The Used of Modified Conjoint Analysis to Evaluate Interest Level and Value of Items in Instrument Development.

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Abstract

Expert judgment about items in the research of education is generally done using pair wise comparison method that aims to determine the expert's opinion on some items that were evaluated. This method is also used to determine the value of each of these items. This method is difficult to be applied to number of items that too much. With a comparable amount as $_2C_n$ or $\frac{n!}{(n-2)!\,2}$, where n is the number of items, then the increase in number of items will increase the difficulty of the respondents in comparison to. This is further complicated if each item being compared have some variables in determining its quality. To overcome this problem, the authors suggest the use of conjoint analysis is commonly used in marketing research, to evaluate a variable interest rate. This method was modified to suit the intended use of the method of paired comparisons, which determine the level of interest and the value of each item.

Keywords: Conjoint Analysis; Modification; Pair Comparison

INTRODUCTION

Item evaluation conducted by expert is one of the item evaluation technique that aims to decide which items are choosen for further analysis. The results expert evaluation is commonly analyzed using various metods, one of them is pair wise comparison, which also aims to evaluate the quality of each item (Djaali and Muljono, 2008).

The pair wise comparison method can be done easily, when the number of items to be analyzed are not so many. With the number of comparison as many as $_2C_n$ atau $\frac{n!}{(n-2)!\,2}$, where *n* is the number of items, then the increase of items will also increase the difficulties for respondent to do a comparison. As an example, when the number of items are 6, 7, 8 and 9, then the total number to be compared are 15, 21, 28 and 36, respectively.

The comparison will become more complicated if each item to be compared has other variables or atributes to decide its quality. For example, the items at the instrument for the ability of students' critical thinking. Critical thinking is useful to understand teaching materials, to solve the problems or to conduct a discussion. As components that compose the item, these three components are not stated clearly. In addition, there are other components that can increase the difficulties in using pairwise comparison method. To overcome these two problems, the author suggest the of use Conjoint Analysis.

Conjoint Analysis is a research technique that commonly in marketing research. Since about 1970 this analysis is widely used as a tool to develop new products, predict consumer's response to alternative pricing strategies or for running market simulations. According to Tripathi and Siddiqui (2010), conjoint analysis has been used to estimates the structure of a consumer's preferences, given his/her overall evaluations of a set of alternatives that are pre-specified in terms of levels of different attributes.

Using Conjoint Analysis, the value that experts place on any product is equivalent to the sum of the utility they derive from all the attributes making up a product. Further, it assumes that the preference for a product and the likelihood to purchase it are in proportion to the utility an individual gains from the product. Conjoint Analysis assumes that a product or service consist of some component of attributes. For example, a mobile phone has some attributes such as color, size, price, memory capacity, data transfer capability, and model style (Tanujaya, 2009).

In the proposed method, a slight difference is found with the existence of one item, where each item is not stated clearly. For this reason we have to assume that each item consists of attributes and level. This is the modification form of Conjoint Analysis that will be used in this research. With this Modified Conjoint Analysis, the limitation of pair wise comparison method can be overcome and minimized.

To show or proof that pairwise comparison method some has limitations in analyzing the expert evaluation, the following experiment was conducted.

EXPERIMENTAL

Materials used in this research consists of 9 items, build from Dimension: Concepts Formulation and Indicator: Basic Skills Building. The items are as follow:

1. I ask the instructor/my teacher until I fully understand the concept of mathematics that has been taught.
2. I try to get as many informations as possible concerning mathematics subjects from friends.
3. I read several references so that I have a good understanding on the concepts of mathematics.
4. I write complicated mathematics formula on a piece of paper so that I can read it anytime.
5. I put mathematics formulas on the wall of my bedroom so that I can see and read it more often.
6. I make notes on mathematical problems that I do not fully understand yet.
7. Mathematics lesson is the most boring lesson.
8. I do not want to go to school if there is a mathematic class.
9. I do not stop studyng, if I have not finished my mathematical problems using the formula given by my teacher.

This research involved 30 experts who evaluate and give score to items being evaluated. The experts consists of mathematics teachers, post graduate students of Education, and Doctors in Education. These 30 experts are divided into 3 groups, each group consisted of 10 person. The grouping of experts is decided randomly (clustered random sampling), so each group consists of all types of expert.

In conducting the researh, each expert is asked to conduct two activities, namely:

(1) The expert is asked to compare the 9 items, following the pair wise comparison procedure without knowing the existence of dditional attributes;

(2) The expert are asked to make ordering and valuing the items using the Conjoint Analysis procedure after knowing that there are additional attributes.

In applying the pair wise comparison analysis, the experts are asked to decide the Important Value sequence between two items of comparison. By this way there will be 36 kinds of comparison. Meanwhile, in the Conjoint analysis there is an assumption that the 9 items are assumed as one combination of a product (service).

The next step, the experts are asked to put the items in sequence, and give grades for each item. The highest rank declares the best item with highest grade item, and so forth. Order of sequence are put from 1 to 9, while grade item from 1 to 100. The different grade or quality between the ranks are not always the same, depend on grading or scoring done by the expert. For example, item 3 ranked 1, with the score 90, item 2 ranked 2 with the score 89, while item 9 ranked 3, with the score 78.

Results of the experts are then commonly be analyzed using multiple comparison method, while using modified Conjointt analysis the procedures are as follow:

- Result of expert judgment are put in a table
- The results are given score to decided the final ranking
- The resulted data is analyzed using the modified Conjoint Analysis procedure

Modification of Conjoint Analysis is done in deciding the attributes and score of each attribute. The main difference between commonly used Conjoint Analysis and this modified method is that the attribute in this method does not always consist of several levels. In other words there are attributes that only have one level. In addition, one item consists of only one attribute with one or several levels of attribute.

It could be noticed that the items to be analysed have specific indicator that can be classified as "attribute". These nine activity items can be grouped into three attributes i.e: (a) First Activity relating with other people, i.e.: item 1 and 2; (b) Second Activity that being done by themselves, which are items no. 3, 4, 5, 6, and 9; and (c) Third Activity which is their personal-driven motivation, are items 7, and 8. The First Activity consists of two level, that is to ask and to write. The Second Activity is to write, to read, and to ask; while Third Activity is a passive action.

The next step is to give codes to each attribute that will function as a dummy variable. The use of dummy variable in regression analysis, according to Churchill and Jacobucci (2002) is one of the important characteristics in conjoint analysis. The resulted codes are used to construct the variable of X matrix. After composing the X matrix, regression analysis is done between these matrix with Y variables, which are scores given by the experts.

RESULTS AND DISCUSSION

By using pairwise comparison method, an expert will compare the 9 items, while in modified Conjoint Analysis method the expert make comparison as many as 36 times. The experts are not only need longer time to spend but also will face problems in deciding the sequence of the items, as he or she has not fully understand the existing items, and thus will have an impact on the ranking. The result of expert's evaluation is presented next.

Table 1: The Items Ordered of Three Experts Groups using Pair wise Comparison

Rank	Expert's Group		
	A	**B**	**C**
1	7	4	5
2	3	6	6
3	9	8	8
4	5	7	4
5	1	2	2
6	6	1	3
7	8	5	1
8	2	9	9
9	4	3	7

Table 1 shows that there is a striking difference in item order results between the three groups of experts. This is perhaps due to lack of clear criteria used by the experts as foundation in comparing the items At the case where the results of evaluation by the three group of experts are combined, is presented in Table 2.

Tabel 2: The Items Ordered of Experts are combined Using Pair wise Comparison.

Rank	1	2	3	4	5	6	7	8	9
Item	6	5	8	4	2	3	9	7	1

The result analysis as shown in Table 2, indicates that the results are not quite different with the results analysis in Table 1. At both result analysis (Table 1, and Table 2) if only 4 items are chosen, then activities related with other people (item 1 and 2) is not selected to further analysis.

Which activity is important to reflect the main indicator? If the expert who evaluate the items doesn't pay attention to the three variables, then it may happens that one or two criteria will not be represented among the items that are selected.

The experimental result as shown in Table 1 and 2 reveal that one of the important component in the achievement of building the basic skill is based on activities related with other people (Item 1 and Item 2) which will not be involved in further evaluation. In fact, the results are not different if the evaluation and scoring of the expert is done using modified Conjoint Analysis. However, results of the analysis show that the researcher can do a wisefull choice, so that all component that are supposed to contribute in one indicator can be fully utilized. The result analysis of Conjoint is shown next in Table 3.

Table 3: Result of conjoint analysis on the importance value of item

Atributes	Highest utility	Lowest utility	Difference	Relative Importance
Activity that being done by myself	3.45	-2.57	6.02	0.73
activities related with other people	0.86	0.00	0.66	0.08
Personal-driven motivation	1.53	0.00	1.53	0.19
Sum			8.21	

Table 3 reveals that activities conducted by the students themselves have a highest important value followed by personal-driven motivation activities and activities related with other people. By this way the result shows ranks of interest that differs with the results derived from multiple comparison method as shown in Table 1 and Table 2. Analysis results derived from modified Conjoint Analysis provide a higher number and more detail information. By using results of Conjoint Analysis as presented in Table 3, the selection of items can be done in groups. For example, because items 3, 4, 5, 6, and 9 that can be done by each student themselves, these five items don't need to be used all together. By using results of pairwise comparison at Table 2, only item 6 and item 5 can be utilized. By this way based on results of Conjoint analysis only four items are recommended for further analysis. They are item 5, 6, 8, and 2.

CONCLUSION

Conjoint Analysis advantageous properties compared with pair wise comparison method in analyzing results of experts judgment of items. In order to use modified conjoint method, there is a need to decide level and attribute of items to analyse. Conjoint analysis is modified with the assumption that only one grade and attribute can be used to evaluate

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