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Formulating Research Problem in Academic Writing: Indonesian Expert Authors' Cognitive Experience

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ABSTRACT

This research aims to reconstruct the cognitive process in formulating research problems in writing scientific journal articles. Through a grounded theory approach, this study reveals six important findings related to the formulation of research problems in scientific journal articles, i.e.: a gap between expectations and reality; intensive search by finding possibilities, norm testing results and case studies; mapping global structure of issues; and data replication. This research concludes that the formulation of research problems in writing scientific journal articles is identical to the research gap (RG). As an empty space or a vast space of possibilities, RG can be entered and examined more deeply and seriously by researchers in various disciplines so that they can explore and discover new knowledge. This research has an important and significant impact on the development of science and technology. It offers a new approach to how cognitive experiences were constructed. The results of the construction of this cognitive process have tangible benefits for many people regarding how research problems and research questions are formulated.

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1. Introduction

The world's scientists across disciplines do not deny how central the position of problem formulation in a research both in the realm of natural sciences, social-humanities sciences as well as language and communication sciences. The direction of a research project will not be accurate without a well-defined problem. In order for the findings of their study and scientific publications to significantly advance human civilization and have a substantial impact on the advancement of science, researchers and scientific writers must therefore be highly aware on research problem.

Numerous studies on the development of research problems have been done by academics from various disciplines. All agreed on the significance of research problems and the proper way to formulate them (Chen et al., 2022; Wisse & Roeland, 2022; Wordvice, 2022; Bhasin, 2022; Vasanthakumari, 2021; Bermudez, 2021; Higashihara & Horiuchi, 2021; Misra & Agarwal, 2020; McCombes, 2019; Gasparyan et al. 2019; Howard-Grenville et al., 2019; Fandino, 2019; Saunders et. al., 2019; Mattick et al., 2018; Ratan et al., 2018; Nirmalasari et. al., 2018; Bryne, 2017; Akhidime, 2017; Thomas, 2015; & Shoket, 2014).

There is a direct organic relationship between research problems and research topics. The research problem is a formal formulation of the research gap that has not been studied by other researchers before. Therefore, good research topics are challenging and need critical thought. They should also be pertinent, narrow, and practicable (Mattick et al., 2018; McCombes, 2019; Excelsior College, 2022). It takes time to formulate a research problem. According to Chen et al. (2022), prior literature is typically a "black box" when it comes to research questions.

The quality of publications is greatly raised by research that is driven by questions.The better a research question is defined, the better the researcher will know what to look for, the better the research may be planned, and the better it will be to pick relevant data and eliminate irrelevant data. Additionally, reviewers may more accurately determine if research has achieved its stated goals when it is question-driven (Wisse & Roeland, 2022).

Additionally, focused and precise study questions are essential and become the heart of a research. Using interrogative words like "how" and "what" can help questions be more detailed and produce more relevant responses, according to McCombes (2019). The existing advice on problem formulation concentrates on the researcher and what that person may do to make sure that the practitioner's views are included (Howard-Grenville et al., 2019). Regarding this, Rahardja et. al. (2018) supported the idea that the formulation of a research problem can be compared to the initial impression made when performing a study. The core of any research project is an issue. There won't be any research if there are no issues (Nirmalasari et al., 2018).

The term "problem formulation," which is now frequently used to refer to "problem statements," describes it as a string of words built methodically to communicate the significance of a research undertaking (Nasution et. al., 2018). Good research questions are challenging and need critical thought. They should also be pertinent, narrow, and practicable (Mattick et al., 2018; McCombes, 2019) and should be plausible, interesting, novel, ethical, relevant, manageable, suitable, with potential value, publishability, and systematic (Fandino, 2019).

Mattick, et al.(2018) confirm that a good research question should be: precisely and precisely formulated: the ideas should be carefully chosen; researchable: the question must be able to be answered on the basis of practicable research; the question must be suitably narrowed without being overly broad; neither too basic nor too complex; open: the question must be written in such a way that it can be answered in ways other than just "yes" or "no"; The question must be unique and novel and should encourage fresh information-gathering.

Thomas (2015) reiterates the value of research problems and the appropriate structure for presenting them. The importance of understanding concepts and dimensions and converting them into measurable indicators or variables is emphasized by his study. In accordance with

this, Shoket (2014) asserts that an empirical investigation ought to come after the formulation of the issue. The goals and limitations of the inquiry should be stated in the formulation of the research problem. There are definitions of important terms and questions that need to be answered as well.

Choosing a topic and formulating the focus of a question in the research process is the initial stage that a researcher must do before starting to do a series of subsequent research activities (Handayani et al., 2018). Planning and careful consideration are needed when developing quantitative or qualitative research, particularly when conceptualizing research questions and hypotheses (Excelsior College, 2022). Ambiguous research question and hypotheses can result in unclear and weak research objectives (Higashihara & Horiuchi, 2021).

Good management of researchers in determining and formulating the problem can be used as a determinant of direction, guidance, or focus of the research itself. Through the formulation of the problem also the researcher becomes aware of how relevant data is and what data is not relevant to his research activities (Nirmalasari et. al., 2018).

Professional researchers could easily identify a research problem because they have been quite familiar with the phenomena in which a problem generally presents itself. By considering the phenomena which include (1) a difficulty or deficiency to be overcome; (2) a condition to be improved upon; (3) a gap in knowledge that exists in scholarly literature that is to be filled; (4) a theory that requires meaningful understanding; or (5) a body of knowledge or views held in different clime that requires validation or confirmation for local application, professional researchers could easily recognize suitable problem to study (Pardede, 2018).

A research problem is the basis of a research paper. It is a difficulty, gap, problem or shortcoming which needs to be addressed in the area of research that the researcher wishes to undertake. Only when a research problem is identified the researcher can analyze the issues in that particular area and provide the solutions to the problem identified. Framing an articulate and precise research problem is crucial to writing a quality research paper because the success, appropriateness and novelty of a research paper are dependent upon its research problem (Ravindra, 2022).

According to Farias et al. (2019), once the topic to be researched is defined, there is the need to perform three important stages, in order to identify gaps to be subsequently adopted as research problems: (1) theoretical gaps — theoretical research; (2) practical gaps — practical research; and (3) theoretical practical gaps — converging points between theoretical and practical gaps.

Once a series of gaps or theoretical attention points were identified based on the findings of the analysis of the papers, it can be used as research problems (Marchisotti & Filho, 2022).

To construct effective research questions and hypotheses, it is very important to: 1) clarify the background and 2) identify the research problem at the outset of the research, within a specific timeframe (Misra & Agarwal, 2020). Then, 3) review or conduct preliminary research to collect all available knowledge about the possible research questions by studying theories and previous studies (Bhasin, 2022). Afterwards, 4) construct research questions to investigate the research problem. Identify variables to be accessed from the research questions (Excelsior College, 2022) and make operational definitions of constructs from the research problem and questions. Thereafter, 5) construct specific deductive or inductive

predictions in the form of hypotheses. Finally, 6) state the study aims (Barroga & Matanguihan, 2022).

Research questions are essentially formulated based on conventional theories and real-world processes, which allow the inception of novel studies and the ethical testing of ideas (Wordvice, 2022; Gasparyan et.al., 2019). Carefully formulated research questions and hypotheses define well-founded objectives, which in turn determine the appropriate design, course, and outcome of the study (Barroga & Matanguihan, 2022).

In qualitative research, research questions are utilized more frequently than objectives or hypotheses. By posing "what" or "how" questions, these inquiries seek to learn about, comprehend, examine, or characterize events. In order to elicit a description rather than to relate variables or compare groups, the questions are open-ended. Throughout the qualitative investigation, the questions are continuously revised, reformulated, and altered (International Institute of Health Sciences, 2022). Since the development of this issue, research management has grown more targeted and directed, and this includes deciding what kinds of data are required based on the study that has been done (Rahardja et al., 2018).

Extensive research tools or debates can result from mistakes in methodology or ways of posing questions. The variables under study could serve as the research instrument. In particular, if the method of data gathering involves employing direct observation, such interviews, the costs paid, the length of the research, and the requirement for a large deal of energy increase as the number of variables being evaluated increases (Febriyanto & Yulianto, 2018).

The quality of research results can be determined depending on the formulation of the problem. If the proposed problem formulation is well organized, the study's findings can be deemed to be positive. In contrast, if the formulation of the problem in the research is poorly managed, the results may not be ideal or perhaps make the situation worse (Nirmalasari et al., 2018). The research question directs the choice of the study methodology, design, data analysis strategy, and creation of practical implications and suggestions (Bermudez, 2021).

The introduction should explain the composition used in constructing the research formulation, explain how the research explains the research gap in elaborating the current issue, and say what the formulation should be expressed to support and criticize the prior research (Sahib & Murshid, 2020).

Any given research's direction and purpose(s), which may include any one or a combination of the following, are defined by the research challenge. (1) The closing of knowledge gaps that already exist. (2) Understanding the connections between many facets of nature or phenomena. (3) Validating and testing a body of knowledge, a theory, or a belief, whether it be new or old. (4) The requirement for theory development. (5) The resolving and clarifying of ambiguous or conventional findings. (6) Supporting modifications to current practice? (Akhidime, 2017).

The research questions therefore need to specify the issue or problem being examined (this forms the basis of the potential practical implications of the study), and what the research seeks to find out, explain and answer (Saunders et. al.,2019). When developing your research question it is important to avoid over-relying on one that only prompts descriptive answers. Rather, the research question should be sufficiently open-ended to promote an explanation.

Good explanatory research questions are therefore more likely to start with words or phrases such as 'why', 'in what ways', and 'to what extent'. Similarly, exploratory research questions tend to start with words such as 'how' or 'what', and as such are able to elicit a broad range of answers. It is important that research questions are not too simple and not too ambitious either (Wintersberger & Saunders, 2020).

However, attention to the study of cognitive function in writing is still general in nature, it has not explored how cognitive processes take place, what are the obstacles and how to overcome them - until now the researchers have not explored. Especially in the stages of research such as how the cognitive process in formulating research problems. We have confirmation that the research problem is actually a form of formal language from the research gap. Once the development of research results on a particular topic has been known from the past until now, a researcher is able to identify a research gap: an empty space that has not been researched by others around the world. This empty space can be entered by researchers and every layer of issues can be proposed the formulation of research problems.

During the last decade, there has not been any research that specifically reconstructs cognitive processes in the formulation of research problems in other scientific journals. So far, developing research questions is one of the crucial stages in the research process. The research question must be formulated appropriately as it will guide the research project and help in building logical arguments. The research question should be clear and focused that summarizes the problem the researcher will be going to investigate. In formulating research problems, each scientific writer as the informants of this study had different cognitive experiences. This happens because of differences in disciplinary backgrounds. This study seeks to uncover the informants' cognitive experiences in formulating research problems. Hopefully, their cognitive experiences will be useful in inspiring many people, especially students, practitioners and researchers in formulating research problems in academic writing.

2. Research Methodology

2.1 Research Design

This study used a grounded theory research design. Referring to the purpose of this study, i.e: to reconstruct the cognitive processes in academic writing experienced by three expert writers, the grounded theory research design is deemed appropriate to be applied in this study. According to Creswell (2012), researchers utilize the grounded theory research design when they need a theory or explanation of a process. A "process" theory, which depicts the progression of an event, activity, action, or interaction over time, is the theory employed in grounded theory research. Researchers that use grounded theory must go through organized data collection processes, such as classifying data into groups, connecting those groups, and developing a theory to describe a certain process. Determine whether a grounded theory research design is appropriate for the study challenge is one of the eight processes or methods that Creswell (2012) describes. choosing the cognitive processes that should be investigated; obtaining the necessary authorization and access for study; retaining hypothetical sampling; Data encoding, selective coding, theory development, theory validation, and writing a report on grounded theory research.

2.2 Data and Data Sources

There are two kinds of data used in this research, namely (a) primary data, in the form of interview results and article documents written by informants; and (b) secondary data, in the form of library research, by collecting literature and various relevant reading sources.

2.3 Data Collection Techniques and Procedures

Data collection techniques in academic writing are done through (1) interviews, and (2) article documents. In-depth interviews were conducted with 3 selected informants from a number of universities in Indonesia. The selection of the three Indonesian scientists was based on considerations, among others: (1) Productive in producing scientific publications on Scopus and or the Web of Science; (2) Ease of accessing them for the purposes of observation and in-depth interviews as well as obtaining the necessary written documents; and (3) the diversity of informants with different knowledge groups was deliberately carried out to see whether there were variations in cognitive processes as reflected in the interview process and their academic writings.

Interviews were conducted intensively to obtain in-depth and even unexpected information. As suggested by Charmaz (2006), for grounded theory-based research, the questions asked should be in the form of open-ended questions. From the informants' answers, it can stimulate a more detailed discussion of the topic. Intensive interviews as suggested by Charmaz (2014) allows researchers to deepen the experience of informants in more detail, ask about the thoughts, feelings, and actions of informants, check for accuracy, validate the informants' humanity, perspectives, or actions, use observation skills for further discussion, respect informants and expressed appreciation for participating in being an informant in our research.

2.4 Data Analysis Procedure

One important feature of grounded theory research is the constant comparative analysis method in which the process of data collection and data analysis takes place simultaneously and interactively (Glaser & Strauss, 1967). This analysis process involves constant comparisons between words, sentences, paragraphs, codes and categories. This activity is important to identify similarities and differences in data. The process continues until the writing of the research report is declared complete.There are three stages of analysis carried out in this study, as suggested by Corbin and Strauss (2008), namely: (1) open coding; (2) axial coding, (3) selective coding, and (4) generating theory.

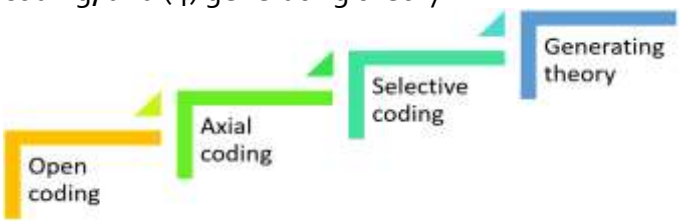

Figure 1: *Data analysis procedures of grounded theory approach as suggested by Corbin and Strauss (2008)*

3. Findings and Discussion

From the results of interviews and analysis of article documents, the following phenomena were found:

3.1 Gap between Expectations and Reality

There is a research gap between expectations and reality inspired informants to formulate the research problem. This gap is a reference point for researchers to formulate research problems. Like the cognitive experience of DS, the research problem was formulated because of a research gap in a particular research area and then the problem formulation was raised. In formulating problems, DS emphasized the importance of identifying the type of research to be carried out and how to formulate appropriate and interesting problems in accordance with the demands of the times. And, of course examining gaps that have not been explored by many other researchers around the world. Research gaps are gaps in problems in a specific research topic that have not been addressed or have not been investigated by other scientists around the world. Regarding this research gap, DS, who has a background in the sociology of education and history, argued that:

> *The flow of thinking usually looks at the formulation of the problem, then it is reduced to a question, then a goal is formulated. The goal is formulated through appropriate methods to achieve research objectives. It depends on whether this research can be finished in a year or more. If research is based on research and development, usually it cannot be finished in a year because there are many steps, it will not be finished in ten steps. Because it has to do field trials* (Interview with DS, April 5th, 2019).

As experienced by DS, after formulating the problem, what he determined what the focus of his research was. This focus is what guides him in conducting research. This is in line with Smith's (2019) suggestions that the formulation of the problem will provide direction for a study to stay on track. After determining the focus of the research, he made indicators to be observed. The following is DS's cognitive experience related to the gap (gaps) relationship, research focus, indicators, and observation objectives.

> *Yes, of course we will return to the research question, then what is the focus? It guides us. Then we make what indicators will be observed? For example, I make observations in class, the focus is where mastery of class observation is, mastery of methods, or use of the media. So if the observation is of course very related in the formulation of the problem. What will be observed we reduce to the focuses or indicators. But it is true that in observation, we hope that qualitative must be a natural setting, not to be disturbed. Just a little as possible of minimizing our presence can interfere the setting in the process.* (Interview with DS, 5 April 2020)

According to DS, the formulation of the problem is closely related to the research method, whether a research is basic research, development research, or applied research. If the development research from the research questions has also been seen, for example how to develop learning models, how to develop multicultural-based textbooks. The goal was general, namely to produce a multicultural-based history textbook.

> *The method is of course not a survey method because it is not suitable, of course it must be research and development. So from the development questions, starting from how to develop conceptual textbooks, how to draft multicultural textbooks, how are the results of limited trials, how are the results of extensive trials, and finally become the final product. So in the formulation of questions and research objectives and methods are very related. Today I see many students who do not really understand the*

> *formulation, objectives, and methods that are not connected* (Interview with DS, April 5th, 2020).

The cognitive flow in formulating research problems with research objectives and research methods can be described as follows:

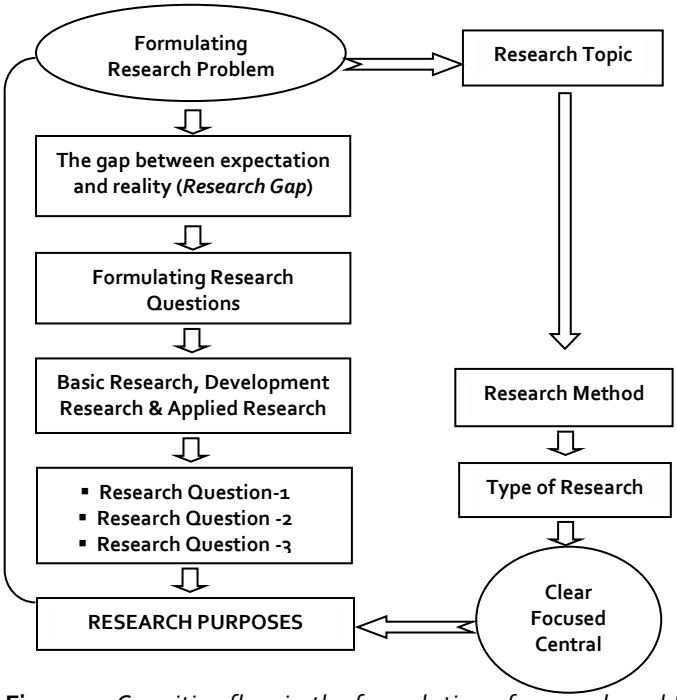

Figure 2*: Cognitive flow in the formulation of research problems with research objectives and research methods*

3.2 Library research process with normative juridical approach

Relatively different from DS, research in the field of law usually appears after carrying out intensive library research activities with a normative juridical approach. Based on ALH's cognitive experience, the formulation of problems is obtained after going through the literature research process related to research topics as his expertise area. However, ALH emphasized that library research must be oriented to primary library sources, not secondary, let alone tertiary sources. The primary sources in such legal studies can be in the form of international treaties, domestic laws and regulations, and expert opinions.

> ....developing research questions to find answers is generally done with a research library first. The research library is for its primary sources. It is a polygal instrument. In this international agreement, literature, court decisions, social media, the primary source is domestic legislation, it is also added to confirm sometimes for confirmation, namely the opinions of experts. Namely through interviews to obtain information sources (Interview with ALH on April 5th, 2020).

Research questions in the field of law generally use a normative juridical approach. Research questions that often arise are open-ended question patterns such as "why" and "how". However, according to ALH, because of its juridical normative nature, in research in the field of law, research questions that are often used usually begin with "why".

> Research questions that usually arise are why and how. But what is emphasized is *why*. Because it is normative, unless what is being studied is to look for weaknesses in a research, then that is how to research and so on. But if it is normative research, then the *why* will be even stronger there (ALH Interview on April 5th, 2020).

Diagrammatically, this flow of research problem formulation by library research can be described as follows:

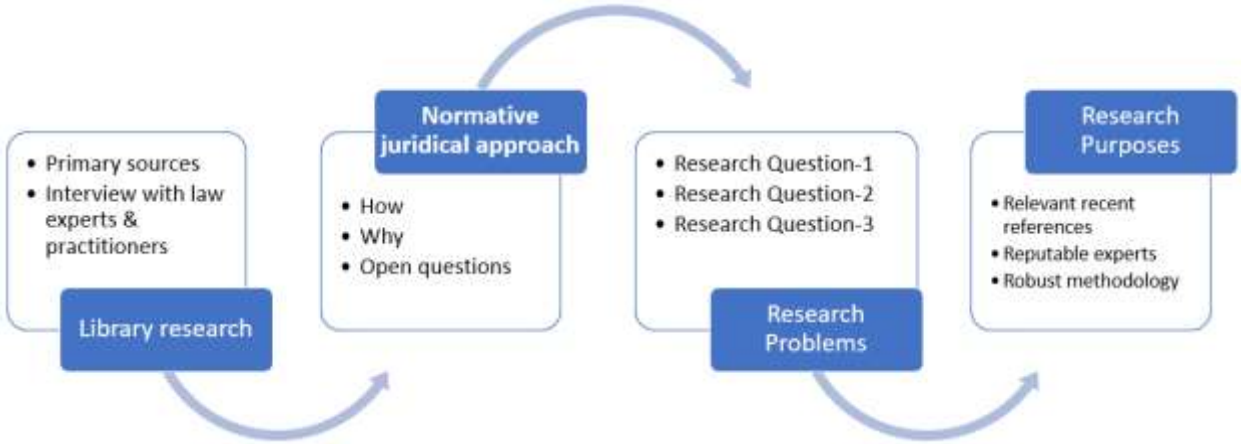

Figure 3: *Flow of research problem formulation conducted by library research*

The cognitive experience above was triangulated with existing documents published in a number of reputable international journals (indexed in Scopus), was concretely reflected. In his work entitled "*State Control and the privatization of the Indonesian telecommunications industry: From ownership to regulation published in the Journal of International Commercial Law and Technology* 5(2), ALH formulated research problems with open question patterns such as *How* and *Why*? Like: "How does the state control and the privatization of the Indonesian telecommunications industry? Why the telecommunications licensing regime become a new method of state control after privatization of telecommunications? In his article entitled "Telecommunications licensing regime: A new method of state control after provatization of telecommunications published in the *Journal of International Commercial Law and Technology* 9(2). Likewise, open questions such as: How does remotely piloted aircraft (RPA) regulation model in several countries and what Indonesia can learn? in his article entitled "In search of remotely piloted aircraft regulations state practices and international law perspective what Indonesia can learn?" published in *Brawijaya Law Journal* 5(1).

Tabel 2: *Patterns of "how" and "why" open questions in formulating research problems*

No	Title of the Article	Questions Pattern	Author	Journal	Volume (Issue), Year
1.	*State Control and the privatization of the Indonesian telecommunications industry: From ownership to regulation*	- How does the state control and the *privatization of the Indonesian telecommunications industry?*	ALH	*Journal of International Commercial Law and Technology*	5(2), 2010

2.	*Telecommunications licensing regime: A new method of state control after provatization of telecommunications*	- *Why does the telecommunications licensing regime become a new method of state control after provatization of telecommunications?*	ALH	*Journal of International Commercial Law and Technology*	9(2), 2014
3.	*In search of remotely piloted aircraft regulations state practices and international law perspective what Indonesia can learn?*	-*How does remotely piloted aircraft (RPA) regulation model in several countries and what Indonesia can learn?*	ALH, NR	*Brawijaya Law Journal*	5(1), 2018

3.2 Intensive searching with finding possibilities

The basis for the formulation of research problems is based on intensive searching by finding possibilities to be tested alternatively experienced by the FK. FK cognitive experience, gives valuable lessons about the importance of the process of searching for literature related to the field of expertise or research interest that can enrich the treasury of research problems to be raised. This FK cognitive experience is in line with Sullivan and Min (2017) and Barrett (2014) who asserted that gaps may be found by intensive search of existing literature. That intensive search has the goal of finding possibilities. This is the possible opportunity that is raised as a research problem and at the same time can be formulated into a research gap. The following is the FK's explanation regarding this:

> How to improve the electronic properties of carbon nano? "I searched several related ones, oh some of them used dopping techniques, some were oxidized, oh some were using this method. Then I asked the professor, from the state of the art, may I not use these methods. Then my professor asked, "Which way do you want to be fit?" for example the Z method, I submitted the theoretical background. This mechanism may be the same as the methods suggested. But the way how we conduct the experiment may be simpler. In fact, for example, it could be a water-based medium because it is not complicated. No need for special equipment, no need for high temperatures. Then, I discussed it with the professor after the searching and it is usually because we find possibilities that can still be researched (Interview with FK, June 1st, 2020).

However, according to FK, when the space for possible research problems can be raised, but when it is brought to the laboratory it does not always run regularly, what she finds even can be anomalies. Research in the field of science, as admitted by FK, often finds anomalies that give surprises because they are not predicted beforehand.

> Human research is unpredictable. It's the same as in Chemistry. Our image is linear. If the concentration is increased, it is increased, the result is this. So, how if we find the bad evident? If my professor likes to teach, don't throw it away. Sometimes normal phenomena always exist. Whatever the result can be discussed. Oh yeah, this is still possible, other people haven't published it yet, oh this is still consistent with the theme. Sometimes at that end the theme is still that, or it can be changed. That's natural, in my opinion. But the scope is more less without it, only later the

> angle, the point of view we present the data whether from the left or right angle depending on the data we have. (Interview FK, June 1st, 2020).

This FK cognitive experience can be illustrated in a diagram as the following:

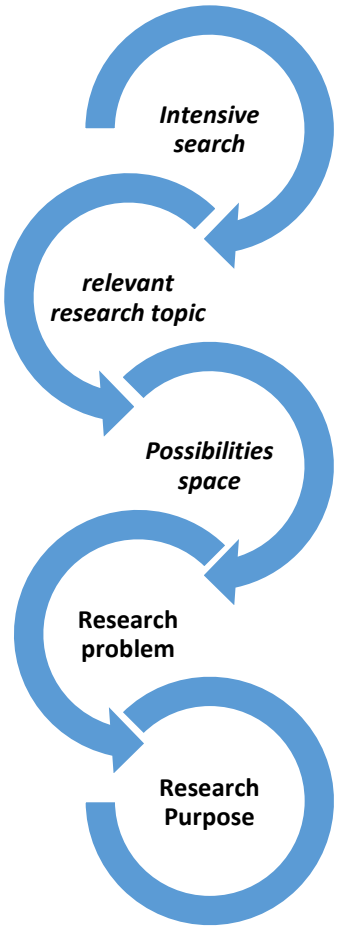

Figure 4: *The flow of problem formulation research carried out by intensive search for space of possibility*

3.3 Norms testing and case studies

In research in the field of law, research issues are raised from testing legal norms which are generally deductive. In some legal research, a deductive-inductive mixed method is also used to formulate and answer research problems. Based on ALH's cognitive experience, which always deals with legal issues, in particular, it is revealed that detailed knowledge of legal cases can be a basis for problem formulation as well as a main reference in developing case analysis. The following is the complete narrative of ALH regarding this matter.

> *That is when testing norms, well, in general, the research is deductive. Because we validate it, so if it is a case study, it can also be inductive. So in general, it is even mixed, because in writing a good legal argumentation is mainly backed up with cases. That's why in western countries, where they are reliable writers, that is an extraordinary case. That's why they refer to it, there are a lot of cases* (Interview with ALH, April 9th, 2020)

Even in teaching law, according to ALH, lecturers and law researchers in Europe often start legal research by recording cases.

> *For example, I will teach about international colonial interpretations, for example there are 15 cases that must be known related to it. There I will say, try any case. If 30% of the students already recognize the related cases there, a way will be seen. So if it is less than 30%, the lecturer will not continue. Because they have to read the case first. So the case is very important. Because the students want to see, confirmating is when the law works in the field. So, each background has a different logic (Interview with ALH,* April 9th, 2020*).*

Based on the cognitive experience of DS, the formulation of research problems is also tailored to the objectives of the research itself. The research objectives are also influenced by the level in the research roadmap. The patterns of research questions follow the objective, whether basic research, development research or applied research. The following is an explanation of the DS related to this.

> *If you examine existing textbooks and compare with other textbooks, that is basic research. If we want to develop an ordinary textbook into an alternative textbook, that is called development research. The question must also be a development question. Unlike the questions for basic research which are only to compare one textbook to another. As applied research, the question applies something too. So the research formulation is related to the goal*. (Interview with DS, April 5th, 2020).

3.4 Mapping global issue structure

From the structure of the emerging global issues, FK tried to present alternative solutions. The structure of the issues written by a number of authors published in various reputable international scientific journals has overcome reports or findings The task of researcher is to try to provide answers or alternative solutions to those offered by existing researchers.

The alternatives offered by the FK are novelty aspects that have an impact on the science advancement. Because based on her experience, journal editors do not only look at the quality of existing data, but if it does not have an impact on the benefit of society and scientific progress, the manuscript will find it difficult to penetrate the reviewing process.

He gave an example of the membrane topic which was not considered as a new issue and many researchers have written about it. The author's task is to find alternative technologies that have an element of novelty that can be introduced to the academic community and audiences in this regard. In principle, there are alternative ideas offered from the existing issue map.

> *That's a research problem, for example if I'm okay, then I don't go through the process of using disinfection or chlorine, for example I want to use an anti-bacterial membrane. The research question is what kind of anti-bacterial membrane do you want to make? What is the pre-preparation model? The question was made beforehand, that's not it. But more on these; where is the research going? What are the issues you want to overcome? What is the current work that has been established? Then where do we have the idea? Maybe later the research question could be like this: "What is the optimum concentration of the bioside that will be added?"* (Interview with FK, June 1st, 2020).

Diagrammatically, the FK cognitive experience in formulating research problems and research objectives can be described as follows:

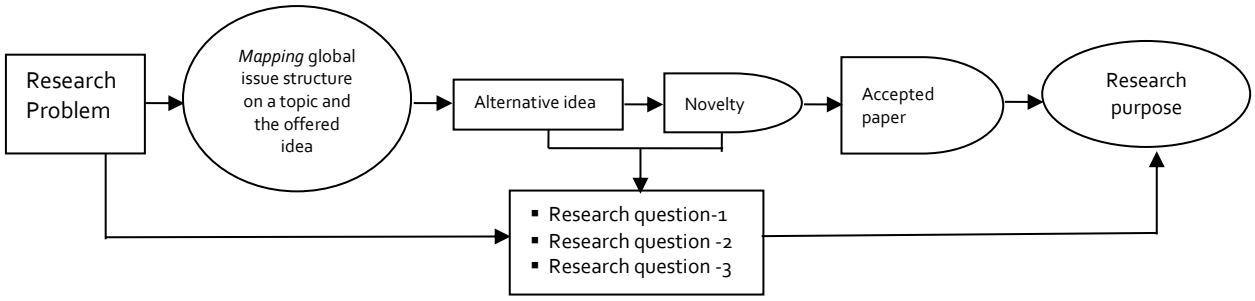

Figure 4: *The flow of research problem mapping based on the mapping of the issue structure and the alternative ideas offered.*

3.5 Data Replication

An effort in formulating research problems that is beyond the norm is also experienced by FK. This cognitive experience actually inspired and encouraged her to raise research problems that have never been revealed by other scientists/writers, namely data replication. FK explained that the plural habit of scientists/writers often considers data to be insignificant so that it must be reduced or eliminated. In this context, a scientist/writer must have perseverance, patience, and never give up in conducting research, including treating data. Namely, replicating the same data, by bringing up different ways and points of view (angle). Data that was previously deemed useless and had to be discarded emerged to alternative findings that were very useful, both for the wider community and for the development of science. The idea of data replication to find gaps in new issues that can be researched and ways is one of the most studied phenomena (Milani & Navimipour, 2017).

The following is the FK's explanation regarding the importance of data replication as to bring up alternative ideas or novelty values, if the way to analyze the data is different from what is customary:

> At that time, I found a finding that was different from the prevalence of publishers. If we usually think, Oh... this data is wrong, then we throw it away. In conducting a research, we have to be patient, have to be sincere, don't give up quickly. Because sometimes if we don't follow the trend, it's discarded, but if we know how to discuss the data, it will be accepted. But if it doesn't match ours, it's discarded, constructivism theory is discarded from data. Even though it could be something that is really interesting, and it could be a new invention. But it was because at that time we didn't have the way to discuss, how to describe the data in the good way (Interview with FK, June 1st, 2020).

This cognitive experience is strengthened by the advice of his professor when FK studied in Japan. His professor advised her not to easily believe and not be pessimistic about the data that other people have reviewed. These data later shocked the academic world.

> *That's why in science we often have data replication. It was measured at least three times for data producibility, and so on. However, if there is data that is not in accordance with this, we will immediately discard it. Without really thinking, what is the interesting theme? People say that science is an exact science. In fact, there are many uncertainties in it. Because we can't predict, but theoretically we have assumptions*. (Interview with FK, June 1st, 2020).

The relationship of data replication, research problems and different ways of analyzing data as to imerge useful scientific findings can be summarized in the following cognitive path:

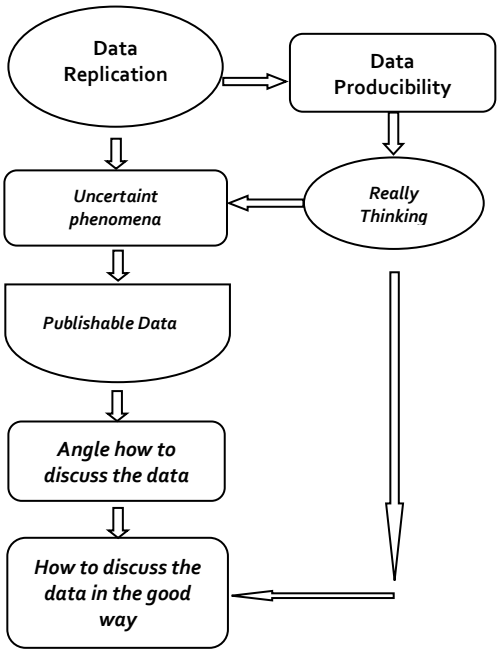

Figure 5*: Flow of research problem formulation from the results of data replication*

4. Conclusion

The various cognitive experiences of the informants in determining research problems indicate the influence of the disciplines they are involved in. However, there are many common threads that connect these various cognitive experiences. Among them: the importance of reviewing existing libraries so that researchers have the provisions to know the latest developments (state of the art) of each of their research interests.

By knowing the state of the art of previous studies, each informant was able to identify research gaps that had not been explored by other researchers. In these research exploration spaces, many researchers are inspired to ask various kinds of research questions. Surely, the cognitive experiences of each informant were also influenced by their research ecosystem. If a tertiary institution has an established research roadmap, then actually the direction and orientation of the research is more guided, than one that does not have a research roadmap.

In general, the informants had the same experience that the research questions posed had a close organic relationship with the research objectives. In short, research questions are a ladder in formulating research objectives. In other words, the research objective is the formal formulation of the research question. This can be seen from the cognitive flow in the formulation of research problems with research objectives and research methods.

Undoubtedly, research questions are the flower of research. Because the purpose of the research is actually to answer research questions. However, for many novice researchers, the formulation of the research question is simply not easy. Various studies teach us that their weakness in doing intensive and extensive literature searches makes them often constrained in their research productivity. Therefore, this study provides an important scientific

contribution in exploring how expert and senior researchers explore and identify research gaps as well as in formulating research questions.

The determination of research problems and objectives experienced by research informants is influenced by the disciplines occupied by each research informant. In general, the determination of problems and research objectives is due to: There is a gap between expectations of reality; library research with a normative juridical approach; intensive searching of previous research results by finding possibilities; Testing norms and case studies also identify research problems and research objectives; mapping global structure of issues; and data replication of reduced data. This research is limited to the cognitive process of research problem formulation. Of course, this potential study has a number of limitations. However, given that problem formulation is so central to research, this article finds its significance. Because in fact, the research aims to answer research questions. If the research question is to be answered properly, then methodologically, a study is already on track.

This research has an important and significant impact on the development of science and technology. Because this research offers a new approach to how cognitive experiences were constructed. The results of the construction of this cognitive process have tangible benefits for many people regarding how research problems and research questions are formulated. This study is certainly very interesting and provides strong benefits for novice researchers in particular.

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