

Investigation of Doctoral Theses in the Field of Physics Education in Turkiye in Terms of Theoretical Framework and Conceptual Framework

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ABSTRACT

The theoretical framework and conceptual framework help to determine the purpose of scientific research, facilitate the analysis of data, organize the thoughts of researchers, increase the reliability of research, and ensure that research is shared in a wide area. Although these two concepts seem to be basically the same, they have structural differences and the roles they assume are not same. Despite this, it is seen that many researchers use these two concepts when structuring their academic studies without fully distinguishing between them. In this research, 87 doctoral theses in the field of physics education in Turkiye from past to present were examined in terms of theoretical framework and conceptual framework. In the study, the case study, which is one of the qualitative research approaches, was used and the obtained data were analyzed with descriptive method. As a result of the findings obtained, it was seen that all of the theses had at least one theoretical framework or conceptual framework, and instead of these two titles, five different titles were used: theoretical framework in 29 of 87 theses, conceptual framework in 18, introduction in 18, literature review in 15 and general information in 7. When the distribution of theses in terms of theoretical framework and conceptual framework was analyzed, 64 of the 87 theses were evaluated under the titles of conceptual framework and 23 of them were evaluated under theoretical framework titles. In addition, when the distribution of approaches, theories, models, strategies and methods used in the theses was examined, it was concluded that they were mostly accumulated in the learning-teaching, conceptual understanding, cognitive dimension and affective dimension categories.

Keywords: Physics education, doctoral theses, theoretical framework, conceptual framework, learning and teaching approaches.

INTRODUCTION

It is important to establish a theory, theoretical framework or conceptual framework on the basis of scientific research. These elements play a key role in determining the purpose of the research, research questions, hypotheses and conclusions. Lewin (1951) emphasized the power of theory to explain complex phenomena with the words “There is nothing as practical as a good theory” (p. 169). Van de Ven (1989) pointed out the importance of the theory as follows: “Good theory is practical precisely because it advances knowledge in a scientific discipline, guides research towards crucial questions, and enlightens the profession of management.” (p. 486). On the other hand, Wacker (1998) listed the importance of theories for researches and researchers as providing a framework for making analysis, providing effective methods for field development, and providing transparent explanations for the pragmatic world. Theory is a structure that examines in depth how an event occurs under certain or different conditions and tries to extend and explain the information and assumptions present in the event to critical limits (Çepni, 2021). Kerlinger (1986) stated that the theory is “A set of interrelated constructs (concepts), definitions, and propositions that presents a systematic view of phenomena specifying relations among variables, with the purpose of explaining and predicting the phenomena” (p. 9). Theory, in this sense, can be thought of as a plan, acting as a guide for modeling a structure. The fact that a

sketch depicts the elements of a structure and the relationship of each element to each other is just as a theory depicting the concepts that make it up and the relationship of the concepts to each other (Imenda, 2014). The common aspects of the definitions of theory made in different disciplines are that the theory has components such as some assumptions and concepts and that these components are the system consisting of the relationships between them and that it undertakes the task of predicting and explaining some facts or events (Bingölbali, Arslan and Zembat, 2016).

On the other hand, in educational sciences and field education researches, two more concepts such as theoretical framework and conceptual framework are closely related to theory. The theoretical framework refers to the theory that

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a researcher wants to guide him in his research. Thus, the theoretical framework is the application of a theory or a set of concepts taken from that theory to provide an explanation of an event or to shed light on a particular event or research problem (Imenda, 2014). A well-prepared theoretical framework helps researchers to obtain sound scientific facts on the contrary, it explains that the subject of research was formed in the past on the basis of sound theories, and that the subject did not arise suddenly. The researcher is asked to state the theories on which he / she is based in the theoretical framework he / she has created for his / her research and to establish the relationship of these theories with the work done. It is very difficult to determine the research questions without establishing a theoretical framework in the research (Çepni, 2021; Kartarı, 2017).

The conceptual framework, on the other hand, can be defined as a result of bringing together a series of related concepts to explain or predict a particular event. The process of arriving at a conceptual framework is similar to an inductive process in which small individual parts are put together to tell a larger map of possible relationships. A conceptual framework is derived from concepts while a theoretical framework is derived from a single theory (Imenda, 2014). The theoretical and conceptual framework explains the path of a research and bases it firmly on theoretical structures. The overall objective

of the two frameworks is to make research findings more meaningful, more acceptable, and generalizable for theoretical structures in the research field. The theoretical framework helps to stimulate research while enabling the expansion of knowledge by providing both direction and impetus to the inquiry of research. It also improves the experimentation and rigor of a research (Adom, Hussein, and Agyem, 2018).

In the literature, it is seen that the theoretical framework and the conceptual framework, even the term literature review, are often used interchangeably by researchers, to explain each other, and as steps in each other's process (Rocco & Plakhotnik, 2009). A literature review in a scientific research is done to develop a conceptual framework or to find a research topic, and in this sense it is a term that is structurally different from the theoretical framework and conceptual framework (Merriam & Simpson, 2000). On the other hand, the theoretical framework and the conceptual framework are two terms that are often confused. There are similar and different aspects between the theoretical framework and the conceptual framework. When similar aspects are considered, both concepts aim to reveal research that is holistic and has a consistent structure in itself. While the creation of the conceptual framework by the researcher makes it a more subjective structure, the creation of the theoretical framework by scientific means and the fact that it contains scientific information that the researcher accepts as

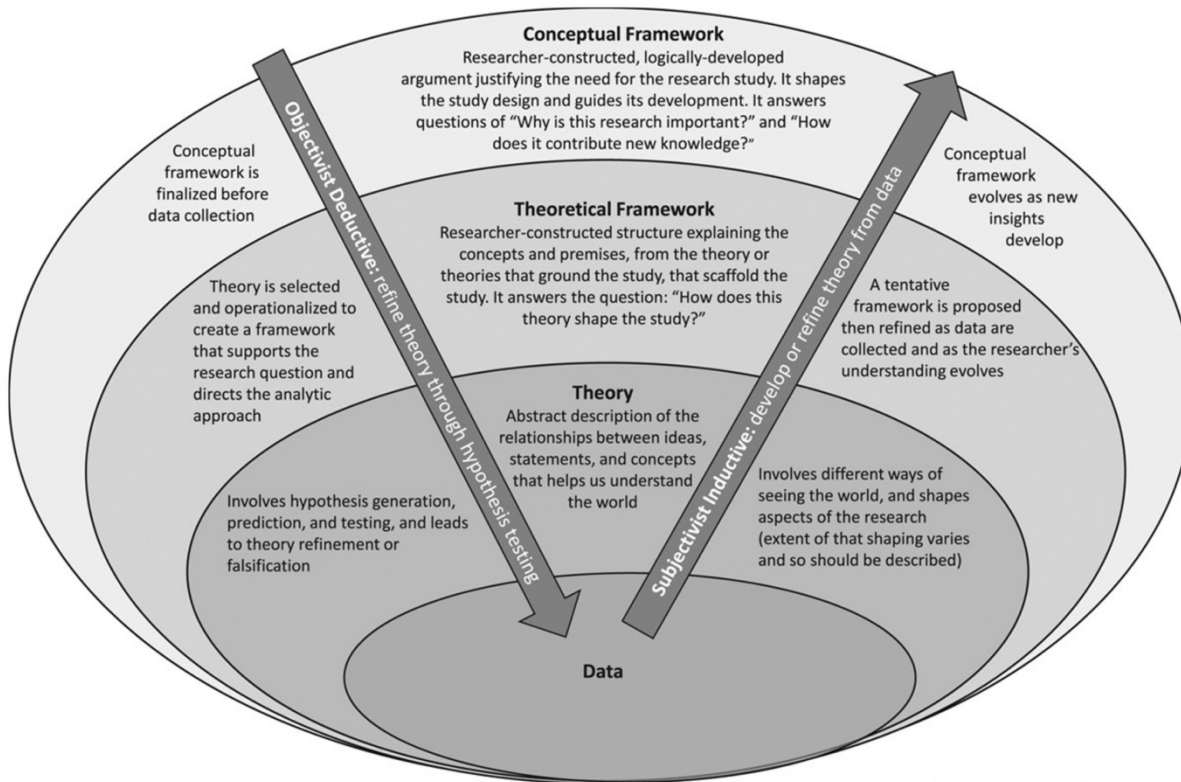


Fig. 1: Similarities and Differences between Theory, Theoretical Framework and Conceptual Framework (Varpio et al., 2020).

a basis for his research turns it into an objective structure. The most important point here is that the conceptual framework is a broader structure that includes the theoretical framework (Çepni, 2021; Varpio et al., 2020).

When Figure 1 is examined, it is seen that the most general and comprehensive framework is the conceptual framework. In the model, it is aimed to refine the target theory by creating hypotheses testing with objectivist deductive approach. In the same model, when moving from the bottom up, it is aimed to develop a data-based theory or to refine the developed theory with a subjectivist inductive approach (Varpio et al., 2020). As a result, the conceptual or theoretical framework is the soul of every research project and they determine how a particular researcher formulates the research problem and how they investigate the problem and what meaning they attach to the data obtained from such research (Imenda, 2014).

Theory and theoretical approaches allow for a better understanding and understanding of physics education and teaching, as in all areas. The reasons for the difficulties experienced by students in physics learning, how students structure a physical information, how a predictive roadmap for physics teaching can be answered with theory and theoretical approaches. Graduate theses that complement scientifically important goals are among the most important resources that reflect the breadth and depth of the subject under study, as well as the overall view of the field in question. In this sense, it is a matter of curiosity what are the approaches, theories, models, strategies, and methods related to teaching used in graduate theses written in the field of physics education and whether they are correctly formed as a theoretical framework or conceptual framework in the structure of the theses. When the relevant literature is reviewed; although there are studies on the trends of research in the field of science/physics education in Turkiye (Kaltakçı Gürel et al., 2017, Karamustafaoğlu, 2009; Kiras, 2019; Yılmaz, 2019), there is no study that examines the researches in terms of theoretical and conceptual framework. In this study, it is aimed to examine the doctoral theses written in Turkiye in terms of theoretical framework and conceptual framework and to determine the approaches, theories, models, strategies, and methods used in these theses. For this purpose, the following questions were tried to be answered:

1. How is the distribution of theses in terms of theoretical framework and conceptual framework and how should it be?
2. What are the approaches, theories, models, strategies, and methods used in the theses?

METHOD

In this section, information about the research method is given. This information is presented un-

der the titles of research model, research design, study group, data collection and data analysis.

Research Model and Design

In this study, the doctoral theses on physics education in Turkiye in terms of theoretical and conceptual framework were analyzed and case study which is one of the qualitative research methods was used. In case studies, the elements such as documents, reports, archives, direct observations, interviews, participant observations, technological products or artefacts (Yin, 2003). The theoretical and conceptual frameworks of the doctoral theses on physics education in Turkiye form the case of this study.

Study Group

The data source of the study consists of the doctoral theses on physics education in Turkiye, which are accessible on the database of Higher Education Council Thesis Center. Criterion sampling, which is one of the purposive sampling methods, was used in order to select theses. The criteria in the research were determined as “physics education” and “doctoral level theses”. Doctoral theses were included in the research because theoretical and conceptual framework are utilized more consciously in doctoral theses than master theses. The theses analyzed in the study were reached from Higher Education Council Thesis database by searching subject, thesis type and branch / department respectively with the keywords “education”, “doctoral” and “physics education, physics teaching, physics”. As a result of searching, 91 theses were reached in total; however, 87 theses were included in the study because whole documents of 2 theses were not accessed online and 2 theses are purely related to physics. The distribution of

Table 1. The Distribution of the Universities where Theses Prepared

<i>Universities where theses were prepared</i>	<i>(f)</i>	<i>(%)</i>
Karadeniz Technical University	15	17
Balıkesir University	13	15
Ataturk University	12	14
Gazi University	12	14
Marmara University	12	14
Dokuz Eylul University	6	7
Dicle University	5	6
Selcuk University	4	5
Trabzon University	4	5
Celal Bayar University	1	1
Canakkale Onsekiz Mart University	1	1
Hacettepe University	1	1
Suleyman Demirel University	1	1
TOTAL	87	100

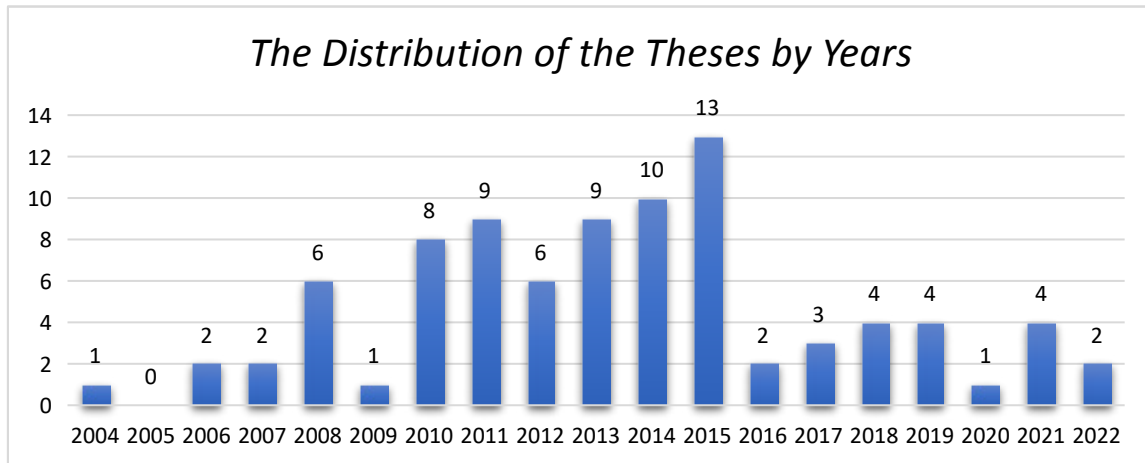


Fig. 2: The Distribution of the Theses by Years

the theses in the study according to the universities where the theses prepared and their years were presented in Table 1 and Figure 1. According to this, the theses were seen to be prepared in 13 different universities between 2004 and 2022.

Data Collection

Data of the research was gathered with the aid of document analysis technique. In document analysis technique, written, oral and visual materials can be used in accordance with the aim (Bogdan & Biklen, 1992). In the study, first step is to classify reached theses according to their departments and transfer them into computer as PDF document. These theses were coded and information about their years, their universities, departments, the usage of theoretical framework or conceptual framework, the usage of approach, theory models, strategy or method were encoded into the spreadsheet program.

Data Analysis

Through document analysis, from the cover pages of the theses, information related to the years, universities, departments were transferred into spreadsheet program. In addition to this, the theses were examined till the method sections and the information about where theoretical or conceptual framework exist in which titles of the theses were coded. Also, whether these theses should be theoretical framework or conceptual framework were examined. While examining, Imenda's (2014) theoretical or conceptual framework approach was utilized. If the study focused on only one theory or continues with only one theory, it was evaluated as theoretical framework and if more than one theory was dealt with together, it was evaluated as conceptual framework.

In addition to this, in the studies structured around a particular theoretical framework but investigating the effect on independent variables, the studies that seem to

have a theoretical framework considering the theories grounding the independent variables were evaluated as having conceptual framework. On the other hand, the approaches, theories, models, strategies, and methods discussed in the theoretical or conceptual frameworks of the theses were determined and classified. The categories utilized in this classification are learning-teaching, conceptual understanding, cognitive dimension, affective dimension, skills, technology, material design, teacher education, measurement and evaluation, curriculum, modelling, socio-cultural dimension, interdisciplinary association, and nature of science. Findings obtained through descriptive analysis are presented in tables as frequency and percentage.

Results

In this section, findings were respectively presented according to the research problems.

What is the current distribution of theses in terms of theoretical framework and conceptual framework and how should it be?

Theses were examined in terms of theoretical and conceptual framework and the approaches, theories, models, strategies, and methods that constructed the theses were presented as the categories in Table 2.

As seen in Table 2, even though the approaches, theories, models, strategies, and methods were expressed differently, they were gathered generally under these categories: Theoretical framework ($f = 29$), conceptual framework ($f = 18$), introduction ($f = 18$), literature review ($f = 15$) and general information ($f = 7$). Among these categories, theoretical framework and conceptual framework were used most. On the other hand, although all the theses had a theoretical or conceptual framework, it is noticeable that instead of these titles, they were under the titles of introduction,

Table 2: Theoretical framework and conceptual framework status in theses

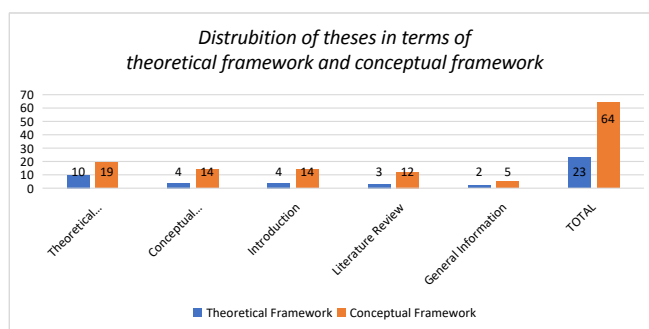
Categories	Subcategories	Frequency (f)	Total Frequency (Σf)
Theoretical Framework	Theoretical Framework	26	29
	Theoretical Foundations	2	
	Theoretical Structure	1	
Conceptual Framework	Conceptual Framework	18	18
Introduction	Introduction	18	18
Literature Review	Literature	3	15
	Related Literature	5	
	Related Research	2	
	Source Research	1	
	Source Review	1	
	Literature Review	2	
	Literature Research	1	
	General Information	General Information	
TOTAL		87	87

Table 3: How should the theses be distributed in terms of theoretical framework and conceptual framework?

Categories	Theoretical Framework		Conceptual Framework	
	f	%	f	%
Theoretical Framework	10	11	19	22
Conceptual Framework	4	5	14	16
Introduction	4	5	14	16
Literature Review	3	3	12	14
General Information	2	2	5	6
TOTAL	23	26	64	74

literature review and general information. Therefore, the titles of theoretical framework and conceptual framework were not used in their places in the theses covered in the study. Depending on Imenda's (2014) definition, theses were re-examined in terms of theoretical framework and conceptual framework and the findings were presented in Table 3.

When Table 3 is examined, it is seen that 23 of 87 doctoral theses (26%) in the field of physics education can be evaluated within the theoretical framework and 64 (74%) within the conceptual framework. When examined in detail, it was determined that 10 of 29 theses within the scope of the theoretical framework are in the theoretical framework and 19 of them are in the conceptual framework. Furthermore, it was determined that 4 theses of 18 theses can be evaluated within theoretical framework and 14 of them can be evaluated within conceptual framework. Similarly, 4 of 18 theses in scope of introduction are in the theoretical framework and 14 of them are in the conceptual framework; 3 of the 15 theses within the scope of literature review are in the theoretical framework and 12 of them are in the conceptual framework. Finally, it has been

**Figure 3:** How should the theses be distributed in terms of theoretical framework and conceptual framework?

determined that 2 of the 7 theses within the scope of general information can be evaluated in theoretical framework and 5 theses in conceptual framework.

What are the approaches, theories, models, strategies, and methods used in theses?

When the theoretical and conceptual frameworks of doctoral theses in the field of physics education in Turkiye were examined, the approaches, theories, models, strategies and methods used in theses are seen to gather under the categories of learning-teaching, conceptual understanding, cognitive dimension, affective dimension, skills, technology, material design, teacher education, measurement and evaluation, curriculum, modelling, socio-cultural dimension, interdisciplinary association and nature of science, and the frequencies and percentages of these categories are presented in Table 4.

As can be seen from Table 4, it was seen that the approaches, theories, models, strategies, and methods used in the theses examined were mostly in the learning-teaching

Table 4: The Distribution of Approaches, Theories, Models, Strategies, and Methods Used in the Theses

Categories	<i>f</i>	%
Learning-teaching	59	23
Conceptual understanding	42	16
Cognitive dimension	40	16
Affective dimension	30	12
Skills	24	9
Technology	19	7
Material design	16	6
Teacher education	5	2
Measurement and evaluation	5	2
Curriculum	4	2
Modelling	4	2
Socio-cultural dimension	4	2
Interdisciplinary association	3	1
Nature of science	3	1
TOTAL	258*	100

* Since more than one approach, theory, model, strategy or method is used in the theses examined, the total frequency differs from the total number of theses.

(23%), conceptual understanding (16%), cognitive dimension (16%), and affective dimension (12%) categories. This category was followed by skills (9%), technology (7%), material design (6%) categories respectively. On the other hand, it is seen that fewer studies have been carried out in the categories of teacher education (2%), measurement and evaluation (2%), curriculum (2%), modelling (2%), socio-cultural dimension (2%), interdisciplinary association (1%) and nature of science (1%).

DISCUSSION AND CONCLUSIONS

In this section, discussion, results, and recommendations regarding the findings obtained as a result of examining the doctoral theses on physics education in Türkiye in terms of theoretical and conceptual framework.

The first sub-problem of the research is “What is the distribution be in terms of theoretical and conceptual framework and how should they be?” According to the findings obtained regarding first sub-problem, the approaches, theories, models, strategies, and methods used in the examined theses are presented under the titles of theoretical framework, conceptual framework, introduction, literature review and general information. It is seen that the most used title among these is the theoretical framework, followed by the conceptual framework, introduction and literature review titles, respectively. It is concluded that the least used title is general information. Although all of the examined theses have a theoretical framework or a conceptual framework, it

is noteworthy that in some studies is instead of these titles, the titles as introduction, literature review and general information were used. However, it has been concluded that the theoretical framework and conceptual framework titles are used interchangeably in many theses examined. It is considered that this stems from the thesis templates from the institutes. In a supportive way, Çepni (2021) stated that in the postgraduate thesis writing guides were created by many institutes in Türkiye, the conceptual framework and the theoretical framework are often confused and in most of them they are given only as titles without explaining how to create these concepts.

When how the distribution of theses should be in terms of theoretical framework and conceptual framework is examined, it is concluded that about three-quarters of theses can be evaluated within the scope of the conceptual framework, and one-fourth of them can be evaluated within the scope of the theoretical framework. It has been evaluated that approximately one third of the theses presented within the theoretical framework are in this framework, and two thirds should be within the conceptual framework. What is more, it is concluded that approximately four-fifths of the theses presented within the conceptual framework can be evaluated within this scope, and one-fifth should be evaluated within the theoretical framework. On the other hand, it is concluded that about three-quarters of the theses presented under the titles of introduction, literature review and general information should be in the conceptual framework, and one-fourth should be in the theoretical framework. Although subjects such as academic achievement and attitude are examined as independent variables in many theses, it is seen that theoretical information about these variables is generally not given. In the mentioned theses, it is seen that the learning-teaching approach, which is used more in the theoretical framework, is explained. Therefore, there is another result that we use a theoretical framework instead of a conceptual framework in some theses.

When all these results are evaluated, it is understood that researches did not pay attention to the distinction between theoretical and conceptual framework while constructing their scientific research process. Therefore, it is seen that they have difficulty in the process of publishing articles on qualified journals because theoretical and conceptual framework cannot be created effectively in general (Lederman & Lederman, 2015; Ravitch & Riggan, 2012). Although research methods, designs, sampling methods, validity and reliability issues are mainly included in a great number of sources related to the scientific research process, it is seen that the theoretical and conceptual framework and how they should be created, which has an important place in the scientific research process, is not mentioned (Çepni, 2021; Erdoğan, 2001; Kivunja, 2018).

According to another finding of the study, the approaches, theories, models, strategies and methods used in the theses

are gathered respectively under the categories of learning-teaching, conceptual understanding, cognitive dimension, affective dimension, skills, technology, material design, teacher education, measurement and evaluation, curriculum, modelling, socio-cultural dimension, interdisciplinary association and nature of science categories. When the studies on the tendencies of the researches in science/physics education are examined in the literature, it is seen that the most studied subjects in these studies, in parallel with the results of the research, are the approach, theory, model, strategy and methods to learning-teaching, and conceptual understanding (Kaltakçı Gürel et al. 2017; Karamustafaoğlu, 2009; Kiras, 2019; Yılmaz, 2019). Based on the results obtained in this sense, as Kiras (2019) stated, it can be said that the studies carried out in the field of science/physics education abroad affect the curricula created in Türkiye and the curricula affect the studies carried out in the country.

As a result of this study, it brings the necessity that the concepts of theoretical framework and conceptual framework should be discussed in a more detailed way in the sources for scientific research processes. However, it can be recommended to give more importance to this subject in the courses related to scientific research method and also it is a recommendation for the institutes present their thesis templates with “theoretical/ conceptual framework” as two options. Considering the templates of the institutes as guidelines rather than absolute rules can eliminate this misuse. In the future researches, the distribution of the titles of introduction, literature review and general information, which are used instead of theoretical framework and conceptual framework in thesis studies, can be examined according to years. In this way, it can be seen whether there is an awareness of this issue over time.

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