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Predictive Effects of Online Peer-Assessment on Student Question-Generation

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Abstract: The study examined the predictive effects of online peer-assessment on student question-generation. Specifically, the individual and collective predictive effects of two types of feedback (i.e., quantitative ratings and descriptive comments) available in peer-assessment learning systems on student question-generation performance were investigated. A total of 233 students participated in the study for six weeks. An online learning system that allows students to contribute to and benefit from the process of question-generation and peer-assessment was adopted. The regression result found that quantitative ratings and descriptive comments individually and collectively significantly predicted question-generation performance. Suggestions for learning system development are provided.

Keywords: online learning system, peer-assessment, student question-generation

Introduction

Both theoretical and empirical foundations of student question-generation support its beneficial effect on learning [1-6]. Recently, in view of the numerous advantageous features of network technology, a number of online learning systems with student question-generation as the focus have been developed. Most existing systems enable students to generate questions of different types and to incorporate media formats as part of the question. Also frequently included in these systems is an element of peer-assessment [6-11].

The benefits of including peer-assessment within the student question-generation context can be understood and appreciated in light of cognitive conflict theory, social constructivism and social learning [12-14]. Nevertheless, there is a lack of empirical evidence supporting the coupling effects of online peer-assessment with student question-generation. An investigation into such issues as "if and how feedback students receive during online peer-assessment affect student question-generation performance" will warrant its inclusion in online student question-generation systems. Since feedback can be expressed in quantitative and descriptive forms, its individual and collective predicative effects on student question-generation are examined. Three research hypotheses are proposed in the study:

1. The averaged quantitative ratings received from assessors on the composed questions will significantly predict student question-generation performance.
2. The quality of descriptive comments received from assessors on the composed questions will significantly predict student question-generation performance.
3. The averaged quantitative ratings and the quality of descriptive comments received from assessors on the composed questions will collectively significantly predict student question-generation performance.

In consideration of the fact that a considerable proportion of students do not experience question-generation during their formal schooling [15-16] and have viewed student question-generation as difficult or very difficult [11], answers to the above questions will help provide some directions for better online question-generation activity design and implementation.

1. Method

1.1 Online Learning System

A learning environment that allows students to contribute and benefit from the process of constructing question items and receiving feedback from their peers about the composed questions was used. Essentially, the question-generation sub-system enables multimedia files to be included as parts of the question and texts of different fonts, size and styles can be used (see Figure 1).

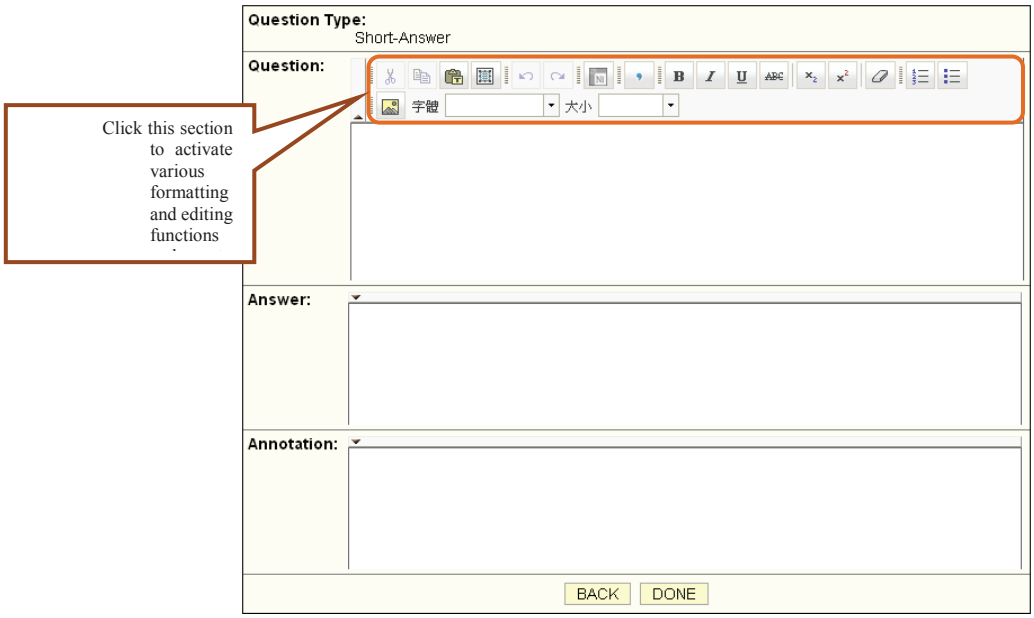

Figure 1 A screenshot of short-answer question-generation

The peer-assessment sub-system, on the other hand, enables assessors to give their evaluative feedback using an online assessment form. On the form, assessors can assess the overall quality of the generated question on a five-point rating scale (from "well below average" to "well above average") and to rate their recommendation of the question to be included in the drill-and-practice item bank (from "Will not recommend at all," to "highly recommend"). Also, assessors can give descriptive comments with regards to the question being examined in a designated feedback space by referring to a set of built-in criteria (see Figure 2).

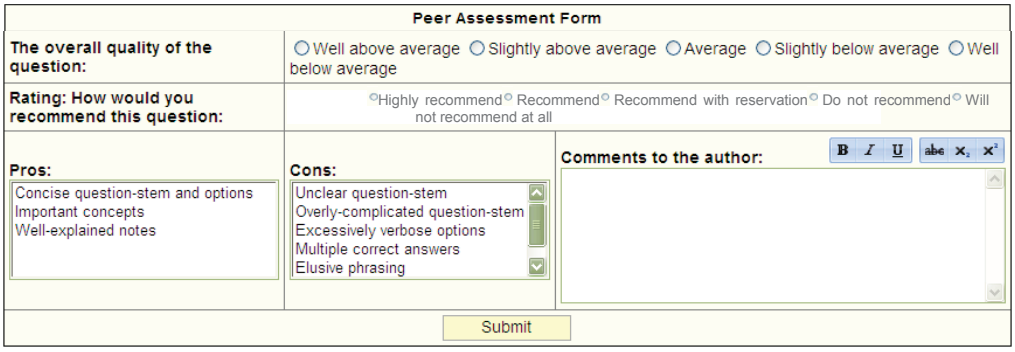

Figure 2. Assessment form for assessors to provide feedback to question-authors

1.2 Participants and Implementation Procedures

Two hundred and thirty-three 5th graders from eight classes participated in the study for six consecutive weeks. Participants were informed that the introduced online question-generation and peer-assessment activity was intended to augment their science learning.

Each week for the duration of the study, students headed to a computer laboratory to participate in a 40-minute learning activity after attending three instructional sessions allocated for science. To ensure that participants possessed the fundamental skills of the introduced activity, a training session on generating chosen question types and the coupled online peer-assessment with hands-on activity was arranged at the commencement of the study. Considering that true/false and multiple-choice questions are among the most frequently encountered question types in primary schools in Taiwan, these two types of question-generation options were chosen. Each week students were directed to individually generate at least one question for each of the two chosen question types in accordance with the instructional content covered that week and assess at least two questions from a pool of peer-generated questions for each chosen question type.

1.3 Variables

The quantitative ratings received from assessors consisted of two parts: the overall quality of the question and recommendation for inclusion in follow-up drill-and-practice sessions. The overall quality and recommendation received from assessors per question per week were averaged throughout the activity.

The quality of descriptive comments received from assessors on the composed questions and student performance in question-generation was defined against a set of criteria. For peer-assessment, all comments question-authors received with regards to a specific question item were analyzed against a pre-defined scheme and were averaged. The averaged scores per question per week were then summed up. Specifically, the quality of descriptive comments was evaluated in terms of four discrete levels: general comments, specific comments where strengths and weakness are identified, identification for improvement and explicit suggestion for further refinement of questions.

To assess students' performances in question-generation, in reference to the Torrance creativity index [17], King's question cognitive levels [18] and questions generated by students, the following criteria were adopted: fluency, flexibility, elaboration, originality, cognitive level and importance. Each of the indexes was further operationally defined to ensure objective assessment.

2. Results

2.1 Descriptive statistics of examined variables

The means and standard deviations of the quality of feedback received on the composed questions (including quantitative peer-ratings and descriptive comments) and students' performance in question-generation are listed in Table 1.

Table 1 Descriptive statistics and correlations between variables (N=233)

Variable	Quantitative ratings	Descriptive comments	Question-generation
Mean (SD)	3.45 (0.68)	6.70 (3.60)	32.11 (13.56)

Note: * p <0.05, ** p <0.01

2.2 The predictive effect of quantitative ratings on question-generation performance

The regression result presented in Table 2 supports that the quantitative ratings significantly predict question-generation performance, (β = 0.28, p < 0.01).

Table2 Regression analysis for quantitative ratings predicting question-generation performance

	B	SEB	β
Model			
Constant	12.72	4.46	
Quantitative ratings	5.60	1.27	0.28**
R-square		0.08	
F		19.59**	

Note: *a.* Predictor:(Constant), Quantitative ratings

b. Dependent variable: Question-generation performance

c. * p <0.05, ** p <0.01

2.3 The predictive effect of the quality of descriptive comments on question-generation performance

The regression result presented in Table 3 supports that the quality of descriptive comments significantly predicts question-generation performance, (β= 0.37, p < 0.01).

Table 3 Regression analyses for quality of descriptive comments predicting question-generatic performance

	B	SEB	β
Model			
Constant	22.80	1.74	
Quality of descriptive comments	1.39	0.23	0.37**
R square		0.14	

F	36.48**

Note: *a.* Predictor:(Constant), Quality of descriptive comments

b. Dependent variable: Question-generation performance
c. p* <0.05, ***p* <0.01

2.4 The collective predictive effect of the quantitative ratings and the quality of descriptive comments received on question-generation performance

To avoid multicollinearity, Pearson correlations was conducted and found that quantitative ratings is not correlated with the quality of descriptive comments (r= 0.1, p =0.13); therefore, these two variables could collectively included in multiple regression analysis. The quality of descriptive comments significantly predicted a significant proportion of variance on students' question-generation performance (R^2 = 0.14, F=36.48, p < 0.01). Adding the variable of quantitative ratings significantly enhanced the R-square (R^2 change = 0.06, F=16.98, p < 0.01); therefore, the quality of descriptive comments and quantitative ratings collectively significantly predict question-generation performance (β_{qual}= 0.35, p < 0.01; β_{quan}= 0.25, p < 0.01, respectively).

Table 4 Multiple Regression analyses for Quality of feedback predicting question-generation performance

	Model 1			Model 2		
Variable	B	SE	β		SE	β
Constant	22.80	1.75		6.44	4.32	
Quality of descriptive comments	1.39	0.23	0.37**	1.30	0.22	0.35**
Quantitative ratings				4.91	1.19	0.25**
R-square		0.14			0.20	
F for change in R-square					16.98**	

3. Discussion and conclusions

Numerous online student question-generation learning systems have been developed for students to interact with the content by generating questions and to interact with their peers online for the improvement of the questions by peer-assessment. This study explored whether feedback received from peers contributed to question-generation performance.

The current study confirmed the coupling effects of online peer-assessment on student question-generation performance. Specifically, this study substantiated that the quantitative ratings and the quality of descriptive comments question-authors received from peers individually and collectively contributed to their question-generation performance. In other words, question-authors who received higher quantitative ratings tend to demonstrate better performance in composing questions. Also, the better quality of descriptive feedback received on their composed questions leads to higher performance in question-generation tasks. Furthermore, question-authors who received higher quality of descriptive feedback together with higher ratings on their questions tend to demonstrate better performance in composing questions.

The obtained findings have important empirical significance as well as implications for online system developments. First, despite that peer-assessment is coupled with question-generation in most existing online learning systems, its supportive effects on

student question-generation performance has rarely been substantiated empirically. This present study, for the first time, evidenced the respective and collective effects of quantitative ratings and descriptive comments and supported the inclusion of peer-assessment in online student question-generation systems.

Based on the findings of this study, several suggestions are provided. First, instructors with students inexperienced in student question-generation and who can benefit from extra support for better question-generation performance are advised to include an element of online peer-assessment for the promotion of performance in the introduced task. Second, as this study found that the variable of descriptive feedback explained more variance of question-generation performance, the importance of providing question-authors with descriptive feedback could not be ignored. Finally, online student question-generation system with peer-assessment should consider including both quantitative ratings together with descriptive comments key-in space for maximal question-generation performance.

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