

Expert Opinion Process: Applications in Education

Bayona-Ore, Luz

Universidad Autónoma del Perú
Dirección de Investigación
Lima Perú
sbayonao@hotmail.com

Fernández Zavala, Ronald

Universidad Autónoma del Perú
Facultad de Ingeniería y Arquitectura
Lima Perú
rfernandez@autonoma.edu.pe

Luyo Cruz, María

Universidad Autónoma del Perú
Facultad de Ingeniería y Arquitectura
Lima Perú
maryacruzluyo@gmail.com

ABSTRACT

Expert opinion is a technique used in different areas of scientific research, which, in some way, guarantees its social and methodological validity. This method is also used as an instrument to make long-term predictions, with different types of solutions to obtain a concise answer that is achieved with the help of experts who exchange information, cultures and experiences to provide solutions to the relevant and timely problems that may arise. The purpose of this article is to review the quality literature regarding experts' opinion of different applications. This research resulted in an extensive relationship with the topics of technology, technology foresight, and especially education.

CCS Concepts

• **Human-centered computing** → **Human computer interaction (HCI)**

Keywords

Expert opinion; method Delphi; education

1. INTRODUCTION

The Delphi method is a technique used to obtain expert opinion. It is a systematic procedure employed for reliable consensus among a selected panel of experts [1]. Delphi is based on other well-known methods such as Focus Group and Group Nominal [1] and has been applied for different purposes in various fields of knowledge such as health, environmental, agribusiness and education. In the education sector, the Delphi method has been used for learning competences, content to include in the curriculum, roles of university lecturers, self-assessed distance education [2], identification of topics for student learning [3], or the creation of rubrics [4]. Also, this method has been applied in foresight [5] as well as in the technology sector.

Some applications in the technology sector are used (1) to learn about new technologies for online communication and predict new trends [6], (2) predict mobile broadband traffic [5], (3) prevent accidents through the use of smartphone applications or (4)

forecast new markets.

During the implementation process, ideas and consensus come from the participants who are specialists with different cultural experiences and different points of view. The purpose of this article is to know the different applications of the Delphi method especially in the technology, foresight and education sectors.

This article has been structured into five sections. Section 2 presents the background. Section 3 describes the methodology used. Section 4 describes the results. Finally, Section 5 provides a brief conclusion.

2. BACKGROUND

2.1 Delphi Method

The Delphi method allows to consult a group of experts to validate a proposal, taking into account their knowledge, experience, or research they have conducted. It is a formal and systematic method used to analyze complex problems, based on consultation with experts, in order to obtain the most reliable consensus [7]. The main premise of the Delphi method is based on the assumption that group opinion is more valid than individual opinion [8]. It is a qualitative research method with quantitative elements, combining expertise with tacit knowledge. This method is used in foresight and other futurists studies. It can display a variety of future scenarios, using specialists from around the world [9] who exchange knowledge, cultural experiences, and points of view in order to provide solutions to relevant and timely issues facing organizations [10].

This method is repeated in a number of rounds until the final results of the study [7]. According to [11], expert opinion can be performed in two ways: (1) informally, where the opinions of experts are chosen implicitly, are unstructured and undocumented and (2) formally, by analyzing uncertainty using data provided by experts, which in turn provide unique data or augment existing ones. The Delphi method consists of four phases [9]: (1) raise open questions that are clear, concise and are do not induce responses for experts to respond to (2) facilitator compiles a summary of the initial responses to send to experts for them to evaluate, rank or compare. (3) experts each receive a summary either for feedback or for submission of final results, and (4) the practical approach: the process (sending and receiving information), which allows to observe how each question provides varying results, is usually completed in two or three rounds.

The Delphi method has four characteristics [7]: use of experts who are in a specific field or have technical knowledge and are part of the expert panel; it is an iterative process because the experts can give their opinion on more than one occasion; this iterative process is provided through feedback; in order to ensure anonymity and avoid being influenced participants do not know each other's answers. At the end of this process, a statistical

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analysis report, which includes all the responses in each round, reveals whether there is divergence or convergence of views or different levels of consensus. One of the tools the Delphi method uses is face-to-face or online questionnaire and interview. Collecting responses from questionnaires may be manual or automated. Mobile applications designed for smartphones or tablets can also be used to facilitate the tasks or steps to develop [12]. With regard to the experts in different locations, it is necessary to use technology [6]. The use of technologies has become dominant in individual and company activities in order to

optimize response time and make the decision-making process more practical but this is not necessarily face-to-face [13].

Delphi's method takes into account the inclusion criteria, selection and number of experts, quality and competence of the panel, how to organize communication, progress of the iterative process, the time between rounds, percentage of abandonment, appropriate consensus criteria and stability to reflect the character of the research problem and the object of study. Since its inception, the Delphi method has undergone a number of modifications (see Table 1).

Table 1. Types of Delphi

Type	Description	Communication
Classical Delphi	Uses an open first round to facilitate idea generation to elicit opinion and gain consensus	e-mail
Modified Delphi	Usually replaced the first postal round with face-to-face interview	Postal/ e-mail
Decision Delphi	Focuses on making decisions rather than reaching consensus	
Real Time Delphi	Similar process to classical Delphi, except that experts may be in the same room.	Real time
e-Delphi	Similar process to classical Delphi, but administered by email or online web survey	e-mail/online web
Online Delphi	Same process as classical Delphi, but questionnaires are submitted online	Online
Technological Delphi	Similar to Classical or real time Delphi, but using technology that allows experts to respond to questions immediately and allows instant feedback.	Hand held keypads

2.2 Advantages and Disadvantages

This method has advantages and disadvantages [14]. Among the advantages are (1) the experts' opinion are subjective and are based on their experience and therefore offer better quality, (2) the influence of opinion leaders decreases so that each expert freely expresses his or her opinion, (3) anonymity and confidentiality means that a third party cannot influence the response, keeping it in real time as absolute truths, and (5) in making decisions, it is useful for an organization to get an opinion or consensus on an issue or problem. Among the disadvantages we can mention (1) there is a risk of getting erroneous results through a bad approach to the questionnaire, (2) high costs, and (3) a long runtime required.

3. METHOD

A literature review was carried out to explore the use and application of the Delphi method. Articles published between 2012-2018 were identified. The research strategy to identify the articles included automatic electronic databases searches. The articles that were identified include relevant scientific indexed studies. The databases consulted were: IEEE Xplore Digital Library, ScienceDirect, ACM Digital Library and Google Scholar.

The keywords that were used to search each database were identified. These were: "Expert opinion" and "Delphi". This procedure is based on the selection process of the relevant studies. First, a primary search is carried out to identify the potential primary studies: in this step, a quick reading of the title of the articles is made. The articles that related to the topic were read in full.

4. RESULTS

The results of the literature review show that the Delphi method is used in various sectors such as technology, foresight and education. The experts' opinions are used to know a certain point of view on a specific topic because they have some experience or

studies on the subject. This aspect, according to the literature reviewed, can be disadvantageous when several experts are brought together because one expert may want to impose his or her point of view. In contrast, views usually change when experts reach a consensus [20]. In these cases, the Delphi method helps experts reach a consensus through the use of specialized surveys according to the subject and the research, and offers organizations the choice of accepting their responses, thus inspiring confidence and guaranteeing that the information provided is truthful and accurate [21]. This gives us the ability to compare the responses from the other experts and reach a homogeneous response to the subject to be dealt with. As mentioned in the investigation on information systems, through Delphi, rigorous evaluation of experts' classification offers a broad perspective that ensures correct results and reduces errors.

Expert opinion has an extensive relationship with technology. It allows to learn through new communication technologies online and predicts new trends in this regard [6], or identifies benefits and obstacles of short sea interstate transport. Also, this method is used for identifying future technology scenarios, better known as foresight, predicting mobile broadband traffic [5], and evaluating the basic functions and mechanisms of mobile online translation tools. The use of technology to obtain expert opinion is helpful in software quality studies or in the use of mobile phones that leads to time saving and profitability. In turn, it facilitates forecasting future business, identifying a specific topic and taking concrete decisions based on the result [15] or handling personal information for future or current personnel involved in the business [16].

In the field of foresight, experts, including specialists from different countries, with different cultures and viewpoints, are essential to identify future possibilities based on real knowledge, [9] Thus, gathering these experts' views is helpful for foresight. Foresight can be applied in the industrial sector to meet the futures market to sell certain products such as reaching

sustainable markets and a spatially increasing distribution for the years 2020 to 2030 [7], or by combining different views for different products and comparing the end results to recommend the best product for the user [18]. It has also been used to predict the reduction in CO2 emissions by 26% [19].

4.1 Expert Opinion on Education

The Delphi method has been developed in various areas of scientific research such as the Education Sciences. In the field of education, expert opinion is valuable to see results that can change the dynamics of global teaching. An example of this is the various research to evaluate quality indicators in distance education programs [2], and identify topics that are important, and difficult, in computing subjects [3]. Also, the Delphi method is used to create learning-oriented rubrics for Computer Science principles teachers and improve the teaching provided in this science [4]. The Delphi method has been applied to reach consensus in

different areas of education such as validating indicators to assess universities, identifying areas of tension that are barriers to inclusion of information and communication technologies (ICTs), digital competence skills, training contents, developing new curriculum, curriculum content, impact of emergent technologies such as cloud computing, competencies and student learning outcomes, creating rubrics, or trends in e-learning, (see Table 2). The Delphi method is commonly used to set priorities or to reach consensus. In its original form, the Delphi process is a multi-stage approach with each stage building on the results of the previous one and consists of two or more rounds of questionnaires administered by post to a panel of experts [8]. The number of rounds varies on average from 2 to 3. Depending on the complexity and available resources, the number of experts varies from one study to another. There is interest in carrying out studies that translate the Delphi method, which indicates its validity.

Table 2. Method Delphi applications on education

Applications	Rounds	Experts involved	Year	Author
Study to validate indicators to assess university institutions	2	45 experts	2012	[22]
Study to identify areas of tension that might impede a more comprehensive inclusion of ICT in educational settings	4	Three expert panels 41, 230 and 569	2013	[23]
Study on the skills and attitudes to define the construct of digital competence	2	95 experts	2013	[24]
Study to identify topics on educational psychology to teach at university	2	48 experts	2013	[25]
Study to investigate current practices and educational theories based on osteopathic technique	2	14 experts	2013	[26]
Study on the content of training in information and communications technologies for university teachers	2	68 experts	2014	[27]
Study on Technological Pedagogical Content Knowledge-practical (TPACK) to identify the model indicators	2	54 experts	2014	[28]
Study to explore the roles of university teachers and their preparation for personal learning environments	3	34 experts	2014	[29]
Study to identify health problems for training education in the fields of nutrition and physical activity, and the competencies needed to solve these problems	3	21 experts	2015	[30]
Develop a new curriculum for a master's degree for nursing programs and provide a reference for nursing education in China.	3	26 experts	2016	[31]
Study on the application of the Delphi method for creating rubrics oriented learning, computer science	3	18 experts	2017	[4]
Study on trends in e-learning as support for postgraduate courses	3	20 experts	2017	[32]
Study on forecasting healthcare education priorities.	3	51 experts	2017	[33]
Study to determine the essential content to include in the curriculum of the student-as-professor programs	3	25 experts	2018	[34]
Study on the current and future impact of Cloud computing in education	2	11 experts	2018	[35]
Study on student learning competencies related to the development of pharmaceutical and social knowledge base	3	20 experts	2018	[36]

There are several proposals to improve the Delphi method. The Delphi hybrid approach aims to harmonize the potential of the method's Focus Group, Modified Nominal Group and standard Delphi and reduce their combined limitations through applications in real contexts with experts who are professionals in their respective activities [1]. One such proposal is to improve the analytical part of the Delphi method when groups of panellists are different, using heterogeneous panels to increase the range between the views of the first round [2]. Another is to allow individual panellists to change their judgment or understanding in their responses to complete the survey and then use this as feedback.

5. CONCLUSIONS

The Delphi method, a leading investigation method to obtain the opinion of experts, is the dynamic that establishes relationships with selected experts. Expert opinion is used in different areas such as foresight, technology, industry and education. It is a good process to achieve a truthful and accurate viewpoint of an issue that needs to be resolved. The use of technology improves the expert opinion process, saving time and cost. The Delphi method, using technology to collect experts' opinion from wherever they are located, is carried out in real time. For this reason, it is

important to apply technology to automate the expert opinion process.

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