

計畫名稱：中學生資訊科技之網路學習與評量系統之研究-子計畫一網路問卷與訪談系統及執行模式之研究(3/3)

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主持人：國立交通大學 教育研究所 周倩

執行期限：89.8.1-90.7.31

Tel: +886-3-5731808

Fax: +886-3-5738083

email: cchow@cc.nctu.edu.tw

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中文摘要

本文敘述線上德懷術(Delphi technique, 又稱得菲法)的發展與評估結果。E-Delphi系統是以ASP技術建置在Web上,其功能包含建置專家名單、問卷題目、email信件,計算答案、幫助決定問題一致性與穩定度等。其優點包括簡化工作流程、縮短寄送與收發問卷的時間、提供方便隱密的溝通管道等。其適用於探討網路科技相關議題,而專家又習於用網路溝通的研究情境。

Introduction

The Delphi technique has become a widely used tool in a variety of disciplines (Holden & Wedman, 1993; Rowe & Wright, 1999; Thach & Murphy, 1995) for measuring and aiding forecasting and decision making since 1960. Dalkey and Helmer (1963) claim that this technique produces a reliable consensus among an expert group by a series of intensive questionnaires interspersed with controlled opinion feedback. Typically, a Delphi study is conducted in a number of rounds. In the first round, a questionnaire is created, sent to panel members to complete and return, and the responses are analyzed. In the next round, a new questionnaire is developed from the previous responses, and then sent to panel members. The aim of the series of questionnaires is to achieve a consensus of opinion by allowing members to re-consider and re-rate their opinions regarding the items in the questionnaire.

The Delphi technique undoubtedly has both advantages and disadvantages; one of the major disadvantages is its potential for sloppy execution (Gupta & Clarke, 1996). That is, Delphi studies relying on traditional mailing systems require relatively long periods of time to construct questionnaires and collect panel members' opinions. In addition,

during the course of execution, some members may not complete or return the questionnaires for each round; therefore, valuable members may be lost. In order to resolve these problems, an e-Delphi system was developed, in which all questionnaire construction and communication with panel members were accomplished using the Web. The e-Delphi system speeds up the execution of sending and returning questionnaires, and helps monitor panel members' responding status.

System Users and Requirements

There are two types of users identified by the e-Delphi system: the project leader, who conducts the study, and panel members, who answer questionnaires. The e-Delphi system is primarily for project leaders to more efficiently and effectively conduct Delphi studies, but it also benefits panel members, enabling them to link directly to the system and enter their opinions.

The basic requirements for the e-Delphi system are below:

1. Provide a friendly interface that allows the project leader to develop and send questionnaires to panel members.
2. Provide a friendly interface that allows panel members to input data.
3. Perform calculations on panel members' input entries.
4. Prepare individual questionnaires with multimedia presentation.
5. Help project leader determine the stability of each item of the questionnaire.
6. Allow project leader to monitor the execution of the study and to easily communicate with panel members.

The resulting e-Delphi system was built on the Web, using Active Server Page (ASP) techniques. For readability, technical details are omitted and only the functions and some user-interfaces are introduced below. The figures are taken from the author's present Delphi study, "Competence for Information & Communication Technology Educators (ICT educator)."

System Functions and Interface

The system interface consists of three areas shown on the screen. The first is the horizontal bar on top of the screen (figure 1), which consists of information on the current study, including its name, current round number, and number of panel members who have completed the questionnaire (if round number is two or higher). This area provides project leaders with the necessary information to monitor and further their Delphi studies—and it is especially helpful when project leaders' are engaged in multiple, concurrent Delphi studies.

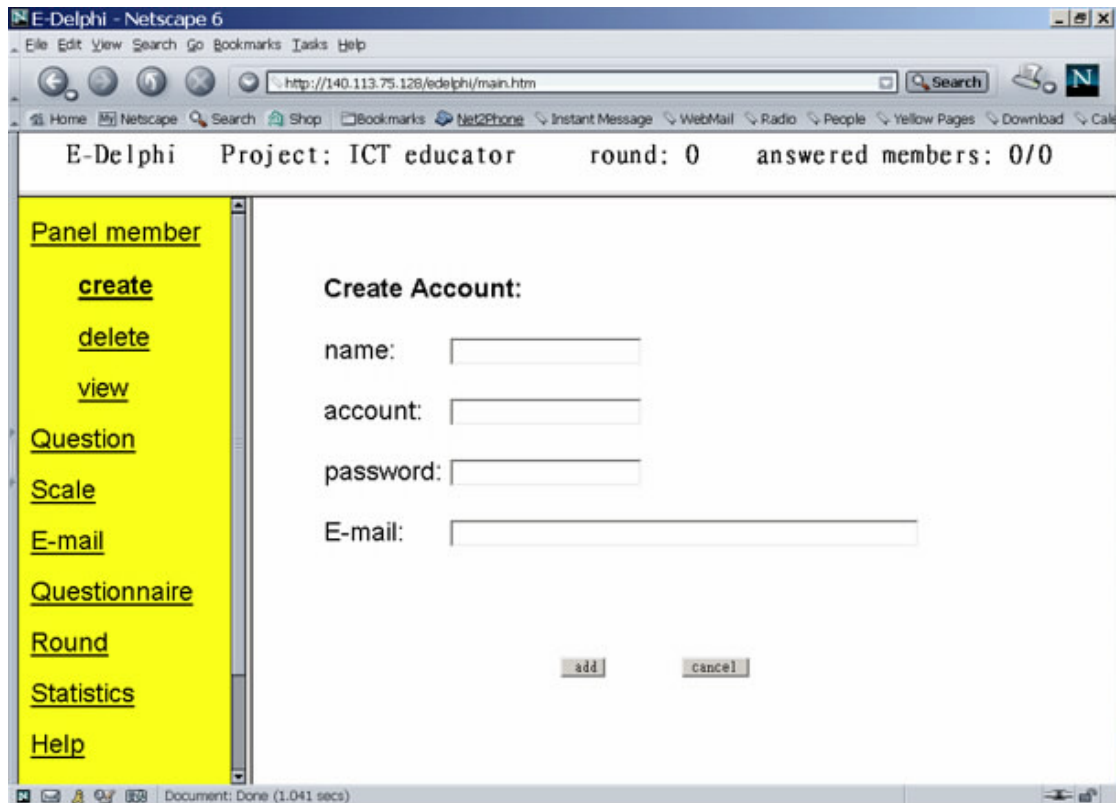


Figure 1: Sample screen of the e-Delphi system showing its interface design

As shown in Figure 1, the vertical area at the left of the screen lists all Delphi function buttons. Project leaders may select any function and work within the largest area beside the function lists on the screen. There are nine buttons, briefly described below:

1. Panel member. Project leaders must first establish panel members for any new Delphi study. This function includes three sub-functions: (a) create account: project leader should enter each member's name, account number, password, and e-mail address; (b) delete account: project leader can delete individual members' account from an existing member list; (c) view account: project leader can view all panel members and, using the create or delete account functions, modify the members list to include only those appropriate for the study.
2. Question. The next step is to develop the study's questionnaires. This function includes two sub-functions: (a) create question: project leader should enter each question here; (b) view (and delete) question: project leaders can view all existing questions here and delete unwanted questions. Figure 2 shows the sample screen of view questions.

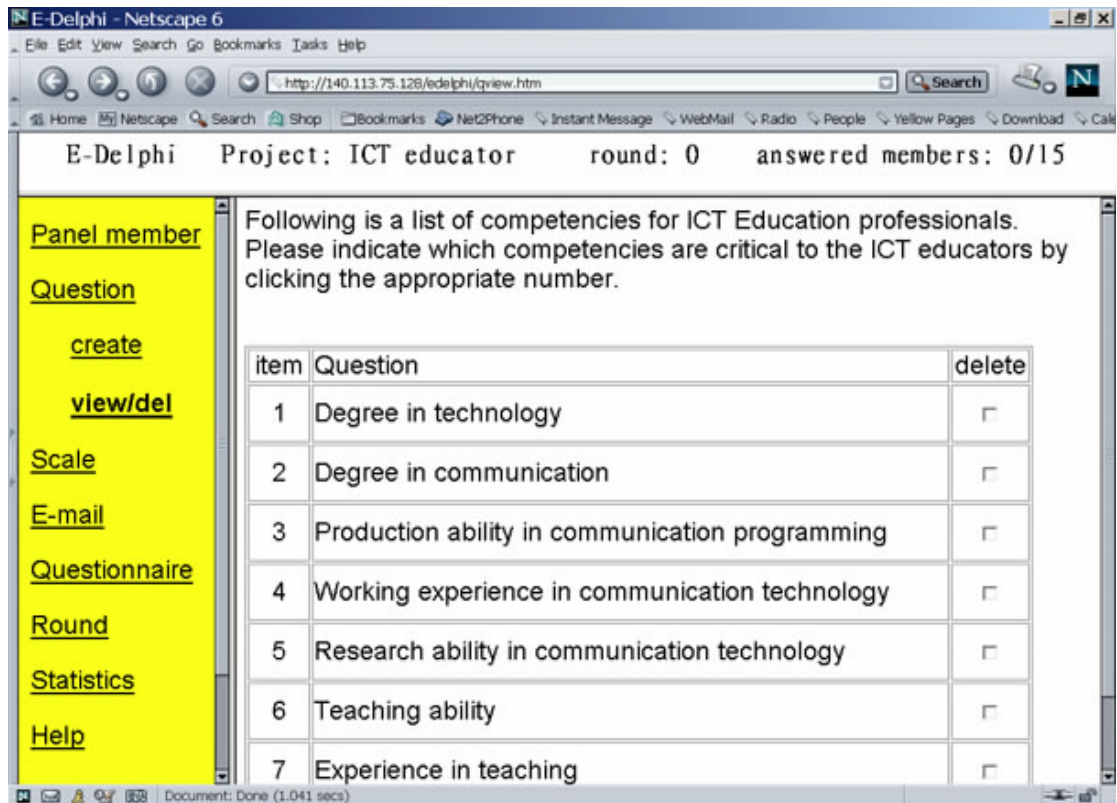


Figure 2: The-Delphi system showing the view/del questionnaire function

3. Scale. After developing the questionnaire, project leaders should determine the scale and scale indicators for the questionnaire. For example, after project leaders enter “5” to the scale, the system will ask them to enter the verbal indicators for 1, 2, 3, 4, and 5. For instance, the project leader can enter Very Disagree, Disagree, Neutral, Agree, or Very Agree for each indicator.
4. E-mail. This function allows project leaders to write cover letters and follow-up letters to be sent to panel member. Cover letters usually contain the purpose of the study, expected date of completion, and so on. The system will automatically add the Web address of the Delphi study, panel members’ account numbers, and the password to this and subsequent letters. When panel members receive e-mail letters, they can click the Web address included in the letter, access the system, and enter their account numbers and password to access the questionnaire.
5. Questionnaire. This function allows project leaders to overview each questionnaire, including the introduction, each question and its order, scale and indicator. If project leaders decide to modify questionnaires, they can use functions 2 and 3, as described above. Figure 3 shows a second round questionnaire.

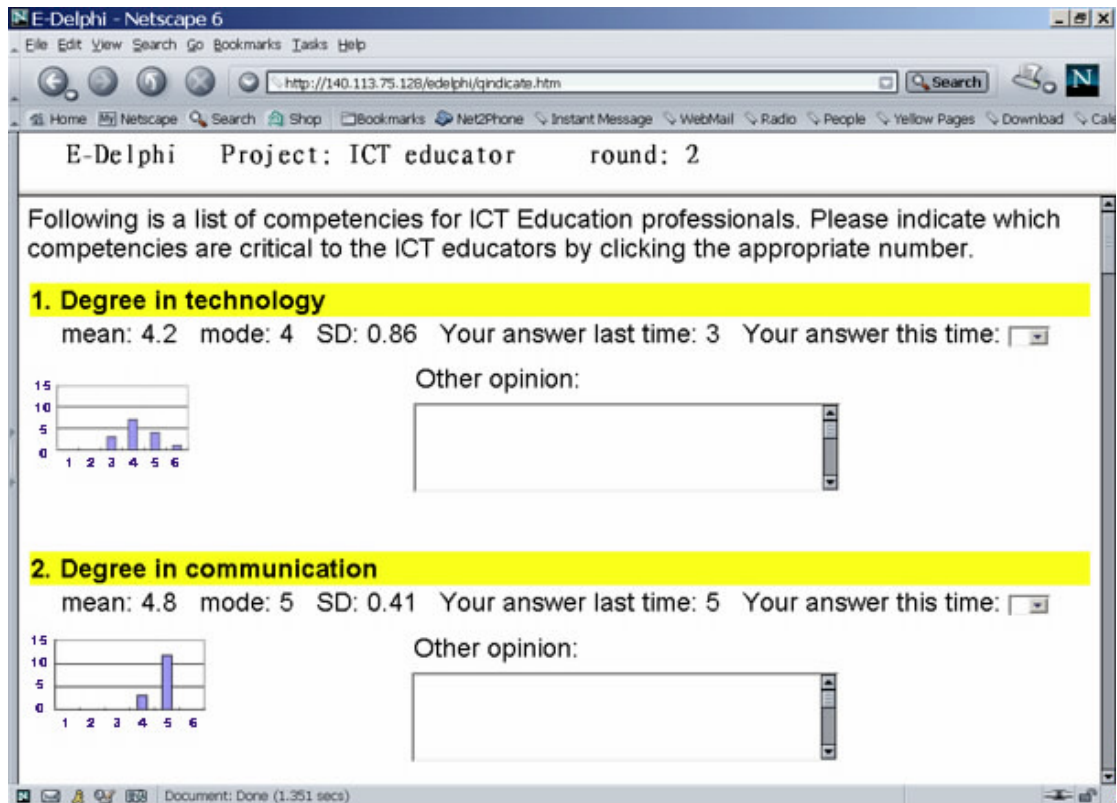


Figure 3: The e-delphi system showing the questionnaire for panel member

6. Round. This function allows project leaders to (a) send a follow-up e-mail letter to members who did not complete the current-round questionnaire, and (b) send the next-round cover letters and questionnaires to panel members.
7. Statistics. This function allows project leaders to calculate panel members' inputs for each round. The system will calculate the number of panel members who answered any given question, as well as the mean, standard deviation, mode, quartile deviation, and net person-changes. Quartile deviation, which is the difference between 25th and 75th percentile in a frequency distribution, help project leaders determine the consensus of each question. If any question receives a quartile deviation (≤ 0.60) this question is considered to have achieved high consensus. Moderate consensus was defined as a quartile deviation (> 0.60 and ≤ 1.00). Net person-changes, determined by dividing changed-inputs by the number of panel members, helps determine stability. If any question's net person-changes is less than 15% between two distributions, this question is considered to have reached stability. The system automatically signals each question's degree of consensus and stability by different colors.
8. Help. This provides a detailed description of each function button, as well as sample

cover letters and follow-up letters.

9. Exit. This button allows the project leader to leave the system.

Evaluating the E-Delphi system

In order to evaluate the usability and interface design of the E-Delphi system, a study entitled “Information and Communication Technology Educator” (ICT Educator) was conducted, in which 15 panel experts participated. Panel members, all of whom specialize in information and communication technology, experienced no difficulty in accessing the system and completing and submitting their questionnaires for each round. After completing the third round questionnaire, members were required to answer an additional questionnaire on the use of the system. Their answers indicated that the use of e-mail and the Web in this Delphi study made it easier for them to participate and complete their tasks than other Delphi studies in which they had participated. They recommended that if a Delphi study focuses on network technology, and all panel members use Internet applications regularly, then it is best to employ on-line Delphi methods such as the one described in this paper. However, some interface design problems such as the layout of the questionnaire were identified, and revisions will be made accordingly.

From the viewpoint of a Delphi study project leader, the major advantage of this system is that it saves a lot of execution time, including developing and sending individual questionnaires, sending follow-up letters and accompanying questionnaires, performing statistical functions, and determining the consensus and stability of each question. The execution of the entire ICT Educator study included three rounds of questionnaire distributions, two follow-up letters, and data calculation; the total execution time was four weeks, compared with the average six to 12 months in a traditional Delphi study. In addition, this system retains the merits of the traditional Delphi system in which panel members are anonymous to each other, while providing an easy channel for members to communicate with the project leader.

Final remarks

The e-Delphi system described in this paper is an innovative approach to an existing forecasting method; this system will continue to be revised, and more functions will be added for a higher level of “user-friendliness.” The e-Delphi system is a less labor-intensive system than the traditional method, and is not paper-reliant. This and other developing technologies will continue to offer Delphi project leaders and panel experts the benefit of Web-based research tools.

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