The Seventh IEEE International Conference on Advanced Learning Technologies

ICALT 2007
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Not Afraid to Ask

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ABSTRACT

Questioning is an essential process of learning and thinking. However, few students are willing to ask questions in class because of the pressure from many sources including their past experiences, teachers, peers, or themselves. A computer system NATA was designed in this research based on the two-phase questioning process to help students ask questions by reducing their questioning pressure. An experiment was conducted to study the effectiveness of NATA. More than 85% of the students in this research agreed that NATA made classroom questioning easier and more comfortable and could promote their questioning and the class’ questioning atmosphere. The results also showed significant improvement of students’ questioning behaviors after using the system.

1. Introduction

Albert Einstein said: “The important thing is not to stop questioning.” Questioning is a powerful tool to make decisions, solve problems, and make things better [9]. Questioning is also critical to the development of reflective and metacognitive thinking. People examine and challenge their knowledge and understanding through questioning process. By doing that, they are able to change and improve their learning and thinking, generate new ideas, and motivate their curiosity [10]. Students who ask questions are active learners that they can do their learning more deeply and assimilate and apply the knowledge they have learned [13]. Students can not truly think, learn, and understand unless they have questions [8]. Therefore, how to motivate students to think and ask questions is one of the critical tasks in teaching.

Although questioning is an essential key to learning and thinking, few students are willing to ask questions in class. About 95% of students who have questions do not ask their questions in the classroom [4]. One of the main reasons that students hesitate to raise their questions is the pressure of questioning [1][2][4][5][13]. The pressure comes from four sources: (1) Cultural background: The traditional social-cultural perceptions and parental attitudes toward questioning will have long-term effect on students that discourage their questioning behavior. For example, parents in Taiwan used to tell their children that good students always keep quiet in class and do not question teachers. (2) Teachers: Either a teacher’s teaching style that does not promote students to ask questions or his/her negative responses to students’ questioning will make students feel much stressful to ask questions in class. (3) Peers: When students receive unpleasant feedback from their classmates, their courage and willingness of asking questions will decrease. Finally, no one will ask questions in class. (4) Personality: Students who are shy, lack of self-confidence, bad at expressing thoughts verbally or easy to feel nervous and anxious in public usually give up asking questions in class. It is hard for students to ask questions in class if they can not overcome the above pressures.

In order to encourage students to raise questions in class, we develop a prototype of the questioning system NATA (Not Afraid to Ask) in Spring 2006. The main idea of the design is to reduce the questioning pressure of students. A usability test was conducted among 123 students and the opinions of using the system were gathered from these students. The results indicated that NATA can help students to ask question in class. In this research, we redesign the interface and increase new functions to make the questioning process easier and more interesting according to previous students’ opinions and the observation in the classroom. In addition to users’ opinions, we also collected questioning data to investigate the change of students’ questioning behaviors before and after using NATA.

The contribution of this research is that we develop a computer system that can promote students’ questioning behaviors and motivate students to start to ask questions in the class by lowering the pressure of questioning.
2. Related Works

Several researchers have suggested different ways to make asking questioning easier for students who are afraid to ask questions in class. For example, students can write down their questions during class and return those to their teachers after class; the questions will then be answered by the teachers at the beginning of next class. Students can also ask questions through online forums or email after class [1][13]. Although these methods can reduce the questioning pressure of students that comes from students’ classmates, themselves, and their past experience to some degree, they are usually failed to provide appropriate timing for students to ask questions and get answers at the moment when students still have fresh ideas of their learning.

Some studies have tried to design computer systems to improve question-and-answer activities in the class. Audience Response System [12] and EduClickII System [3] are the examples of using special-designed hardware device for students to respond to teacher’s questions by simply pushing the buttons on the device. Classroom Feedback System [7] is another system that allows students to answer questions by typing texts. These systems were found to improve students’ active learning and their interaction with teachers. However, the main purpose of these systems was to support students to answer questions but not to ask questions. Boomerang is a two-way questioning system that students can both answer and ask questions through it [11]. Yet, little attention has been paid on how to assist and encourage students to ask questions in class without fear.

The aim of NATA is to encourage students to ask questions actively by reducing the pressure of asking questions and making the questioning process easy and interesting in the class. It is hoped that students are allowed to think freely and willing to share their ideas and questions with their teacher and classmates. The design and functionality of NATA are introduced in the next section.

3. System Design

When students do the thinking and come up with questions in their learning process, they have to overcome a lot of intrinsic and extrinsic pressure before they can raise their hands and ask questions [6][13]. Moreover, students are not willing to be the first one to ask questions because they can not expect the reactions of their teachers or classmates toward their questions. As a result, it is hard to promote the questioning atmosphere in the class because no one would break the ice of questioning activity [4]. Hence, the main idea of NATA is to reduce the questioning pressure by lowering and distributing the degree and the sources of pressure so that students can raise their questions easily and successfully by using this system.

Based on the observation of students questioning behaviors in the classroom, questioning process can be divided into two phases. We call it “the two-phase questioning process”. Phase 1 is preparation of questions. In this stage, questions are formed in students’ brains and then jotted down on papers or memorized. The priorities of these questions will be set and some questions might not be asked. Phase 2 is asking questions. In this stage, students raise their questions that are already prepared in their mind or on papers. Figure 1 shows the design of NATA to reduce questioning pressure of students. The left part illustrates the degree of pressures students have to overcome before they can raise questions in traditional classrooms. The right part shows the pressure of asking questions is dispersed by NATA based on the questioning phases. The objective of NATA is to make it easier for students to overcome the questioning pressure because the pressure in each phase is lower than the degree in the traditional classroom.

![Figure 1: NATA can reduce the pressure of questioning.](image)

The main features of NATA includes: Question Input, Questioning Race, Statistics Report, and Data Record. The design and function of each feature is described as follows.

- **Question Input**

This feature allows students and teachers to enter the questions they want to ask at any time during the class. Traditionally, people usually keep questions in mind or jot down their questions they want to ask during the class and wait for chance to ask questions. However, remembering all questions they would like to ask is not easy because they have to pay attention to the lecture or presentation while trying to remember the questions at the same time. Although writing questions on papers can help people remember what to ask later, this is not an efficient way for students to organize, modify, and keep their questions. Besides, it is difficult for teachers to immediately observe how many students have prepared questions and what kind
of questions they want to ask. By using NATA, both teachers and students can jot down questions right away and modify them at anytime before the questions are asked. This feature can be viewed as a personal digit question taker.

The feature is corresponding to the questioning process Phase1. It is designed to reduce the questioning pressure by giving students more time and a convenient tool to prepare questions as well as giving them the right to decide whether to ask the questions they prepared. It can also increase students’ self-confidence because they can fully control their preparation of questions. Moreover, students can prepare questions without worrying about being criticized by other people because the questions they entered will not be shown to the class until they decide to actually ask the questions. This will make students feel easy and comfortable to prepare and enter questions, especially for those who are shy, bad at oral expression, or lack of confidence or who need more time to prepare questions. By organizing the questions and thinking over and modifying them, students are encouraged to do self-reflection and to improve their meta-cognitive and critical thinking abilities.

- **Questioning Race**

   After preparing questions, the next phase is to ask questions. In traditional classroom, students raise hands to ask questions. By using NATA, students simply click the bell showed aside each question they entered and the question will then be asked. The mechanisms of questioning race turn the questioning process into exciting and interesting game because the key point is to make students willing to be the first one to ask question. Once someone starts to ask question, other students will feel less stressful and more comfortable and easy to ask questions and the questioning atmosphere will be improved. Additional rewards (e.g., extra bonus) can also be given to help encouraging students to click the bells if necessary.

   The rule of the questioning race is that students have to push bells and try to win the chance of asking questions. Each time when teacher open a round for questioning race, each question entered by students will be accompanied with a bell. Students have to choose the question they want to ask and click the bell of the question as quick as they can before the racing time is over. The system will decide the winner and send his/her question and ID to everyone’s screen immediately. The decision rule of the winner is based on the speed of clicking the bell, the winner delay, and a randomly assigned number (we call it “lucky number”). The winner is the one who get the smallest value of the sum of these three indicators’ data. Winner delay is controlled by the delay mechanism in order to let everyone have the opportunity to win the chance for questioning. That is, the winner will be given a fixed delay value in the next round of the questioning race. In addition, the purpose of the lucky number is that students who click bells slower can still have chance to be the winner. This will help them still be willing to press the bells even if other student already clicked the bell.

   To make the questioning race more interesting, a countdown scheme is designed to draw students’ attention and to create the exciting atmosphere of waiting to press the bell. After teacher sets the start of a questioning race, a countdown clock will appear on students’ screens (see Figure 2). The questioning bells will be shown after the countdown finishes.

   While students have to wait until the questioning time to ask questions, teacher can hit the bells aside the questions s/he entered at anytime during the class.

   ![Image](image.png)

   **Figure 2:** The countdown clock and Statistics Report of the whole class and individually students.

- **Statistics Report**

   Statistics Report (Figure 2&3) allows students and teachers to know the questioning performance of all students in real-time. The amount of questions entered and asked by the whole class and by individual students is updated and displayed respectively on the top of the questioning window and in a table that can be open and closed. Besides, the messages of all activities such as the start of questioning race and the determination of the winner are displayed on everyone’s screen in real-time. The main idea of this feature is to encourage and stimulate students to think more questions and ask more through the clearly presented statistics. It is also convenient and timesaving for teachers to keep records of all students about how many and what questions they have asked.
Moreover, the data can be a fair reference of grading when necessary.

![Image](image.png)

**Figure 3:** The questions entered by a student (mid-left) and all questions being asked in the class (mid-right)

**Data Record**

This feature saves details of the questions that are entered, modified, and asked. Although only the final modification of the questions is displayed, every change will be saved for future reference and analysis. Questions that are entered and asked will be kept in NATA after the class so that students and teachers can go over those questions again whenever they want. Teachers can identify what and how much students have learned and what difficulties these students encountered so that they can adjust their teaching strategies or pace accordingly. As for students, reading others’ questions may stimulate their thinking and learn to make good questions as well as improve their questioning skills. Questions can also be organized for further discussion after class.

**4. Implementation**

The NATA system was implemented in the course “Introduction to Computers” of the Department of Psychology at a private university in Taiwan. Students used NATA to enter and ask their questions during midterm group presentations. There were 56 students into 17 groups. Each group had about 20 minutes to present their subjects and 10 minutes for other students to ask regarding their subject. Three to four groups of students presented in the two-hour class each week for five weeks. In order to compare students’ questioning behaviors before and after using the NATA system, the questioning activity during the first two weeks were processed in traditional way, that is, students listened to the presentations and raised their hands to ask questions after the presentation. Students could write down their questions during the presentation if they want. The questioning data of the first two weeks were recorded by teaching assistant. After two weeks of presentation, the NATA system was applied to the class for three weeks. The effectiveness of NATA on students’ questioning behaviors was evaluated in this study. A self-designed questionnaire was also used to collect the students’ opinions regarding the use of the system.

When using NATA, every student could enter questions at any time during the presentation. After the presentation, teacher started the questioning race that students had to click on the “bell” showed aside each question they have entered to compete for the chance to ask out the question. The winner’s question would then be showed on everyone’s screen. After the presenters answered the question, teacher would then open the questioning race for next round. During the questioning race, students could keep entering their questions. The number of rounds opened would depend on the time available.

**5. Results and Discussion**

The results show statistically significant difference of the effect of NATA on students questioning behaviors. The amount of questions that students prepared by entering in NATA is significantly more than by writing on papers traditionally ($t = 2.89, p < 0.05$). There are also significantly more different students preparing questions by the use of NATA than in traditional questioning process ($t = 2.72, p < 0.05$). The findings suggest that NATA can motivate more students to think more questions in comparison with traditional way of ask questions. To investigate whether NATA encouraged more students to ask questions, the finding shows the number of students who clicked the bell in NATA to ask questions is significantly higher than raised hands to ask question traditionally ($t = 6.75, p < 0.001$).

From the results of users’ opinions, the NATA is thought to be helpful to students’ questioning regarding to its design. More than 90% of students agreed that the design of Question Input can make questioning easier and less stressful because they can jot down and edit their questions at anytime during the class and decide whether to ask those questions later. In addition, more than 85% of students reported that the mechanisms of Questioning Race make the questioning process more interesting and improve the questioning atmosphere of the class. There are more than 60% of students agreed that they would enter more questions and clicked the bells when they saw the Statistics
Students also reported that they can clearly know about the content of each being-asked question (96.4%), think of further questions (73.2%), and learn more about how to ask questions (87.5%) when they see what other students asked. Overall, about 95% of students hope to use NATA again in the future.

6. Conclusion and Future Work

In this research, we found that NATA can increase students’ willingness of asking questions and improve their questioning behaviors because this system makes the questioning process less stressful and more exciting. We view this system as a bridge to help students stride across the obstacles of questioning and hope it can have long-term effect on their questioning behaviors. Because the system was only used for three weeks, whether the outcomes of the effectiveness were resulted by the effect of novelty will need to be clarified by future studies. Because more than 70% of students hoped to get the comments of their questions from their teacher and classmates, the other issue that is valuable to explore in the future is how the feedbacks given to the questions from others will impact the willingness and quality of questioning, and improve reflective and metacognitive thinking of students.

7. References


