

Question Asking During Collaborative Problem Solving in an Online Game Environment

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Abstract. This paper investigated frequency of questions and depth of questions in terms of both task difficulty and game phase when players collaboratively solve problems in an online game environment, Land Science. The results showed frequency of questions increased with both the task difficulty and unfamiliar tasks in the game phases. We also found players asked much more shallow questions than intermediate and deep questions, but more deep questions than intermediate questions.

Keywords: question asking, collaborative problem solving, online game environment.

Question Asking. Questions that students ask reflect their specific knowledge deficits, uncertainty about information, and apparent contradictions [1]. Student question asking reveals active learning, construction of knowledge, curiosity and the extent of the depth of the learning process [2]. Previous research on question asking focused on the classroom [3] and one-on-one tutoring [4] environments. Student questions in the classroom were infrequent and unsophisticated as compared with one-on-one tutoring environments, because one-on-one tutoring environments could tailor activities to the student's knowledge deficit and removing social barriers [1]. Recently, multiparty educational games have allowed groups of students to interact with computer-mediated communication on tasks that require collaborative learning and problem solving [5]. However, there are few empirical studies on question asking in this multiparty environment. This study investigated the question asking during collaborative problem solving in an online game environment, Land Science.

Land Science is an interactive urban-planning simulation with collaborative problem solving in an online game environment [6]. Players are assigned an in-game internship in which they act as land planners in a virtual city with the guidance of a mentor. They communicate with others through text chats for inquiries.

This paper examines the frequency of questions as a function of the task difficulty, game phase, and question depth in Land Science. Three hypotheses are proposed: the frequency of questions increases as a function of increasing (1) task difficulty, (2) the task unfamiliarity, and (3) question depth.

Method. 100 middle and high school students participated in 7 Land Science games. Two student researchers manually identified 1,936 (13.32%) questions from students' chats, and then coded them into 18 question categories according to the *Graesser-Pearson Taxonomy* [7], and the Other category (the average Kappas above .76). Then the questions were scaled into shallow, intermediate, versus deep level (see 7 for detail). The 14 stages of the game were scaled into easy, medium and difficult by a member of the Land Science development team based on the task familiarity and complexity. In addition, four phases were coded as introduction, new task, repeated task and closing.

Results and Discussion. Relative frequency of questions was operationally defined in the unit of per 100 words. Jonckheere-Terpstra trend tests were performed on 3 task difficult levels and 4 game phases separately. Results showed that the frequency of questions increased with task difficulty ($p=.023$), and with task unfamiliarity ($p=.071$). A nonparametric Kendall's tau-b test confirmed the trend ($r=.458$) in task difficulty and task unfamiliarity ($r=.331$). Therefore, players did ask more questions as task difficulty and task unfamiliarity increased. General Linear Model showed there was a significant effect for depth of question, $F(2,37)=401.27$, $p<.001$, $\eta^2=.956$. Post-hoc Bonferroni tests indicated that shallow questions ($M=.80$, $SD=.097$) were significantly more than deep ($M=.15$, $SD=.078$) and intermediate ($M=.05$, $SD=.032$) questions, and deep questions were significantly more than intermediate questions.

These findings confirmed that question asking during collaborative problem solving in multiparty educational game environment was similar to classroom environment: players asked more shallow questions [5]. Therefore, the mentor should demonstrate how to ask deep question in order to facilitate deep learning.

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