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Examination of Postgraduate Theses in Sciences within the Interdisciplinary Context

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ABSTRACT

Nowadays, the rapid spread of the interdisciplinary approach contributes to the development of disciplines and scientific developments in many ways. Therefore, how the interdisciplinary approach is addressed in the studies carried out is important in terms of guiding other studies. For this purpose, an attempt to determine how 155 doctorate theses which were written in science departments at a university located in Turkey's south between 2010-2016 addressed the study discipline, subject of study and interdisciplinary approach process was made in this study. Furthermore, the opinions of instructors working in these departments on the interdisciplinary approach were also examined. As a result of the study, it was seen that 140 theses were written with the disciplinary approach, 15 theses were written with the interdisciplinary approach, and they were also associated with economics, sociology, psychology and geography among social science disciplines. The facts that the concept of interdisciplinary is not exactly known and that the necessary conditions for studying have not been provided, the lack of time, the presence of gaps in disciplines and failure to ensure the adequate cooperation are important reasons for the limited number of studies carried out with the interdisciplinary approach. Therefore, it is important to promote interdisciplinary studies and to provide suitable conditions for studying.

KEYWORDS
Discipline, Interdisciplinary, Postgraduate, Sciences

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Introduction

In the age we live in, the rapid development of science and technology contributes to human life in many areas and also leads people to new studies and pursuits. This situation prompts individuals to further thinking, research and production. While many situations encountered in the orientation process lead to the further examination and investigation of the content and to the new formation processes in disciplines, they provide the formation of new disciplines in unanswerable situations. While Demir (2008) defines discipline as a teachable information and subject area with specific terminology, teaching methods, applications, and content, Parker (2002) defines it as a study area with specific infrastructure, information, concepts, methods, hypotheses and viewpoints in its own way. Critical thinking, creative thinking, associating information with different areas and self-renewal appear as the needs of individuals for the rapid increase in field information in disciplines and for ensuring adaptation to new developments in

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this process (Erdinç, 2010).Therefore, the primary purpose should be the interdisciplinary approach instead of the disciplinary thinking approach in the education system. Because the teaching performed depending on a single discipline or field may cause information learned to be disconnected from each other and unrelated, and the areal viewpoint which is difficult to change (Dervişoğlu & Soran, 2003).However, the combination of two or more areas and the integration of the content in a meaningful way come into question in the interdisciplinary approach (Jacobs, 1989; Roush, 2008).In this process, individuals gain the skills of sharing information, being informed in different areas, establishing relationships between the fields, multi-directional thinking and producing different solutions to problems (Drake & Burns, 2004). Therefore, it is necessary to provide opportunities suitable for the enriched learning environments that integrate different disciplines and for the formation of different opinions while designing an interdisciplinary curriculum in educational levels (Miller, 2005).Here, the point that needs to be taken into account is to determine the discipline, where it starts and ends, the points covered by it, and what kind of changes it has undergone (Demir, 2008).To know these properties related to disciplines is guiding for the designing, structuring and implementation of the process in interdisciplinary studies. In this context, when interdisciplinary studies in the literature were examined, it was determined that the studies were mostly focused on a concept or a theme, and these studies were mostly associated with social sciences, mathematics, technology and educational sciences (Akins &Akerson, 2002; Demir, 2009; Demirel, Tuncel, Demirhan & Demir, 2008; Focht & Abramson, 2009; Hamalosmanoğlu & Güven, 2014; İlhan, 2011; Kunduroğlu, 2010). In addition, the fact that the study subjects are structured with usual disciplines by the interdisciplinary approach in these studies leads to the need for interdisciplinary studies involving different disciplines. For instance, interdisciplinary examination and investigation of technological devices which are rapidly developing in our day with different disciplines such as philosophy, sociology, and geography as well as constantly examining them with the disciplines such as physics, chemistry and mathematics may enable the formation of new ideas. Attention should be paid to new and recurrent interdisciplinary teaching and studies at all levels of education and courses to achieve these achievements in a globalizing world. It was seen that there was a limited number of studies when interdisciplinary studies in sciences that involve many disciplines and offer opportunity for the interdisciplinary approach were examined for this purpose (Akins & Akerson, 2002; Cervetti, Barber, Dorph, Pearson & Goldschmidt, 2012; Dervişoğlu&Soran, 2003; Gürdal, Şahin &Bayram, 1999). However, sciences, one of the natural sciences, allows for the in-depth examination of nature and natural events, understanding the nature of the information and producing different information (Osborne, Erduran & Simon, 2004). In this process, physics, one of science disciplines, contributes to sciences by examining the universe, substance and the properties of energy, chemistry contributes to it by investigating the structure, properties, and reactions of the substance, biology contributes to it by examining the interactions of all living creatures with each other and the environment. Besides, mathematics and statistics disciplines also ensure the interpretation of results in sciences by explaining the meaning of patterns and structures. Therefore, priority should be given to interdisciplinary studies in sciences instead of studies carried out by the disciplinary approach. The examination of the studies carried out in sciences by integrating under a single study and the determination of how the interdisciplinary approach is addressed in the studies, with which disciplines it is associated and on what subject it is applied will be guiding for the interdisciplinary studies to be carried out. Moreover, this study is expected to create ideas regarding the elimination of deficiencies in new studies to be carried out as well as contributing to being informed about the current situations of the studies carried out in sciences and to the determination of their interdisciplinary status. For this purpose, examination of the studies carried out in sciences within the interdisciplinary context constitutes the primary purpose of our

study. The facts that the examination of theses within the interdisciplinary context is performed with thematic and methodological methods (Bağcı, 2013; Çiltaş, Güler & Sözbilir, 2012; İlhan, 2011; İşçi, 2013; Ulutaş & Ubuz, 2008) and that it is performed only in education and music disciplines (Turna & Bolat, 2015; Ece & Çeşit, 2011) in the relevant literature support the need for the study. In addition, the results of this study are thought to ensure the revealing of the new science subject areas in sciences and the use of the interdisciplinary approach in the teaching of them. Thus, 155 theses were addressed for the examination of doctorate theses which were written in the institute of science at a university located in Turkey's south within the interdisciplinary context, and answers were sought for the following questions within the scope of the study.

(1). How are doctorate theses distributed within the context of study discipline and subject themes by years?

(2).How is the relationship of doctorate theses with the other disciplines within the interdisciplinary context distributed?

(3). What are the opinions of the instructors working in sciences on interdisciplinary studies in postgraduate theses?

Method

Research Model

This study was designed by the case study, one of qualitative research designs, performed to determine the association status of the studies carried out in sciences within the interdisciplinary context. The case study is a research method which examines a current fact within its own real-life environment and which is used in cases where more than one evidence or data source are available (Yin, 1984; cited by. Şimşek&Yıldırım, 2011, p.277).Cresswell (2007) defines case study as the research approach that examines one or more situations with multiple data collection tools (observation, interview, document, reports, etc.) and in which themes are defined according to it. In line with the purpose of the study, document review and interview techniques were used in the data collection. Although doctorate theses which were suitable for the purpose of the study were addressed in the document review, the opinions of the instructors working at the university were analyzed for a clearer determination of the real situation.

Data Collection

Within the scope of the document review, doctorate theses which were published in the physics, chemistry, biology, mathematics and statistics departments in the university's institute of science between 2010 and 2016 were analyzed in the study. The reason for the inclusion of only doctorate theses in the study process is the fact that doctorate theses comprise a more detailed study process, and the reason for the examination of the last six years is the fact that the thesis subjects are thought to be current. In this context, thesis catalog of the CoHE was used in determining the theses. The theses examined were classified by the headings of study discipline, subject heading, subject content, study year and the other disciplines with which they are associated, and the coding form was formed and filled in.

Another data collection tool of the study is the interview method. The semi-structured interview form which was developed by the researchers and formed by being supported with expert opinions was used in the interviews. The studies carried out with the discipline/interdisciplinary approach, disciplinary/interdisciplinary approach and the questions containing the suggestions for the interdisciplinary studies were included in the interview form. The participants who were randomly determined in the interview were a total of eight people from physics (f:2), chemistry (f:2), biology (f:1), mathematics (f:1) and statistics (f:2) departments. The voice recorder and note-taking method were used to avoid data loss during the interview, and the length of the interview was 15-20 minutes on average for each participant. The data obtained by the recorder and

note taking were examined on question basis by typing into the computer environment as written raw texts, and coding was performed.

Analysis of the data

In the study, tables were created by filling the coding form in line with the sub-purposes of the research in the analysis of relevant documents. In the tables created, the frequency values of the theses were calculated by including their disciplines by years, themes and status of the discipline/interdisciplinary association. The content analysis method was adopted in the data analysis of the interviews, and the themes and codes were created. Besides, participants' opinions were also included to ensure transferability. In this context, codes such as I1 and I2 were used for the instructors.

In the process of the analysis of data, data were coded by two researchers because of the errors that might arise from the different interpretation of the data by the researchers. In this context, the reliability was calculated as .91 by using Miles and Huberman's (1994) reliability formula ($R_{reliability}$= Consensus/Consensus+Dissensus) for the calculation of the coding reliability.

Findings

The findings obtained were explained by presenting under three headings in parallel with the sub-purposes of the study.

Findings regarding the disciplines and subjects of the theses

The distributions of the doctorate theses examined within the scope of the study according to their disciplines, subject areas and years are presented in Table 1 The descriptive values of the study disciplines were performed by the researchers, and the theming of the subjects of the studies was performed by the researchers and subject area specialists.

When the analysis results in Table 1 are examined, it is seen that 2013 is the year during which the maximum (f:34) number of theses was written, and it is followed by 2010 with 27 theses, 2011 with 25 theses and 2014 with 24 theses, respectively. 2016 is the year during which the minimum number of theses was written by (f:12). When the fact that 2016 is still continuing is taken into account, the number of theses may further increase. When the disciplines of the theses were analyzed by years, it was seen that they were in the physics (f:46) discipline at most, and in the mathematics (f: 13) discipline at least. Besides, it was determined that studies were carried out in chemistry (f:42), biology (f:37) and statistics (f:17).It was seen that the study subjects of the disciplines varied by years.

It was seen that the subject areas in the physics discipline focused on crystals and conductivity in 2010, on crystals and particle accelerator in 2011, on different subjects such as crystals and radioactivity in 2012, on crystals and radioactivity in 2013, on particle accelerator in 2014, on graphenes in 2015, and on different subjects such as orthorhombic compounds and proton collision in 2016. From this point of view, it was seen that the subjects of crystals and radioactivity were mostly studied. In addition, it can be said that physics subjects mostly include modern physics studies instead of classical physics.

It was seen that the subjects were focused on the polymer in 2010, on fuel in 2011, on corrosion in 2012 and 2013, on metal complexes in 2014, on lithium batteries in 2015, and on the metal complex in 2016.The theses written in the field of chemistry are mostly about corrosion.

The theses in the biology discipline discussing the creatures focused on the subjects of world creatures and cancer cells. When subject areas were further analyzed by years, it was determined that they focused on creatures world in 2010, 2011, 2012, 2013 and 2014, on the soil in 2015 and on different subjects such as genetics and drug in 2016.

Table 1. Descriptive Results of the Discipline and Subject Areas of the Theses examined between 2010 and 2016

	Years																	
Discipline	**2010**	**f**	**2011**	**f**	**2012**	**f**	**2013**	**f**	**2014**	**f**	**2015**	**f**	**2016**	**f**	**Total**
Physics	Conductivity	3	Crystals	2	Solar collectors	1	Radioactivity	3	Particle accelerator	3	Graphene	2	Orthorhombic compounds	1	46
	Crystals	2	Particle accelerator	2	Crystals	1	Crystals	2	Magnetic properties	3	Sunshine duration	1	Proton collision	1	
	Radioactivity	2	Conductivity	1	Radioactivity	1	Conductivity	2	Radioactivity	1	Manganite	1	Electromagnetic properties	1	
	Hadronic decay	1	Durability	1	Proton collision	1	Particle accelerator	1	Crystals	1	Semiconductor	1			
	X-ray	1	Graphene	1	Stars	1			Systems	1					
		9		7		5		8		9		5		3	
Chemistry	Polymer	3	Fuel	2	Corrosion	4	Corrosion	4	Metal complex	4	Lithium battery	1	Metal complex	2	42
	System	1	Corrosion	1	System	1	Creatures world	3	Substance complex	1	Polymer	1	Lithium batteries	1	
	Plant	1	Molecule	1	Plant core	1	Molecular structure	3	Lanthanite	1	Metal complex	1			
	Corrosion	1					Cancer cell	1			Enzyme	1			
							Fuel	1							
							Crystals	1							
		6		4		6		13		6		4		3	
Biology	Creatures world	3	Creatures world	1	Creatures world	2	Creatures world	6	Creatures world	6	Soil	2	Genetic	1	37
	Cancer cell	2	Tnt	1	Soil	1	Cancer	2	Cancer cell	1	Creatures world	1	Drug	1	
	Drug	2			Cancer cell	1	Cell	1					Cancer cell	1	
	Hormone	1					Food	1							
		8		2		4		10		7		3		3	
Statistics	No study	-	Estimators	2	Regression	2	Distributions	2	Estimator	1	Estimation methods	1	Estimator	3	17
			Mixed Distribution	2							Equation	1			
			Reliability Analysis	1							Variable Analysis	1			
			Cluster analysis	1											
		-		6		2		2		1		3		3	
Mathematics	Algebra	4	Algebra	6	No study	-	Algebra	1	Algebra	1	Algebra	1	No study	-	13
Total (f)		27		25		17		34		24		16		12	155

It was found that the subject of algebra in all years (except 2016) in the mathematics discipline, and the subjects of estimators in 2011 and 2014, regression in 2012, distributions in 2013, estimation methods in 2015 and estimator in 2016 in the statistics discipline that provide the explanation of expressions and patterns in science, health and other sciences were mostly included.

Consequently, it was seen in the research findings that the subjects of crystals and radioactivity in the physics discipline, corrosion in the chemistry discipline, creatures world in the biology discipline, algebra in the mathematics discipline, and estimators in the statistics discipline were mostly studied.

Findings regarding the Interdisciplinary Association Status of the Theses

In theses examined in the study, it was seen that the interdisciplinary association was established with social sciences. The findings obtained are presented in Table 2.

Table 2. Findings regarding the Theses in which the Interdisciplinary Association with Social Sciences was Established

Years	**Discipline**	**Number of Theses**	**Field with which Interdisciplinary Association was Established**			
			Psychology	**Sociology**	**Economics**	**Geography**
2010	Chemistry	2	-	1	2	-
2011	Chemistry	1	-	-	1	-
	Biology	1	1	1	1	1
2012	Chemistry	1	-	1	1	-
2013	Chemistry	2	-	1	2	-
	Biology	2	-	-	2	-
2014	Biology	2	-	-	2	-
	Physics	1	-	1	1	1
2015	Biology	1	-	-	1	-
	Chemistry	1	-	-	1	-
	Physics	1	-	-	1	1
2016		-	-	-	-	-
Total (f)		15	1	5	15	3

According to the findings in table 2, it was concluded that the theses with the interdisciplinary approach were written in the physics, chemistry and biology disciplines. When the number of theses written with the interdisciplinary approach according to study disciplines is analyzed, there are a total of 15 theses in chemistry (f:7), biology (f:6) and physics (f:2). The disciplines

with which these theses were associated were mostly in the economy (f:15) discipline, it is followed by sociology (f:5), geography (f:3) and psychology (f:1) disciplines, respectively. In this context, when theses were separately analyzed according to study disciplines, it was also found that the studies carried out in the chemistry discipline were mostly associated with the sociology and economics fields. Some general information about some of the chemistry theses are as following:

Yılmaz (2012) designed heat exchangers of different types and geometries for the recovery of waste heat in the phase change material by thermal energy storage in dishwashers. Along with the analysis of the findings obtained, it was concluded that the thermal energy storage unit designed in the dishwasher provides energy saving, makes economic contributions and is more useful systems for the life of living creatures by reducing the release of harmful gasses into the environment.

In his study, Kır (2013) examined the washing properties of the chemical derivatives created for economical and environmentally friendly cleaning agent production in the textile industry, and their reactions with the dyestuff hydrolyzate. As a result of the findings obtained, it was concluded that products tend to reduce energy and water consumption. In this case, it is stated that the importation of these substances will decrease by affecting the domestic market economy, and people will have a healthier lifestyle.

In the biology discipline, studies were mostly associated with the fields of economics. Some of these studies are as following:

In his study, Mercimek (2011) determined the amount of TNT pollution on the NATO and Kilis territories with the colorimetric and HPLC analysis. As a result of the data obtained, a high amount of Tnt was found on these territories, and this situation was associated with the soil, economy and hence the quality of life and social life of humans and other living creatures.

In his study, Tatlı (2013) performed the acidic, alkaline and neutral cellulase enzyme isolation and characterization from thermophilic Bacillus sp.strains isolated from soil and compost. According to the research results, it was concluded that these enzymes could be used safely in numerous industrial areas especially in fruit juice production, recycling of waste papers, textile products, and cleaning products, and they would contribute to the industrial economy.

In the physics discipline, an association of the studies within the interdisciplinary context was mostly performed in the economics and geography disciplines. In this context, Atız (2014) among the relevant thesis samples built an integrated solar energy system in order to produce and store thermal energy from solar energy and to perform heating applications. For this experimental mechanism, Atız (2014) examined the heating performance of the integrated system, that consisted of planar and vacuum tube solar collectors and solar pond, for a test chamber. As a result of the experiments carried out, it was found that this system provided energy efficiency in different time (months) periods, salt concentrations and temperatures. It was stated that this situation would change people's way of heating, makes contributions in terms of economy and could be used in all settlements. Moreover, in the table, the psychology discipline

was only studied with the biology discipline within the interdisciplinary context, and the biology and physics disciplines were studied with geography discipline within the interdisciplinary context.

Instructors' Opinions on the Disciplinary/Interdisciplinary Approach

In the study, interviews were conducted with eight instructors working in sciences after examining the doctorate theses. It was seen that the professional experiences of the instructors were between 15-20 or 20-25 years, and each of them had different areas of expertise. The following themes and codes were achieved in the interviews conducted with the instructors.

The Concept of Discipline/Interdisciplinary

According to the instructors, the concept of discipline was defined as the accumulation of knowledge in the relevant field (f:6), a certain method in a field (f:5), specialization in his/her field (f:3) and producing information (f:3). The quotations related to this subject are as following.

"Discipline, studying in your own field, accumulation of knowledge in your own field, an academic study (I1)."

"Discipline is studying in your own field. To know what you don't know in science. Science has no limits. It is information gathering in a certain field and the characteristics unique to that field. It has own information and method (I3)".

"They are scientific contents in a certain field and unique to that field. They are the situations with the specific method, technique, and content of the field (I4)."

According to the instructors, the interdisciplinary concept was expressed as studying together with the other disciplines (f:6), interdisciplinary common ground (f:4) and science studies for implementation (f:2). I4 expressed his opinions on this subject as following. *"It includes other sciences and is performing a study on a common subject with them. These are in all fields of life. It is to explain and solve a situation existing in your own discipline by receiving support from other disciplines. For instance, engineering is the together study of medicine and chemistry."*(I6) expressed his opinions on this subject as *"It refers to some fields of science or more fields of science. There are more applications, theoretical fields are less".*

Disciplinary/Interdisciplinary Approach in Studies:

The fact that the studies are carried out with the disciplinary/interdisciplinary approach contributes to the development of science in many aspects. In this context, as a result of the interviews conducted in the study, it was seen that instructors had different opinions on carrying out studies with the disciplinary or interdisciplinary approach. Among (f:5) people who indicated that the disciplinary approach fills the information gaps in science, (I1) expressed his opinions on this subject as following*;"There is an issue in the field, there are deficiencies, the selected subjects are important. They should be disciplinary in the experimental and theoretical areas",* (I8) said *"Disciplinary study is the production and discovery of new knowledge. Discipline must develop by itself. But it occurs when interdisciplinary is demanded. ".*

Regarding some of the opinions of instructors on the fact that the interdisciplinary approach (f:5) should be preferred to understand the causes of everything;(I3) said *"The fact that it is interdisciplinary is always good. Science is not to discover something new. It is to find what you wonder or the problems. It is to find out why and how. To say that I have overcome this deficiency is not the science. After initial discovery, others think to use it. The sharp line should not be drawn, it is necessary not to be stick only to the discipline. There should be viewpoint with different areas. It increases both communication and confidence*",(I5) *said "I think the interdisciplinary approach mainly contributes to science. Because you can look at a subject from different aspects. In this viewpoint, people's knowledge, experiences, suggestions and different thoughts ensure opening new ways. Thus, this provides a perspective in a subject in different ways. Otherwise, it becomes a viewpoint with a single discipline."*

The opinion that the approach adopted in the study process occurs in the study process (f:1) was expressed by (I6) as following *"The natural consequence of the questions or research conducted, you cannot necessarily plan. It is related to the field you are studying, the field you are studying leads you to this understanding, it leads you if you cannot think disciplinary or interdisciplinary".*

Current Situation of Instructors' Interdisciplinary Studies in their Study Areas

In the study, the question of performing studies with the disciplinary/interdisciplinary approach in their own fields was posed to instructors, and the codes achieved were disciplinary (f:4), the interdisciplinary approach has been developing recently (f:3) and interdisciplinary (f:2).The quotations related to this situation are as following.

"*Interdisciplinary highly serves the purpose in our field. We are performing this. It is necessary to examine the living creature as a whole, this needs social sciences, and the data obtained by positive science are applied to people, social creatures (I2)."*

"It is gradually developing. We did not perform due to impossibility in the past, but today opportunities are good, and we perform. There was no communication opportunity in the past, everything took a long time. The interdisciplinary study is further developing because communication network is good (such as telephone, the Internet) (I3)."

"…interdisciplinary is not too much. First of all, everyone has a narrow frame because of the culture, everyone thinks that they are best in their own field and there is no need for others. To perform a study with the other fields is risky because continuity may not be ensured with the units from which support is received, interaction is provided with difficulties. Therefore, there is a need for a good organization (I4)."

Interdisciplinary Status in Instructors' Individual Studies and in Theses Supervised by them

In the interviews conducted with the instructors, it was concluded that three people (f:3) used the interdisciplinary approach effectively in their individual studies and theses, and it was mostly associated with psychology,

sociology and economics fields in social sciences. Some opinions on this situation are as following.

(*I2): "What is the reason for making corrosion, material forms chemical substance inside while returning to its nature. It causes damage in terms of health and you become ill, and you transmit it when you become ill. You will pollute the atmosphere if you breathe in the car and bus as you are ill, you will influence other people"*

(I3): "I studied lead pollution in the turnip. And, it was not found in this city. It does not just interest me. I explained it in the language of science. It should have a language that can be understood by everyone, related to the literature. Or…..teacher found this, accordingly do not eat this plant, it affects the health. It also affects human community because this food affects the way of life of other individuals."

(I7): …my latest study is related to human movement and behaviors, in other words, it is a little bit related to psychology. The fact that the humans use their mind and logic for an event or use their past and knowledge as a thinking being in decision making is related to the logical circuit design that occurs in the human brain in the individual or social sense. For instance, the decision-making process during shopping, that is to say, a lady or person goes into a shop to buy a bag, but she buys shoes."

Suggestions for Carrying out Studies with the Interdisciplinary Approach

Instructors made suggestions for the teaching process of the course (f:4), undergraduate and postgraduate curriculum (f:3) and course teachers (f:2) for the interdisciplinary studies that will be carried out in the future. Instructors stated that being open to communication, implementation of collaborative and interdisciplinary teaching methods/techniques, doing homework with the interdisciplinary approach, development of positive attitudes for the interdisciplinary approach, and increasing the participation in science fairs and projects would contribute to interdisciplinary studies in the teaching process of the course. (I8)'s statements of *"…especially, we should have environments that bring people together like this science fair. Therefore, I recommend all our instructors and our research assistants to participate in national and international congresses. Because interaction occurs in these studies, and our study goes into different dimensions over time",* and (I4)'s statements of *"We can ask for the assignments as interdisciplinary in undergraduate. But first, we believe that there should be the necessary disciplinary information. We should inform our instructors in other fields about these kinds of studies"* are some quotations relate to this situation.

In their suggestions for the undergraduate and postgraduate curriculum, instructors indicated the limitation of course contents, the presence of problem-based subjects in courses, and the presence of the course called interdisciplinary teaching. The statements of (I5) on this subject are as following, *"Instructors from different disciplines can come to the department and give a lecture. Interdisciplinary courses should be included in undergraduate and postgraduate educations. However, it is mainly important to teach discipline well in*

undergraduate education. Interdisciplinary does not come into question without teaching discipline. Interdisciplinary studies should be presented during the courses as examples, positive attitudes should be developed. People should know that becoming specialized only in their own field is not sufficient. Because science is not independent.

In the suggestions for course teachers, instructors stated that teachers should be open to communication, have different viewpoints and be in cooperation with other teachers. While (I3)'s opinion on this subject was "*It is necessary not to wear blinders alone during courses. Experts should have different viewpoints, they should not become specialized only in their fields, opinions should be received from the experts in other disciplines*", (I4)'s opinion was *"...first, we believe that there should be the necessary disciplinary information. We should inform our instructors in other fields about these kinds of studies. Everyone should have different viewpoints. ..... it is necessary to be in communication among themselves and with other fields, projects should be performed, students should participate in this process. "*

Discussion, Conclusion and Suggestions

In this study, 155 doctorate theses which were written in the physics, chemistry, biology, mathematics and statistics departments of sciences between 2010-2016 were examined, and the working status of the theses within the interdisciplinary context was determined. In addition to this, instructors working in these departments were asked for their opinions, and an attempt to bring together the data obtained was made. In this process, theses were firstly examined in detail under the headings of study discipline, subject theme, and interdisciplinary approach status. In the interviews conducted with the instructors, opinions related to the process of carrying out studies with the disciplinary/interdisciplinary approach were received.

In the study, maximum numbers of theses were written in 2013, and minimum numbers of theses were written in 2016 by years. Theses were written in physics at most, and they were written in mathematics at least by disciplines. It was also determined that there was not any tendency regarding the fact that the number of studies varied by years and departments. The reason for this situation can be explained by the fact that the number of students who graduated from the departments in the years during which the study was carried out varied. When the study subject areas of the theses were analyzed, it was concluded that they mainly focused on the subjects of crystals and radioactivity in physics, corrosion in chemistry, creatures world and cancer cell in biology, algebra in mathematics, estimator in statistics. The reason for the concentration of disciplines in these subjects may be the fact that thesis supervisors are expert in these subjects and preferred to study these subjects. The statements of the instructors in the forms *of "studying in your own field, accumulation of knowledge in your own field, an academic study* (I1) *and unique study subject* (I6)" in the definition of the discipline can explain the reasons for the preference of these subjects. In addition, the presence of the scientific knowledge gap or deficiency on these subjects in study disciplines can be another reason. Besides, this result of the study shows parallelism with the studies of Kanatlı&Çekici (2013) and Parker (2002).

In the study, it was concluded that 15 theses were written with the interdisciplinary approach and 140 theses were written with the disciplinary approach when the association status of the theses within the interdisciplinary context was analyzed. The reason for the excessiveness of disciplinary studies may be the fact that instructors have a consensus that finding the missing information as disciplinary is the main purpose in sciences and interdisciplinary studies cannot be carried out without disciplines. The fact that Arslantaş (2013) stated in his study that interdisciplinary studies are formed depending on the disciplines and that deficiencies in disciplines should be overcome supports this opinion. Besides, the fact that instructors have the opinions such as the fact that interdisciplinary studies take a long time, limited opportunities and the fact that some experts do not support cooperation is another reason supporting the excessiveness of disciplinary studies. Özhamamcı (2013) emphasizes that interdisciplinary study rapidly increased along with the development of science and technology and cooperation is important in this process.

When the status of the studies carried out with the interdisciplinary approach was analyzed, it can be said that the number of interdisciplinary studies is 15 and this is very low compared to 155 theses. The fact that instructors think that interdisciplinary studies should be carried out with sciences close to the field, they are just for practice, and interdisciplinary studies are formed by coming together of many experts may explain why interdisciplinary studies are limited. However, interdisciplinary studies can also be carried out both with the disciplines close to the field and with the disciplines far from the field, the point that needs to be taken into account in this process is to organize the process well and to keep the viewpoints wide. In this context, Roush (2008) expressed that interdisciplinary studies are far from the combination of more than one disciplines, and what really needs to be done is to bring together the contents of the disciplines in a meaningful way. For instance, the concept of force in the physics discipline can be associated with biology and chemistry which are close disciplines and also with the disciplines such as economics, geography, and geology.

Thus, it was determined in the study that the disciplines of interdisciplinary theses were in the chemistry, biology and physics disciplines, and these studies were associated with the sociology, geography and psychology fields including economics. Within the scope of the research; in the studies carried out by Kır (2013), Mercimek (2011) and Yılmaz (2012) in the chemistry discipline, Caf (2015) and Tatlı (2013) in the biology discipline and Atız (2014) in the physics discipline, the fact that they firstly created the theoretical information with the disciplinary approach in the study process and then they examined the effect of this information on living creatures especially on people, soil structure, agricultural areas, economics and the environment supports the result of the study.

The fact that the studies in the mathematics and statistics disciplines were carried out with the disciplinary approach is another result of the study. When the reasons for this situation are considered, it was caused by the fact that the studies in these disciplines mostly contained theorem and evidence (Gök Kaya, 2014; Sönmez, 2011; Velioğlu, 2013). In addition, the fact that the instructors working in the departments of mathematics and statistics have

opinions that there are deficiencies in disciplines and interdisciplinary study cannot be performed without eliminating these deficiencies may explain the fact that theses are written with the disciplinary approach.I8's statements of *"... Firstly, I need to uncover the theoretical knowledge. Information is missing in the theoretical and disciplinary sense", and I7's statements of"... the field we are studying is not very suitable for interdisciplinary. If it is suitable, there are not people from other disciplines around us. These naturally arise. If the field is missing, you cannot do anything"* support this situation. In addition, the opinions of the instructors in these departments on the specialization in their own study areas with the disciplinary approach and failure to ensure cooperation with the experts in other fields may affect the subject selection and approach of the theses. In this context, Dervişoğlu&Soran (2003) and Frykholm& Glasson (2005) draw attention to the compliance of course contents with the interdisciplinary approach and to the good organization of the process.

In the study, it can be said that the excessiveness of theses written with the disciplinary approach was affected by many aspects such as the study subject, study process, viewpoint, time and the conditions. The limited number of interdisciplinary studies can be explained by the factors such as the fact that the need for having multiple and different perspectives in science has just been realized, a new discovery of different study fields, and the fact that there is a progress in a limited area with the disciplinary approach has just been realized. These reasons stated are supported by the opinions of the participants. In the relevant literature, the study carried out by Turna&Bolat (2015) in educational sciences by the help of ProQuest and CoHE database was examined within the interdisciplinary context, and it was concluded that the interdisciplinary approach has not been mostly included in the theses written in Turkey. In their study, Ece&Çeşit (2011) examined the post-graduate theses by the help of CoHE database to determine how many interdisciplinary studies were carried out in the field of music and which results were achieved, and they concluded that interdisciplinary studies increase as we come closer to these days. The fact that it was concluded that there were limited numbers of interdisciplinary studies in both studies shows parallelism with our research result. However, the rapid increase in knowledge, development of technology in today's world and the fact that each situation is related to more than one disciplines in our daily life indicate the need for the interdisciplinary approach (Turna, Bolat&Keskin, 2012). It is necessary to concentrate on out-of-school learning environment with the activities such as teachers' cooperation, group work, projects and exhibition, and in-depth learning should be ensured with less content in disciplines at all levels of education for the acquisition of these skills (Dervişoğlu&Soran, 2003). Within the scope of the study, the opinions of "teaching processes should be enriched, out-of-school learning environments such as projects, science fairs and exhibitions should be increased, course contents should be limited, and cooperation should be made with out-of-field experts" which were expressed by the instructors for increasing interdisciplinary studies support this situation.

It is thought that this study will help the researchers who want to study with the interdisciplinary approach in the fields of science in terms of both theory and literature data. The enlargement of the year range of the disciplines included in the study, the inclusion of the postgraduate theses and theses written at different universities into the process, examination of the theses

written in different fields such as engineering and health, and the inclusion of foreign theses in the database can be recommended to researchers for new studies.

Disclosure statement

The Authors reported that no competing financial interest.

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