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Leveraging Context for Computer-Supported Student-generated Questions and EFL Learning in Grammar Instruction: Its Effects on Task Performance

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Abstract: Inspired by the concept of 'learning in context,' this study aimed toward examining the effect of computer-supported student-generated questions (SQG) with a given reading passage (acting as the context) on the quality of generated questions and task completion for grammar learning. Thirty-eight college sophomores with Intermediate English level taking a two-credit English course at a university in southern Taiwan participated in two back-to-back SQG activities on grammar covered in instruction during regular class. A newly developed online system equipped with computer-supported procedural prompts and design was adopted to support SQG as individual knowledge construction activities. Four grading criteria — Importance, Fluency, Originality, and Elaboration, were devised for the assessment of the quality of student-generated questions. The results of the repeated measures analysis of variance showed significant differences in task performance total scores between the two SQG activities, attesting SQG without a given passage exceling SQG with a given passage. Additionally, SQG without a given reading passage led to significantly better performance in Fluency, Originality and Elaboration indices than SQG with a given passage. Finally, the result of the chi-square test showed a near-significant difference (p = .054) between the two SQG activities in task completion, with comparatively more participants completing the task under the SQG without given context condition than the SQG with context condition.

Keywords: Computer-supported individual learning, EFL learners, grammar instruction, learning in context, student-generated questions, task performance

1. Introduction

1.1 Learner-centered Approach and Student-generated Questions

Traditional teacher-centered instruction in the classroom has been gradually shifted to learner-centered approaches, and a number of researchers have recommended various learning strategies to promote learning. Student question-generation (SQG) is one of such approaches found to assist understanding and enhance individual learning (Aflalo, 2021; Barlow & Cates, 2006; Rosli, Capraro, & Capraro, 2014; Stevens, et al., 2020; Yu, Chang & Wu, 2015). For instance, Rosli, Capraro, and Capraro's meta-analysis (2014) on the effectiveness of problem posing in mathematics indicated that problem posing activities had significant influences on student problem solving skills, achievement, and attitudes toward mathematics. Benefits of SQG were also proved by Barlow and Cates' research (2006) for its revealing student understanding of mathematics, creating ownership of learning for students as well as providing teachers with an alternative assessment of student learning. The research conducted by Aflalo (2021) showed that student ability to answer higher-order thinking questions was improved through SQG. When investigating English academic achievement of a group of 106 six-graders, Yu, Chan, and Wu (2015) found significantly better academic performance and higher learning motivation in the online question-generation group than the online drill-and-practice group. The finding from Stevens et al.'s research (2020) also reported that middle-grade students in social studies, history, and science classes improved their reading comprehension by applying the SQG strategy. Additionally, according to the National Reading Panel report, question-generation with

answers is one of the seven effective text comprehension strategies (i.e., question asking, question answering, monitoring, summarization, story mapping, graphic organizers and cooperative grouping) (p.30) (Shanahan, 2005). The research by Khansir and Dashti's research (2014) investigating the effect of question-generation on Iranian EFL high school students found significant impacts of question-generation on reading comprehension.

2. SQG Activities with Procedural Prompts and Context

In spite of the overwhelming evidence on the benefits of SQG, most students were found to be inexperienced in this strategy (Yu, 2009). In light of this, researchers (e.g., Brown & Walter, 2005; King, 1990, 1992; Rosenshine, Meister, & Chamman, 1996; Stoyanova & Ellerton, 1996; Yu & Pan, 2014; Yu, Tsai, & Wu, 2013) proposed the use of procedural prompts to support SQG. Among these, the "signal words" (i.e., who, when, what, why, where, and how) procedural prompt is the easily learned and most frequently used (Rosenshine, Meister, & Chamman, 1996). "Main idea" involves, firstly, identifying the key idea(s) of a reading paragraph or an article and then referring to the identified ideas for the SQG activities. "What-If-Not" proposed by Brown and Walter (2005) uses the attributes contained in the original problem and changes any of the attribute(s) for generating new problems.

In light of the advantageous features of computer and network technologies, a couple of learning systems targeting SQG have been developed and are equipped with adaptable procedural prompts to support computer-supported personalized learning environments (e.g., QuARKS by Yu, 2009). Empirical studies generally confirmed the supportive effects of the provision of prompts for SQG (e.g., Byun et al. 2014; Gelmini-Hornsby et al., 2011; Yu & Pan, 2014; Yu, Tsai, & Wu, 2013). For instance, a study conducted by Byun et al. (2014) examined the effects of three different questioning strategies on problem solving among university students: to use question prompts provided by instructors, to develop peer-generated question, and to generate one's own question prompts first and then rewrite the questions with reference to the instructor's prompt list. The results found that students in the question prompts provided by the instructor group performed better than students in the other two arrangements in problem solving. Byun et al. (2014) further indicated that it's not easy for students to construct high-quality questions without any support. Another evidence from Gelmini-Hornsby et al.'s study (2011) showed that 46 elementary school students in the storytelling class in the question-prompts group generated more questions than the students in the no-question prompts group.

Currently, literature on SQG mostly focuses on the provision of procedural prompts to help student inexperience in SQG while promoting learning effects. Nonetheless, another possible form of support appearing especially relevant for language learning is the provision of a given context. A given context is suggested to be beneficial for language learning (Hadley, 2003; Mart, 2013; McLaughlin, Rossman, McLeod, 1983). In grammar instruction, many researchers (e.g., Akramova & Burkhonova, 2019; Hadley, 2003; Mart, 2013) encouraged instructors to put language learning in "logical contexts, either through authentic discourse-length input or through learning materials that stimulate authentic input using sentences that follow in logical sequence" (Hadley, 2003, p.152) since "by dealing with related units of information rather than isolated bits, more efficient processing becomes possible" (McLaughlin, Rossman & McLeod, 1983, p.138). As noted by Fawaz (n.d.), "Context gives a more precise understanding of how to use the grammar, and provides accuracy in the studied language both in oral and written skills." It is believed that when learners are provided with a chance to explore grammar in context, they can see how and why different forms exist to express different meanings and understand the grammar rules in a specific discourse context. When a passage is provided as a reading context, text comprehension strategies could help the readers synthesize the information in the passage, relate the information to their prior knowledge, and monitor their understanding toward the passage (Pressley, 2000).

Put one step further, to explore whether learners can attend to both form and meaning at the same time when processing input, Input Processing Hypothesis, proposed by VanPatten and Cadierno (1993), declares that with limited attention, "learners process input for meaning before they process it for form" in sentences (VanPatten, 1990; Wong, 2001), and both meaning and form could not be

processed at the same time (Lee, 2007). In VanPatten and Cadierno's research (1990), examining the attention to both form and meaning at the same time when processing input, the results showed that learners, especially for the beginners, had difficulties to pay attention to both content and form in input processing in the aural condition.

However, some researchers (e.g., Norris & Ortega, 2000; Winke, 2013) reported that directing learners' attention to both form and meaning simultaneously didn't affect reading comprehension. Yet others found that comprehension was only affected when learners' attention was paid to form in the aural condition, but not the case when form given in written condition (Wong, 2003).

1.3 Grammar Instruction

Grammar plays a crucial role in language learning and teaching (Loewen, Li, Fei, Thompson, Nakatsukasa, Ahn & Chen, 2009; Peng, 2017; Richards & Reppen, 2014). In light of its indispensable role in mastering a foreign language in the four language skills (i.e., speaking, reading, writing and listening), different grammar instructional models have been proposed.

In Second Language Acquisition (SLA), some researchers support "Focus on form" (i.e. implicit instruction), emphasizing that language input and meaning-based interaction are the focus (Long, 1991), and that learners' attention is given to comprehension checks through interactional modifications. Alternatively, others support "Focus on forms" (i.e., explicit instruction), stressing the pragmatic aspect of the target language, pragmatic awareness-raising explicit instruction during the process, and learners' attention to the grammatical form for developing language pragmatic competence (Bardovi-Harlig & Mahan-Taylor, 2003; Eslami-Rasekh, 2005; Norris & Ortega, 2000; Rafieyan, 2016; Sheen, 2002). Regardless their different focus, as revealed in Norris and Ortega's (2000) meta-analysis study, both approaches were "equally effective" (p.501).

1.4 Research Questions of This Study

In view of the fact that EFL learners' grammatical competence usually affects their understanding of reading materials, and that many researchers stress the importance of explicit instruction over implicit instruction in second language learning (Norris & Ortega, 2000), this study integrated explicit "Focus on forms" grammar instruction with computer-supported built-in "What-If-Not" procedural prompt in the integrated online SQG activities. Additionally, knowing the potential of given logical contexts for language learning (Hadley, 2003; Mart, 2013; McLaughlin, Rossman, McLeod, 1983), but the effects of its inclusion for SQG is yet to be explored, in this study the effects of two SQG activities (i.e., one without a given context and the other with a given context) are examined. Explicitly, two research questions for this study are examined:

RQ#1. Are there any significant differences in the quality of student-generated questions between SQG with a given reading passage (acting as the context for grammar learning) and SQG without a given passage?

RQ#2: Are there any significant differences in task completion between the two SQG activities?

2. Methods

2.1 Participants

Thirty-eight sophomores (24 males and 14 females) enrolled in a General English course at a university in southern Taiwan participated in this study. Their English proficiency level was classified at the intermediate level based on a campus-wide standardized TOEIC mock, which was B1 according to the Common European Framework of Reference (CEFR). All of the participants didn't have prior experience in SQG in classrooms.

2.2 Learning System Adopted in This Study

An online system recently developed by the research team led by the corresponding author was adopted for this study. The system supports different types of question-generation, including multiple-choice questions (MCQ), short-answer questions, true/false questions, fill-in-the-blank questions. Different cognitive support to assist learners with limited experience in generating a set of questions to be administered together (i.e., a testlet) (e.g., conceptual framework for creating a given context/scenario and associated item set, context-dependent examples for generating item set, etc.) are also built in. For a detailed description on the design principles guiding the development of the adopted system, please refer to Yu (2021). In this study, MCQ (with four choices) was chosen as the question type for this study.

2.3 Instructional Design and Implementation Procedures of the Study

The online SQG activities were introduced to the two-credit English course after the mid-term exam. The grammar rules taught in the class were first conditional (real conditional), second conditional (unreal conditional), and third conditional (past unreal conditional). To support SQG, the 'What-If-Not' procedural prompt was selected. To test the research hypotheses, the researchers designed two SQG activities — SQG1 (i.e., SQG without a given reading passage) and SQG2 (i.e., SQG with a given reading passage).

At the beginning of SQG1, a review and training session was arranged. It consisted of four main components: (1) a quick review on the three grammatical rules covered in the previous class; (2) an introduction on the use of the "What-If-Not" procedural prompt for SQG of MCQ (with sample MCQ) (see the upper-right corner of Figure 1); (3) an explanation on quality MCQ (e.g., targeting the grammar taught, relating to the given reading passage, etc.); and (4) a description on the procedural steps to generate MCQ in the adopted system. Following the review and training, the participants were asked to generate MCQ by rewriting any one of the three given MCQ of their choice (shown by clicking on the respective boxes at the left side of Figure 1) by either changing their tenses in the form of real conditional (first conditional) or unreal conditionals (second conditional and third conditional), or simply creating a new one (see the bottom portion of Figure 1) in ten minutes.

Figure 1. Task description (top), the use of the "What-If-Not" procedural prompt for SQG of MCQ with sample MCQ (upper-right portion), three given MCQ to work from for SQG1 (left), and key-in space for SQG1 (bottom portion)

For SQG2, a brief training session on how to rewrite MCQ (i.e., the use of the "What-If-Not" procedural prompt for SQG of MCQ) based on a given reading passage (see the upper-right corner of Figure 2) was arranged. Afterwards, a new passage with a new set of three MCQ based on the given passage were given for SQG2 (see the top and left side of Figure 2), and the participants were asked to submit a MCQ in 15 minutes. The passages given in the training session and SQG2 were created by the researcher based on the topic "Ethics and Values" in the textbook *Top Notch 2*. The given passage given for SQG2 was "Amber and Daniel reserved a table and had dinner together to celebrate their

20th wedding anniversary in a fine American restaurant. They ate some delicious food such as shrimp cocktail, garden salad, tomato bisque and sirloin. After they finished their dinner, they paid the bill and found that the total on the receipt was wrong. They should pay $39.70, but the restaurant undercharged them for $30.2. Amber thought they should tell the clerk, but Daniel suggested that they would just split without telling the clerk." The reading passage provided a concrete situation for the participants to generate MCQ relating to the context while testing the grammar rules targeted in the class.

In essence, for both SQG1 and SQG2, the participants were directed to generate MCQ on the same set of grammatical rules. The only difference between SQG1 and SQG2 lies in whether a reading passage is given for SQG activities.

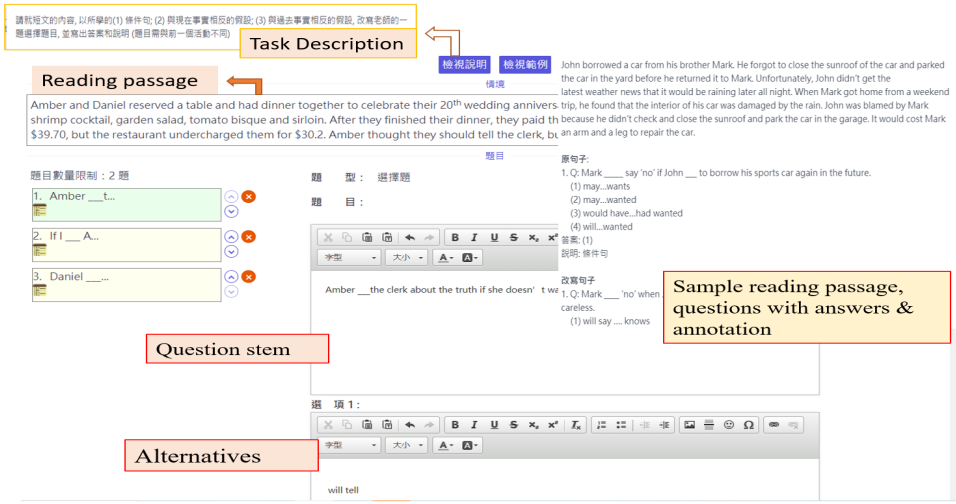

Figure 2. Task description and the given reading passage for SQG2 (top), the use of the "What-If-Not" procedural prompt for SQG of MCQ with sample MCQ on the given reading passage (upper-right portion), three given MCQ relating to the given passage to work from for SQG2 (left), and key-in space for SQG2 (bottom portion)

2.4 Data Compilation and Analysis of SQG1 and SQG2

In this study, a total of 76 MCQ the participants generated during SQG1 and SQG2 were collected and analyzed. William's Taxonomy (1996) for creativity (on originality and elaboration) and Yu and Wu's (2016) criteria for SQG were referred to. Explicitly, grading criteria with four indices were devised and defined to assess the performance of student-generated MCQ — Importance, Fluency, Originality and Elaboration (see Table 1). It should be noted that the importance index is set as the prerequisite criteria for the scoring of all the other indexes. That is, only importance criterion is met, will the question be assessed further and scores be gained on the other three criteria.

Two experienced English teachers who have more than 20 years of English teaching experience independently assessed all questions generated by the participants against the grading criteria. To ensure inter-rater reliability, percent agreement was used. The results evidenced satisfactory reliability (81.58% and 84.21% for SQG1 and SQG2, respectively).

For the data analysis of RQ#1, one-way repeated measures analysis of variance (ANOVA) was used whereas the chi-square test was adopted for RQ#2.

Table 1. *Grading Criteria for the Quality of SQG*

Dimensions	Definition	Points
Importance (I)	The generated MCQ tests the grammar rules covered in the current lesson and are related to the passage, but not the same as the example questions and answers.	1
Fluency (F)	The generated MCQ is in comprehensible expression with no grammatical or spelling errors.	6

	The generated MCQ is in comprehensible expression with no grammatical errors, but minor spelling errors.	5
	The generated MCQ is in comprehensible expression with no spelling errors, but minor grammatical errors.	4
	The generated MCQ is in comprehensible expression with minor spelling errors and grammatical errors.	3
	The generated MCQ is in comprehensible expression based on the example sentences by minor modification or adding one or a few words with no spelling or grammatical errors.	2
	The generated MCQ is in comprehensible expression based on the example sentences by minor modification or adding one or a few words with minor spelling or grammatical errors.	1
	The alternatives include one correct answer and three distractors and the answer key matches the correct alternative.	1
	The annotation provided for the generated questions matches the correct alternative and answer key.	1
Originality (O)	The generated MCQ is written or re-written in a novel way with the required grammar and is totally different from the example questions (of a given passage).	7
	The generated MCQ is written or re-written by using synonyms, substitutes and a large modification on sentence units (such as subjects, verbs, objects, adjectives, and adverbs) based on example sentences (of a given passage) with the specified grammar and four alternatives different from the example sentences.	6
	The generated question stem is written or re-written by using synonyms, substitutes or moderate modification on sentence units (such as subjects, verbs, objects, adjectives, and adverbs) based on example sentences (of a given passage) with different specified grammar and part of the four alternatives that are different from the example sentences.	5
	The generated question stem is written or re-written by using synonyms, substitutes or minor modification on sentence units (such as subjects, verbs, objects, adjectives, and adverbs) or by changing or adding a time marker based on example sentences (of a given passage) with different required grammar and the same four alternatives as the example sentences.	4
	The generated question stem is written or re-written by using synonyms, substitutes or minor modification on sentence units (such as subjects, verbs, objects, adjectives, and adverbs) or by changing or adding a time marker based on example sentences (of a given passage) with same specified grammar and the four alternatives that are different from the example sentences.	3
	The generated question stem is written or re-written by using synonyms, substitutes or minor modification on sentence units (such as subjects, verbs, objects, adjectives, and adverbs) or by changing or adding a time marker based on example sentences (of a given passage) with same required grammar and part of the four alternatives that are different from the example sentences.	2
	The generated question stem is written or re-written by using synonyms, substitutes or minor modification on sentence units (such as subjects, verbs, objects, adjectives, and adverbs) or by changing or adding a time marker based on example sentences (of a given passage) with required grammar and four alternatives that are the same as the example sentences.	1
Elaboration (E)	The generated MCQ is expanded, enriched, or embellished based on previous ideas or thought (of the given passage) to make it easier to understand or more interesting.	2
	The generated MCQ is expanded, enriched, or embellished based on example sentences (of the given passage) to make it easier to understand or more interesting.	1

3. Results

In response to RQ#1, as shown in Table 2, the mean scores of all four indices of SQG1 were higher than those of SQG2. The result of the repeated measures ANOVA on total scores indicated that there was a significant difference between SQG1 and SQG2, F (1,151) = 15.35, $p < .001$, $\eta^2 = 0.092$, with the students performing better in SQG1 (i.e., SQG without a given context) than in SQG2. Furthermore, comparisons among the respective four indices showed that the students in SQG1 significantly outperformed those in SQG2 in Fluency ($p = .003 < .05$), Originality ($p = .029 < .05$), and Elaboration ($p = .012 < .05$). Although no significant differences between SQG1 and SQG2 were found in Importance, it nearly reaches the significance level, $p = .055$.

Table 2. *Comparisons between SQG Performance with and without a Given Passage*

	Importance		Fluency		Originality		Elaboration		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SQG1 (Without a given passage)	.87	.34	4.63	3.02	4.58	2.73	1.29	.77	2.81	2.70
SQG2 (With a given passage)	.68	.47	2.68	2.57	3.21	2.61	.84	.75	1.86	2.17

N=38

In regard to RQ#2, as shown in Table 3, more than 85% of the students in SQG1 completed the task whereas a comparatively fewer participants completed the task in SQG2 (68.4%). The result of the chi-square test showed a near-significant difference in task completion between these two activities, $X^2(1, 76) = 3.71$, $p = .054 > .05$.

Table 3. *Task Completion in SQG1 and SQG2*

	SQG1 *f* (%)	SQG2 *f* (%)	Total
No	5 (13.2%)	12 (31.6%)	17 (22.4%)
Yes	33 (86.8%)	26 (68.4%)	59 (77.6%)
Total	38 (100%)	38 (100%)	76 (100%)

4. Discussion and Conclusions

This study aims to investigate whether providing a context for computer-supported SQG on grammar leads to positive effects on task performance. Explicitly, issues regarding if computer-supported SQG with and without a given reading passage affected student performance in terms of the quality of generated MCQ and task completion were examined. To draw students' attention directly to the grammatical form, explicit "Focus on forms" grammar instruction was adopted, and the What-If-Not procedural prompt was integrated to support online SQG activities. Based on the empirical studies (e.g., Akramova & Burkhonova, 2019; Hadley, 2003; Mart, 2013), putting grammar instruction in "logical contexts, either through authentic discourse-length input or through learning materials that stimulate authentic input using sentences that follow in logical sequence" (Hadley, 2003, p.152) is suggested as an ideal method. On the basis of these theoretical basis, the authors speculated that better task performance would be observed from SQG with a given passage.

However, the findings obtained revealed the opposite. Specifically, the results found students performed better in the without a given passage condition than the given passage condition in both

observed variables. The findings are not in line with the authors' expectation, nor did it resonate with what McLaughlin, Rossman, and McLeod suggested (1983) — "dealing with related units of information rather than isolated bits, more efficient processing becomes possible (p.138)." Possible explanations are provided to account for the unexpected findings.

When asked to generate MCQ on the basis of a given reading passage, students had to read a short passage, comprehend the meaning/logic/flow of the passage, summarize the information from the text before they can proceed to the task of SQG. In other words, for SQG2, students not only need to deal with the targeted grammar rules, but also need to relate to the information in the given passage. In other words, it reflects what Input Processing Hypothesis suggested (VanPatten & Cadierno, 1993) — with limited attention, "learners process input for meaning before they process it for form" (VanPatten, 1990; Wong, 2001), and that both meaning and form couldn't be processed at the same time (Lee, 2007). When students couldn't parse sentences and make form-meaning connections, their comprehension would be affected. Furthermore, VanPatten and Williams (2007) indicated that "context may be of use only for learners who are able to process information with little cost to attentional efforts" (p.130). For the learners with a low level of processing ability, they need to put efforts toward comprehension (VanPatten & Williams, 2007). Since generating questions with answers is itself a task of difficulty (Yu, 2009), let alone generating questions relating to a passage within a constrained time limit while needing to comply to the additional criterion associated with SQG2. Additionally, considering that the English proficiency level (i.e., intermediate) and lack of past experience in SQG of the current participants, the difficulty level experienced by the participants during SQG2 would presumably be higher than that experienced during SQG1. All factors concerned, it would add additional cognitive load on the participants; thus, leading to the diminishing learning performance and comparatively lower completion rate of SQG2 as compared to SQG1.

4.1 Limitations of The Study and Suggestions for Future Studies

This study was conducted in two-credit class with only two SQG activities to be completed in limited in-class time by college students at the intermediate English proficiency level. Future studies with a longer period, more allocated time for SQG, and students at different English proficiency levels are suggested. Moreover, rather than adopting a within-subjects design, a quasi-experimental research design with two treatment groups, each assigned to different SQGs could be implemented. Finally, a questionnaire and an interview eliciting students' perspectives toward different incorporated SQGs regarding the difficulties they encountered during SQGs could be conducted so that more insight can be obtained.

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