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Using Delphi Technique: Making Sense of Consensus in Concept Mapping Structure and Multiple Choice Questions (MCQ)

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ABSTRACT

The Delphi technique is a widely used and accepted method for gathering data from participants within domain of expertise. The objective of this study is to discuss the process of the three rounds Delphi technique in seeking a consensus of concept mapping structure and Multiple Choice Questions (MCQ) in Diabetic Mellitus subject. In the first, round, participants were given a structured questionnaire regarding item of concept mapping structure and MCQ in Diabetic Mellitus subject. The second were added mean and median value of round one. In the third round were add mean and median value of round two were added. Participants were asked to rate the categorised responses from Round 1 on a scale of 1 to 5, with 1 being “Very irrelevant” and 5 being “Very relevant”. This technique does not require participants to meet face-to-face, thereby making it useful to conduct surveys with qualified people over a wide geographic area. The feedback process allows and encourages the selected Delphi participants to reassess their initial judgements about the information provided in previous iterations. Data is then analysed to check for consistency of experts’ responses between rounds. Instrument developed from the Delphi technique research findings is also examined for validation from experts in educational medical health sciences on content and constructs validity. Analysis on the consensus of data from experts was based on median, inter quartile range and quartile deviation on Round 1, 2 and 3 data. Therefore, the Delphi technique is an appropriate method for identifying significant issues related with academic.

Keywords: *Delphi technique, Concept mapping structure, MCQ (Multiple Choice Questions), Nursing students*

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Introduction

In the literature, Delphi has been applied in various fields such as program planning, needs assessment, policy determination, and resource utilisation. The Delphi technique

was developed by the Rand Corporation in the 1950’s by Dalkey and Helmer (1). It is a method for the “systematic solicitation and collation of judgements on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarised

information and feedback of opinions derived from earlier responses” (2). Predicated on the rationale that, “two heads are better than one, or...more heads are better than one” (3). It is well suited as a method for consensus-building by using a series of questionnaires delivered using multiple iterations to collect data from a panel of selected subjects (1, 4, 5, 6, 7, 8). Members of the groups are selected because they are experts or they have relevant information.

Delbecq et al. (2) specifically indicate that the Delphi technique can be used for achieving the following objectives:

1. To determine or develop a range of possible program alternatives;
2. To explore or expose underlying assumptions or information leading to different judgements;
3. To seek out information which may generate a consensus on the part of the respondent group;
4. To correlate informed judgments on a topic spanning a wide range of disciplines, and;
5. To educate the respondent group as to the diverse and interrelated aspects of the topic (p. 11).

How to Obtain Consensus in Concept Mapping by Using Delphi Technique

Delphi Process

The Delphi process can be continuously iterated until consensus is determined to have been achieved. In this cases, researcher use three round to validate concept maps structure and questionnaire. Three rounds Delphi can achieve group consensus on the issue or problem which are under consideration (2). Custer et al. (9) stated that the consensus or trends towards consensus were documented at the conclusion of Round 3. The three round surveys took place between two months and was conducted via emails and mail. A mail survey offers anonymity and access to widely dispersed samples, and affords respondents

time to complete the questionnaire at their own pace (10).

Subject Selection of Experts

Experts are defined as persons who have knowledge and experience, and ability to influence policy (11). Delphi panelists are selected according to their subject matter expertise so that they can contribute to the topic (12). The criteria used to guide the selection of Delphi subjects, individuals are considered eligible to be invited to participate in a Delphi study if they have related backgrounds and experiences concerning of knowledge related to the target issue. Helmer and Rescher (13), Klee (14), and Oh (15) agreed choosing individuals who are simply knowledgeable concerning the target issue is neither sufficient nor recommended. There are four requirements for expertise: (1) Have knowledge and experience with the issues under investigation; (2) Capacity and willingness to participate; (3) Sufficient time to participate in the Delphi; and (4) Effective communication skills (16).

Size of Delphi Panel

Another problematic issue surrounding the Delphi investigations is the size of panel required (17). There is no agreement regarding the size of the panel and in the Delphi literature it is indicated that panel size varies from a few to hundreds of experts (12, 18, 19, 20, 21, 22). Respondents or participants were identified by a nominating process as having some expertise in virtual teams (2). “The size of the respondent panel is variable. With a homogenous group of people, 10 to 15 participants might be enough” (2).

A good result can be obtained even with small panels of 10–15 individuals (23, 24, 25). The number of experts used in a Delphi study is “generally determined by the number required to constitute a representative pooling of judgements and the information processing capability of the research team” (26). Delbecq et al. (2) encourage giving two weeks for Delphi subjects to respond to each

round (27). However, what constitutes an optimal number of subjects in a Delphi study never reaches a consensus in the literature. In this regard, the number of participants in this Delphi study was 10 participants who were experts at academic field.

Advantages of Delphi Techniques

Provide Anonymity to Respondents

The Delphi techniques provide anonymity to respondents, a controlled feedback process, and the suitability of a variety of statistical analysis techniques to interpret the data (3, 28, 29). One of the primary characteristics and advantages of the Delphi process is subject anonymity which can reduce the effects of dominant individuals which often is a concern when using group-based processes used to collect and synthesize information (3). According to Dalkey (3), noise is that communication which occurs in a group process both distorts the data and deals with group and/or individual interests rather than focusing on problem solving.

Established and Effective Technique

The researcher uses the Delphi techniques because it is established technique and widely uses. By using the Delphi techniques the experts was able to focus on rating, revising, and commenting on the items presented without the distractions normally associated with more traditional face to face meeting in get consensus of concept mapping and Multiple Choice Questions (MCQ). The Delphi techniques were used in many industry sectors, in robotic and advanced automation (30), policy research (31, 32) and nursing (22).

Delphi Technique is Popular Way of Harnessing Opinion

In this technique, the experts were allowed to freely comments on the issues and are free of bias. Delphi technique may be characterised as a method for structuring a group communication process so that the

process is effective in allowing a group of individuals, as a whole, to deal with a complex problem (5). Delphi technique is based on a structural process for collecting and distilling knowledge from a group of experts by means of a series of questionnaires interspersed with controlled opinion feedback (23). A few conditions in which the Delphi technique can be employed (5): Subjective opinions are more suitable than précised analytical technique; Individuals needed to contribute collective ideas are separated by geographic locations but are experienced and considered experts in their respective fields; Individuals involved cannot meet face to face due to time and cost; Anonymity and assurance is needed so that no individual opinion dominates due to influence or personality; and lastly to ensure researcher take into consideration all inputs and opinions.

Disadvantages of Delphi Techniques

Potential of Low Response Rates

The reasons for dropout may be due to lack of time, the Delphi technique can be thought of as too demanding because it involves more than one round or there is no need to amend their earlier replies (33). “In the Delphi technique, [poor response rate] is magnified fourfold because a maximum of four surveys may be sent to the same panelists” (34). Ludwig (26) specifically addresses subject motivation as the key to successful implementation of a Delphi study and investigators need to play an active role in this area to help ensure as high a response rate as possible.

Time Requirements

Increases the workload of investigators and the amount of time needed to successfully complete the data collection process (35). Due to lack of time, the researcher allocates 45 days to the participants to complete the questionnaires. A minimum of 45 days for the administration of a Delphi study is necessary (26, 36). With regard to the time management between iterations, allowing

two weeks for Delphi subjects to respond to each round is encouraged (2). The challenging aspects of conducting a Delphi study is the requirement for proper planning and management because development of the instrument, collecting the data, and administering the questionnaire are interconnected between iterations, ensuring Delphi subjects respond to the investigators on time in analysing the data and developing a new instrument based upon the prior responses.

Manipulated Consensus

The consensus reached in a Delphi may not be a true consensus; it may be a product of specious or manipulated consensus (37). A specious consensus does not contain the best judgement. Instead, it is a compromise position (38). Five common reasons for the failure of Delphi surveys (5) are: Imposing monitor views and preconceptions of a problem upon the respondent group by over-specifying the structure of the Delphi technique and not allowing for contribution of other perspectives related to the problem; Assuming that the Delphi technique can be a surrogate for all other human communications in a given situation; Poor techniques of summarising and presenting the group response and ensuring common interpretations of the evaluation scales utilised in the exercise; Ignoring and not exploring disagreements, so that discouraged dissenters drop out and an artificial consensus is generated; and lastly underestimating the demanding nature of a Delphi technique and the fact that the respondents should be recognised as consultants and properly compensated for their time if the Delphi technique is not an integral part of their job function.

Reliability and Validity

Validity can be divided into three namely: face/content validity, criterion-related validity and construct validity (39). For the validity of assessment using concept maps structure and content (Appendix),

the Delphi technique was carried out by allowing the experts' panel to evaluate the validity before implementation. The Delphi technique was used to collect data and the validity of the survey was enhanced due to the use of experts in the validation process (4, 40). There are 10 expert panel involving in validated the concept mapping structure and questionnaire from Universiti Sains Malaysia (USM), nursing lecturers from USM and Kolej Kejururawatan Kubang Kerian. The Delphi process can be continuously iterated until consensus is achieved. Delphi technique is designed as a group communication process that aims at conducting detailed examinations and discussions of a specific issue for the purpose of goal setting, policy investigation, or predicting the occurrence of future events (36, 41, 42).

Data Collection and Analysis

The Delphi technique involves the use of questionnaires as instrument for data collection. As earlier stated, this study has three rounds modified Delphi technique in the duration of two months: from September 2015–November 2015. All the questionnaires were distributed via emails and mail. Alongside the questionnaires was a formal letter of invitation to the experts to participate as members of the Delphi panel. A brief explanation on the Delphi procedure, with instruction on how to complete the questionnaire was included. Researcher sent e-mail to the Delphi panel as a follow-up when close to the deadline Delphi round, to give warning to all Delphi panel. Each expert was given a code name (i.e., P1 = Panel 1; P2 = Panel 2 etc.) to allow for tracking of returned responses and to track the individual's feedback and ease in data analysis. To ensure ease in completion and return of the questionnaires, a user friendly questionnaire was developed by using word document. Similar study done by Chou (43).

The major statistics used in Delphi studies are measures of central tendency and level of dispersion (standard deviation and inter-quartile range) in order to present

information concerning the collective judgements of respondents (44). Generally, the uses of median and mode are favoured. In the literature, the use of median score, based on Likert-type scale, is strongly favoured (45, 46, 47). One criterion recommends that consensus is achieved by having 80% of subjects' votes falling within two categories on a seven-point scale (36). Green (48) suggests that at least 70% of Delphi subjects need to rate three or higher on a four point Likert-type scale (49, 50) and the median has to be at 3.25 or higher (50).

Delphi Round 1

The questionnaires were emailed and mail to all ten experts together with an official letter of invitation and feedback form. All ten experts successfully responded with feedback, even though some of them exceeded the deadline. In the first round, respondents were given a structured questionnaire regarding item of concept mapping and Multiple Choice Questions (MCQ) in Diabetic Mellitus subject. The researcher provided a guideline for the expert's panel regarding the score to given. The total score is 100%. In the first round, the Delphi panels were provided with closed-ended, 5-point Likert scale questions in order to elicit their level of agreement with a series of statements regarding the relative importance of concept mapping structure that developed by researcher and MCQ. After receiving participants' responses, the researcher convert the collected information into structured questionnaire. Participants were asked to rate the categorised responses from Round 1 on a scale of 1 to 5, with 1 = Very irrelevant; 2 = Not relevant; 3 = Less relevant; 4 = Relevant; and 5 = Very relevant). This questionnaire was used as the survey instrument for the second round of data collection. It should be noted that it is both an acceptable and a common modification of the Delphi process format to use a structured questionnaire in Round 1 based an extensive review of the literature. Kerlinger (51) noted that the use of a modified Delphi process is appropriate if basic information concerning the target issue is available and usable.

The returns of the Round 1 questionnaires were analysed. The return of the Round 2 questionnaires was analysed by applying SPSS version 21 for descriptive statistics. The results were analysed by using the mean and median score. The researcher uses the mean and median score from five point Likert-type scale results. In the literature, the use of median score, based on Likert-type scale, is strongly favoured (45, 46, 47). Basically, consensus on a topic can be decided if a certain percentage of the votes falls within a prescribed range (52). One criterion recommends that consensus is achieved by having 80% of subjects' votes fall within two categories on a seven-point scale (36). Green (48) suggests that at least 70% of Delphi subjects need to rate three or higher on a four point Likert-type scale and the median has to be at 3.25 or higher. The major statistics used in Delphi studies are measures of central tendency (means, median, and mode) and level of dispersion (standard deviation and inter-quartile range) in order to present information concerning the collective judgements of respondents (44). Generally, the uses of median and mode are favoured.

The degree of importance and consensus are justified after each Delphi round before interpretation. The group response median value and the inter quartile range distribution are usually referred as the reference for the degree of importance and consensus in the past research (53, 54, 55). For this study, the analysis of consensus data of the experts was done based on median, inter quartile range and quartile deviation on Round 1, 2 and 3 data. After the median value, inter quartile range and quartile deviations are identified, the subsequent analysis technique is classifying items according to the consensus and importance level. For this study, the consensus level is divided into three levels (high, medium and no consensus) and importance level is divided into two levels (very high and low). The consensus level was determined as high if quartile deviation is less than or equal to 0.5, medium if quartile deviation is in between 0.5 and 1 and no consensus if quartile deviation is more

than 1. The importance level are very high if the median value was 4 and above and low if the median value is less than 3.5.

Delphi Round 2

The questionnaires for Round 2 were sent via email and mail that indicated the next round and what the experts should do. In Round 2, again two weeks were given to the panel to respond. After a given a date, a few follow up emails, messages via Short Messaging Service (SMS) or telephone calls was made. Due to many valuable response questionnaire format has been changed from portrait to landscape layout, to facilitate a better understanding of the experts, where this Round 2 researcher added the results mean and median of the response of the first round. On obtaining get the feedback from participants', the researcher combines together all the feedback in one summary. In the second round, each Delphi participant receives a second questionnaire and is asked to review the items summarised by the investigator based on the information provided in the first round. Accordingly, Delphi panellists may be required to rate or "rank-order items to establish preliminary priorities among items. As a result of Round 2, "areas of disagreement and agreement are identified" (26). In some cases, Delphi panellists are asked to state the rationale concerning rating priorities among items (47). In this round, consensus begins forming and the actual outcomes can be presented among the participants' responses (47). The return of the Round 2 questionnaires was analysed by applying SPSS version 21 for descriptive statistics. The results were analysed by using the mean and median score.

The findings of Delphi Round 2 were based on a 5-point Likert scale. In the Second Round, the median and interquartile range was calculated. Analysis of the Second Round was based on the median and interquartile range of responses. Items were arranged in descending order starting from the highest. The items in the second round were based on the first round findings from the interviews with experts. The questionnaire was in three sections and responses were based on a five

point Likert scale as in Round 1. Analysis of the results from this round involved the median and interquartile range. The median score was used to analyse the level of consensus of experts.

Delphi Round 3

As with Round 1 and 2, two weeks were given to the panel members to respond in Round 3. After a given a date, a few follow-up emails, messages via SMS or telephone calls was made. In the third round and often final round, each Delphi panellist receives a questionnaire that includes the items and ratings summarised by the researcher in the previous round and are asked to revise his/her judgements in order to get the consensus. Participants were asked to review their response, respond again using the same rating scale, and add any comments regarding the responses. From the significant number of extra comments in Round 2, it could be concluded that most of the participants found the same finding. Some of these comments have been cited in the text and some others are presented in the Delphi technique Round 3. The survey was successful in providing a general consensus regarding MCQ and concept mapping structure. This round provide Delphi panellists with the opportunity to make further clarifications of both the information and their judgements of the relative importance of the items. The list of remaining items, their ratings, minority opinions, and items achieving consensus are distributed to the panellists. This round provides a final opportunity for participants to revise their judgements.

In the third round, the experts can retain their original answer as given in Round 2 where their answers are given as interquartile ranges. Experts might change their answer in the third round if their initial responses fell outside the interquartile range or the experts may choose to retain answers that fall outside the interquartile range, and give their reasons for retaining their answers. The third round is aimed at achieving consensus and narrowing the range of differences in opinion among the experts. After the third round, the data

were analysed and the median as well as interquartile range calculated. Findings from the Delphi third round were used to answer the research question.

Summary

The Delphi technique becomes an important in data collection methodology with a wide variety of applications and uses for people who want to gather information of the study interest. However, subject selection and the time frames for conducting and completing a Delphi study are two areas which should be considered carefully prior to initiating the study. Cooperation from participants' in Delphi as the key to the successful implementation and investigators need to play an active role in this area to help ensure as high a response rate as possible. Based on literature review, it appears that Delphi is the most popular consensus method because of the need and value of obtaining consensus opinions and may be applied to evaluate clinical, educational, and policy issues in oral health care (56).

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