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The Effect of Contextual Student-Generated Questions on EFL Learners' English Learning Performance, Language Learning Strategy Use, and Perceived Cognitive Load

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Abstract: The importance of learning English has been widely recognized in the English as a Second or Foreign Language (ESL/EFL) context and effective teaching and learning approaches to enhancing English learners' linguistic and pragmatic knowledge have been called for. The purpose of the study aimed at comparing the effect of a contextual student-generated question (cSGQ) strategy on English learning performance, learning strategy use, and perceived cognitive load. A quasi-experiment with pre-and post-test was employed and the results based on the analysis of covariance technique showed that students in the cSGQ group outperformed those in the SGQ group in terms of English learning performance. However, no significant differences in learning strategy use and cognitive load were found between the two groups.

Keywords: Contextual learning, English learning, innovative teaching and learning approaches, online learning activities, student-generated questions

1. Introduction

1.1 The Present Situation and Obstacle of English Teaching and Learning for University Students in Taiwan

English curricula have been incorporated into programs for students of all majors in Taiwan, and most universities in Taiwan have set different levels of English proficiency as one of the graduation criteria (Wu & Wu, 2010). In other words, regardless of majors, most university students in Taiwan should achieve a certain level of English proficiency to get a university diploma.

As one of the required courses for Taiwanese university students, the issue of how to facilitate students in the English as a Foreign Language (EFL) context to improve their English proficiency has caught much attention. Although the curricula for English teaching and learning in Taiwan have undergone great changes in the past few decades, the widely used technique is still the traditional teaching method (Chang, 2011) with a lot of translation and rotation such as the Grammar Translation Method (GTM) (Prator & Celce-Murcia, 1979) with its focus on the accuracy of direct translation and
Audio-lingual Method (ALM) with its focus on the repeated linguistic structures for English learners (Fries, 1945).

However, such practice was found to hinder Taiwanese learners from developing pragmatic functions of the language (Lan, 2015). That is, students taught with traditional methods such as GTM would heavily rely on teachers' instruction and explanations (Chang, 2011) on the grammatical translation rules and rotated memorization of sentence structures,

where students develop their target language proficiency in a de-contextualized learning environment. Also, repeated memorization and rote learning of sentence structures, as stressed by ALM, provide students with limited chances to actually use the language (Chang, 2011), which prevents learners from developing communicative competence in English.

1.2 Student-generated Questions and Contextual Student-generated Questions Tasks and the Benefits for Learning

Student-generated Questions (SGQ) refers to the teaching and learning strategy where students generate questions and corresponding answers to demonstrate their level of knowledge and understanding of the targeted learning materials (Yu & Wu, 2020). Several advantages associated with SGQ have been found for learners, such as confirming one's own understanding of the learning contents, resolving misconceptions, and fulfilling knowledge gaps (Chin, 2002; Juan, 2021; Offerdahl & Montplaisir, 2014).

The effectiveness of SGQ on learning has been widely recognized in the past few decades (Foster, 2011; Juan, 2021; Khaki, 2014; Mays, Yeh & Chen, 2020; Offerdahl & Montplaisir, 2014). For example, the use of SGQ in math class was found to be effective in enhancing learners' affective perceptions on account of the autonomous nature of SGQ tasks (Foster, 2011). Moreover, elementary school students' English reading ability was proved to be significantly enhanced after the SGQ tasks, and improved engagement and interest in learning English were reported (Mays, Yeh & Chen, 2020). SGQ was also used as a reading strategy for students to further enhance English reading comprehension (Khaki, 2014). When completing the SGQ learning tasks, learners are provided with the opportunity to actually use English (Mays, Yeh, & Chen, 2020).

Different from SGQ, contextual student-generated Questions (cSGQ), an elaborated approach to SQG proposed by Yu (2021), stresses the provision of a context for students to generate questions. That is, under the cSGQ arrangement, students are given a specific scenario around which to generate questions. As the generated questions are expected to correspond to the given scenario, reflecting the situational clues and details of the given context (such as the characters in the story and the timeline of the events), students should not only attend to the targeted English but also detect and analyze important information within the given context for successfully completing the cSGQ learning tasks. Despite its potential, research on cSGQ's effectiveness is very limited. Up till now, only few studies focusing on exploring the effect of cSGQ on English learners and for those that did (e.g., Cheng & Yu, 2021; Lin & Yu, 2021), they only examined the effectiveness of cSGQ on English grammar learning and SGQ task completion and task performance. As such, the potential of cSGQ should be further investigated, specifically, the effect of cSGQ on learning strategy use and perceived cognitive load is focused in this study to provide better insights into the application of cSGQ into English curriculums.

1.3 Language Learning Strategy Use

Apart from the interest in effective English teaching pedagogy, other factors influencing the success of developing target language proficiency have also caught the attention of both the teaching practitioners and researchers in this field, such as the use of learning strategies. Learning strategies refer to the conscious mental activities and behaviors learners employ and activate for the attainment of learning goals (O'Malley, Chamot, Stewner-Manzanares, Russo, & Kupper, 1985). According to Oxford (1990), direct strategies, including cognitive strategies, memory strategies, and compensation strategies have been widely applied and researched. Cognitive strategies have been not only associated with higher levels of cognitive process, but also linked with methods employed by the learners to enhance their learning performance such as memorizing, repeating, and relating (Costley, 2020). Memory strategies suggest the effective measures students use to get familiar with the learning materials, such as rote learning (Zhou, 2018). Compensation strategies are the needed measures used by the learners when they are faced with challenging situations such as asking for help and searching for information on the Internet (Syafryadin, Martina & Salniwati, 2020).

The use of learning strategies has been found to be associated with better learning performance. For example, a significant relationship between the use of learning strategy and their learning performance in English was found in the study conducted by Azizmohammadi and Barjesteh (2020). Also, the use of learning strategies was found statistically significant related to English listening performance (Irgin & Erten, 2020).

1.4 Cognitive Load

Cognitive load refers to learners' perception toward the assigned tasks and concerns limited facilities of working memory (Costley, 2020; Paas, Renkl, & Sweller, 2004). That is, when engaged in the learning tasks, learners would self-perceive the amount of information and mental effort required in the process of completing the learning tasks. The proponents of cognitive load theory suggest that the design and presentation of instruction and learning materials should correspond to the "significant limitations" of the human capability of processing the presented information (Pass, van Gog, & Sweller, 2010; Sepp, Howard, Tindall-Ford, Agostinho, & Pass, 2019). The instructional design and provided materials should be appropriate for learners' cognitive capacity to process and should avoid overloading the cognitive demand during the process of learning (Mutlu-Bayraktar, Cosgun, & Altan, 2019). Thus, it is crucial to understand students' perceived cognitive load when innovative designs for instruction are used such as cSGQ learning tasks in this study.

1.5 The Purpose and Research Questions of the Study

During the process of cSGQ for English learning, it is anticipated that students not only use targeted English as the focus for the formation of their questions but also would detect and analyze important clues and pragmatic functions of using the language embedded within the given context. That is, when completing cSGQ learning tasks, students should not only fulfill the requirements of the SGQ task but should also use the information from the given context for question generation, which reflect the information from the given scenario with the hope to develop communicative purpose and pragmatic functions of using English. Additionally, when applying such innovative pedagogical design such as cSGQ into English curriculums, many factors influencing the success of developing target language proficiency should also be considered, such as the use of learning strategies involved in the process of completing the cSGQ learning tasks and perceived cognitive load regarding the instructional design of the cSGQ learning activity.

With the focus on exploring the learning effect of cSGQ and resolving possible issues mentioned above as faced by English learners, the present study is designed to investigate the potential effect of cSGQ and SGQ learning activities on English learners in terms of English learning performance, the use of learning strategies and perceived cognitive load. Specifically, three research questions are examined in the study:

RQ#1 Do students in the cSGQ group have better English learning performance than those in the SGQ group?

RQ#2 Do students in the cSGQ group employ more learning strategies than those in the SGQ group?

RQ#3 Do students in the cSGQ group perceive more cognitive load than those in the SGQ group?

2. Method

2.1 The Participants and Study Context

In the present study, three classes with 79 university students in southern Taiwan were recruited and randomly assigned to two treatment groups: the cSGQ with 42 students and SGQ group with 37 students. The course was a required general course called 'Freshman English for all Non-English Major Freshmen.' The pre-test results indicated that the English proficiency between the two groups was similar (F = 0.856, p = .358). All of the participating students didn't have prior experience in SGQ before the experiment and their English proficiency level was B1 based on the Common European Framework of Reference for Languages: Learning, Teaching, Assessment (CEFR).

2.2 The Learning Materials

The course is a general education course for university freshmen and the textbook used in the study was selected by the language center of the participating university. The selected topics for the English learning activity were tenses and subjunctive moods, which were incorporated into two separated lessons in the textbook. After the instruction on the two selected topics, the students were asked to generate questions as online learning activities.

2.3 Instruments

The pre- and post-test test consisted of 50 questions with 25 for tenses and 25 for subjunctive moods, respectively, to assess student English learning performance. If the student gets one of them correct, he/she will get 2 marks. The test questions were constructed by the first author and further examined by two professors with more than ten years of teaching English for ESL and EFL learners in Taiwan. Also, it should be noted that 18 questions were specifically for the knowledge of grammatical structures and seven questions for evaluating learners' understanding of using the knowledge within the context. For the subjunctive moods, again 18 questions were for the grammatical knowledge and 7 questions for assessing contextual understanding on the usage of within the given context. As an example of the latter, A: Do you want to go to the movie with me tonight? B: I did with May. Clearly, the utterance from B contained the usage of past tense and involved the contextual meaning. As can be understood, students not only need to identify the correct tense of the sentence but also apply the linguistic knowledge into the context to successfully decode the contextual meaning of the sentence.

A questionnaire on learning strategy use with 40 questions and cognitive load with 10 questions was employed before and after the experiment to explore students' learning strategy use and cognitive load while exposed to the two teaching and learning approaches. The questionnaire on the use of English learning strategies was based on the English learning strategy scale (SILL, Strategy Inventory for Language Learning), which was compiled by Oxford's (1990) Language Learning Strategies and includes memory, cognition, and compensation strategies. The Cronbach's alpha value was 0.866 for memory strategies, 0.819 for compensation strategies, and 0.92 for cognitive strategies. As evidenced by the data obtained from the participants of the study, it was excellent in terms of consistency and robustness (Bao, 2010).

The questionnaire used to examine students' perceived cognitive load was based on the study conducted by Kuan (2016), with ten questions on a seven-point Likert scale. The correlation of the two factors (i.e., mental effort and confidence and performance) conducted by Yu and Lin (2020) reached .60. The sum of the scores from all questions suggests students' perceived cognitive load toward the learning activity in the study.

2.4 The Online Learning Systems

Two learning systems with similar system structures were used for the two treatment groups — Testlet (Yu, 2021) for the cSGQ group and QuARKS (Yu, 2009) for the SGQ group. The interface of QuARKS is shown in Figure 1, with the major fields and functions provided for students to generate questions while the interface of the Testlet is shown in Figure 2. As can be seen in Figures 1 and 2, both systems have similar functions, support the generation of questions, and allow students access to a set of built-in online procedural prompts with context-appropriate examples as scaffold of question-generation. In essence, the main difference between the two systems lies in Testlet having an additional field reserved for the given context (see the top portion of Figure 2) for students in the cSGQ group to base their generated questions on.

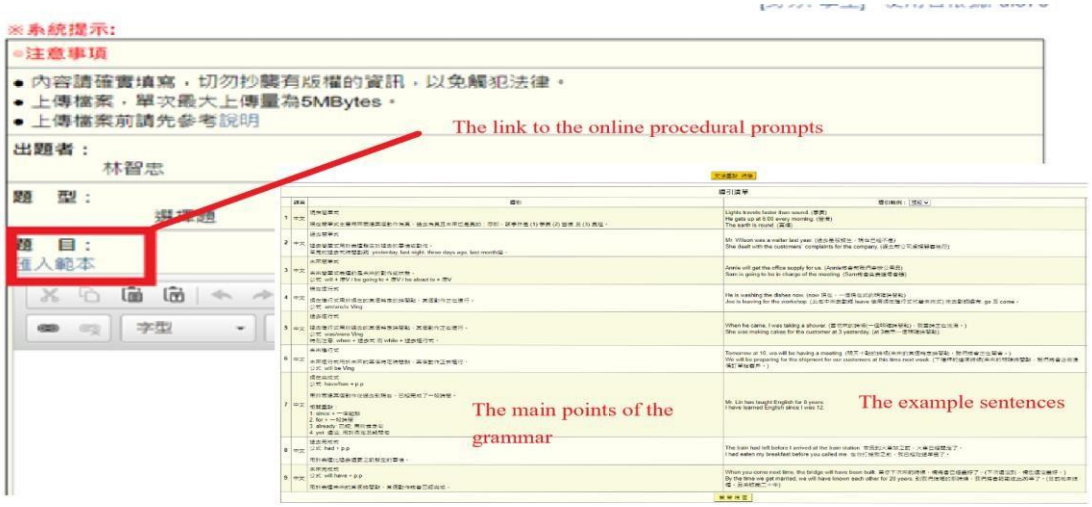

Figure 1. The Screenshot of the Areas and Procedural Prompts for Students in SGQ group on QuARKS.

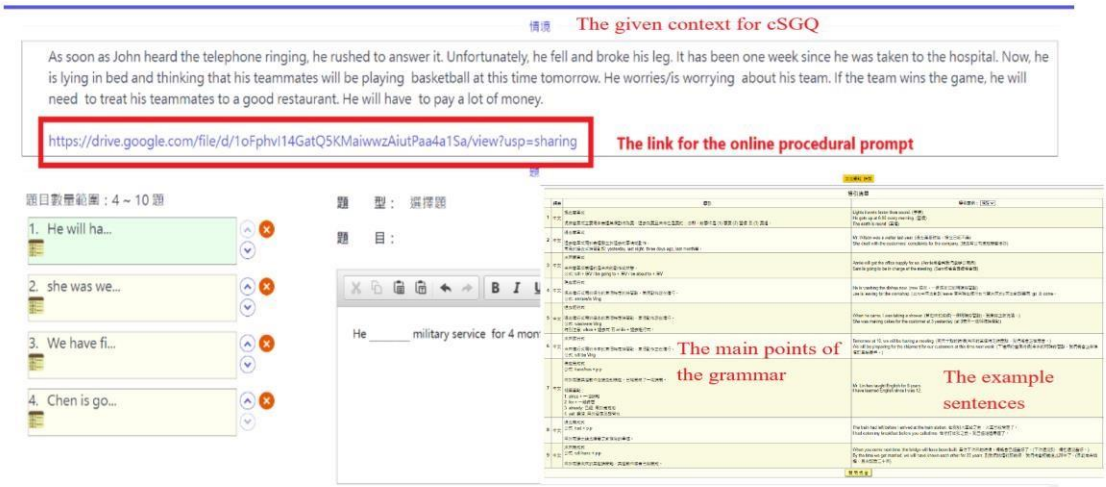

Figure 2. The Screenshot of the Areas (with a reserved column for the given context on the top) and Procedural Prompts for Students in cSGQ group on Testlet.

2.5 Research and Study Design

A quasi-experimental research with the pre- and post-test design was employed. The independent variables are the two online SGQ learning tasks: cSGQ and SGQ learning activity, and the dependent variables include the participants' learning performance on the two targeted

English, the use of learning strategies and perceived cognitive load toward the two designs of learning activities in the present study.

The research procedure was depicted in Figure 3. Before the experiment, all of the students in the two groups were asked to take the pre-test on the English learning and the pre-questionnaire on learning strategy use. After the learning activity on week five, all the students were asked to fill the pretest perceived cognitive load toward the SGQ learning activity questionnaire.

The post-test on the first targeted English grammars, tenses, was conducted on week nine. After finishing the fourth online learning activity, all the students were asked to complete the same perceived cognitive load questionnaire again. On week 17, the students finished the use of learning strategies questionnaire and on week 18, a post-test on subjunctive moods was conducted to assess their learning.

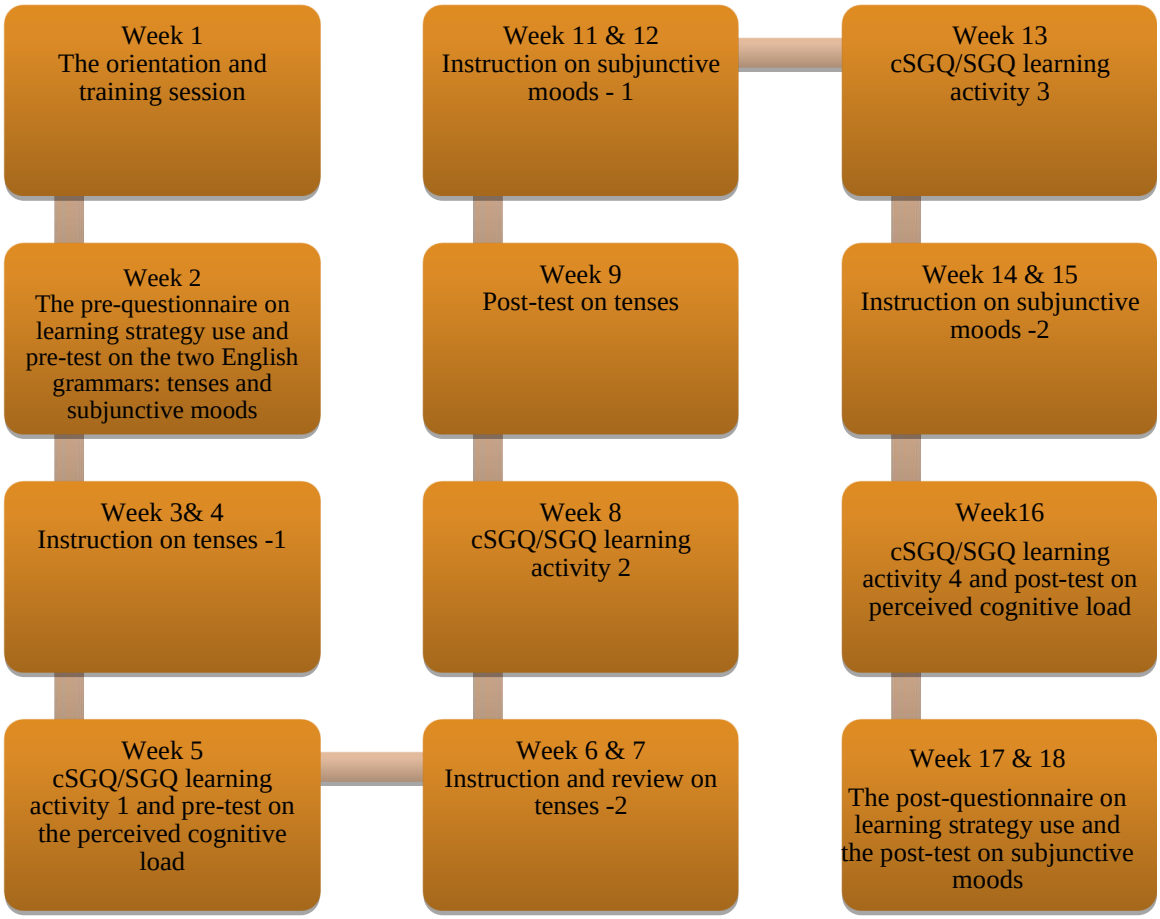

Figure 3. Experimental Procedure of the Study.

2.6 Data Analysis

To examine the effectiveness of cSGQ learning activity on EFL learners, the one-way analysis of covariance (ANCOVA) was performed on SPSS (version 23), using the scores of the pre-test as covariates. After ensuring the homogeneity, one-way ANCOVA was performed to compare the difference between the cSGQ and SGQ groups in terms of learning performance on the two targeted English, the use of learning strategies and perceived cognitive load.

3. Results and Discussion

3.1 English Learning Performance

The assumption that the regression coefficients between the two groups was homogeneous was satisfied, $F = 0.856$, $p = .358$. As shown in Table 1, the results of ANCOVA showed that the difference between the two groups reach the level of significance, $F = 12.278$, $p = .001$.

Table 1. *Descriptive Statistics and the ANCOVA Result of English Learning Performance*.

Groups		Mean (*s.d.*)[+]	Adjusted Mean	*F*	*p*
cSGQ group (*N*=42)	Pre-test	59.83 (9.88)	71.07	12.278	.001
	Post-test	69.66 (7.5)			
SGQ group (*N*=37)	Pre-test	52.04 (7.85)	64.72		
	Post-test	66.32 (8.66)			

[+] s.d.: standard deviation

As expected, students in the cSGQ group would have better English learning performance because in the process of completing cSGQ learning tasks, they would not only need to fulfill the requirements of SGQ learning task, but also pay further attention to the given contexts in order to generate questions congruent with the given scenario. Such process would trigger learners' awareness to the details within the given context, detecting essential clues and information regarding the usage of English, leading to better English learning performance. As illustrated by the example question generated by one participant of the cSGQ group (Figure 4), before embarking on question-generation, students in the cSGQ group would need to decode the given context so as to extract essential information (e.g., the time and sequence of the action). Then, they would employ both the linguistic knowledge (e.g., the usage of past tense, linguistic structures of forming questions) and situational information they detected from the context (e.g., the main character of the story, the sequence of action in the given context) for successfully completing the cSGQ learning tasks. The processes involved in applying the learned linguistic knowledge to the given context may raise learners' attention to both the linguistic clues and contextual awareness, leading to the development of pragmatic competency of using English (by combining the linguistic knowledge and situational information) and overall enhancement of language proficiency.

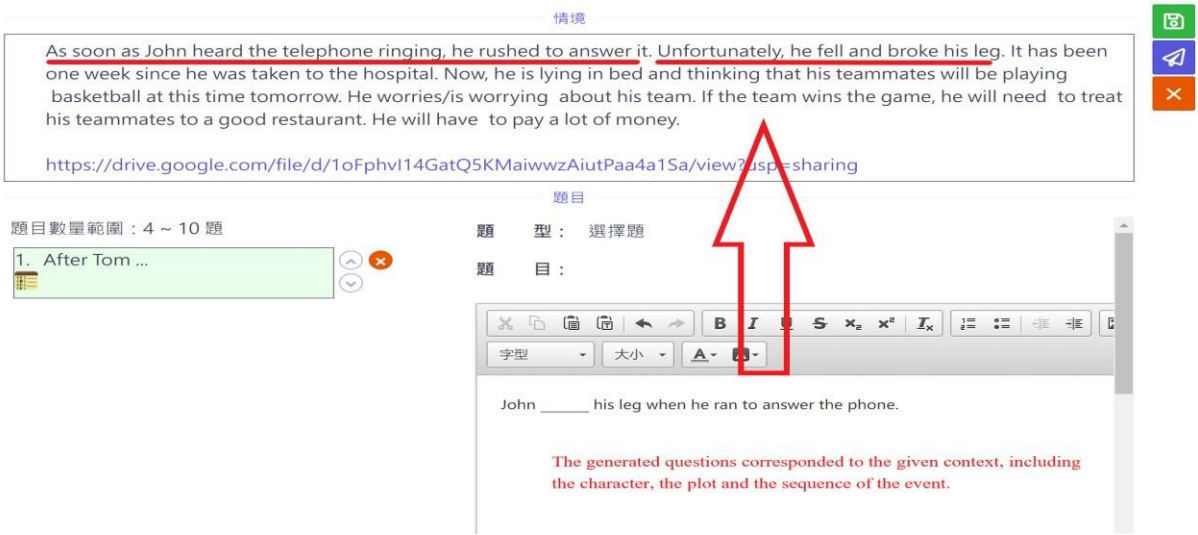

Figure 4. The Example Question Generated by One of the Participants in the cSGQ group.

3.2 The Use of Language Learning Strategies

The ANCOVA was performed to see whether the use of language learning strategies differ between the two groups after the treatment. Table 2 showed the results of language learning strategy use. No significant differences were found between two treatment groups in terms of memory strategy ($F = .385$, $p = .656$), compensation strategy ($F = .103$, $p = .469$) and cognitive strategy ($F = .241$, $p = .475$).

While no instruction on how to use learning strategies was provided for either group, with the additional scenario given for the cSGQ group, we expected that more use of strategies (such as analyzing the context, and applying the situational information) would be required of the cSGQ group. Nonetheless, our data did not confirm our hypothesis. One possible reason for there being no statistical significance may lie in the limited times of cSGQ learning tasks. In the present study, there were only three times for cSGQ learning tasks, which might prevent students in the present study from developing habits of using these language learning strategies.

Table 2. *Descriptive Statistics and the ANCOVA Result of the Use of Language Learning Strategy*

Memory strategy

Groups		Mean (s.d.)[+]	Adjusted Mean	*F*	*p*
cSGQ group (*N*=42)	Pre-test	41.29 (7.98)	45.86	.385	.656
	Post-test	45.21 (8.4)			
SGQ group (*N*=37)	Pre-test	43.59 (5.96)	45.17		
	Post-test	45.89 (7.31)			

Compensation strategy

Groups		Mean (s.d.)[+]	Adjusted Mean	*F*	*p*
cSGQ group (*N*=42)	Pre-test	12.78 (1.73)	13.35	.103	.469
	Post-test	13.21 (1.91)			
SGQ group (*N*=37)	Pre-test	13.4 (2.26)	13.66		
	Post-test	13.81 (2.27)			

Cognitive strategy

Groups		Mean (s.d.)[+]	Adjusted Mean	*F*	*p*
cSGQ group (*N*=42)	Pre-test	103.29 (17.25)	111.74	.241	.475
	Post-test	110.21 (17.12)			
SGQ group (*N*=37)	Pre-test	107.81 (16.63)	113.87		
	Post-test	115.56 (18.23)			

[+] s.d.: standard deviation

3.3 The Perceived Cognitive Load

The results of using ANCOVA on the perceived cognitive load between the two groups were shown in Table 3. As for the perceived cognitive load between the two groups, no significant differences were found, $F = 0.414$, $p = .522$.

It was surprising that students in the cSGQ group didn't perceive more cognitive load compared with those in the SGQ group since the design of cSGQ learning task was comparatively complicated, and thus, participants in cSGQ group were expected to invest more mental effort into the learning tasks. The results regarding the perceived cognitive load showed that the innovative design of cSGQ was appropriate, in terms of cognitive challenging, for the learners in the present study.

Table 3. *Descriptive Statistics and the ANCOVA Result of the Perceived Cognitive Load*

Groups		Mean (s.d.)[+]	Adjusted Mean	*F*	*p*
cSGQ group (*N*=42)	Pre-test	36.9 (4.96)	36.69	.414	.522
	Post-test	33.37 (4.57)			
SGQ group (*N*=37)	Pre-test	34.72 (3.46)	37.8		
	Post-test	33.76 (3.64)			

[+] s.d.: standard deviation

4. Conclusion

The present study adopted cSGQ learning tasks for EFL learners to cultivate their English proficiency and its effect as compared to SGQ was examined in terms of English learning performance, language learning strategy use and perceived cognitive load. Results showed that students in the cSGQ group outperformed those in SGQ group on English learning performance

while no significant differences on the use of language learning strategies were found between the two groups. Also, no significant differences regarding the perceived cognitive load were found toward the two different designs of SGQ learning tasks. The present study contributes to the field's understanding of the various forces influencing English learning performance such as the designs of cSGQ learning tasks, the use of language learning strategies, and perceived cognitive load associated with cSGQ and SGQ learning activities. Regarding the design of cSGQ learning tasks for English learners, an innovative design of combining contextual learning with SGQ was devised and its effectiveness was attested by the present study to demonstrate its facilating effects on increasing the awareness on the linguistic clues and contextual information when using English.

Since the present study only focuses on the application of cSGQ into English learning, future research could investigate its application into other subjects to fully illustrate its learning potential for learners. Also, future studies could focus on other important outcomes of English learning, such as learning motivation and attitude toward learning English in light of its influential effects on the development of target language proficiency.

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