

Rediscovering the Delphi Technique: A Review of the Literature

Milena P. Staykova

Jefferson College of Health Sciences at Carilion Clinic
Indiana Wesleyan University. United States

The popularity of the Delphi technique as a research method has declined in the last decades. A review of the literature focusing on the technique presents a new and different opportunity for rediscovering the benefits of this type of research. Few recent studies have examined the process, compared the validity and reliability, and identified the appropriate sample size for the technique. In this paper, the author will include a review of the literature to discuss the pros and cons of using the Delphi technique in research related to sensitive topics including the competencies of nurse educators in curriculum.

Researchers from different disciplines have used the Delphi technique in nursing and medical field in attempt to explore new topics or achieve an expert-directed consensus on sensitive issues and complex problems (Bobonich & Cooper, 2012; Jing et al., 2013, Lock, 2011; Iqbal & Popin-Young, 2009; Tack et al., 2017). Limiting group pressure and authority are some of the main benefits of that research approach (Boobonich & Cooper, 2012, Humphrey-Murto, Varpio, Gonsalves, & Wood, 2017; Mannix, 2011; Tack et al., 2017). The other benefits range from exchanging ideas based on iterative feedback and creating a matrix for interactive communication, respectful collaboration leading to group consensus (Lock, 2011).

Reviewing the published literature on the Delphi technique, the author found that the terminology “Delphi technique” was frequently interchangeable with the terms “Delphi study”, “Delphi method”, and “Delphi design”. Plessus and Human (2007) searched the literature from the 1975s to 2007 to define the Delphi technique. Forth et al. (2016) screened 101 studies in a systematic review to conclude that 88.2% used Delphi technique to define nursing competencies and curriculum. The authors reported challenges defining the process, sample size, number of rounds, and initial questionnaire. Humphrey-Murto et al., (2017) concluded limitations in defining the consensus process. McPherson, Reese, and Wendler (2018) conducted a literature review to describe the Delphi method as a qualitative research approach. Only few studies included discussion related to the process, compared the validity and reliability, and identified the appropriate sample size for the technique

Researchers faced difficulties defining the technique because of its adaptive nature and multiple interpretations. Many authors concluded that the Delphi technique was a group communication process with a scientific merit for collecting data, either qualitative and quantitative (Asghari, Samadi, & Rashidian, 2013; Jing et al., 2013; Bobonich & Cooper, 2012; Dewald, 2012; Lakanmaa et al., 2012; McPherson, Reese, & Wendler, 2018; Staykova 2012, Tack et al., 2017).

Challenges in defining the Delphi technique were noted when the literature was searched from 2008 to 2018. Yes, nursing researchers have used the constructs (elements) of the Delphi technique to set up a multi-round forum for discussions when they have studied clinical or educational competencies in the nursing profession (Tack et al., 2017). However, there were

few studies discussing the technique's process, sample size, and validity and reliability. The purpose of this critical appraisal was to examine the state of literature on the Delphi technique and its process, validity and reliability, and sample size. Another aim was to identify published studies that have used the Delphi technique in identifying nursing competencies and curriculum standards.

METHOD AND SEARCH STRATEGY

The critical appraisal is a method for inclusive review of the literature on a specific topic. The review of this literature started with searching two major and most popular electronic databases such as EBSCO with its multiple databases and ProQuest integrating 16 databases. The initial search included the terms "Delphi technique", "Delphi method", "Delphi design", "nursing competencies", and "curriculum". In an advanced search option of the databases, the following criteria were entered (1) published date from 2008 to 2018, (2) English language, (3) peer-review scholarly journals, and (4) humans. The initial literature search resulted in 11,363 publications using the Boolean phrase "Delphi technique"; the key terms "Delphi method" yielded 1,879 results; the words "Delphi study" led to 4,143 findings, the words "Delphi design" reduced it to 112 papers. Combining the words "Delphi technique" and "definition" resulted in 818 items. Searching for "Delphi technique" and "validity" resulted in 2 publications. Searching for "Delphi technique" and "sample" resulted in 1 article. Combining the key terms "Delphi technique" and "nursing competence" resulted in 27 studies, adding the word "curriculum" discovered only 3 studies.

Similar results were found when searching the ProQuest database. Using the key terms "Delphi technique" and "nursing competencies" resulted in 203 publications. Adding the word "curriculum" reduced it to 127 publications. However, after manually reviewing the 127 papers it was noted that not all the publications included the words "Delphi technique", "nursing", "curriculum", in a combination or were research-based, i.e. of the 128 publications, 103 were listed as non-research reports, 20 were general information, five were news, and three were conference proceedings. From both databases, only 21 studies met the inclusion criteria and the key word combinations. These studies were manually reviewed and summarized in this paper.

THE HISTORY OF THE DELPHI TECHNIQUE

The history of the Delphi technique can be traced back to ancient Greek mythology and the poetry of Homer (Kennedy, 2004; Plessus & Human, 2007; Whitehead, 2008). A Delphi oracle gathered information from many sources and was considered "one of the most truthful" (Kennedy, 2004, p. 505) and "trustworthy" of expert informants in the myths (Whitehead, 2008, p. 893). In a similar manner, the modern Delphi researchers who gather opinions from many sources are considered experts. Experts' willingness to participate in the multi-round forum and come to a consensus with colleagues, by offering constructive feedback, are the key features of a study based on a Delphi technique.

Norman Dalkey introduced the Delphi technique around 1940-1950 for a RAND corporation military defense project "Project Delphi" concerning the decision-making for atomic bombing (Humphrey-Murto et al., 2017; Plessus & Human, 2007; Skulmoski et al., 2007). Olaf Helmer and Norman Dalkey pioneered and validated the Delphi technique as a scientifically rigorous research strategy with a statistical significance that was more accurate than group or individual opinions (Plessus & Human, 2007). The early Delphi method included four elements- iteration, anonymity, controlled feedback, and statistical data analysis (Plessus & Human, 2007). To summarize the Delphi research process, Humphrey-Murto (2017) and Kennedy (2004) contended that the Delphi method provided an opportunity for experts

(panelists) to share their knowledge and judgments about a complex problem anonymously. The experts reviewed how respective feedback aligned with other group members and then it allowed them to change their judgments if desired. The collaborative work continued over a series of iterative rounds until consensus and stability (majority agreement often called majority ruling) were reached (Humphrey-Murto, 2017; Kennedy, 2004).

CONSTRUCTS OF DELPHI TECHNIQUE

Construct is defined as a combination of concepts (Polit & Beck, 2017). The Delphi technique has several fundamental constructs that can be organized as follows: (1) the Delphi process and instrument, (2) anonymity and multi-round iterations with a controlled feedback, (3) the consensus or majority ruling, (4) expert panel responses based on statistical input, (5) reliability and validity, and (6) sample size and choices. In a study, the rounds may range from a minimum of two to a maximum of five or more rounds; it may include multiple submissions of the same or similar questionnaires. Therefore, a clear explanation of the nature of the Delphi technique is critical for participant retention. The multi-round iterations may confuse novice researchers. For that reason, a guide in a Delphi data collection procedure for a principal investigator contemplating a Delphi study is outlined in Table 1 with a summary of specific actions for each step.

Table 1
The Delphi Technique Process

Step	Purpose	Comments
Step 1	<ol style="list-style-type: none"> 1. Select the topic and objectives 2. Identify candidates 3. Select and invite participants 4. Develop/obtain permission to use instrument or questionnaire and label it as Survey or Questionnaire #1 5. Send the 1st package 	<ol style="list-style-type: none"> 1a. Research the literature for the state of evidence on the topic 1b. Create at least 3 measurable objectives, use active verbs based on Bloom's taxonomy. 2a. Network with peers, reach out to advisors and mentors 2b. Review qualifications of potential candidates (CV, webbios) from public sites i.e. organizations, institutions. 3 a. Select participants based on the eligibility/study criteria 3b. Send a Letter of Invitation with a Letter of Informed Consent (provide ample time for the candidates to review the purpose, benefits and risks, and logistics i.e. time commitment). 3c. Prepare survey or questionnaire #1 (validated questionnaire is preferred; with original instrument run Cronbach alfa) 4a. Select a scale for data collection 5. The 1st package should include: Cover Letter, Questionnaire #1, Letter of Introduction, Instructions, and Deadlines.
Step 2	<ol style="list-style-type: none"> 1. Reminders 	<ol style="list-style-type: none"> 1a. If necessary send weekly reminders i.e. email, twitter, personal calls
Step 3	<ol style="list-style-type: none"> 1. Collect data from Round 1 2. Analyze the data from Round 1 3. Follow up on Round 1 	<ol style="list-style-type: none"> 1. Calculate return responses 2a. Use SPSS or Excel spread sheet to enter data for analysis 2b. Calculate percentage (%), mean (μ), standard deviation (SD) from Round 1 3. Send a follow-up letter or call to remind the participants to complete the questionnaire within the deadline
Step 4	<ol style="list-style-type: none"> 1. Introduce Round 2 survey or Questionnaire 2. Add percentage values and calculate the mean 	<ol style="list-style-type: none"> 1a. Thank participants for completing Round 1 1b. Reiterate the study purpose and the repetitive nature of the survey or questionnaire 1c. Introduce Round 2 with instructions and questionnaire #2 2a. In questionnaire #2 include (a) statistical data based on the panel responses for each item with $\%$, μ, SD (b) summarize responses from the open-ended questions, and (c) provide a box for revisions to "agree" with panelists or for new entry/response <p><i>Note:</i> The panelists should review the summarized answers of the other participants and decide to come to collaborative consensus with the participants or keep prior answers</p>
Step 5	<ol style="list-style-type: none"> 1. Collect data from Round 2 2. Analyze data 3. Follow up on Round 2 	<ol style="list-style-type: none"> 1a. Use Excel spreadsheet or SPSS 2. Calculate return responses $\%$, μ, SD 3. Send a follow-up letter to remind the participants of the deadlines
Step 6	<ol style="list-style-type: none"> 1. Introduce Round 3 2. Analyze data 3. Follow up on Round 3 	<ol style="list-style-type: none"> 1. Thank participants for completing Round 2 1b. Introduce Round 3 and reiterate the study purpose and the repetitive nature of the questionnaire 2. Calculate return responses $\%$, μ, SD 3. Send a follow-up letter to remind the participants of the deadlines
Subsequent Steps	<ol style="list-style-type: none"> 1. Subsequent rounds will repeat step 2, 3, 4, 5, and 6 	<ol style="list-style-type: none"> 1. A repetition of rounds may continue until the study aim is achieved i.e. all members of the panel have come to consensus or majority ruling as established by the principal investigator was reached
Final Step	<ol style="list-style-type: none"> 1. Final round 2. Send a final letter 	<ol style="list-style-type: none"> 1. All members of the panel have reached consensus or majority ruling was established. <p><i>Note:</i> In case where consensus is not reached, the investigator may settle for majority ruling</p> <ol style="list-style-type: none"> 2a. Notify the participants for the closing of the study 2b. Include a "Thank you!" note for participation 2c. If the study includes an incentive, explain how and when the participants will receive it

Copyright MPStaykova, 2018. Request permission at mpstaykova@jchs.edu

THE DELPHI TECHNIQUE PROCESS

The Delphi technique is a complex, multi-step process. The first step in the process is to select the topic and the questionnaire (Tack et al., 2017). Questions in the survey may be derived from literature review or after consulting with experts in the field; therefore, clarity in wording is critical (Humphrey-Murto et al., 2017). An initial questionnaire may be piloted in a small group that will be excluded from the main study (Humphrey-Murto et al., 2017; Staykova, 2012).

Next step is to identify a panel of experts who meet specific inclusion criteria (Humphrey-Murto et al., 2017; Skulmoski et al., 2007; Tack et al., 2017). An initiation letter should be sent to potential candidates to introduce the purpose of the study with risk and benefits. Furthermore, a detailed description about the criteria for participation, especially the inclusion and exclusion criteria, expectations, and time commitment should accompany the first letter. Stating the timeframe for each round of the study is critical because a study based on the Delphi technique may ask for commitment from 4 and 16 months (Watson, 2008). Attrition is also a serious threat to the success of studies using Delphi technique (Humphrey-Murto et al., 2017).

The potential candidates should receive an invitation to become panelists and complete electronic questionnaires after they satisfy the criteria and sign an informed consent. Participants should have opportunity to ask questions and clarify concerns by calling, e-mailing, or sending a letter. For that reason, the principal investigator should include contact information with the invitation letter. For data collection purposes, any personal records identifying participants should be encrypted using an identification number or code for each panelist during each round.

The next step in a Delphi technique is to set up the iteration procedure. In the first and subsequent round of questionnaires, the participants need to use a measurable scale such as Likert scale to rate their responses on a broad subject area (Humphrey-Murto et al., 2017; Irvine, 2005). The questionnaire in the second round should narrow down the subject areas and include the summarized responses from the first-round. A comment section (qualitative construct) may provide an opportunity for the participants to enter feedback and express professional judgment on specific questions in an anonymous environment. Then, based on the new information, the researcher summarizes the responses and returns them to the participants in a subsequent round asking them to change or keep their previous answers (Staykova, 2012). During the second round, the panelists will see the summarized responses of the other participants for the first time. Then, the participants will have the opportunity to review the answers of the other panelists as quantitative data such as %, μ , SD . Each panelist will have a choice to adjust any or all previous answers or maintain current choices in a good conscience.

The third round of questions may ask the participants to clarify and prioritize those revised answers from the second round. Participants should be provided with an option to explain the rationale for their latest positions using comment boxes. Reproducing the summarized participants' statements in the next rounds will maintain the asynchronous conversation. Repetition of rounds should continue until all members of the panel reach agreement or a majority ruling is attained.

THE DELPHI INSTRUMENT-SURVEY/ QUESTIONNAIRE

A feedback on a specific issue in a Delphi study is achieved by using a survey or often called questionnaire as a data collection instrument. The survey collects data by questions with quantitative or qualitative components. The questions in the survey may range from general to specific, depending on the round (Skulmoski et al., 2007). A qualitative data in a survey is gathered by open-ended questions (Humphrey-Murto et al., 2017; Lakanmaa et al., 2012; Iqbal & Popin-Young, 2009; Tack et al., 2017). The use of open-ended questions allows participants to *brainstorm* and include their own responses in comment boxes to generate ideas (Iqbal & Popin-Young, 2009; Humphrey-Murto et al., 2017). With each round, the questions become more focused on the topic by using the professional judgment of the panelists as well reviewing the other participants' responses (Mannix, 2011). The review of the other

participants' responses will help the panel members reach a consensus or majority ruling on a specific topic.

The quantitative data in a Delphi study is collected when the quantitative-style questionnaires or surveys include measurable scales. A survey may include two basic scales, (a) a categorical scale, divided into nominal and ordinal scales and (b) a continuous scale, divided into interval and ratio scales (Polit & Beck, 2014; Creswell, 2011). The educational research favors combined scales because they provide variation and stronger statistical analysis (Creswell, 2011). In a Delphi study, an attitudinal scale may help measure attitudes toward competency statements. Using attitudinal scales results in collecting rich data for statistical analysis (Akins et al., 2005; Carpenter, 2008; Iqbal & Popin-Young, 2009). The quantifiable aspect allows for calculating the mean importance score and mode of the responses, and provides data results necessary to direct questions and participant choices in subsequent rounds (Carpenter, 2008).

ANONYMITY

The Delphi technique creates an environment for maintaining participants' confidentiality as well as privacy. The individual participant's personal information is kept confidential by the researchers. The confidential process provides an opportunity for the participants to express their thoughts and positions freely (Akins et al., 2005; Tack et al., 2017), leading to "transform[ing] opinion into group consensus" (Whitehead, p. 893). Furthermore, the technique provides a forum for an open-minded group communication that may be otherwise influenced by an individual attitude. Given the advantage of anonymous expression of thoughts and opinions, the technique eliminates the influence of peer pressure and bias (Humphrey-Murto et al., 2017; Plessis & Human, 2007; Tack et al., 2017). Even though true anonymity is difficult to guarantee (the researcher has access to identifiable information), coding participants' responses may improve that issue. The anonymous participant responses strengthen the validity of the study and professional judgments are submitted without geographical or physical fact-to-face limitations (Humphrey-Murto et al., 2017; Kuruback & Gulson, 2007). This approach is invaluable when the researcher is attempting to achieve expert consensus (Humphrey-Murto et al., 2017; Tack et al., 2017) on sensitive topics including nursing competencies.

ITERATION AND CONTROLLED FEEDBACK

The Delphi technique is based on a multi-round approach (Humphrey-Murto et al., 2017; Tack et al., 2017; Lakanmaa, Suominen, Perttilä, J., Puukka, & Leino-Kilpi, 2012). Controlled feedback is achieved by those multiple rounds distributing specifically designed questionnaires among the participants, and collecting data during each round. Data is collected using a step-wise process (see Table 1). Most studies have used two to three rounds also called multiple iterations; however, limited empirical evidence was available to conclude a reasonable number of rounds to achieve consensus (Humphrey-Murto et al., 2017). Researchers recommended establishing criteria for study termination that should be based on either consensus or stability (majority ruling) that was derived from unchanged responses (Humphrey-Murto et al., 2017).

CONSENSUS OR MAJORITY RULING

The central constructs of a Delphi technique is building consensus. Consensus represents the collective opinion of an expert panel in solving problems when limited evidence exists (Douglas & Bonner, 2011; Humphrey-Murto et al., 2017). Based on a literature review, it was noted that only a selective number of studies achieved consensus while other studies used a majority ruling (Burns & Grove, 2009). Majority ruling was based on the idea of the

participants' consent during the final round when at least 80% agreement was achieved on the investigated issue (O'Conner, 2008).

The definition of consensus may vary from 51 to 80% (Humphrey-Murto et al., 2017). Tack et al., (2017) ranged the consensus from 75 to 80% agreement. Dekker-Groen et al. (2010) discussed that consensus is "a minimum of 75% agreement" (p. 1571). Jinx et al., (2013) have also set the consensus at 75%. On the other hand, Iqbal and Popin-Young (2009) noted that to achieve consensus, it is necessary to have at least 70% agreement by the expert panelists. Humphrey-Murto et al. (2017) also considered consensus when an item achieved 70% "agree" or "strongly agree" responses.

Burns and Grove (2009) concluded that in some cases the principal investigator may need to settle for majority ruling instead of absolute consensus to terminate the study. The majority ruling or a median score as an outcome of the process may be personalized for each study (Humphrey-Murto et al., 2017). Lock (2011) added that the technique should be modified to fit the specific needs of the study especially after multiple iterations.

STATISTICAL DATA COLLECTION AND ANALYSIS

Data collection for a study using the Delphi technique typically begins with a survey. Safe-survey database for electronic submission or a stamped mail route are two common approaches for survey distribution. Electronic questionnaires are popular distribution methods because they are easy to use, cost-effective, save time, and provide a quick approach to data collection (Creswell, 2011; Humphrey-Murto et al., 2017). With the electronic questionnaire, questions are uploaded to a website, where an electronic link is created, and then the participants are provided information on accessing and completing the survey.

In the first round in a Delphi study, the participants rate various statements and/or question items from the survey. The survey is usually based on a Likert scale (Humphrey-Murto et al., 2017; Tack et al., 2017). However, Lakanmaa et al., (2012) based the first round of their study on an open-ended essay questionnaire to collect data. In that study, a 22-page narrative was analyzed deductively followed by inductive content analysis. In the second round, the participants rated questions based on 5-point Likert scale; descriptive statistics established the mean value and consensus percentage.

For subsequent rounds of the survey, a column should include a total percentage for each item; the higher the percentage, the higher the agreement among the participants. Next to the total percentage, a mean score should indicate where the group stands in reaching consensus on a specific item. Humphrey-Murto et al., (2017) suggested using mean, median, or frequency distribution for statistical analysis. Some studies have included standard deviation to show the differences in the mean (Staykova, 2012). The lower the standard deviation, the lower the variation in the mean is. A key with explanation of each statistical value must accompany each round.

The last column in a subsequent questionnaire should provide the opportunity for panelists to re-evaluate or re-rate their initial response after reviewing the anonymized summary of the other panelists. A participant may choose to keep the same answer by checking off the number selected during the first round or change the answer based on the answers of others to tighten the growing consensus.

ENSURING DELPHI TECHNIQUE VALIDITY AND RELIABILITY

Investigators considering the Delphi technique often question its validity and reliability. Several strategies may help in establishing these two parameters. Adherence to methodology

(Ferguson, 2006) and careful selection of a questionnaire/survey (Stiles, 2005) validated in previous studies can ascertain validity and reliability. Using a panel of experts will improve the data reliability and external validity of a study by encouraging experts to use their professional judgment to reach a consensus in settings of uncertainty (Alexander, 2009; Iqbal & Popin-Young, 2009). According to Iqbal and Popin-Young (2009), the expert panel feedback in the design of questions improves reliability and validity. Rating the same question several times by the panelists ensure the (Inter-Rater) reliability when the mean value remains the same.

The first questionnaire should include a set of demographic questions. The purpose of the demographic data is to guarantee that the panel of participants is well represented and that it has mirrored the target population. Face, content, and construct validity are achieved by the expert judgment of the participants who are determining the inclusion of important competencies, and the number and type of items in each questionnaire (Melnik & Fineout-Overholt, 2015).

On the other hand, a principal investigator's subjective opinions, the inability to recruit a sufficient sample, and misinterpreting data may jeopardize the study and survey validity and become a serious confounding factor (Stiles, 2005). To improve validity, researchers recommended recruiting a large sample of panel members (Kuruback & Gulson, 2007). Conducting a pilot study with a pilot sample is another alternative to increase the internal validity of a study and to clarify items in a questionnaire (Staykova, 2012). A pilot study usually includes a small number of participants and is critical "in determining the feasibility of subject enrollment, the intervention, the protocol of data collection plan for the study, and the likelihood that subjects will complete the follow-up measures" (Melnik & Fineout-Overholt, 2015, p. 267). The pilot sample should be excluded from the full-scope study. A preliminary study will help the investigator identify and correct weaknesses prior to conducting a full-scope study (Staykova, 2012).

SAMPLE SIZE IN A DELPHI TECHNIQUE

Investigators using the Delphi technique frequently ask what sample size will ensure reliable and valid results and conclusions. The sample size in a Delphi technique may range from six to thousands; however, not the sample size but the representation and expertise are more valuable than the size (Humphrey-Murto et al., 2017, p. 17). Stiles (2005) concluded that 20 to 50 experts constitute a large enough sample to accomplish the aim of a study. According to Skulmoski, Hartman, and Krahn (2007), "in homogeneous group a small sample ranging from 10 to 15 participants can lead to sufficient results" (p. 10) considering the expertise of the participants. Humphrey-Murto et al. (2017) concluded that six panelists may be too small whereas 12 or more could be a reasonable size; O'Conner (2008) found a range from five to 20 experts to be suitable for a Delphi study.

A small sample may yield reliable results because "groups as small as four have been found to perform as well as larger groups" (O'Conner, p. 236). Rass (2008) added that a small Delphi panel may lead to good results because conclusions were based on the expertise of the panelists. A small sample in a Delphi study should be large enough to identify characteristics and themes (Akins et al., 2005, Humphrey-Murto et al., 2017; O'Connor, 2008; Stiles, 2005). Therefore, a smaller number of participants committed to the Delphi study may contribute to successful outcomes (Humphrey-Murto et al., 2017). The Delphi technique offers the flexibility of using a small or large sample in generating reliable conclusions.

Sampling Choices in a Delphi Technique

The number of participants and the sampling choices in a Delphi study depends on the purpose of the study, the time, and the resources available (Iqbal & Popin-Young, 2009). For example, if the goal of the Delphi study is to measure the opinion of the panelists then fewer rounds and participants are relevant. On the other hand, if the goal is to achieve consensus, the study may include three or more rounds with a larger sample of panelists and may extend from four to many months (Iqbal & Popin-Young, 2009).

After reviewing the literature, researchers found a few sampling choices appropriate for Delphi studies (Akins et al., 2005). The choices are convenience and purposive or a criterion sample (Akins et al., 2005). Convenience sampling has several limitations. For example, recruiting participants who are available at the time of the study to obtain the desired sample size increases the risk for bias and the lack of representativeness (Burns & Groves, 2009). A purposive sample is the most appropriate for the Delphi study in which an expert opinion is necessary (Creswell, 2011; Davis et al., 2008; Skulmoski et al., 2007). In the purposeful sampling procedure, the investigators selects individuals based on preset criteria such as knowledge and expertise in the investigated phenomenon or problem (Creswell, 2011). This procedure strengthens the claims of reliability and validity in a study (Iqbal & Popin-Young, 2009).

REVIEW OF RESEARCH DESIGNS AND THEIR APPROPRIATENESS FOR STUDIES ON NURSING COMPETENCIES IN CURRICULUM

A design selected for a study needs to reflect first the uniqueness of the research problem in a scientifically valid and reliable fashion (Burns & Grove, 2009). After reviewing applied, action, ethnographic, heuristic, holistic, grounded theory, and a Delphi design, Alexander (2008) and Staykova (2012) concluded that the mixed method modified Delphi design best suits the purpose of a study researching nursing competencies and curriculum. Several other research designs may be applicable to a study examining the competencies of nurse educators in curriculum; however, the designs are excluded because of limitations. For example, a non-experimental design is appropriate for describing and explaining a phenomenon in qualitative studies (Melnik & Fineout-Overholt, 2015).

Case or cohort studies and correlational descriptive research are types of descriptive studies (Melnik & Fineout-Overholt, 2015). The case study offers the benefit “to determine associations with a smaller number of subjects” (Melnik & Fineout-Overholt, 2015, p. 258). However, a risk for bias is a major limitation in a case study design (Melnik & Fineout-Overholt, 2015). The cohort study involves a longitudinal observation to determine a relationship between the variables. The length of participant commitment and the economical dependability to follow the subjects for longer time make the design unfeasible (Melnik & Fineout-Overholt, 2015). Correlational descriptive research is appropriate when investigating the relationship between two variables. A study examining the nursing competencies in curriculum is not examining the relationship of the variables but is interested in identifying them; therefore, the correlational descriptive design is not suitable. After reviewing the literature, Lock (2011) confirms that the Delphi technique is a useful approach for identify nursing competencies in curriculum.

A Delphi technique is the appropriate design for a study examining nursing competencies in curriculum for two major reasons. First, identifying specific nursing competencies in curriculum is a sensitive topic and a complex problem that requires consensus and anonymous response without a group bias or pressure. Second, several authors noted that a Delphi technique is appropriate for diverse health care settings, nursing practice, medicine, and

medical education for many reasons (Akins et al., 2005; Doughlas, & Bonner, 2011; Humphrey-Murto et al., 2017; Tack et al., 2017; Whitehead, 2008). For example, the Delphi technique is a research process that centralizes expert opinion (Douglas & Bonner, 2011) and heightens the reliability and validity of a study.

A Delphi design helps define patterns, themes, and solve problems without sufficient evidence.

CHALLENGES IN USING DELPHI TECHNIQUE

Critiques of the Delphi technique have focused on several weaknesses. The method lacks guidance and a standard description regarding data interpretation; it is less helpful when researching new theories or knowledge (Iqbal & Popin-Young, 2009). Other limitations “include lack of clear guidelines on aspects such as expert selection, size of the expert panel, and the definition of consensus” (Schell, 2006, p. 440). Researchers noted methodological issues with the Delphi technique related to panel description, consensus measuring, and process modification (Humphrey-Murto et al., 2017; Lock, 2011; Tack et al., 2017). Furthermore, generalizations of one study are limited to a panel of participants; another group may reach different consensus (Iqbal & Popin-Young, 2009).

Examining the multi-round constructs of the Delphi technique, numerous limitations are noted. A challenge during the first step in a Delphi study is the participants’ recruitment and cooperation. Poor responses are major limitations to the intended research, causing incomplete data and errors in analysis (Creswell, 2011; Neuman, 2011; Humphrey-Murto et al., 2017). The data collection process may fail if most participants do not respond to the questionnaires. Furthermore, participants dropping out during subsequent rounds may endanger the internal validity; therefore, a high level of commitment is critical for a study success (Iqbal & Popin-Young, 2009). Ito, Ota, and Matsuda (2011) noted that “the response rate of panelists declines as the number of rounds progresses” (p. 450) with a response rate as low as 25% to 30% in a mailed survey format. Reasons for poor response may include tiresomeness from the repetitive nature of the questionnaires and the extended time of commitment, incorrect addresses, language barriers, and persistent attempts to survey faculty as well as unclear guidelines and explanations about the survey completion (Neuman, 2011).

Several strategies may improve the participants’ responses and minimize refusal and dropout rates (Melnik & Fineout-Overholt, 2015). Initial commitment of the participants to each round is the best strategy to enhance validity and decrease the sample bias (O’Conner, 2008). Making the panelists’ participation meaningful by explaining the importance of the study results may lead to increased participation and minimized dropout rates (Melnik & Fineout-Overholt, 2015). Conducting preliminary investigation, such a pilot study in the areas of planned surveys will increase the learning about the population residing in the location and will help to clarify vague questions (Humphrey-Murto et al., 2017; Melnik & Fineout-Overholt; Neuman, 2011).

Direct, persistent but respectful, and personal contacts with the panelists would likely promote participation. Regular calls, follow-up e-mails or sending letters during different rounds may improve the contact, cooperation, and completion rates, as well as the total and non-response rates (Melnik & Fineout-Overholt, 2015). Training the research personnel, developing clear and concise questionnaires with detailed instructions, and writing cover letters with explanations concerning expectations may hopefully improve the total responses (Neuman, 2011). Finally, to motivate participation in each round, a small monetary incentive for participation, such as a gift card or item drawing, may be included with the closing letter, after completing the study’s rounds.

CONCLUSIONS

The Delphi technique provides the researchers with unique way to study variables that are considered sensitive or difficult to measure. Research on the Delphi technique has shown that the approach is effective when applied in small or large groups (Rass, 2008; Humphrey-Murto et al., 2017; Skulmoski, Hartman, & Krahn, 2007; Tack et al., 2017). Consensus that is achieved with few rounds of questionnaires is more accurate than surveys of traditional groups or individual-experts opinion (O'Connor, 2008). Being economically reasonable and time sparing, the Delphi technique accommodates quick modifications based on participants' feedback (Humphrey-Murto et al., 2017; Iqbal & Popin-Young, 2009; Schell, 2006). Akins et al. (2005) further contended the "Delphi method has demonstrated decision-making advantages over traditional conferences, group discussions, brainstorming, and other interactive group activities" (p. 3). The expert panel decision-making with resulting consensus leads to valuable conclusions that the other research methods may not achieve (Humphrey-Murto et al., 2017).

Research on Delphi technique, nursing competencies in the past 10 years exists but is limited to about 200 studies. Few example, Bitten et al., (2018) studied the development of gerontological nursing competencies based on e-Delphi technique. Forth et al., (2016) conducted systematic literature review to study consensus methods in nursing education. LaFauci (2009) investigated the attitudes and clinical competencies of second-year associate degree nursing students and full- and part-time faculty. The author used a mixed method and clinical instructional experience questionnaire developed by Hickey in 2005. Poindexter (2008) used a non-experimental survey design to examine the qualifications and competencies of novice nurse educators to teach in the academic field. However, the research on nursing competencies in curriculum is scarce indicating a research gap that needs to be addressed urgently.

The Delphi technique may offer a suitable and non-judgmental environment for a study examining the unique nature of the nursing competencies in curriculum. By virtually eliminating open peer pressure, the Delphi technique is one of the best ways to ensure that the participants will provide unbiased feedback. Rediscovering the benefits of the Delphi technique and offering step-by-step guidelines may benefit researchers contemplating to study sensitive topics.

References

- Akins, R. B., Tolson, H., & Cole, B. R. (2005). Stability of response characteristics of a Delphi panel: Application of bootstrap data expansion. *BMC Medical Research Methodology*, 5(37), 1-12. doi:10.1186/1471-2288-5-37.
- Alexander, D. R. (2008). *A modified Delphi study of future crises and required leader competencies*. (Doctoral dissertation, University of Phoenix, 2013), ProQuest Digital Dissertations. AAT 3349271.
- Asghari, F., Samadi, A., & Rashidian, A. (2013). Medical ethics course for undergraduate medical students: A needs assessment study. *Journal of Medical Ethics & History of Medicine*, 6(1), 1-7.
- Boobnick & Cooper. (2012). A core curriculum for dermatology nurse practitioners: Using Delphi technique. *Journal of Dermatology Nurses' Association*, 4(2), 108-120. doi:10.1097/JDN.0b013e31824ab94c
- Britten, N., Traynor, V., & Osmond, T. (2018). Developing gerontological nursing competencies: An e-Delphi study. *Australian Nursing & Midwifery Journal*, 25(7), 42. Retrieved from <http://search.ebscohost.com>
- Burns, N., & Grove, S. (2009). *The practice of nursing research: Appraisal, synthesis, and generation of evidence* (6th ed.). St. Louise, MO: Elsevier.
- Carpenter, A. (2008). *Experts' educational content recommendations for nontraditional careers and eighth-grade girls: A Delphi study*. (Doctoral dissertation, University of Phoenix, 2008). Retrieved from ProQuest Digital Dissertations. AAT 3370938
- Creswell, J. W. (2011). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Upper Saddle River, NJ: Pearson.
- Davis, R., Turner, E., Hicks, D., & Tipson, M. (2008). Developing an integrated career and competency framework for diabetes nursing. *Journal of Clinical Nursing*, 17(2), 168-174. doi:10.1111/j.1365-2702.2006.01866.x
- Dekker-Groen, A. M., Marieke F., S., & Stokking, K. M. (2011). Teacher competences required for developing reflection skills of nursing students. *Journal of Advanced Nursing*, 67(7), 1568-1579. doi:10.1111/j.1365

- Dewald, R. J. (2012). Teaching strategies that promote a culturally sensitive nursing education. *Nursing Education Perspectives*, 33(6), 410-2. Retrieved from <http://search.proquest.com/docview/1269079890?accountid=35812>
- Douglas, B., & Bonner, A. (2011). Clinical Education for Nephrology Nurse Practitioner Candidates in Australia: A Consensus Statement. *Renal Society of Australasia Journal*, 7(1), 13-23.
- Ferguson, K. (2006). *Barriers to completion for nontraditional nursing students in a baccalaureate degree nursing program*. (Doctoral dissertation, Capella University-Minnesota, 2006). Retrieved from ProQuest Digital Dissertations. AAT 3223885.
- Foth, T., Efstathiou, N., Vanderspank-Wright, B., Ufholz, L.-A., Dütthorn, N., Zimansky, M.,...Humphrey-Murto, S. (2016). The use of Delphi and nominal group technique in nursing education: A review. *International Journal of Nursing Studies*, 60, 112–120. <https://doi.org/10.1016/j.ijnurstu.2016.04.015>
- Humphrey-Murto, S., Varpio, L., Gonsalves, C., & Wood, T. J. (2017). Using consensus group methods such as Delphi and nominal group in medical education research. *Medical Teacher*, 39(1), 14–19.
- Ito, C., Ota, K., & Matsuda, M. (2011). Educational content in nurse education in Japan: A Delphi study. *Nursing Ethics*, 18(3), 441-454. doi:10.1177/0969733010385530
- Iqbal, S., & Popin-Young, L. (2009). The Delphi method. *Psychologists*, 22(7), 598-600.
- Irvine, F. (2005). Exploring district nursing competencies in health promotion: The use of the Delphi technique. *Journal of Clinical Nursing*, 14(8), 965-975. doi:10.1111/j.1365-2702.2005.01193.x
- Jing Yu, T., Jin Xiu, C., Tao, W., Xian Liang, L., Li Qun, Y., Feng, D., & Yu Jie, W. (2013). Preliminary curriculum design baccalaureate nursing education in traditional Chinese medicine universities: a Delphi Survey. *Macau Journal Of Nursing*, 12(2), 7-6.
- Kennedy, H. P. (2004). Enhancing Delphi research: Methods and results. *Journal of Advanced Nursing*, 45(5), 504-511. doi:10.1046/j.1365-2648.2003.02933.x
- LaFauci, F. (2009). *Second year associate degree nursing students and nursing faculty attitudes towards clinical educational experiences*. (Doctoral dissertation, Dowling College, 2009). Retrieved from ProQuest Digital Dissertations. AAT 3367943.
- Lakanmaa, R., Suominen, T., Perttilä, J., Puukka, P., & Leino-Kilpi, H. (2012). Competence requirements in intensive and critical care nursing - still in need of definition? A delphi study. *Intensive & Critical Care Nursing*, 28(6), 329-36. doi:http://dx.doi.org/10.1016/j.iccn.2012.03.002
- Lock, L. R. (2011). Selecting examinable nursing core competencies: A Delphi project. *International Nursing Review*, 58(3), 347-353. doi:10.1111/j.1466-7657.2011.00886.x
- Mannix, T. (2011). Using the Delphi technique to develop standards for neonatal intensive care nursing education. *Neonatal, Pediatric & Child Health Nursing*, 14(3), 25-36.
- McPherson, S., Reese, C., & Wendler, M. C. (2018). Methodology update: Delphi studies. *Nursing Research*, 67(5), 404–410. <https://doi.org/10.1097/NNR.0000000000000297>
- Melnik, B., & Overholt, E. (2015). *Evidence-based practice in nursing & healthcare: A guide to best practice* (3rd ed.). Philadelphia, PA: Wolters Kluwer.
- Neuman, L. W. (2011). *Social research methods: Qualitative and quantitative research design* (7th ed.). Boston, MA: Pearson/Allyn & Bacon.
- O'Connor, J. (2008). A study utilizing the Delphi technique to develop a consensus on the importance of certain curricular goals for emergency management associate, bachelor's and master's-level programs in the United States. *Journal of Applied Security Research*, 3(2), 231-240. doi:10.1080/19361610802135946
- Poindexter, K. A. (2008). *Essential novice nurse educator role competencies and qualifications to teach in a pre-licensure registered nurses education program*. (Doctoral Dissertation, Western Michigan University, 2009). Retrieved from ProQuest Digital Dissertations. AAT 3316931.
- Polit, D. & Beck, C. (2017). *Essentials of nursing research: Appraising evidence for nursing practice* (9thed.). Philadelphia, PA: Lippincott, Williams & Wilkins.
- Rass, J. (2008). *A Delphi panel study of nursing competencies for rural nursing in the state of Maine*. (Doctoral dissertation, Capella University, 2008). Retrieved from ProQuest Digital Dissertations. AAT 3320353.
- Schell, K. A. (2006, November). A Delphi study of innovative teaching in baccalaureate nursing education. *Journal of Nursing Education*, 45(11), 439-448.
- Skulmoski, G. J., Hartman, F. T., & Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education*, 6, 1-21.
- Staykova, M. (2012). A pilot Delphi study: Competencies of nurse educators in curriculum design. *Teaching and Learning in Nursing*, 7(3), 113-117.
- Stiles, J. H. (2005). *The charter school leader: In investigation of leadership qualities, knowledge, and experience*. (Doctoral Dissertation, University of Phoenix, 2005). Retrieved from ProQuest Digital Dissertations. AAT 3172361.
- Tack, J., Boardman, H., Layer, P., Schiefke, I., Jayne, D., Scarpignato, C., ... Emmanuel, A. (2017). An expert consensus definition of failure of a treatment to provide adequate relief (F-PAR) for chronic constipation - an international Delphi survey. *Alimentary Pharmacology & Therapeutics*, 45(3), 434–442. <https://doi.org/10.1111/apt.13874>
- Watson, T. (2008). Public relations research priorities: A Delphi study. *Journal of Communication Management*, 12(2), 104-123. doi:http://dx.doi.org/10.1108/13632540810881938
- Whitehead, D. (2008). An international Delphi study examining health promotion and health education in nursing practice, education and policy. *Journal of Clinical Nursing*, 17(7), 891-900. doi: 10.1111/j.1365-2702.2007.02079.x