

## The Delphi Technique as a Method to Obtain Consensus in Health Care Education Research

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### ABSTRACT

The Delphi technique is a widely used and accepted method to obtain consensus among the experts. This technique uses a judgement to prove the accuracy of the content item when evaluating instrument. The objective of this study is to discuss the process of the three rounds Delphi technique to obtain consensus of concept mapping care plan and multiple choice questions (MCQ) in Diabetic Mellitus subject. In the first round, participants were given a structured questionnaire regarding item of concept mapping care plan and MCQ in Diabetic Mellitus subject. In the second round, the mean and median values of round one were added. In the third round, the mean and median values 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 that participants be collocated or 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. The analysis of consensus data of the experts was done based on median, inter quartile range and quartile deviation on round one, two and three data. The median score was used to analyse the level of consensus of experts and result shows that in all three rounds Delphi the medium result more than 4. It reported that level of importance of the statements were high. As a conclusion, the concept mapping care plan and MCQ have meets the consensus by using three rounds of Delphi techniques. Therefore, the Delphi technique is the best method to obtain consensus in health care education research.

**Keywords:** *Delphi technique, concept mapping care plan, multiple choice questions (MCQ), health care education research*

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## INTRODUCTION

The Delphi technique is a widely used and was accepted method for gathering data from participants within domain of expertise. This technique uses a judgement to prove the accuracy until consensus is determined. The Delphi technique was developed by the Rand Corporation in the 1950's by Dalkey and Helmer (1). In Delphi technique, cooperation from participants' is the key to the 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 (2). 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 (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, 4–8).

Justification for the selection of the Delphi technique by researcher because Delphi method is a systematic way of combining the individual results obtained with the conclusion (9). In addition, the Delphi technique is established technique and widely uses. The selection of a research technique consider a few things such as the number of sample size, research objective, research problem, research practices and skill. The Delphi technique is a qualitative tool, which is used to elicit expert's opinion, without the cost of 'face-to-face' interaction, when information about the existing problem is restricted (10).

### Objective of Study

The objective of this study is to discuss the process of the three rounds Delphi technique in seeking a consensus of concept mapping care plan and multiple choice questions (MCQ) in Diabetic Mellitus subject.

## LITERATURE REVIEW

### Subject Selection of Experts

Dalkey (11) defines the experts in the Delphi technique as a knowledgeable and skilled in a particular field. Experts are defined as persons who have knowledge and experience, and ability to influence policy (12). Delphi panelists are selected according to their subject matter expertise so that they can contribute to the topic (13). Regarding 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 somewhat related backgrounds and experiences concerning of knowledge related to the target issue. Helmer and Rescher (14), Klee (15), and Oh (16) concur those 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 (17).

### Size of Delphi Panel

The more participants' in Delphi are getting better (11). Another problematic issue surrounding the Delphi investigations is the size of panel required (18). 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 (13, 19–23). Respondents or participants were identified by a nominating process as having some expertise in virtual teams (24). "The size of the respondent panel is variable. With a homogenous group of people, ten to fifteen participants might be enough" (24).

A good result can be obtained even with small panels of 10–15 individuals (25–27). 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” (28). Delbecq et al. (24) note that giving two weeks for Delphi subjects to respond to each round is encouraged (29).

## METHODOLOGY

The Delphi process can be continuously iterated until consensus is determined to have been achieved. In this cases, researcher has decided to use three rounds for validate concept mapping care plan and MCQ. Three rounds Delphi can achieve group consensus on the issue or problem which are under consideration (24). 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 care plan and MCQ. For this study, the expert panels were selected who met the specific qualifications and expertise in the study subject. In this technique, the experts were given free comments related the issues and it is free of bias. Delphi technique may be characterized 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 (25).

## RELIABILITY AND VALIDITY

Validity can be divided into three namely: face/content validity, criterion- related validity and construct validity (30). For the validity of assessment using concept mapping care plan (Appendix A) and MCQ questions, the Delphi technique was done by given to 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, 31). There are ten expert panels involving in validated the concept mapping care plan and questionnaire from Universiti Sains Malaysia (USM), lecturer nursing from USM and tutor nursing from Kolej Kejururawatan Kubang Kerian. The Delphi process can be continuously iterated until consensus is determined to have been 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 (32–34).

## DATA COLLECTION

The Delphi technique involves the use of questionnaires as instrument for data collection. This study have three rounds modified Delphi technique and the duration was two months: Starting from September 2015–November 2015. Each expert panel was given two weeks based on Delbecq et al. (24) for each round of Delphi, however, due to time constraints and the ultimate expert panel, it takes two months. 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.

All the questionnaires were distributed via emails and mail. 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. It also to make easier when do data analysis. To ensure ease in completion and return of the questionnaires, a user friendly questionnaire was developed by using word document. It is similar in study done by Chou (35).

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 (36). 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 (37–39). One criterion recommends that consensus is achieved by having 80% of subjects votes falling within two categories on a seven-point scale (32). Green (40) suggests that at least 70% of Delphi subjects need to rate three or higher on a four point Likert-type scale (41, 42) and the median has to be at 3.25 or higher (42).

### Delphi Round One

The questionnaires were emailed and mail to all ten experts together with an official letter of invitation and feedback form. In the first round, respondents were given a structured questionnaire regarding item of concept mapping care plan and MCQ in Diabetic Mellitus subject. The researcher provided a guideline for the expert's panel regarding the scores to given. The total scores are 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 care plan and MCQ that developed by researcher. In round one, offers a suitable environment to the experts to anonymously discuss and express themselves. After receiving participants' responses, researcher needs to convert the collected information into a well-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 is 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 that is based upon an extensive review of the literature. Kerlinger (43) 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 23 for descriptive statistics. Basically, consensus on a topic can be decided if a certain percentage of the votes falls within a prescribed range (44). 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 (36). Generally, the uses of median and mode are favoured.

The degree of importance and consensus are justified after each Delphi round before making 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 (45–47). For the example of 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 level and importance level.

### Delphi Round Two

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. In Round 2, the question was modified based on the experts' panel comments. Results on Round 1 also indicated that most of experts were give scores between four to

five. Due to many valuable responses the format of questionnaire was changed from portrait to the landscape layout, so that easier for the experts understanding, where in this Round 2 the researcher add result of min and median that got from respond Round 1. When get the feedback from participants', the researcher will combine together all the feedback in one summary of the comments. In the second round, each Delphi participant received a second questionnaire and they were 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" (28). In some cases, Delphi panellists were asked to state the rationale concerning rating priorities among items (39). In this round, consensus begins forming and the actual outcomes can be presented among the participants' responses (39).

### Delphi Round Three

As with Round 1 and Round 2, two weeks were given to the panel members to respond in Round 3. In the third round and often final round, each Delphi panellist received a questionnaire included the items and ratings summarised by the researcher in the previous round and were 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. 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 concept mapping care plan and MCQ.

This round gives Delphi panellists an opportunity to make further clarifications on 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. 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 their 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.

The degree of importance and consensus are justified after each Delphi round before making interpretation. In this study, the analysis of consensus data of the experts was done based on median, inter quartile range and quartile deviation on round one, two and three data. After the median value, inter quartile range and quartile deviations are identified, the subsequent analysis technique is classifying items according to the consensus level and importance level. In 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.

## RESULT AND ANALYSIS

In the validation process, the researcher using three rounds Delphi techniques to validate and concept mapping care plan (9 items) and MCQ (20 items). In this

Delphi technique ten experts were invited to participate. The experts were contacted through personal phone calls or email. In this study, the researcher used formula from Norizan (45) as a guideline to get the consensus and importance of items (refer Tables 1 and 2). The value of inter quartile range using the formula  $(Q3-Q1)$  were determined using Microsoft SPSS version

23.0 and reported in the round three questionnaire. The data from the round three were treated in a similar way. The formula for identifying deviation (QD) is as follows:

$$\text{Formula: QD} = \frac{\text{Inter - quartile range}}{2} = \frac{(Q3 - Q1)}{2}$$

**Table 1:** Level of consensus and importance

Quartile deviation (QD)	Level of consensus	Median	Level of importance
Less or equal to 0.5 ( $QD \leq 0.5$ )	High	4 and above ( $M \geq 4$ )	High
More than 0.5 and less than or equal to 1.0 ( $0.5 < QD \leq 1.0$ )	Moderate	3.5 and less ( $M \leq 3.5$ )	Low
More than 1.0 ( $QD > 1.0$ )	Low and no consensus	-	-

Note: Formula by Norizan (45) on classifications of consensus was determined at three levels.

**Table 2:** Description of the classifications

Level	Description
High importance – high consensus	Items that achieved high consensus with QD value of less or equal to 0.5, but are regarded as important and very important with median of 4 and above $[(QD \leq 0.5) \text{ and } (M \geq 4)]$
High importance – moderate consensus	Items that achieved moderate consensus with QD value of more than 0.5 and less of equal to 1.0, but are regarded as important and very important with median 4 and above $[(0.5 < QD \leq 1.0) \text{ and } (M \geq 4)]$
High importance – no consensus	Items that did not achieve consensus with QD value of more than 1.0, but are regarded as important and very important with median of 4 and above $[(QD > 1.0) \text{ and } (M \geq 4)]$
Low importance – high consensus	Items that achieved high consensus with QD value of less or equal to 0.5, but are regarded as moderate and not important with median of 3.5 and less $[(QD \leq 0.5) \text{ and } (M \leq 3.5)]$
Low importance – moderate consensus	Items that achieved moderate consensus with QD value of more than 0.5 and less of equal to 1.0, but are regarded as moderate and not important with median of 3.5 and less $[(QD > 0.5) \text{ and } (M \leq 3.5)]$
Low importance – no consensus	Items that did not achieve consensus with QD value of more than 1.0, but are regarded as moderate and not important with median of 3.5 and less $[(QD > 1.0) \text{ and } (M \leq 3.5)]$

Source: Adapted from Norizan (45).

**Table 3:** Consensus in concept mapping care plan through three round Delphi technique

Item	Round of Delphi								
	Round 1			Round 2			Round 3		
	Median	Mean	QD	Median	Mean	QD	Median	Mean	QD
Statement 1	5.0	4.7	0.5	5.0	4.7	0.5	5.0	4.7	0.5
Statement 2	5.0	4.7	0.5	5.0	4.7	0.5	5.0	4.7	0.5
Statement 3	5.0	5.0	0	5.0	4.7	0.5	5.0	4.7	0.5
Statement 4	5.0	5.0	0	5.0	4.4	1.0	5.0	4.7	0.5
Statement 5	5.0	5.0	0	5.0	4.4	1.0	5.0	4.7	0.5
Statement 6	5.0	5.0	0	5.0	4.7	0.5	5.0	4.7	0.5
Statement 7	5.0	4.7	0.5	5.0	4.1	1.5	5.0	4.7	0.5
Statement 8	5.0	5.0	0	5.0	4.7	0.5	5.0	4.7	0.5
Statement 9	5.0	5.0	0	5.0	4.7	0.5	5.0	4.7	0.5

**Table 4:** Consensus in multiple choice questions (MCQ) through three round Delphi technique

Item	Round of Delphi								
	Round 1			Round 2			Round 3		
	Median	Mean	QD	Median	Mean	QD	Median	Mean	QD
Statement 1	4.0	3.5	2.0	4.0	4.0	1.0	5.0	4.6	0.5
Statement 2	4.0	3.8	1.5	4.0	4.0	1.0	4.5	4.5	0.5
Statement 3	4.0	3.8	1.5	4.0	4.3	0.5	4.5	4.5	0.5
Statement 4	4.0	4.4	0.5	3.0	3.8	1.0	4.0	4.4	0.5
Statement 5	4.0	4.1	1.0	5.0	4.4	1.0	5.0	4.6	0.5
Statement 6	4.0	3.5	2	4.0	3.7	0.5	5.0	4.8	0.5
Statement 7	4.0	3.8	1.5	3.0	3.4	0.5	4.5	4.7	0.5
Statement 8	4.0	3.8	1.5	4.0	3.7	0.5	4.5	4.6	0.5
Statement 9	4.0	4.1	1.0	5.0	4.4	1.0	5.0	4.7	0.5
Statement 10	4.0	4.1	1.0	5.0	4.4	1.0	4.5	4.5	0.5
Statement 11	4.0	4.0	0	4.0	4.4	0.5	5.0	4.8	0.5
Statement 12	5.0	4.7	0.5	4.0	4.1	1.0	4.5	4.5	0.5
Statement 13	3.0	3.3	0.5	5.0	4.7	0.5	4.0	4.4	0.5
Statement 14	4.0	4.0	0	5.0	4.4	1.0	4.5	4.5	0.5
Statement 15	3.0	3.3	0.5	4.0	4.4	0.5	4.0	4.3	0.5
Statement 16	4.0	4.4	0.5	5.0	4.4	1.0	5.0	4.6	0.5
Statement 17	4.0	3.5	2.0	4.0	3.4	1.0	4.0	4.1	1.0
Statement 18	4.0	3.5	2.0	4.0	4.0	0	4.0	4.4	0.5
Statement 19	4.0	3.8	1.5	4.0	3.7	0.5	4.5	4.5	0.5
Statement 20	3.0	3.2	2.0	4.0	4.0	0	4.0	4.2	1.0

Table 3 show that in first, second and third Delphi rounds, all the Quartile Deviation (QD) of the statements was less or equal to 0.5 ( $QD \leq 0.5$ ), it indicate that the level of consensus was high. In others word all expert panels' responses lying into scale of 5 (very relevant). The median scores were used to analyse the level of consensus of experts and result shows that in all three rounds Delphi the medium result more than 4. It reported that level of importance of the statements were high. In conclusion the concept mapping care plan reaching consensus in Delphi technique and provided a reliable manner to conclude that ten of expert panels overall agreement upon the nine statements assumed.

Table 4 show that in the first Delphi round, there are statements have low and no consensus which were Statements 1, 2, 3, 6, 7, 8, 17, 18, 19 and 20. The Quartile Deviation (QD) may be above 1. Respectively, there may be a case where the experts panel responses lying into scale of 2 (not relevant). However after the correction were made, they were denoting overall consensus among ten statements. This in turn can conclude that ten of expert panels overall agreement upon the 20 statements assumed. The median score was used to analyse the level of consensus of experts. In first Delphi round, the statements was less than 3.5 were Statements 13, 15 and 20. In Delphi Round Two, after the modified was done based on the comments of experts, these statements got the medium result of 3.5. However the statements of Item 4 and 7 got the median less 3.5. In Delphi Round 3, all the statements got the value of medium 4 and above, which reported that level of importance of the statements were high, except Statements 17 and 20, item that achieved moderate consensus with QD value equal to 1.0, and very important with the value of median was 4.

## DISCUSSION

### Consensus in Concept Mapping Care Plan through Three Rounds Delphi Technique

The Delphi techniques are widely used and accepted method for gathering data from participants within domain of expertise (2). The Delphi process can be continuously iterated until consensus is determined to have been achieved (2). In the validation process, the researcher using three rounds Delphi techniques to validate concept mapping structure (9 items). The three rounds survey took place between two months and was conducted via emails and mail.

After three rounds of Delphi, researcher found that the concept mapping structure shows at agreed upon by all the expert panels (ten experts) have get a positive comment. The Delphi techniques result shows that the Quartile Deviation (QD) of the statements was less or equal to 0.5 ( $QD \leq 0.5$ ), it indicate that the level of consensus was high. In other word all expert panel responses lying into scale of 5 (very relevant).

The development of concept mapping care plan at clinical practices was used to evaluate the students academic achievement in clinical pratices. Concept mapping care plan is useful for students' preparation for clinical practices. In nursing education, concept mapping has been used as a teaching strategy to provide students the opportunity to visualise and integrate theories with the nursing process. This concept mapping care plan allowed the students to determine the patient problems and interrelationships based on analyse the patient data and plan comprehensive nursing care. By using concept mapping care plan, the students have a total view of patient care, where patient's medical conditions and nursing education can be made to be related. It promotes a holistic view of the patient care and prepare student to think critically when the student

understand the concept, relationship to plan and evaluate nursing care. The students whose using concept mapping can see the holistic view of the patients (48). This representation allows the students to see a patient's problem and visually connect with nursing interventions (49).

### **Consensus in Multiple Choice Questions (MCQ) through Three Rounds Delphi Technique**

The most common and frequently used by the teacher-constructed tests to testing students' knowledge was multiple choice questions (MCQ) (50). In nursing research and education, multiple choice questions are used extensively and play a fundamental role in the design of research studies or educational programs (51). In the context of nursing research and/or education, the literature review regarding format, structure, validity and reliability in MCQ is not many and most of the current literature in this area is based on opinion or consensus.

In the validation process, the researcher using three rounds Delphi techniques to validate MCQ (20 items). After completed three rounds of Delphi techniques, result shows that Quartile Deviation (QD) of the statements was less or equal to 0.5 ( $QD \leq 0.5$ ), except the Statements of 17 and 20, it indicate that the level of consensus was high. In other word all expert panel responses lying into scale of 5 (very relevant). The median score was used to analyse the level of consensus of experts and result shows that in all three rounds Delphi the medium result more than 4. It was reported that level of importance of the statements were high.

Similar finding in Miller (52) study to ascertain the opinion of experts on indicators considered to measure the movement towards sustainable tourism. In these statements, experts were asked to provide their opinion choosing a value from 1 (strongly disagree) to 5 (strongly agree). In such a case, the consensus is proposed to be

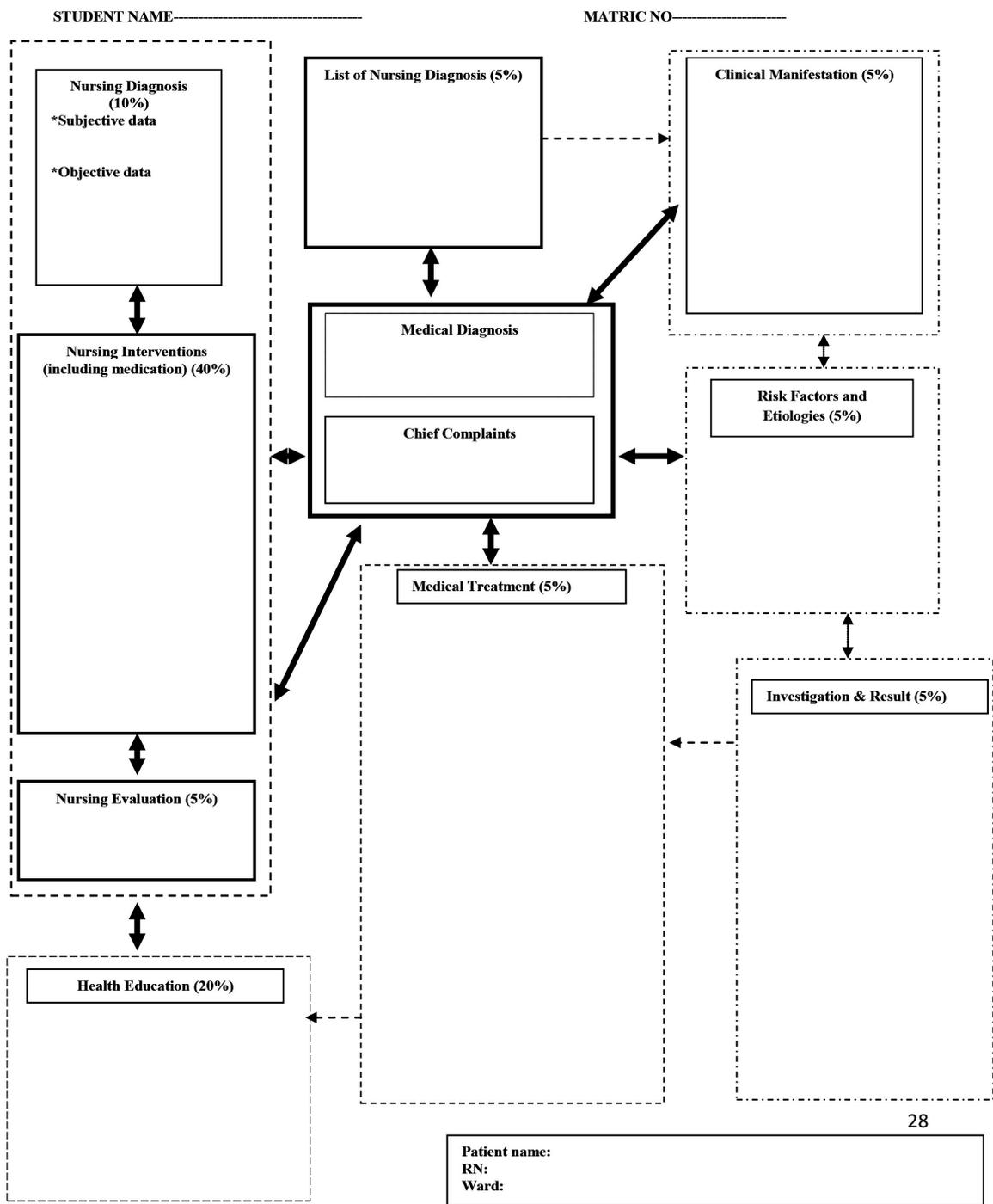
assessed using three measures combinatory: (1) The 51% of experts responding to the category 'strongly', (2) the interquartile range below 1 (53, 54); and (3) the standard deviation below 1.5 (55).

MCQ must be developing base on or above the students' cognitive level. The objective of MCQ test is to enhance and promote students' critical thinking. For that reason, the development of the questions at analyse, synthesise and evaluation levels. The questions format cover must be analyse, synthesise and evaluate by the students. MCQ have long been applied in assessing the student critical thinking ability used to assess student academic performance, and to develop critical thinking ability (56). According to Morrison & Free (57) and Youngblood & Beitz (58), the students can make a connection learning in theoretical concept in the classroom and the clinical practices if the MCQ questions relate to the clinical situations.

### **CONCLUSION**

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. Delphi technique was used because this is the best method to obtain consensus in health care education research. This technique uses a judgement to prove the accuracy of the content item when evaluating instrument. 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. As a conclusion, the concept mapping care plan and MCQ have meets the consensus by using three rounds of Delphi techniques. Concept mapping care plan enhanced the knowledge and the understanding of the nursing students and also improving the quality of clinical education.

**APPENDIX A: ASSESSMENT USING CONCEPT MAPPING CARE PLAN**



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