

# A Sophisticated Method of Questionnaires of Classroom Using a Computer and a Survey of the Format

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## Abstract

A questionnaire using a computer (hereinafter called "electronic questionnaire" can be composed more freely in comparison with one printed on a paper.

In the study reported in this paper, questionnaires are so composed that a hierarchical structure is provided in between items when an item of question (original item) can be substituted by several different items of question (low order items). And, in some cases, the original item may be interpreted to several different meanings, and therefore, an answerer may desire to have low order items so that he (she) can answer easily to more physical items.

Thus, the system allows him (her) making answers to the low order items.

In this case, a format which normally displays not only the original item but also corresponding low order items is compared with another format which displays low order items only when an answerer desires to review low order items. A comparing experiment was conducted with students. In this paper, it is described that the result of the experiment indicates there are more answerers who prefer the latter. Also examined are detailed primary factors.

## 1. Introduction

In a high level education at universities, etc., evaluation issues are being considered to be important as a revolution of education. An evaluation of class is one of them. As contents of a class diversify, so called omnibus system in which several professors lecture by shifting is increasing, and the evaluation of class is presumed to be everlasting. Under such circumstances, it is desired that questionnaires with evaluation loads of the students taken into consideration be designed and a simple summarizing means be developed.

Under the above circumstance, this study takes up the electronic questionnaire, and examines the presented format. When a questionnaire is of an electronic type, it

becomes possible, up to a certain level, to allow answerers selecting a format displayed on a computer screen and answering to the questionnaire by their own desires[1].

In this study, the following two structures of questionnaire format are taken up.

- (1)An answer can be selected out of many different answers.
- (2)The item of a question is in a hierarchical structure having high and low order items as shown in Figure 1.

Primarily, format of questionnaire is unified so as to enhance reliability of answered data and to ease interpretation of totaled results. In other words, almost all answerers answer in a same format. In the case of an attitude survey, however, it is assumed that some answerers may desire to answer to several more physical items (low order items) because expression of a question (original item) has a width in the interpretations. On the other hand, some other answerers may desire to answer to the original item only because number of low order items is too many and the answerers are loaded too much. For this reason, it is ruled that students are allowed to select either the original items or low order items as an exception of the unified answer format.

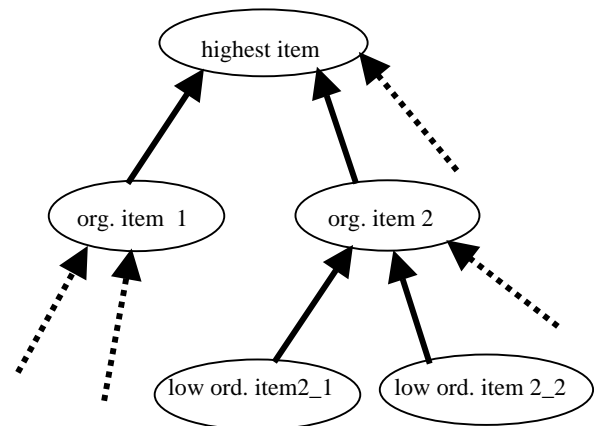


Figure 1. Hierarchical questionnaire items

In this study, formats of original items and low order items displayed on the screen are compared.

Next, it is necessary to summarize answers of the low order items and to calculate evaluation value of the original items. As an effective means, fuzzy integral was taken into the field of view and items of the questionnaire were composed so that the process can be realized. To be more physically, each item should be given with a subjective importance. Therefore, the questionnaire is in such a format as that answerers answer not only to each question but also subjective importance of the item.

## 2. Format comparing experiment

When both the original items and corresponding low order items are displayed on a computer screen, students are able to compare them, and select whichever easy to answer. On the other hand, however, it may be said that informative relationship between the original items and low order items can be made clear by displaying low order items only when required. Taking this into considerations, for method to display original items and the corresponding low order items, the following two formats are compared.

- (1) Normally displayed method: Original items are displayed on a part of the screen, and the low order items are also normally displayed. (Figure 2)
- (2) Displayed only when required method: Original items are displayed on a part of the screen, and the low order items are displayed only when the answerers request. (Figure 3)

To compare these, items for evaluation of a class indicated in Table 1 are used as a sample of questionnaire. On the screen, three original items and choices are displayed in the left hand half, and lower order items are displayed in the right hand half. The pictures in the right and left hands can be moved up and down separately with the scroll bar. The choices are so designed that the answerers can answer to both the [Degree of accuracy to each item] and [Subjective importance]. The answers are so designed that the answerers can answer to either the original items or the low order items, or to both the original and low order items.

In the displayed only when required method, [Low order item reading] is added to the choices of [Accuracy] in the left hand original items. When this is selected, the right hand low order items are displayed. And, it is so designed that when [Return to the original item] is selected, it returns to a picture of the original items only.

Now, in order to evaluate two formats, the students were asked which they prefer the normally displayed method or displayed only when required method. As the results, almost 80% of the students selected the displayed

only when required method as indicated in Table 2(b) [Comprehensive judgment]. Further, for various primary factors related to the selection, Table 2 (a) was prepared based on the prior studies[3], etc., and the students were asked as indicated in the [Contents of question]. From this result, [Clearness of the correspondence between

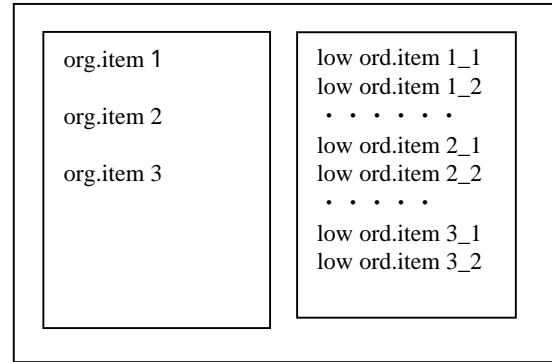


Figure 2. Normally displayed method

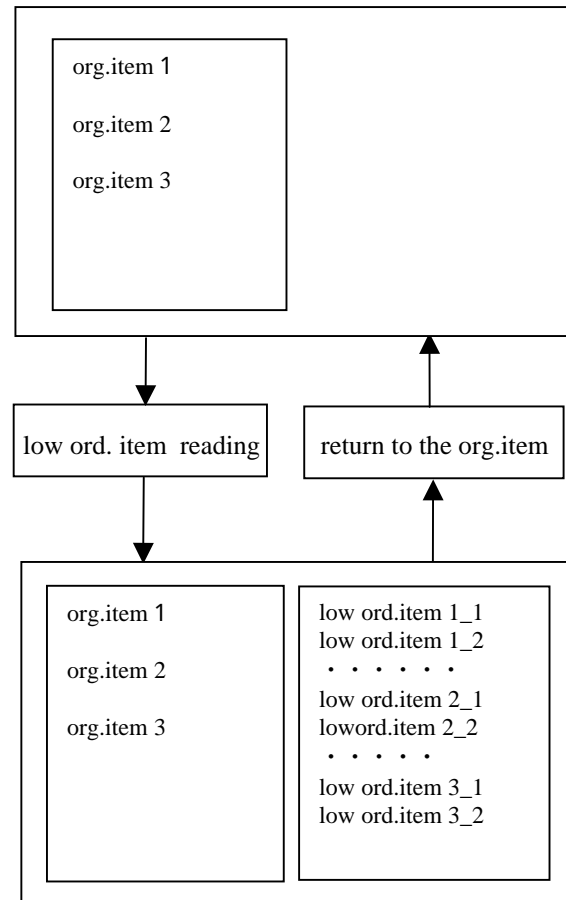


Figure 3. Displayed only when required method

**Table 1. Structure of questionnaire**

Highest item	Satisfied with the class		
Original item	1. Satisfied with the knowledge obtained in the class	2. Satisfied with the class forwarding method	3. Satisfied with the atmosphere of education
Low order items	1-1 Interested in the theme taken up in the class	2-1 Questions were made lively	3-1 The used education equipment were functioning exactly.
	1-2 The professor was familiar with the expert knowledge related to the theme.	2-2 The professor was well in giving presentations.	3-2 There was no surrounding noise which hinders the class.

**Table 2. Comparison of questionnaire formats**

**(a) Relative primary factors and answers (%)**

Contents of question	1. I don't think so.	2. ?	3. I think so.	<sup>2</sup> -examination of 1 and 3 frequencies
a. In the normally displayed method, [It is not necessary to control the mouse to display low order items.] In this point of view, I prefer the normally displayed method	0.33	0.04	0.63	-
b. In the normally displayed method, [For any answerer, all low order items can be referred (by simply scrolling).] In this point of view, I prefer the normally displayed method.	0.33	0.00	0.67	-
c. In the normally displayed method, [Skipped portions can be answered by going and coming back from the right and left or vice versa across answers of the left picture and those of the right picture. In other words, answering act is not affected by writing sequence.] In this point of view, I prefer the normally displayed method.	0.59	0.00	0.41	-
d. In the displayed only when required method, [For those answerers who don't desire low order items, unnecessary information is not displayed. In other words, the displayed contents are optimized.] In this point of view, I prefer the displayed only when required method.	0.33	0.04	0.63	-
e. In the displayed only when required method, [For any original items, the corresponding low order items are displayed in the immediate right side (without scrolling), and low order items are distinct.] In this point of view, I prefer the displayed only when required method.	0.11	0.04	0.85	Meaningful as p < 0.01
f. In the displayed only when required method, [The original items to which I am going to answer and only the corresponding low order items are displayed. As only relative items are displayed, considerations before answering can be made deeply.] In this point of view, I prefer the displayed only when required method	0.37	0.00	0.63	-

**(b) Comprehensive judgment (%)**

Contents of question	1. I prefer the normally displayed method.	2. ?	3. I prefer the displayed only when required method	<sup>2</sup> -examination of 1 and 3 frequencies
As an comprehensive judgment	0.18	0.04	0.78	Meaningful as p < 0.05

**Table 3. Comparison of features of questionnaire methods**

Compared items	Printed on paper method	This electronic questionnaire method
Contents of question	Fixed regardless of answerer's will	Can be changed by answerer's will
Obtained information	Information answered to the question only	Information which indicates detailed information of which item the answerer was interested in, in addition to the information of the answer
Summarization of answers	A simple summarization such as an average of all answerers	It is required to summarize answer value of the original item from answer values of the low order items
Summarizing work	Computer input/output are required	When a summarizing algorithm has been decided, can be summarized in an instant.

the original items and low order items on the screen] can be observed as the main reason why the students selected the displayed only when required method.

Further, the number of students participated in this experiment was 27. They were asked to fill in questionnaires after evaluating a class in both the displayed normally method and displayed only when required method so as to have them understood how to handle the electronic questionnaire.

Furthermore, to have students written the subjective importance by themselves, they were asked for difficulty by selecting their answers from many different answers. As the result, many students answered "May be able to check if there was an explanation which could be understood easily". However, in the examination, it did not appear as "meaningful".

### 3. Substitutional indication of question and summarization of information

Table 3 collects features of the electronic questionnaires suggested against the ordinary questionnaires printed on paper.

As described above, in this system, answerers can select either the original items or corresponding low order items when the original items have low order items. Consequently, the sum up of answers is not as simple as the ordinary questionnaires printed on paper. Reason why it is not easy is because, when a student answers to the low order items, it is required to obtain an answer value of the original item from the result by a proper method. Information summarization of answer values for all original items is made after setting the method to obtain the answer value.

As a method of the information summarization, the fuzzy integral has been known. In this case, it is required to have answerers written the subjective importance, and it is assumed that the difficulty is affected by either the contents of the question are physical or not.

In case of examples of the items shown on the Table 1 which were used for the experiment, for the low order items for the [1. Satisfied with the knowledge obtained in the class.], such matters which can be segregated

comparatively easily as, for example, [1-1. Interested in the theme taken up in the class.], [1-2. The professor was familiar with the expert knowledge related to the theme.] are objects of evaluations. Against this, the object of evaluation of the low order items for the highest order item [Satisfied with the class] is comparatively vague like [1. Satisfied with the knowledge obtained in the class], [2. Satisfied with the class forwarding method]. And, it is assumed that weaker the physical expression of items may be, it would be harder to decide the importance by collating the relationship between items.

On the other hand, when the purpose is to use an evaluation of the education as a reference for the future classes, in many cases, an opportunity provided with plural evaluation values is highly suggestive rather than that with only one evaluation value.

Based on the above considerations, when speaking in the examples of the Table 1, it is assumed to be optimum to give importance to low order items only, without giving importance to the original item.

Moreover, the method to calculate evaluation value of an original item from answers of low order items using the fuzzy integral is omitted. In the fuzzy integral, it is necessary to decide an importance function which expresses importance of the group of items[2]. If - Fuzzy measurement is used as an importance function, the correlation coefficient among items must have been given. It may be difficult to obtain the correlation coefficient depending on a number of answerers to low order items. Therefore, such a method as that a questionnaire planner decides the strength of correlation between two items, and substitutes the correlation coefficient with that value, could be suggested.

### 4. Conclusion

Format of the electronic questionnaire was examined for such a case as that items of the questionnaire have a relationship of high and low orders.

The method in which low order items are displayed only when it is desired to display them was compared with the method in which display is made normally re-

ardless of desired or not. As the result of the experiment, it was made clear that the trend to prefer the former type would be high. In addition, it was described that when answered to the low order items, the fuzzy integral could be used to summarize the information as well as the problem points.

## References

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