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The Efficacy of a Web-based Domain Independent Question-Posing and Peer Assessment Learning System

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Abstract

In light of constructivism and cognitive psychology a networked learning system enabling students to construct multiple-choice questions, which can be assessed, viewed and answered by peers, was described in the paper. A preliminary study evaluating various functions and features in the system and its learning potentials was conducted with 52 six-graders. Overall, students rated favorably on the system's interface design and potentials in promoting their cognitive capability in the content domain. Student written responses combined with classrooms observations further provided descriptive evidence for the system's facilitative effect for student learning. Via playing the roles of question posers, assessors, viewers, revisers and answers at different points in the learning process, students tended to actively engage in the learning process by constructing and re-constructing their own interpretations of the world of information around them, which is facilitative for their own understanding and cognitive development.

Introduction

With the advent of networking and multimedia technologies, the emphasis on technology-based education of all kinds for the support of student learning has been the focus of contemporary education. In view of web's potentials for interactivity, collaboration, and learning, a project gearing toward developing a learning system, named Question-Posing and Peer Assessment learning environment (hereinafter named, QPPA), which allows question-posing, peer-assessing, viewing and drill-and-practicing for various subject matters for all educational levels was launched in 2001.

The rationale directing the project gleans from constructionism and cognitive psychology. Constructionism considers engaging students in meaningful experiences as the essence of learning. It emphasizes that learners create their own interpretations of the world of information around them. The goal of instruction, from the perspectives of constructionists, is to create situations that enhance learners' interpretation and reflection of their own understanding and cognitive development [1, 2]. Contrasting with traditional classrooms where students answer questions given by teachers, enabling students to contribute to the process of questions generation and assessment while learning tends to encourage more active manipulation of information and knowledge on the learners' part. Researchers in cognitive psychology, on the other hand, have long held that if information is to be retained and related to information already stored in memory, learners must engage in elaboration to help cognitive structuring and/or reconstruction [3, 4]. Elaboration like those involved in question posing and assessment may very well help learners comprehend and learn instructional materials.

In the following section, an overview of the learning environment is introduced. As researchers suggested that engaging in the process of question-posing and/or peer assessment is conducive to student cognitive growth [5-8], a preliminary study examining student perceptions toward the potentials of various functions and features in the system for the promotion of cognitive growth is described. Finally, results from the study are offered.

QPPA Learning Environment

Mainly, QPPA is comprised of four functions. Question construction. To contribute a question, students need to provide an item stem, the correct answer for the posted question, and three plausible alternatives. All questions constructed by students are put in a temporary item bank database. Peer assessment. The system installs a peer assessment mechanism to create dialogue and further learning among question constructors and assessors. Peer assessment by at least five assessors and with at least half of the assessors rated the question as acceptable was set as the criterion for transferring questions from the temporary item bank database to the formal item bank database. Peer Viewing. By observing questions constructed by others and comments/suggestions given by assessors, peer viewing function provides an observational learning opportunity for students to learn from each other. Drill-and-practice. Students can choose the exact number of questions from the formal test bank database for drill-and-practice exercises. After answering, feedback as to how many questions answered correctly and a review button, which permits further reviewing and learning, was provided. Beside these four main functions, additional features, such as, Edu-dollars (i.e., a virtual currency), ranking lists, statistics notification on individual and class average performance, etc. were included in QPPA to increase its intrinsic motivational appealingness to users.

Methodology

By engaging students in various functions in QPPA

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and playing various roles as question constructors, assessors, observers, editors and answers, the system intends to provide students with a learning environment conducive to their cognitive growth. A preliminary study examining the system's design features for the potentials of student learning is conducted with two classes of six-grade students (N=52). Students participated in the study for six instructional sessions for three days. Students used the system as an extra-curricular learning tool for mathematics, natural science and social science. A post-session self-report questionnaire consisting of three parts was disseminated to students to be completed individually. The first part measures student "Confidence Toward The System's Potentials in Promoting Cognitive Ability" (α = .60). Seven Likert scale items were included and rated on a five-part discrete scale. Sample questions included, "*The system has a facilitating effect for content comprehension and understanding of the subject matter I am studying; if I can use the system to support my learning throughout the semester, I am confident that my capability in the specific subject area will improve*." The second part of the questionnaire collects student opinions toward the usefulness and user-friendliness of the various functions and features contained in QPPA. Finally, one open-ended question was included to gather information on student attitude toward various functions of the system for the support of their learning—"*In terms of learning, which part of the system impresses you most, and in what way*."

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Results & Discussion

Based on the collected data, it was found that averagely 73.5% participants felt "agree" or "strongly agree" to statements on the scale. Data on the usefulness of QPPA further showed that a considerably high percentage of users surveyed supported the functions contained in QPPA as facilitative for their own learning. Specifically, 86.5% agreed with the statement that question construction is promotive to student learning, while 92.3 % and 90.3% agreed that peer assessment and drill-and-practice, respectively, as conducive to learning. Moreover, 73.1%-78.9% participants agreed that various auxiliary features in the system as effective and beneficial for student learning. Finally, more than 90% surveyed rated the design of QPPA learning environment as user-friendly and easy to surf within.

Overall, students rated favorably on the system's interface design and potentials in promoting their cognitive capability in the specific content domain. Student written responses to the open-ended question further gives insights as to how the learning process was supported in the system --"*Constructing questions helps me understand the subject content more; constructing questions helps me develop a deeper understanding of the questions; peer assessment gives me a chance to see how others construct item stems and options; peer assessment of questions generated by other peers gives me the opportunity to see others' flaws in reasoning, which helps my learning; through carefully analyzing item stems and plausible options peer assessment and viewing helps my own learning, constructing question gives me a sense of achievement*." These entries from participants provided descriptive evidence for the system's facilitative effect for student learning.

Observations during the classrooms also showed that students were focused and fervent throughout the study. Activities like: gazing through textbooks, comparing different sources of references, asking for clarifications for a specific term, inquiring about different ways to frame a question, arguing over options for a specific test stem for their plausibility, rushing to the computer lab, logging on the system at home, etc. are behaviors frequently observed during the activity. These kinds of active learning actualize what constructionists and cognitive psychologists suggest.

Considering that currently web-based performance elicitation and assessment systems available mostly focus on drill-and-practice and/or testing activity, systems allowing question posing, peer assessment and peer viewing might be emphasized. By permitting so, a more constructive learning atmosphere may be cultivated, where students construct and re-construct their own interpretations of the world of information around them, which is facilitative for their own understanding and cognitive development.

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