

Online Student Testlet-Generation as an Innovation Approach to Student-Created Assessment: Its Learning Effects

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Abstract: The effect of student question-generation (SQG) strategies on promoting student cognitive and affective development has generally been confirmed by empirical studies. While questions of various types have been included in SQG activities, the potential of testlets as a possible form has yet been closely explored. Given that the inclusion of testlets in international assessment as well as national and local testing is prominent, its learning effects await to be examined. Hence, this study aimed to investigate the comparative effects of online SQG and student testlet-generation (STG) on academic achievement, learning strategy use, learning motivation, learning attitude, and cognitive load. A pre-test and post-test quasi-experimental research method was adopted. Two classes of sixth-grade students ($n=54$) from a primary school in Chiayi, Taiwan were invited to participate in the 8-week study. The online learning activities were introduced to support the teaching and learning of Chinese language and two systems developed by the researcher were adopted. Data analyzed by the analysis of covariance technique found no significant differences in any of the observed variables. In other words, both online SQG and STG had comparable learning effects on all examined variables. Given the comparable learning effects of STG and SQG for supporting primary school student learning (as substantiated by this study) and the many educative effects of SQG (as having been well attested by numerous empirical studies), instructors are encouraged to incorporate testlets as an innovative approach to student-created assessment. This work is significant in providing empirical evidence on the comparable learning effects of SQG and STG on cognitive and affective outcomes across several aspects of educational importance, and also in expanding the realm of SQG as well as innovative student-created assessment approaches.

Keywords: learning effects, online learning activity, primary school students, student question-generation, student testlet-generation

1. Introduction

Student question-generation (SQG) denotes engaging students in generating questions with corresponding answers around areas of the instructional content or recently experienced educational event they personally deem important, relevant, and/or interesting (Yu & Kuo, 2024). With its emphasis on knowledge elaboration, construction, and integration, SQG is believed to direct learners to self-regulate their learning and build meaningful connections among the current study material, related knowledge pieces, and life experiences (Yu, 2024).

With its strong theoretical foundations in cognitive constructivism, metacognition, self-regulated learning, and self-determination theory, the effect of SQG on promoting student cognitive and affective development has generally been confirmed by empirical studies in various domains (Yu, 2024), including Akben (2020) in chemistry, Aflalo (2021) in biology, Asgari and Ganji (2020) in English, and Geiger et al. (2021) in accounting as well as a couple of synthesized studies (e.g., Song, 2016; Wang et al., 2022; Zhang et al., 2024). While questions of various types (e.g., true/false, multiple-choice, short-answer, fill-in-the-blank) have been included in SQG activities (Yu & Kuo, 2024), the potential of testlets as a promising form has yet been closely examined.

Conceptually, a testlet consists of a group of question items around a focal stimulus (e.g., a single textual passage, or a graphical map, picture, diagram, chart, and table) (Yu, 2024). Despite the inclusion of testlets in international assessment, such as the Programme for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS), and Progress in International Reading Literacy Study (PIRLS) as well as national and local testing is increasingly prominent, its effects on student learning outcomes await to be understood. Thus, this study aimed to investigate the comparative learning effects of online SQG and student testlet-generation (STG).

2. Method

This study adopted a pretest-posttest quasi-experimental research design, lasting eight weeks. Two classes of sixth-grade students ($n=54$) from a primary school in Chiayi city, Taiwan participated and were randomly assigned to two treatment groups — the online SQG and the online STG. The integrated online learning activities were introduced to support the teaching and learning of Chinese language.

This study consisted of three main stages: I. Training and Baseline Establishment (3 weeks), II. Experimental Intervention (5 weeks), and III. Posttest. During Stage I, after weekly in-class online practice sessions, consisting of (a) single item and (b) testlet question types on the current Chinese instructional content, the researcher introduced SQG and trained the participants to generate question items and use the adopted SQG online system. During this stage, the researcher also collected the participants' Chinese academic performance at the prior school-wide exam and administered the learning strategy use, learning motivation, learning attitude, and cognitive load scales before moving to the next stage. During Stage II, as a routine weekly learning activity, the online SQG group continued to do what they did during Stage I (i.e., online practice session→online SQG), whereas the online STG group engaged in the same routine online practice session first, but was followed by the online STG instead. For the participants in the online STG group, on their first exposure to STG (i.e., at 4th week), they received training on the essential knowledge and skills on STG in the adopted STG online system. During Stage III (i.e., after the last session on SQG and STG for the respective online SQG and STG groups at the 8th week), both groups took the same set of questionnaires and their Chinese academic achievement on the exam administered school-wide after this study was collected.

Two online learning systems developed by the first author were adopted for this study. First, the Question Authoring & Reasoning Knowledge System (QuARKS) (Yu, 2009) was used for online practice sessions by both groups and for SQG activities by the online SQG group. The Student Testlet-Generation (STG) system (Yu, 2024) was used by the online STG group for STG activities. The main difference between the two systems for the generation of question items and testlets, essentially, lies in the additional space reserved for scenarios in STG system (the top portion of Figure 1), which would act as the anchor around which a set of question items are to be framed. In contrast, for SQG in QuARKS, students simply go directly to question-generation. For both online SQG and STG groups, three question types most frequently used in primary school settings were adopted: true/false, short-answered, and multiple-choice.

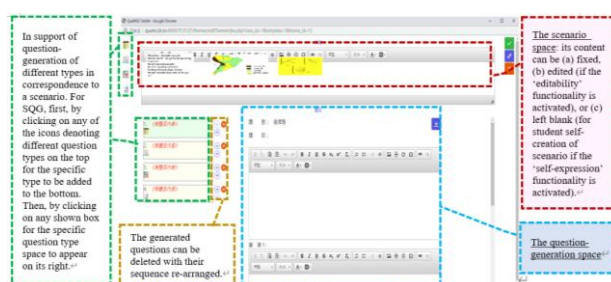


Figure 1. The STG system

The technical quality of Chinese academic achievement pre- and posttests used in this study was assured by item difficulty and discrimination procedures and proved to be satisfactory. All questionnaires adopted in this study had established validity and reliability.

3. Results & Discussion

All data collected were analyzed by the analysis of covariance technique. The results found no significant differences in student Chinese academic achievement, $F(1, 51)=1.44$, $p=.235$, use of cognitive strategies, $F(1, 50)=0.14$, $p=.707$, use of meta-cognitive strategies, $F(1, 50)=0.08$, $p=.785$, learning motivation, $F(1, 50)=0.01$, $p=.925$, learning attitude, $F(1, 49)=2.80$, $p=.101$, and cognitive load, $F(1, 49)=0.36$, $p=.553$. In other words, both online SQG and STG groups had comparable learning effects on all examined variables.

In light of (a) the comparable learning effects of STG and SQG as empirically substantiated in this study, (b) the learning effects of SQG as generally supported by review studies (e.g., Song, 2016; Wang et al., 2022; Zhang et al., 2024), and (c) the increasing presence and use of testlets in education, instructors are encouraged to include STG as an innovative approach to student-created assessment. This work is significant in providing empirical evidence attesting the comparable learning effects of SQG and STG for cognitive and affective outcomes across several aspects of educational importance. Finally, this work has significance in terms of expanding the realm of SQG and innovative student-created assessment approaches.

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