# Türkiye'de Beyin Temelli Öğrenme Üzerine Yapılan Araştırmaların İncelenmesi: İçerik Analizi Çalışması[*]

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## Özet

Son yıllarda akademik alanlara ilişkin literatür incelemelerine dayalı çalışmalara rastlanmaktadır. Bu incelemelerde bir alana ilişkin gelişmeleri ve araştırmacıların eğilimlerini ortaya koymak amacıyla kesitsel çalışmaların yapılması yaygındır. Belli bir alandaki literatürün değerlendirmesinin yapılması, o döneme ilişkin ortaya konan araştırmaların niteliğine dair bilgi vermenin yanında, sonraki araştırmalara da ışık tutucu özellik taşımaktadır. Bu çalışmada; Türkiye'de 2000-2016 yılları arasında Beyin Temelli Öğrenme Yaklaşımı ile ilgili yapılan araştırmalara ilişkin bir içerik analizi yapılması amaçlanmıştır. Çalışmaların yayın yılı, yayın türü, araştırma yöntemi, araştırma konusu, araştırma alanı, örneklem türü, örneklem belirleme yöntemi, veri toplama araçları ve veri analiz yöntemi açısından içerik analizi yapılmıştır. Çalışmada konuyla ilgili olarak 23 makale, 35 yüksek lisans tezi ve 16 doktora tezi olmak üzere toplam 74 araştırmaya ulaşılmıştır. Çalışma sonuçlarına göre araştırmacıların en çok "Fen ve Teknoloji" ve "İngilizce" konu alanlarında çalıştıkları belirlenmiştir. Araştırmalarda en çok nicel araştırma yöntemi ve deneysel modeller kullanılmıştır. Kullanılan istatistiksel testlerden "t testi" ve "ANOVA" gibi fark testlerine dayalı veri analiz teknikleri; veri toplama araçları bakımından ise en çok "başarı testleri" ve "tutum, ilgi, algı" ölçekleri kullanılmıştır. Örneklem seçimi açısından "basit seçkisiz" ve "uygun örnekleme" yöntemleri daha fazla kullanılırken en çok "öğrenci", en az "öğretmen" örneklemleriyle çalışılmıştır.

**Anahtar Kelimeler**

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# Examination of Studies Related of Brain-Based Learning In Turkey: A Study of Content Analysis*

| Abstract | Keywords |
|---|---|
| This study presents a content analysis of brain-based learning studies carried out in Turkey from 2000 to 2016. The purpose of the study is to investigate and identify research trends in brain-based learning studies and to provide a reference point for future studies. The study analyzes in a systematic way 74 studies including 23 journal articles, 35 master theses and 16 PhD dissertations by the publication year, publication type, research method, and research topic, research field, sampling group, sampling size, sampling method, data-collection tool, and data-analysis method. The analysis shows that most of the studies focused on such subject areas as natural science, technology and English language. The study also found that quantitative and experimental research models were the most frequently employed research models. A further analysis of the research methods reveals that the t-test was the most popular statistical tests employed in the studies and such data analysis techniques as ANOVA constituted the majority of comparative data analysis techniques. The findings also highlight that achievement, attitude scale, aptitude and perception tests were the most prevalent date collection tools in the studies under investigation. In terms of sampling, most studies utilized simple random sampling, convenient sampling methods, while using mostly students as subjects for the research. Thus, this study contributes to the recent scholarship on literature review and content analysis in education studies and fills an important gap in the area of brain based learning studies by identifying key trends and patterns in the field and offering suggestions for future research. | |

## INTRODUCTION

The study of learning has long attracted scholarly interests; and the question of how learning occurs has long been an important topic of research leading to majors studies on the topic. In recent years, brain-based learning has become a popular field of study, in part due to the recent developments in neuroscience and its implications for learning (Duman, 2015). Brain-based learning and 'meaningful learning' refer to teaching and learning based on principles derived from understanding of the brain, its biological structure and function (Caine & Caine, 2002). Jensen (2006) states that brain has a direct relation to what teachers and students do at school and that those school activities that are contrary to how the brain works are futile efforts. With the declaration 1990s as the "Decade of Brain," field of neuroscience has gained new momentum (Keleş & Çepni, 2006). Besides the already felt impacts of behavioral, cognitive and humanistic approaches to education and learning techniques, developments in science and technology in the last 30 years have resulted in several important studies on learning and education in recent years. The focus of the recent studies is their emphasis on developing individual capacity to highest level by focusing on developing individual difference, and hence, its emphasis on pedagogical approaches that focus on discovering potential of individual student for learning rather than transmission of knowledge (Jensen, 2000, s. 76). In our country there have been researches concerning brain based learning approach wittin the recent years. Looking info these researches supported by quality- quantify data are available in various levels of education.In our country, researches about brain based learning approach have been found in recent years. Looking at these studies, it appears that there are studies supported in many different stages of education, together with qualitative-quantitative data.

Neuroscience research related to learning and teaching has a long way to go. Nevertheless, the increasing knowledge of our understanding of how the human brain organizes, stores and processes knowledge will in the end produce radical changes in how we learn and teach. Comprehensive and detailed studies on brain and learning are already underway. There is now a need for a detailed and comprehensive analysis and evaluation of the recent literature on brain and learning. The main purpose of this study is to provide a content analysis of brain-based learning studies in Turkey and to offer broad conclusions on the topic. More specifically, it aims to analyze the frequencies and percentages of these studies by publication date, publication type, research method and design, types of courses included in the research along with sampling methods, data collection and analysis methods. The scope of this study is limited to the articles accessed via ULAKBIM (National Center for Academic Network and Information) and master's theses and PhD dissertations accessed via YOK (Turkish Foundation for Higher Education). In order to avoid repetition, articles based on graduate works by the same author were not included in the analysis. Finally, as a content analysis of brain based learning studies in Turkey, this study can provide many valuable insights about the recent scholarly trends and directions and can offer useful suggestions for further research in the field of education.

## METHODOLOGY

This study adopts a content analysis method for the material collected. Content analysis is a widely used method in qualitative research studies. It is a method of data analysis that converts some aspects of textual material into quantitative data (Bauer, 2003) and thus serves as a bridge between statistical conclusions and qualitative analysis of the

textual material under study. Content analysis method involves four main stages, including identifying of codes and themes, coding data, organizing themes and codes, identifying and interpreting findings Yıldırım and Şimşek, 2008). The scope of this study is limited to brain based learning studies conducted in Turkey from 2000 to 2016. The authors created a research study form. This form was developed and further refined with the help of three scholars with the expertise in quantitative methodology and education studies. Coding was done for categories and sub-categories appropriate for the research goals. In order to ensure the internal validity/credibility in coding, the two authors coded the data independently in two different times. Internal validity was measured using the formula developed by Miles and Huberman (1994): coder reliability=coder's agreement coder's disagreement x 100. This study has been considered as reliable as the result of the calculation shows the matching ratio of the coders as .83. During the process of analyzing the data, several categories relevant to the research objectives were created. The study analyzed the distribution of studies by publication year, type, research method, research design, research subject, sampling group, sampling size, sampling method, data collection and data analysis methods were analyzed the data collected. The findings were nalyzed and presented in frequencies and percentages in tables.

## FINDINGS AND DISCUSSION

This section presents the pertinent findings based on the analysis of the frequencies and percentages of the collected data.

### 3.1. Publication Year

**Table 1.** Distribution of Studies by Publication Year

| Publication Type | PhD Diss. | | Master's Thesis | | Article | | Total | |
|---|---|---|---|---|---|---|---|---|
| Year | f | % | f | % | f | % | f | % |
| 2002 | - | - | - | - | 1 | 1.35 | 1 | 1.35 |
| 2004 | - | - | 2 | 2.70 | - | - | 2 | 2.70 |
| 2005 | 1 | 1.35 | 2 | 2.70 | 1 | 1.35 | 4 | 5.40 |
| 2006 | - | - | - | - | 2 | 2.70 | 2 | 2.70 |
| 2007 | 2 | 2.70 | 2 | 2.70 | 3 | 2.70 | 7 | 9.45 |
| 2008 | - | - | 6 | 8.10 | 3 | 4.05 | 9 | 12.16 |
| 2009 | 2 | 2.70 | 3 | 4.05 | - | - | 5 | 6.75 |
| 2010 | 1 | 1.35 | 5 | 6.75 | 3 | 4.05 | 9 | 12.16 |
| 2011 | - | - | 1 | 1.35 | 1 | 1.35 | 2 | 2.70 |
| 2012 | 1 | 1.35 | 3 | 4.05 | 2 | 2.70 | 6 | 8.10 |
| 2013 | 2 | 2.70 | 4 | 5.40 | 1 | 1.35 | 7 | 9.45 |
| 2014 | 4 | 5.40 | 3 | 4.05 | 3 | 4.05 | 10 | 13.51 |
| 2015 | 1 | 1.35 | 4 | 5.40 | 1 | 1.35 | 6 | 8.10 |
| 2016 | 2 | 2.70 | - | - | 2 | 2.70 | 4 | 5.40 |
| Total | 16 | 21.62 | 35 | 47.29 | 23 | 31.08 | 74 | 100 |

As Table 1 demonstrates, 16 studies were conducted between 2000 and 2016. It shows that 13.51% of these studies were conducted in 2014; 12.16% in 2008 and 2010; 9.45% in 2007 2013; 8.10% in 2012, 6.75% in 2009 and 2015, 5.40% in 2005, 2011 and 2016. Moreover, only two studies (2.70%) were carried out in 2004 and there was only one study done in 2002 and 2006 (1.35%). No study found for the years 2000, 2001 and 2003.

The table also shows a noticeable increase in brain-based learning research since 2007 with the largest number of studies (13.51%) carried out in 2014. The table shows substantial increase in the number of studies for the years 2008 and 2010 (12.16%) as well. These findings correspond with the findings of Temel, Sen & Yılmaz (2014) in their study of "Content Analysis of Studies Related to Problem Oriented Learning in Science Education". This recent surge in research on brain-based learning perhaps can be interpreted as indication of growing interest among educators in assessing the impact of student-centered learning following the major overhaul in Turkish educational system that took place in 2004 and 2005.

### 3.2. Publication Type

**Table 2**. Distribution of Studies by Publication Type

| Publication type | f | % |
|---|---|---|
| Doctoral dissertation | 16 | 21.62 |
| Master's thesis | 35 | 47.29 |
| Article | 23 | 31.08 |
| Total | 74 | 100 |

Table 2 presents the frequencies and percentages of the studies by publication type. As the table shows a total of 74 studies were carried out from 2000 to 2016. Out of which, 16 (21.62%) were PhD dissertations, 35 (47.29 %) were master's thesis and 23 (31.08 %) were journal articles. Master's thesis constitutes the highest percentage of the studies. Similar studies in the relevant literature confirm the findings of this study. Erdoğmuş (2009) identified 212 master's thesis and 32 PhD dissertations in his study of "Research Trends in the field of Computer Education and Instructional Technologies (CEIT) in Master's Theses and PhD Dissertations." Similarly, Saban's (2009) "Content Analysis of Turkish Studies Related to Concept of Intelligence" shows a higher percentage of master's thesis (71), followed by journal articles (18), and doctoral dissertations (8).

### 3.3. Research Method

**Table 3**. Distribution of Research Methods

| Method | f | % |
|---|---|---|
| Quantitative | 50 | 67.57 |
| Qualitative | 17 | 22.97 |
| Mixed | 7 | 9.46 |
| Total | 74 | 100 |

As the Table 3 illustrates, among 74 studies, 50 (67.57%) studies employed quantitative research method; 17 (22.97%) were qualitative in nature and only 7 (9.46%) were "mix"

method studies. It should be noted that fewer studies employed mixed method that combines both qualitative and quantitative research methods.

### 3.4. Research Design

**Table 4.** Distribution of Research Designs

| Research Method | Research Design | f | % |
|---|---|---|---|
| Quantitative | Descriptive | 6 | 8.10 |
| | Quasi-experimental | 8 | 10.81 |
| | Experimental | 35 | 47.3 |
| | Subtotal | 50 | 67.57 |
| Qualitative | Literature review | 13 | 17.56 |
| | Meta-analysis | 1 | 1.35 |
| | Case study | 1 | 1.35 |
| | Critical study | 2 | 2.70 |
| | Subtotal | 17 | 22.97 |
| Mixed | Explanatory | 6 | 8.10 |
| | Exploratory | 1 | 1.35 |
| | Subtotal | 7 | 9.45 |
| Total | | 74 | 100 |

Table 4 indicates that 8.10% of quantitative studies (f=50, 67.57%) were descriptive in nature; 10.81% were quasi-experimental and 47.3% were experimental studies. 22.97% percent of qualitative studies (f=17, 22.97%) were literature reviews and 11.76% were critical studies, whereas only 1.35% percent constituted meta-analysis and case studies. Of the seven mixed method studies, 8.10% was explanatory and one (35%) was explanatory research design study. The mixed design studies were those studies that combined quantitative data and qualitative data collection (semi-structured interview forms, student journals, etc.) methods, and were often described as "mixed" design studies by their authors. The research findings of this study correspond with those of similar studies in the field (Çiltaş, Güler & Sözbilir 2012; Göktaş, et al., 2012; Alper & Gülbahar, 2009; Sarı, 2011; Sert, Kurtoğlu, Akıncı & Seferoğlu, 2012; Ulutaş & Ubuz, 2008). Furthermore, a review of research methods revealed that qualitative studies were not a preferred research method. Other studies confirm this conclusion (Çiltaş et al., 2012; Ulutaş & Ubuz, 2008). For De Jong (2007) perhaps, the reason for scholarly preference for experimental design is that compared to descriptive research designs, quantitative methods allow a much faster and easier data collection and makes the data analysis much easier. He also emphasizes a need for descriptive and mixed research approaches in identifying students' emotion and opinions in experimental studies.

**3.5. Research Topic/Course**

**Table 5.** Distribution of Studies by Subject Area/Course

| Courses | f | % |
|---|---|---|
| Natural Science and Technology | 17 | 22.97 |
| English as a Foreign Language (EFL) | 14 | 18.91 |
| Social Studies | 7 | 9.45 |
| Biology | 6 | 8.10 |
| Turkish | 6 | 8.10 |
| Mathematics | 2 | 2.70 |
| Geography | 2 | 2.70 |
| Measurement and Evaluation | 2 | 2.70 |
| Classroom Management | 2 | 2.70 |
| Preschool Education | 1 | 1.35 |
| Special Education (gifted education) | 1 | 1.35 |
| Geometry | 1 | 1.35 |
| Religious Culture & Ethical Knowledge | 1 | 1.35 |
| Physics | 1 | 1.35 |
| Other (more than one subject) | 1 | 1.35 |
| Brain Based Learning | 10 | 13.51 |
| Total | 74 | 100 |

Table 5 shows that of 74 studies examined in this study, 17 (22.91%) focused on science and technology courses, 14 studies (18.91 %) on foreign language courses and 7 studies (9.45 %) studies on social studies knowledge. Moreover, 10 studies (13.51%) examined the topic of brain-based learning. There were biology and Turkish language courses and two studies (2.70%) on mathematics, geography, measurement-evaluation and classroom administration and only one study in preschool education, special education, geography, religious culture and physics respectively.

The findings indicate a scholarly preference for such subjects as science, technology, foreign language, Turkish and biology and a fewer number of studies on other subjects. It should be also noted that conceptual studies on brain-based learning were quite prevalent and were mostly disseminated in journal articles. They were also qualitative studies focusing on the conceptual dimensions of brain-based learning. A closer analysis of the studies by subject area reveals that while there were studies conducted on almost every subject area, there were no doctoral dissertations or research articles on quantitative subjects such as mathematics, geometry and physics. The number of master's thesis on quantitative subjects was also not many. The findings of this study correspond with those by Temel, Şen & Yılmaz (2014) in their study titled "A Content Analysis of Problem Based Learning Studies". The authors, who analyzed 58 problem-based learning studies, found only 20 studies on natural

science and technology. In addition, Doğru, Gençosman, Ataalkın & Şeker (2012) who carried out a content analysis of thesis and dissertations written between 1990 and 2006 in the field of natural sciences education (physics, chemistry, biology, natural science knowledge and technology) found that 333 of 591 studies were on subjects of natural science knowledge/natural science and technology.

### 3.6. Sampling Group

Table 6. Distribution of Studies by Sampling Group

| Sampling Group | | f | % |
|---|---|---|---|
| Student | | | |
| | Preschool | 3 | 4.05 |
| | Primary School | 11 | 14.86 |
| | Secondary School | 20 | 27.02 |
| | High School | 10 | 13.51 |
| | University | 11 | 14.86 |
| | Subtotal | | |
| Teacher | | 4 | 5.40 |
| Documents (academic studies) | | 2 | 2.70 |
| No sampling found | | 13 | 17.56 |
| Total | | 74 | 100 |

Table 6 shows that 55 (74.32%) of sampling groups consisted of students and of the 55 student groups, 20 (27.02%) were middle school and 11 (14.86%) primary and university students and 10 (13.51%) were high school and only three (4.05%) were pre-school students. Akaydın & Çeçen (2015) in their study concluded that in terms of sampling level, middle school students constituted the largest percentage of sampling group with 28% percent. The findings of this study reveal similarities with several studies in the field (Gürdal, Bakioğlu & Öztuna, 2005; Doğru, Gençosman, Ataalkın & Şeker, 2012; Saban, 2009; Sarı, 2011). On the other hand, international studies (Lubienski & Bowen, 2000; Çiltaş 2012 et al.) point out a higher percentage of studies on primary level education and lower percentage of studies on pre-school and adult education. This can be explained by the fact that students often make up the largest working group in education studies and that researchers in the field tend to work with easily accessible subjects. Besides, the highest percentage of student sampling is understandable as most of the materials analyzed in this study were studies examining the impact of brain-based learning on students' academic success and students' attitude toward their classes.

As Table 6 indicates, there were only four (5,40%) studies carried out with teacher sampling groups. The low percentage of studies carried out with teachers or prospective teachers is a major weakness of the studies analyzed in this paper. Teachers play significant role at every level of education including the planning, applying and evaluating the teaching-learning designs. Therefore, studies with teachers and prospective teachers are essential in identifying key issues in education studies. Lastly, the 13 (17.56%) studies that

examined brain based learning do not include any sampling at all. They are mainly critical literature reviews evaluating various publications and works on the topic of brain based learning.

### 3.7. Sampling Size

**Table 7.** Distribution of Studies by Sampling Size

| Number of sampling | f | % |
|---|---|---|
| 1-50 | 22 | 29, 72 |
| 51-100 | 30 | 40, 54 |
| 101-150 | 5 | 6, 75 |
| 151-200 | 1 | 1, 35 |
| 201-250 | 1 | 1, 35 |
| 251-300 | - | - |
| 301-350 | - | - |
| 351-400 | 1 | 1, 35 |
| 401 and above | 1 | 1, 35 |
| No sampling found | 13 | 17, 56 |
| Total | 74 | 100 |

Table 7 shows that there were 22 studies (29.72%) that used sampling groups varying in size between 1 to 50 individuals, 30 studies (40.54%) with 51-100 individuals and 5 studies (6.75%) with 101-150 participants. In addition, it shows that there is only one (1.35%) study in the sampling group of 151 to 200; 201 to 250; 351 and 400 and above sampling group sizes. No study was found in the 251 to 300 and 301 to 350 sampling group sizes. Also, the study found that 13 (17.56%) of the studies were mainly literature reviews with no sampling. The findings highlight that research groups with fewer individuals were preferred to those groups with more individuals. Indeed, only nine of the 61 of studies included sampling groups of 100-400 individuals. The fact that working with smaller groups allows a much faster data collection and that most of the studies employed experimental research design might explain researchers' preference for smaller size sampling groups. Göktaş et al. (2012), who have studied 2115 published articles in the field of education, made similar conclusions in their work. Çiltaş et al. (2012), Sert (2010), Arık & Türkmen (2009), Erdoğmuş (2009), Tatar & Tatar, (2008), Ulutaş & Ubuz, (2008) reached similar conclusions in their respective studies.

### 3.8. Sampling Method

**Table 8.** Distribution of Studies by Sampling Method

| Sampling method | f | % | |
|---|---|---|---|
| Simple random sampling | 32 | 43.24 | |
| Convenience sampling | | 19 | 25.67 |
| Purposive sampling | 7 | 9.45 | |
| Quota sampling | 2 | 2.70 | |
| Stratified sampling | 1 | 1.35 | |
| No sampling | 13 | 17.56 | |
| Total | 74 | 100 | |

Table 8 shows that 32 (43.24%) studies examined in this article employed simple random sampling; 19 (25.67%) convenient sampling, whereas only seven (9.45%) used purposive sampling method. Besides, the study found a low percentage of quota sampling (2.70%) and even a lower percentage of stratified sampling method (1.35%). An explanation for the high prevalence of simple random sampling may be the higher percentage of experimental research design studies. In their study on scholarly tendency in determining sampling methods, Selçuk, et al. (2014) concluded that scholars tend to use random, purposive and convenient sampling methods. Studies by Alper & Gülbahar (2009) and Sert (2010) seem to confirm the findings of this study.

### 3.9. Data Collection Tools

When analyzing the data collection tools, studies that used more than one data collection tool were noted and coding was done by taking into consideration categories of all the tools of data collection. Table 9 indicates the distribution of studies by data collection tools.

**Table 9.** Distribution of Data Collection Tools

| Data Collection Tools | f | % | |
|---|---|---|---|
| Achievement test | 56 | 24.56 | |
| Attitude, aptitude, perception, etc., tests | | 47 | 20.62 |
| Survey/Questionnaire | | 43 | 18.8 |
| Documents | 27 | 11.85 | |
| Interviews forms | 24 | 10.52 | |
| Course materials | 18 | 7.89 | |
| Observation forms | 6 | 2.63 | |
| Alternative tools | 7 | 3.07 | |
| Total | 228 | 100 | |

Table 9 highlights that majority of the studies employed achievement test (f=56, 24.56%), followed by attitude-aptitude-perception test (f=47, 20.62%) data collections tools. These numbers are understandable as most of the studies employed quantitative

(experimental and quasi-experimental) and mixed research methods. Indeed, use of such data collections tools as achievement test, and attitude- aptitude- perception tests in studies of experimental research designs with pre-test and post-test controlled groups is unavoidable. Therefore, it is not surprising that such data collection tools were preferred in comparison to other methods. Moreover, the present study reveals that personal information forms and various Likert style scales were coded as surveys and were preferred with 18.8% percent. Similarly, "documents" were used frequently (f=27, 11.85%) and mostly in article type studies. The interview forms (f=24, 10.52%), on the other hand, were semi-structured forms designed to reflect participants' view and often used to add a qualitative dimension to mixed or quantitative studies. It is of interest to note that only two (63%) studies used observation forms, while course materials constituted seven, 89% and alternative tools comprised three, 7% percent. Since most of the studies examined here employed experimental research designs, it is understandable that they preferred such data collection tools as scale, survey, tests that can provide scholars with measurable "quantitative" data. Variations in data collection tools can be explained as the natural result of diversity in research method models employed by these studies. Furthermore, in reviewing the current findings, it appears that the authors mostly focused on achievement and attitude variables and their impact on brain-based learning and generally preferred quantitative research models. It should be noted that use of different variables could result in differences in research findings and different conclusions. This is an important point. For example, a research that analyzes such perceptual variables as value, interest, motivation in brain based learning environment, may prove useful for designing teaching environments that consider those variables. Sert (2010), Erdoğmuş (2010) and Selçuk et al. (2014) stated the same conclusions in their relevant studies.

### 3.10. Data Analysis/Statistical Techniques

Since most studies employed more than one data analysis techniques, coding was done with consideration for each of the techniques. Table 10 indicates distribution of data analysis/statistical techniques.

**Table 10.** Distribution of Data Analysis Method/Statistical Techniques

| Data Analysis Method/Statistical Techniques | | f | % |
|---|---|---|---|
| Descriptive | Frequency/percentage/chart | 27 | 21.95 |
| | Mean/standard deviation | 16 | 13 |
| | Graphs | 2 | 1.63 |
| | Sub-total | 45 | 36.57 |
| Comparative | *t* test | 41 | 33.33 |
| | ANOVA | 20 | 16.26 |
| | ANCOVA | 3 | 2.43 |
| | Non-parametric tests | 7 | 5.69 |
| | MANOVA/MANCOVA | 2 | 1.63 |
| | Sub-total | 73 | 59.35 |
| Content Analysis | | 5 | 4.07 |
| Total | | 123 | 100 |

As Table 10 indicates, the studies employed inferential analysis technique 73 (59.35%) times. Of these, 41 (33.33%) were *t* tests; 20 (16.26%) ANOVA"; three (2.43%) ANCOVA, and

seven (5.69%) were such non-parametric tests as Man Whitney U, Kruskal Wallis, Wilcoxon Signed Rank and Chi Square, whereas only two (1.63%) were MANOVA/MANCOVA tests. The number of descriptive analysis techniques employed is 45 (36.57%). Of these, 27 (21.95%) consisted of frequency/percentage/chart, 16 (13%) mean/standard deviation and only two (1.62%) were graphic display models. Also noted in Table 10 is the small number (5) of content analysis studies.

Most of the studies, especially those that employed experimental research model, were pre-test and post-test control group research design studies. In pre-test/post-test control group research designs, the use of pre-test scores as covariate and their analysis together with post-test scores, in other words, the use of ANCOVA and a greater preference for t-test that requires comparison of pre-test and post-test squares are notable findings. Since studies analyzed in this study mostly examine the impact of brain based learning on achievement and attitude variables and compare differences in pre-test and post-test scores in relation to such variables, the use of *t*-test is expected. However, given that the higher percentage of the studies are quantitative in nature, fewer use of more advanced statistical analysis techniques such as ANCOVA and MANOVA is rather surprising and a major weakness for the relevant studies. There are numerous studies that correspond with the findings of this study (Ozan & Köse, 2014; Erdem, 2011; Selçuk et al. 2014; Seçer et al. 2014; Saban, 2009; Bal, 2016). In his study, Erdem (2011) identified *t*-test, ANCOVA and descriptive statistics as the most prevalent statistical models used in similar studies. He also noted the scholarly preference for *t*-tests as the primary type of statistical analysis and a seldom use of multivariate analysis technique, even in quantitative studies where the use of such statistical models as ANCOVA is more appropriate. Erdem (2011) contends that such a situation is perhaps related to the formulation of research questions based on statistical techniques already known by authors rather a formulation of statistical techniques appropriate for the research question at hand. Also noted in Table 10 is the smaller percentage of the studies that used non-parametric tests with five, 69% level. Since the statistical power of non-parametric tests are lower than that of their parametric counterparts, the existence of a smaller percentage of non-parametric tests and a smaller number of studies that require non-parametric tests should be interpreted as a positive situation.

## CONCLUSIONS AND SUGGESTIONS

Based on the findings of this study, there are several conclusions that can be drawn.

- When looked across the 16-years span (2000-2016), this study found a trend toward a substantial increase in the number of brain based learning studies since 2007. While 2014 has seen the largest increase in percentage of studies on brain-based learning, the number of studies has also increased noticeably during the years between 2008 and 2010. Also found in this study is the absence of any study for the years 2000, 2001, and 2003.
- This study found that in terms of distribution of publication types, master's theses account for the largest number of studies across the 16-year span, followed by PhD dissertations and journal articles.
- A review of research methods revealed that three primary methods were used to carry out research: (a) qualitative research method, (b) quantitative method, and (c) mixed research method. The findings show quantitative research methods was the most popular research method followed by qualitative and mixed research methods.

- The findings of this study show that among the topic areas (subjects/ units) chosen for research, natural science knowledge, natural science and technology were popular, followed by foreign language (English), Turkish, biology and social studies.
- The study found that the researchers preferred working with student groups, and working with smaller group sizes.
- An analysis of sampling methods revealed that most authors preferred simple random sampling, followed by convenient sampling, purposive sampling, proportion sampling and stratified sampling. A subsequent analysis of the number of data collection techniques revealed that the majority of authors collected data using more than one data collection tools.
- In terms of data analysis techniques, overall, *t* tests were the most popular data analysis techniques, followed frequency/percentage, ANOVA, non-parametric test, ANCOVA, "graphic illustration, MANOVA/MANCOVA and "content analysis" techniques. Recommendations: Below are some suggestions based on the findines of this study.
- There can be more research using qualitative and mixed research method. This can also lead more diversity in data collection techniques.
- The number of studies focusing on teachers can be increased.
- Future researchers should consider using such data analysis modes as ANCOVA, MANOVA, MANCOVA and structural equation model.
- Besides physical science education and foreign language, scholars can conduct more research on courses as diverse as chemistry, physics, social studies, pre-school, etc.
- Future researchers can collect their data from a larger size of sampling groups.
- Researches improving basid brain learning approach can mades with the participation of experts os different disiplines outside esucation field.
- Researches improving brain based learning approach can be made with the participation of experts of different disciplines outside education field.

## REFERENCES

Akaydın, Ş., & Çeçen M. A. (2015). Okuma becerisiyle ilgili makaleler üzerine bir içerik analizi. *Eğitim ve Bilim, 40*(178), 183-198.

Alper, A. ve Gülbahar, Y. (2009). Trends and issues in educational technologies: A review of recent research in TOJET. *The Turkish Online Journal of Educational Technology - TOJET, 8*(2), 124-135.

Arık, R. S., & Türkmen, M. (2009). Eğitim bilimleri alanında yayınlanan bilimsel dergilerde yer alan makalelerin incelenmesi. *I. Uluslararası Türkiye Eğitim Araştırmaları Kongre Kitabı.* http://www.eab.org.tr/ eab/oc/egtconf/pdfkitap/pdf/488.pdf sayfasından erişilmiştir.

Bal, H. (2016). *Türkiye'de düzenlenen uluslararası spor bilimleri kongrelerinde sunulan bildirilerin içerik analizi açısından incelenmesi*. Yüksek Lisans Tezi, Mehmet Akif Ersoy Üniversitesi Eğitim Bilimleri Enstitüsü, Burdur.

Bauer, M. W. (2003). Classical content analysis: A review. In M. W. Bauer & G. Gaskell (Eds). Qualitative researching with text, image and sound (131-151). London: Sage Publication.

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş. ve Demirel, F. (2011). Bilimsel araştırma yöntemleri. Ankara: Pegem A Yayıncılık.

Caine, G. and Caine, R. N. (2002). Making connections: teaching and the human brain (Çev. Ülgen, G.). Ankara: Nobel Yayınları.

Çiltaş, A., Güler, G., & Sözbilir, M. (2012). Türkiye'de matematik eğitimi araştırmaları: bir içerik analizi çalışması. *Kuram ve Uygulamada Eğitim Bilimleri, 12*(1), 565-580.

De Jong, O. (2007). Trends in western science curricula and science education research: A Bird's eye view. *Journal of Baltic Science Education*, 6(1), 15-21.

Doğru, M., Gençosman, T., Ataalkın, A. N., & Şeker, F. (2012). Fen bilimleri eğitiminde çalışılan yüksek lisans ve doktora tezlerinin analizi. *Türk Fen Eğitimi Dergisi, 9*(1), 49-64.

Duman, B. (2015). Neden beyin temelli öğrenme? Ankara: Pegem Akademi.

Erdem, D. (2011). Türkiye'de 2005–2006 Yılları Arasında Yayımlanan Eğitim Bilimleri Dergilerindeki makalelerin bazı özellikler açısından incelenmesi: betimsel bir analiz. *Eğitimde ve Psikolojide Ölçme ve Değerlendirme Dergisi, 2*(1), 140-147.

Erdoğmuş, U., F. (2009). *Türkiye'de BÖTE alanında yapılan yüksek lisans ve doktora tezlerindeki araştırma eğilimleri: bir doküman analizi.* Yüksek Lisans Tezi, Orta Doğu Teknik Üniversitesi Fen Bilimleri Enstitüsü, Ankara.

Göktaş, Y., Hasançebi, F., Varışoğlu, B., Akçay, A., Bayrak, N., Baran, M. ve diğerleri. (2012a). Trends in Educational Research in Turkey: A Content Analysis. *Educational Sciences: Theory & Practice, 12*(1), 455-460.

Gürdal, A., Bakioğlu, A., & Öztuna, A. (2005). Fen bilgisi eğitimi lisansüstü tezlerinin incelenmesi. Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi, 1(17), 53-58.

Jensen, E. (2006). *Beyin uyumlu öğrenme.* (A. Doğanay, Çev.). Adana: Nobel.

Jensen, E. (2000). Brain based learning. *Educational Leadership, 57*(7), 76-78.

Keleş, E., Çepni, S. (2006). Beyin ve öğrenme. *Türk Fen Eğitimi Dergisi, 8*(2), 67-82.

Lubienski, S.T. & Bowen, A. (2000). Who's counting? A Survey of Mathematics Education Research 1982-1998. *Journal for Research in Mathematics Education. 31*(5), 626–633.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis*. Th ousand Oaks, CA: Sage.

Ozan, C., & Köse, E. (2014). Eğitim programları ve öğretim alanındaki araştırma eğilimleri. *Sakarya University Journal of Education, 4(11), 116-136.*

Saban, A. (2009). Çoklu zekâ kuramı ile ilgili Türkçe çalışmaların içerik analizi. *Kuram ve Uygulamada Eğitim Bilimleri. 9*(2), 833-876.

Sarı, Ş. N. (2011). *Türkiye'de kimya eğitimi alanında 2000-2010 yılları arasında yazılmış yüksek lisans tezlerinin içerik analizi.* Yüksek Lisans Tezi, Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.

Seçer, İ., Ay, İ., Ozan, C., & Yılmaz, B.Y. (2014). Rehberlik ve psikolojik danışma alanındaki araştırma eğilimleri: bir içerik analizi. *Turkish Psychological Counseling and Guidance Journal, 5*(41), 49-60.

Selçuk, Z., Palancı, M., Kandemir, M., & Dündar, H. (2014). Eğitim ve bilim dergisinde yayınlanan araştırmaların eğilimleri: içerik analizi. *Eğitim ve Bilim, 39*(173), 430-453.

Sert, G. (2010). *Öğretim teknolojileri alanında yayımlanmış Türkiye adresli makalelerin içerik analizi.* Yüksek Lisans Tezi, Hacettepe Üniversitesi Fen Bilimleri Enstitüsü, Ankara.

Sert, G., Kurtoğlu, M., Akıncı, A. & Seferoğlu, S. S. (2012). *Öğretmenlerin teknoloji kullanma durumlarını inceleyen araştırmalara bir bakış: bir içerik analizi çalışması.* Akademik Bilişim'12-XIV, Akademik Bilişim Konferansında sunulmuş bildiri. Uşak Üniversitesi, Uşak.

Tatar, E., & Tatar, E. (2008). Fen bilimleri ve matematik eğitimi araştırmalarının analizi-I: Anahtar kelimeler. *İnönü Üniversitesi Eğitim Fakültesi Dergisi, 9*(16), 89–103.

Temel, S., Şen, Ş., & Yılmaz, A. (2014). Fen eğitiminde probleme dayalı öğrenme ile ilgili yapılan çalışmalara ilişkin bir içerik analizi: Türkiye örneği. *K. Ü. Kastamonu Eğitim Dergisi, 23*(2), 565-580.

Ulutaş, F., & Ubuz, B. (2008). Matematik eğitiminde araştırmalar ve eğilimler: 2000 ile 2006 yılları arası. *İlköğretim Online, 7*(3), 614-626.

Yıldırım, A., & Şimşek, H. (2008). Sosyal bilimlerde nitel araştırma yöntemleri. Ankara: Seçkin Yayıncılık.