samples t-test indicated that the priming group produced a significantly greater proportion of *wh*-questions with supplied auxiliary verbs than the comparison group ($t(40) = 7.38, p < 0.00$). The effect size was large, Cohen's $d = 2.28$, based on the conventional interpretation of a large effect size as being at least 0.80.

To explore whether the benefits of carrying out collaborative syntactic priming activities persisted over time, the learners' production of *wh*-questions on the delayed post-test was also compared. As shown in Table 5, learners in the priming group again produced more *wh*-questions with supplied auxiliary verbs (136) than interlanguage *wh*-questions with missing auxiliary verbs (50) or other *wh*-question types (44). In contrast, the comparison group produced interlanguage *wh*-questions with missing auxiliary verbs (131) most often, followed by other *wh*-questions (66) and *wh*-questions with supplied auxiliary

TABLE 4
Immediate post-test production of *wh*-questions by type and group

	Priming group			Comparison group		
	Sum	Proportion		Sum	Proportion	
		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>
<i>Wh</i> -questions with supplied auxiliary verbs	124	0.54	0.15	52	0.22	0.13
<i>Wh</i> -questions with missing auxiliary verbs	42	0.19	0.12	120	0.50	0.16
Other <i>wh</i> -questions	61	0.27	0.10	66	0.28	0.10
Total	227			238		

TABLE 5
Delayed post-test production of *wh*-questions by type and group

	Priming group			Comparison group		
	Sum	Proportion		Sum	Proportion	
		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>
<i>Wh</i> -questions with supplied auxiliary verbs	136	0.58	0.26	47	0.20	0.12
<i>Wh</i> -questions with missing auxiliary verbs	50	0.24	0.20	131	0.53	0.13
Other <i>wh</i> -questions	44	0.19	0.13	66	0.27	0.10
Total	230			244		

verbs (47). When calculated as a proportion score, the learners' production of *wh*-questions with supplied auxiliary verbs was 0.58 for the priming group but only 0.20 for the comparison group. An independent-samples *t*-test (equal variance not assumed) indicated that the priming group produced a significantly greater proportion of *wh*-questions with supplied auxiliary verbs than the comparison group, $t(40) = 6.12$, $p < 0.00$. The effect size was large, Cohen's $d = 1.88$, based on the guideline that a large effect size is 0.80 or higher.

Relationship between priming and subsequent production

To gain further insight into the relationship between syntactic priming and subsequent production, the learners' interaction during the activities was considered in more detail. As mentioned in the introduction, the collaborative syntactic priming activities created opportunities for learners to (a) ask their partners the *wh*-question primes provided in the materials (i.e., to articulate models), (b) hear the *wh*-question primes produced by their partners, and (c) generate their own *wh*-questions from prompts. Because syntactic priming activities simultaneously provide input through primes and elicit production from prompts, they raise interesting questions about which feature is associated with the learners' subsequent production.

To explore this issue, the learners' proportion scores for *wh*-questions with supplied auxiliary verbs on the immediate and delayed post-tests were correlated with (a) the number of prime questions that each learner articulated, (b) the number of prime questions that each learner was asked by his or her partner, and (c) the proportion of *wh*-questions with supplied auxiliary verbs that each learner generated from prompts while carrying out the syntactic priming activities.

Pearson correlations indicated that generating *wh*-questions with auxiliary verbs from the prompts had the only significant, positive relationship with the learners' production on the immediate post-test ($r = 0.65$, $p < 0.01$) and approached significance on the delayed post-test ($r = 0.47$, $p = 0.03$). There were no significant correlations between the learners' immediate and delayed post-test scores and the number of prime questions that they articulated or were asked by their partners while carrying out the syntactic priming activities.

Discussion

To summarize the findings, learners who carried out the collaborative syntactic priming activities produced a significantly greater proportion of *wh*-questions with supplied auxiliary verbs than did learners in the comparison group on both immediate and delayed post-tests. The findings also indicated that only the learners' production of *wh*-questions with supplied auxiliary verbs during the syntactic priming activities was significantly correlated with their subsequent production. Neither the number of prime questions they asked their partners nor the number of prime questions they were asked had a significant relationship with their subsequent production on either post-test. This is not unexpected, as previous L2 syntactic priming studies have reported positive associations between learners' production of the target structures during syntactic priming activities and their subsequent production (McDonough & Mackey, 2008; McDonough & Kim, 2009). However, it would be premature to conclude that the benefits of syntactic priming are attributable solely to the language production they elicit rather than to the models they provide. Studies to date have not tested that claim or isolated the impact of the input and production components of syntactic priming activities on learners' subsequent production.

The study has extended the findings of lab-based research that reported a positive relationship between syntactic priming and EFL learners' subsequent production of *wh*-questions (McDonough & Mackey, 2008; McDonough & Kim, 2009). This suggests that learners who interact with their peers, rather than with trained interlocutors, can also benefit from carrying out collaborative syntactic priming activities in L2 classrooms. Unlike the trained interlocutors in lab-based studies, these learners did not receive any instructions about what kinds of questions they should ask and were not given explicit information about the logic or structure of syntactic priming

activities. Nevertheless, they asked each other the prime questions that had been provided in materials without changing the question forms and generated *wh*-questions with supplied auxiliary verbs from the prompts more frequently than other *wh*-question types. Carrying out the collaborative syntactic priming activities had a positive impact on their subsequent performance even though the learners did not provide each other with interactional feedback, produce modified output, or discuss language forms. Since some interactional features may be infrequent or restricted to individual learners in L2 classroom contexts, syntactic priming activities may provide another way to create learning opportunities during peer collaboration.

While the findings largely confirm those of lab-based studies, some aspects of the collaborative activities were unique to the classroom context. In lab-based syntactic priming studies, turn taking is tightly controlled so that the trained interlocutor always produces a prime immediately before the learner generates an utterance from a prompt. Although the current materials were designed to maintain that turn-taking structure, trends in the data suggest that learners did not always follow this pattern. For example, during the nutrition quiz activity, three pairs organized the task so that one learner asked all the prime and prompt questions while the partner only provided answers and then switched roles, rather than taking turns asking and answering questions as specified in the materials.

This turn-taking pattern is illustrated by one learner, Jatuporn, and his partner, Sureerat. Jatuporn had the materials for person A, which contained six prime questions followed by six prompts. Sureerat had the materials for person B, which listed six prompts followed by six primes. The primes and prompts were numbered so that Jatuporn had number 1, which was a prime question, while Sureerat had number 2, which was a prompt. But rather than follow the order specified in the materials, Jatuporn asked his 12 questions consecutively and Sureerat answered them. After producing his six prime questions, Jatuporn generated four *wh*-questions with auxiliary verbs from his prompts, followed by two *wh*-questions with the copula. By implementing the activities in this way, Jatuporn may have primed his own production of *wh*-questions with supplied auxiliary verbs. However, because of the order prompts and primes in her materials, Sureerat generated questions from her prompts first, which resulted in *wh*-questions with the copula or missing auxiliary verbs. She did not ask Jatuporn the prime questions until she had finished generating questions from her prompts, which did

not create optimal opportunities for primed production. In this approach to task management, the learner who produces primes before generating questions from prompts may be more likely to benefit than the learner who generates questions from prompts later in the discourse (i.e., distant from the partner's primes) and before producing their own primes. Therefore, in order to maximize the potential benefit of collaborative syntactic priming activities in L2 classroom contexts, it may be more helpful to create materials that intersperse primes and prompts so that even if learners deviate from the instructions, they can be prompted to generate questions from prompts following the primes.

Another challenge with respect to the use of collaborative syntactic priming activities in L2 classrooms, as opposed to lab-based contexts, concerns the need to complement the course content and objectives. In a classroom environment, learners and teachers typically expect that activities carried out during class time should relate to the unit theme and learning objectives, which is not always an expectation for lab-based research. For the current study, the content focus was alternative medicine, which posed some challenges when the materials were created. Despite having taken required English classes for an average of almost 11 years, the learners were of relatively low proficiency and did not know the relevant lexical items (such as aromatherapy, reflexology, homeopathy, limbic system) necessary to discuss the principles and effectiveness of various treatments. In addition, they did not have much background knowledge about alternative medicine, unlike more general topics, such as movies, hobbies, and personal experiences, and could not be expected to simply generate information to discuss. As a result, the syntactic priming materials had to provide content information and vocabulary that the learners could then use when interacting with their peers.

The provision of content and vocabulary was accomplished by creating priming activities based on short reading passages that provided information about nutrition, health conditions, and alternative therapies. As a result, learners required time to read the passages and ask for clarification about unknown vocabulary before exchanging information with their partners. One challenge when using reading texts as part of syntactic priming activities is that the learners may be inclined to read segments of the passage to each other without actually processing the information. This can be addressed during implementation, such as by allowing learners with the same passage to work together to understand the text prior to interacting with partners who have different texts. Learners might be asked to create notes or

an outline based on their understanding of the content of the text, which they could then use when interacting with their partners rather than relying on the original text. Although the activities were challenging because they targeted both content and linguistic objectives, previous classroom-based studies have shown that activities that integrate both content and language form can promote L2 development (e.g., Leeser, 2008; Rodgers, 2006). Integrating course content into collaborative syntactic priming activities can help learners perceive the relationship between peer interaction and course objectives, thereby increasing the ecological validity for both learners and teachers.

Conclusions

The current study investigated the effectiveness of using collaborative syntactic priming activities in a Thai EFL classroom to encourage the subsequent production of *wh*-questions with supplied auxiliary verbs. The finding that learners who carried out these activities produced more *wh*-questions with supplied auxiliary verbs suggests that learners can benefit from syntactic priming activities when they interact with their peers. Although the findings indicate that collaborative syntactic priming activities may hold promise for L2 classrooms, several limitations of the study should be acknowledged. First, the continued reliance on alternation involving *wh*-questions in L2 syntactic priming research limits its generalizability. Future research should target additional structures in order to determine whether the benefits of syntactic priming are limited to particular structures or whether it can positively affect a variety of structures. These studies might target structures that have equally acceptable alternatives, such as dative constructions or active/passive constructions, as well as structures that show alternation between target-like and interlanguage forms. Next, although syntactic priming has been shown to facilitate the production of auxiliary verbs in *wh*-questions that require them, it may not necessarily promote accuracy involving tense, aspect, or number agreement. Syntactic priming activities may be most effective for learners who alternate between *wh*-questions with supplied and missing auxiliary verbs rather than learners who consistently produce inaccurate auxiliary verbs. Consequently, additional activities designed to promote accuracy may be necessary after learners have begun to produce *wh*-questions with supplied auxiliary verbs.

The current study was situated in a task-oriented, integrated skills EFL course at a university in Thailand, which precludes any generalization of the findings to other instructional contexts. Although their integrated skills course did not include explicit grammar instruction, these learners had numerous years of previous English instruction involving explicit form-focused instruction and limited opportunities to use English for oral communication. The implicit, communicative orientation of the collaborative syntactic priming materials might have helped these learners develop the ability to access language form during meaningful communication in the same way that their previous instructional experiences had emphasized the acquisition of explicit knowledge. It is not clear, however, if learners who have already received meaning-based input and communicative interactions like this in the L2 classroom would similarly benefit from collaborative syntactic priming activities. Previous interactional feedback research has suggested that interaction that provides learning opportunities different from those typical in the L2 classroom may be more effective (Lyster, 2007; Lyster & Mori, 2006). Future research might investigate whether collaborative syntactic priming activities are associated with L2 learning outcomes in instructional contexts that differ from the EFL university context investigated here, such as immersion and second-language classrooms.

Although it was beyond the scope of the current study to examine the learners' performance during each collaborative syntactic priming activity separately, future research might explore the impact of task design and implementation features on their effectiveness. In particular, it would be useful to know whether certain task features or prompt features are more effective for eliciting the target structures. As previous lab-based syntactic priming research has demonstrated that the lexical items provided in the primes and prompts can affect learners' production of the target structures, future research might explore whether these features can be exploited to maximize the benefits of collaborative syntactic priming activities in L2 classrooms.

If future research indicates that collaborative syntactic priming activities are useful for promoting the subsequent production of a variety of L2 structures, then clearly additional classroom-based studies will be needed to identify the most effective ways to design, sequence, and implement these activities. And since cognitive capabilities such as attentional resources, working memory, and pattern detection skills may influence learners' ability to benefit from syntactic priming activities, additional research is necessary to identify potentially useful interactions between learner profiles and task

characteristics. It is hoped that these issues can be addressed so that teachers can acquire additional pedagogical tools to help learners benefit from peer collaboration—not only in terms of developing oral skills and confidence but also in terms of their linguistic development.

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Appendix: Sample pre-test activity

Person A

Part 1

Read the following short passage carefully so you can answer your partner's questions correctly:

How much sleep does a person need?

In general, kids need more sleep than adults—about nine hours a night. Experts say adults should try to get at least seven or eight hours every night. But each person needs a different amount of sleep. They don't know why some people need more while other people need less. Experts also say that the quality of sleep also matters. Deep sleep, known as REM sleep, has greater benefits than light sleep.

Part 2

Ask your partner questions about the passage she read to see how much she learned. Use the words below to make your questions. You can add as many words as you need to make a good question.

Partner's topic: Reasons why our heart beats fast during exercise

1. cells/need?
2. cells/use?
3. red blood cells/carry?
4. heart/pump?
5. heart/beat faster?
6. body/burn?
7. people/lose weight?

Person B

Part 1

Read the following short passage carefully so you can answer your partner's questions correctly.

Why does your heart beat faster when you exercise?

When you run or work out, the cells in your body need more oxygen. They use the oxygen to create energy. Red blood cells carry the oxygen. Red blood cells are pumped through the bloodstream by the heart. When your cells need more oxygen, then your heart beats faster. By using more energy, your body burns calories. Burning calories can help people lose weight.

Part 2

Ask your partner questions about the passage he read to see how much he learned. Use the words below to make your questions. You can add as many words as you need to make a good question.

Partner's topic: Amount of sleep people need

1. kids/need?
2. adults/get?
3. each person/require?
4. they/know?
5. experts/say?
6. REM sleep/define?
7. benefit/have?