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# Content Analysis of Physics Education Studies Published in Turkish Science Educatıon Journal from 2004 to 2011

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## ABSTRACT

This study investigates research trends in articles about physics education in Journal of Turkish Science Education (TUSED) by using content analysis method. There were 125 studies published between 2004 and 2011, and 46 studies related to physics education have been determined. The research trends in these 46 articles have been examined in terms of demographic properties of authors (gender, institution, number of authors, etc.), general themes and physics topics, research methods, sampling procedures and sample sizes, instruments, level of samples, statistical methods, use of covariance, retention test and dependent variables. Research results show that as a general theme, learning approach is the most studied. While concepts related to dynamic are most commonly studied in the articles, light and optics, thermodynamics, vibration and waves are the least studied physics topics. Furthermore, there is no study about modern physics. When we look at methods of 46 studies, quantitative studies are preferred most than qualitative ones. Moreover, samples of the studies were usually chosen from university students. Although, t-test and ANOVA were seen as the most common statistics, MANOVA, MANCOVA, and MRC have not been encountered. There is no study using covariates. This study is the one of the most comprehensive studies in the physics education literature and hope to give deeper insights to the researchers.

**Keywords:** *Content Analysis, Physics Education, Research Trends, Turkish Online Journal of Science Education.*

## INTRODUCTION

Previous studies in the literature from national and international journals, dissertations, handbooks and congresses give new ideas for researchers in order to carry out new studies. At

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this point, content analysis studies take an important role as being a guide by showing what is done in the literature and organizing a large amount of material (Fraenkel & Wallen, 2000). It provides insightful information about research trends and guide researchers about future studies (Cohen, Manion, & Morrison, 2007).

When content analysis studies in the educational literature were examined, it was seen that researchers mainly looked for research methods (Tsai & Wen, 2005; Lee, Wu & Tsai, 2009), research topics (Tsai & Wen, 2005), and data collection instruments and methods (Ulutaş & Ubuz, 2006; Erdoğmuş, 2009). Moreover, some researchers prefer to examine authors' nationality (Tsai & Wen, 2005; Lee, Wu & Tsai, 2009; Chang, Chang, & Tseng, 2010) and how many times the articles were cited (Shin, Feng & Tsai, 2008; Chang, Chang, & Tseng, 2010).

In the field of science education, researchers examined research trends in popular journals such as Journal of Research in Science Teaching, International Journal of Science Education, and Science Education (Tsai & Wen, 2005; Lee, Wu & Tsai, 2009; Chang, Chang, & Tseng, 2010). Tsai and Wen (2005) examined all published studies between the years of 1998 and 2002 in these journals and a total number of 802 studies analyzed in terms of research method, research topic, and authors' nationality. The succeeding study done by Lee, Wu and Tsai (2009) examined the studies published in the same journals between the years of 2003 and 2007. They examined 869 studies and compared the results with the former one. With the results of this study, they introduced how research trends changed in last five years. Apart from these researchers, Chang, Chang, and Tseng (2010) analyzed trends in the same journals and examined 3039 studies published between the years of 1990 and 2007. They stated that examining most cited references gives information about the frontiers and the most popular papers in the field (Chang, Chang, & Tseng, 2010).

In national literature, there have been content analysis studies about educational technology (Gülbahar & Alper, 2009; Küçük, et al., 2010), mathematics education (Çiltaş, Güler, & Sözbilir, 2010; Ulutaş & Ubuz, 2006), educational sciences (Saban, 2009; Yeşildağ, et al., 2010) and environmental education (Erdoğan, 2010). When the studies in the field of science education were investigated, there is an increase in content analysis studies in recent years. As one of these, Sözbilir, Kutu, Yasar and Arpacık (2010a) examined studies conducted by Turkish researchers between the years of 1973 and 2009. They investigated 1249 studies published in 30 national and 37 international journals. In this content analysis, these articles were studied carefully in terms of field of study, topic, research method, sample, statistical methods and instruments used. They concluded that Turkish researchers mainly studied about teaching, learning and attitudes. Also non-empirical research methods, achievement tests, questionnaires and attitude scales were mostly used in examined studies.

In other study Sözbilir et al. (2010b) examined trends in chemistry education between the years of 1999 and 2009 in the world. They compared national and international studies in terms of research topic, research method, sample, instruments and statistical methods. They stated that there is a big difference between national and international studies in terms of research topic and methodology. In another content analysis study at chemistry education, 96 published studies in International Journal of Science Education, Journal of Research in Science Teaching, and Science Education were examined by Tatar, Orğan and Yıldırım (2010). They investigated these studies in terms of research methods, research topics, instruments, and authors' institutions. Tatar et al. indicated that researchers mainly prefer non-empirical research methods and prefer quantitative data collection instruments to qualitative ones.

Moreover, Eryılmaz et al. (2010) examined the research trends in studies about physics education presented in National Science and Mathematics Education Congress (NSMEC) between the years of 2000 and 2008. Since NSMEC is one of the most popular congresses in

the field and has high level of participation, examining studies published in the congress may give a general view of studies in the field. The research trends in these studies have been investigated in terms of research method, statistical methods, instruments used, sample sizes and sampling methods, physics topics and general themes (learning approaches, misconceptions and learning difficulties, factors affecting the success etc.), demographic information of authors (number, gender, institutions, etc.), and use of covariance and retention test. According to this study, the most studies in NSMEC were quantitative in nature like survey, quasi-experimental, and correlational studies and the most frequently studied themes were learning approaches, misconceptions and learning difficulties.

In addition, Bacanak et al. (2011) analyzed four free access online national science education journals. They examined a total of 173 papers published in Journal of Turkish Science Education, Elementary Education Online, Turkish Online Journal of Educational Technology, and Journal of Theory and Practice in Education. They looked for only research methods in these papers and stated that mainly experimental studies and review studies are most common.

## PURPOSE OF THE STUDY

The main aim of this study is to give an insight to the researchers about the trends in the physics education literature. The trend studies provide some features of published studies in the field of major research areas. For instance, they show which topics, research and statistical methods, instruments etc. are generally preferred. In addition, they provide some guidance for new researchers when planning to their studies. For this aim, we investigate published physics education studies in *Journal of Turkish Science Education* (TUSED) between 2004 and 2011. We selected TUSED because it is i) the first journal that publishes only science education articles, ii) refereed "science education journal" that is published since 2004, iii) indexed and abstracted in some of the important education databases (i.e. ProQuest, EBSCO Education Research Complete, Education Research Index SCOPUS), iv) an online and free to get full-text of articles.

The trend studies are usually conducted in international literature. On the other hand, there are limited numbers of the trend studies in Turkey. Thus, this investigation will contribute to display current national research trends in the physics education. From this perspective, it is hoped that this study will fill this gap in the physics education literature. In addition, it can be an insight to the researchers about which points to study. Moreover, there were limited numbers of content analysis studies in national literature. This study can also make an insight to other content analysis studies.

In the light of the previous literature and aim of the study, the following research question are tried to answer: *"What are the research trends in published physics education studies in TUSED between 2004 and 2011?"*

## METHODOLOGY

In this study content analysis research method has been used. This method is a widely used technique in social sciences, which examine written communications in an indirect way and make interpretations about these communications. By doing content analysis, a researcher may describe trends in overtime by examining publications (Frankel & Wallen, 2000). As in this study we aimed to have general information about studies and give trends in one of the online science education journal, so content analysis fits the best research design for this study. We have followed these steps in this content analysis:

***Step 1:*** *Obtain descriptive information related to main research question in the literature.*

***Step 2:*** *Determine sub research questions under main research question:*

1. What are the demographic properties of the authors?
2. What are the general themes and physics topics in published studies?
3. Which research methods are used in published studies?
4. Which sampling procedures and sample sizes are used in published studies?
5. What kinds of instruments are used in published studies?
6. What is the level of samples in published studies?
7. Which statistical methods are used in published studies?
8. Are covariance and retention test used and what dependent variables are chosen in published studies?

***Step 3:*** *Determine the sample and unit of analysis:*

- Our sample includes physics education studies published in TUSED between 2004 and 2011. There were 46 physics education papers. We examined words in papers and coded both manifest and latent communications in these papers.

***Step 4:*** *Formulate themes and codes and develop a coding sheet. After various group discussions the coding sheet was prepared:*

- The articles were analyzed by using a coding sheet. First version of the coding sheet was prepared in the light of the previous studies (Tsai &Wen, 2005; Lee, Wu & Tsai, 2009) and took the latest form after multiple discussions.

| **Themes** | **Sub-Themes** |
|---|---|
| Demographic properties | Number of Authors, Gender, Institutions … |
| General Themes | Learning Approaches, Misconceptions and Learning Difficulties, Teacher Education, Epistemology … |
| Physics Topics | Dynamics, Electricity, Kinematics, General –the studies in which physics topics were not specified … |
| Research Methods | Quantitative (e.g. descriptive, meta-analysis studies), Qualitative (e.g. case, action research studies) and others (e.g. mix-methods, reviews). |
| Statistical Methods | Descriptive Statistics (e.g. frequency, distribution), Inferential Statistics (e.g. non parametric test, T-test, ANOVA, MANCOVA, MRC). |
| Instruments | Filled by Researchers (e.g. rating scales, observation forms) and Filled by Participants/Subjects (e.g. surveys, self-checklists) |
| Sample Sizes | 0-10, 11-30, 31-100, 101-300, 301-1000 and more than 1000 |
| Sampling Procedures | Systematic Sampling, Convenience Sampling, Not Specified … |
| Level of Sample | Pre-school, High School, University, Special Groups, Elementary (1-5), Elementary (5-8), Post-Graduate and In-Service Teachers … |
| Variables and Retention | Covariance, Dependent Variables and Retention Test |

***Step 5:*** *In order to check and provide exclusiveness and comprehensiveness of the coding sheet, some coding process steps were carried out.*

- Firstly, three of the studies were coded individually and independently by eight researchers to improve the consistency of the coding.
- The results were discussed together and the codings were agreed by all the researchers.
- This procedure was repeated once more with four studies and then by continuing to

three studies and a total of 10 studies had been coded with this procedure.

- The coding sheet was revised after these coding processes. Then, to maximize the variance of the coding consistency the least consistent coders were matched together to form coding groups of two researchers.

***Step 6:*** *For the remaining articles, each article was coded by at least two researchers.*

***Step 7:*** *Frequencies and percentages of occurrences have been calculated and content analysis data has been interpreted.*

## FINDINGS

***1.*** *What are the demographic properties (gender, institution and number of authors) of the authors in published studies?*

Frequency and percentage of authors' gender and the number of articles by years were given in Table 1. As seen in Table 1, 66.7% and 33.3% of the 96 authors presented in these studies were male and female, respectively. The number of male authors was in majority by years except 2009.

**Table 1.** *Distribution of Studies by Years and Number of Authors*

| | **2004 f(%)** | **2005 f(%)** | **2006 f(%)** | **2007 f(%)** | **2008 f(%)** | **2009 f(%)** | **2010 f(%)** | **2011 f(%)** | **Total f(%)** |
|---|---|---|---|---|---|---|---|---|---|
| **Article** | 5(10.9) | 4(8.7) | 8(17.4) | 4(8.7) | 5(10.9) | 6(13.0) | 11(23.9) | 3(6.5) | 46(100) |
| Female Author | 5(41.7) | | 5(33.3) | 3(37.5) | 2(15.4) | 9(69.2) | 5(20.8) | 3(42.9) | 32(33.3) |
| Male Author | 7(58.3) | 4(100) | 10(66.7) | 5(62.5) | 11(84.6) | 4(30.8) | 19(79.2) | 4(57.1) | 64(66.7) |
| Total Author | 12(100) | 4(100) | 15 (100) | 8(100) | 13(100) | 13(100) | 24(100) | 7(100) | 96(100) |

According to Table 2, 97.9% of the authors were from various universities, 0.7% was from Ministry of National Education and 1.4% was from other institutions (Turkish Physics Foundation, Turkish Armed Forces). In examination of distribution of the authors' institutions by years, 3% and upper values were taken into consideration. It is seen that 57.3% of the authors were from Balıkesir, Dokuz Eylül, Gazi, Karadeniz Teknik, Atatürk, Ege, Abant İzzet Baysal, and Selçuk University.

**Table 2.** *Distribution of Authors' Institutions by Years*

| **University** | **2004 f(%)** | **2005 f(%)** | **2006 f(%)** | **2007 f(%)** | **2008 f(%)** | **2009 f(%)** | **2010 f(%)** | **2011 f(%)** | **Total f(%)** |
|---|---|---|---|---|---|---|---|---|---|
| Balıkesir | 2(16.7) | | | 2(25.0) | 5(38.5) | | 3(12.5) | | 12 (12.5) |
| Dokuz Eylül | 1(8.3) | | 2(13.3) | 4(50.0) | | 5(38.5) | | | 12 (12.5) |
| Gazi | | | 3(20.0) | | 2(15.4) | | 3(12.5) | | 8 (8.3) |
| Karadeniz Teknik | | 1(25.0) | | 2(25.0) | 1(7.7) | 2(15.4) | | 2(28.6) | 8 (8.3) |
| Atatürk | 3(25.0) | | | | 1(7.7) | | | 1(14.3) | 5 (5.2) |
| Ege | 2(16.7) | | 2(13.3) | | | | | | 4 (4.2) |
| Abant İzzet Baysal | | | | | | | 3(12.5) | | 3(3.1) |
| Selçuk | 1(8.3) | | 1(6.7) | | | 1(7.7) | | | 3(3.1) |
| **Other** | 3(25.0) | 3(75.0) | 7(46.7) | | 4(30.8) | 5(38.5) | 15(62.5) | 4(57.1) | 41(42.7) |
| **Total** | 12(100) | 4(100) | 15(100) | 8(100) | 13(100) | 13(100) | 24(100) | 7(100) | 96 (100) |

***2.*** *What are the general themes and physics topics in published studies?*

The Table 3 shows the distribution of general themes of the physics education studies by years When Table 3 is examined, learning approaches, misconceptions and learning difficulties, affective domain and skills become prominent in general themes of studies. There is no increase or decrease in frequency of general themes by years and nearly all of these themes were used in 2010. Also, it is seen that there is no study whose theme is related to general physics education, special education, educational program development and evaluation, and nature of physics, epistemology and scientific literacy. Moreover, the researchers have not taken into consideration the theme, factors affecting the success since 2006.

**Table 3.** *Distribution of General Themes of the Physics Education Studies by Years*

| General Themes | 2004 f(%) | 2005 f(%) | 2006 f(%) | 2007 f(%) | 2008 f(%) | 2009 f(%) | 2010 f(%) | 2011 f(%) | Total f(%) |
|---|---|---|---|---|---|---|---|---|---|
| Learning Approaches | 3(50,0) | 1(25,0) | 4(33,3) | 1(20,0) | 3(37,5) | 1(12,5) | 4(26,7) | 1(25,0) | 18(29,0) |
| Misconceptions and Learning Difficulties | 1(16,7) | 1(25,0) | | 2(40,0) | 3(37,5) | 1(12,5) | 4(26,7) | | 12(19,4) |
| Affective Domain and Skills | | | 2(16,7) | | 2(25,0) | 1(12,5) | 1(6,7) | | 6(9,4) |
| Measurement and Evaluation | | 1(25,0) | | | | | 2(13,3) | 2(50,0) | 5(8,1) |
| Material Development and Evaluation | | | 2(16,7) | 1(20,0) | | | 1(6,7) | 1(25,0) | 5(8,1) |
| Factors Affecting the Success | 1(16,7) | | 3(25,0) | | | | | | 4(6,5) |
| Usage of technology | 1(16,7) | 1(25,0) | | | | | 1(6,7) | | 3(4,8) |
| Other | | | | | | 3(37,5) | | | 3(4,8) |
| Teacher Education | | | | | | 1(12,5) | 1(6,7) | | 2(3,2) |
| Learning Environment | | | 1(8,3) | | | 1(12,5) | | | 2(3,2) |
| Effects of Gender | | | | 1(20,0) | | | | | 1(1,6) |
| Modeling | | | | | | | 1(6,7) | | 1(1,6) |
| **Total** | 6(100) | 4(100) | 12(100) | 5(100) | 8(100) | 8(100) | 15(100) | 4(100) | 62(100) |

Percent of the distributions of universities to the related theme were given in Table 4. While making this calculation, if there was any study carried out by authors from different universities, total percentage was calculated by distributing the contribution of universities evenly. On the other hand, in the case of more than one authors from the same university, the study was accepted as single-authored paper. In addition, it is seen that universities have preferred to study various themes instead of concentrating on a specific general theme.

**Table 4.** *Distribution of the General Themes with the First Five Universities in the Ranking.*

| General Themes | % | Contribution percent of the first five universities in the ranking | | | | |
|---|---|---|---|---|---|---|
| Learning Approaches | 29.0 | 9 Eylül (3.3) | Gazi (2.2) | Ege (1.7) | Balıkesir (1.3) | 19 Mayıs (1.0) |
| Misconceptions and Learning Difficulties | 19.4 | Balıkesir (6.0) | KTU (2.3) | 9 Eylül (1.0) | Abant İ. B. (1.0) | 19 Mayıs (0.5) |
| Affective Domain and Skills | 9.4 | 9 Eylül (2.0) | Ege (1.0) | Marmara (1.0) | Gazi (0.7) | Balıkesir (0.3) |
| Measurement and Evaluation | 8.1 | Marmara (1.0) | Zonguldak (1.0) | Rize (1.0) | Hacettepe (0.5) | KTU (0.5) |
| Material Development and Evaluation | 8.1 | KTU (1.3) | Dicle (1.0) | İnönü (1.0) | Marmara (1.0) | Atatürk (0.3) |
| Factors Affecting the Success | 6.5 | Ahi Evran (1.0) | 9 Eylül (1.0) | Gazi (1.0) | Selçuk (1.0) | |
| Usage of Technology | 4.8 | Marmara (1.0) | Ege (0.7) | 9 Eylül (0.3) | | |

| | | | |
|---|---|---|---|
| Teacher Education | 3.2 | 9 Eylül (1.0) | |
| Learning Environment | 3.2 | 9 Eylül (1.0) | Erciyes (0.5) |
| Effects of Gender | 1.6 | 9 Eylül (1.0) | |

When distribution of physics topics studied by years (Table 5) was analyzed the most studied physics subjects were collected under the titles of Dynamics, Electricity, Fundamental Physics and General. The studies were coded as "General", if studied physics field was not specified or the study discussed about general problems of physics education. For instance, "The effect of socio-economic status of a student on his/her success in physics learning", "comparative analysis of developments in physics education", and "motivation of physics teacher candidates based on their mode of learning and manner of work" were coded as "General". Besides, Waves and Thermodynamics haven't studied till 2009, Light and Optics haven't studied till 2010 and there is no study about Modern Physics.

**Table 5.** *Distribution of Physics Topics -By Years*

| **Physics Topics** | **2004 f(%)** | **2005 f(%)** | **2006 f(%)** | **2007 f(%)** | **2008 f(%)** | **2009 f(%)** | **2010 f(%)** | **2011 f(%)** | **Total f(%)** |
|---|---|---|---|---|---|---|---|---|---|
| Dynamics | | 2(33.3) | 3(33.3) | 1(25.0) | 2(40.0) | | 2(16.7) | 1(33.3) | 11(21.6) |
| Electricity | 3(50.0) | | 2(22.2) | 1(25.0) | 1(20.0) | 1(16.7) | 2(16.7) | | 10(19.6) |
| Fundamental Physics | 1(16.7) | 1(16.7) | 1(11.1) | 1(25.0) | 1(20.0) | | 1(8.3) | | 6(11.8) |
| General | | | 2(22.2) | 1(25.0) | | | 2(16.7) | 1(33.3) | 6(11.8) |
| Kinematics | | 2(33.3) | | | | | 2(16.7) | | 4(7.8) |
| Magnetism | 2(33.3) | | 1(11.1) | | | 1(16.7) | | | 4(7.8) |
| Energy | | | | | 1(20.0) | 1(16.7) | | 1(33.3) | 3(5.9) |
| Earth and Universe | | 1(16.7) | | | | 1(16.7) | 1(8.3) | | 3(5.9) |
| Vibration and Waves | | | | | | 1(16.7) | 1(8.3) | | 2(3.9) |
| Thermodynamic | | | | | | 1(16.7) | | | 1(2.0) |
| Light and Optics | | | | | | | 1(8.3) | | 1(2.0) |
| Modern Physics | | | | | | | | | |
| **Total** | 6(100) | 6(100) | 9(100) | 4(100) | 5(100) | 6(100) | 12(100) | 3(100) | 51(100) |

The distribution of the physics topics studied according to universities was given in Table 6. When evaluating the distribution of physics topics according to universities, Karadeniz Technical University (KTU) have studied mainly on Dynamics and Energy, Balıkesir University studied on Electricity while the other universities studied about various topics.

**Table 6.** *Distribution of the Relevant Physics Topics with the First Five Universities in the Ranking*

| **Physics Topics -** | **%** | **Contribution percent of the first five universities in the ranking** | | | |
|---|---|---|---|---|---|
| Dynamics | 21.6 | KTU (2.5) | Balıkesir (1.0) | 9 Eylül (1.0) | İnönü (1.0) | 19 Mayıs (1.0) |
| Electricity | 19.6 | Balıkesir (3.0) | Ege (1.7) | Gazi (1.5) | 9 Eylül (1.3) | 19 Mayıs (0.5) |
| Fundamental Physics | 11.8 | 9 Eylül (1.0) | Selçuk (1.0) | Zonguldak Karaelmas (1.0) | Gazi (0.5) | Balıkesir (0.3) |
| General | 11.8 | Abant (1.0) | 9 Eylül (1.0) | Gazi (1.0) | Dicle (1.0) | Rize (1.0) |
| Kinematics | 7.8 | Kanyas Eyalet (1.0) | 19 Mayıs (1.0) | | | |
| Magnetism | 7.8 | Atatürk (1.0) | Balıkesir (1.0) | Gazi (0.5) | | |
| Energy | 5.9 | KTU (1.7) | Atatürk (0.7) | Harran (0.3) | | |
| Earth and Universe | 5.9 | Abant (1.0) | KTU (1.0) | Selçuk (1.0) | | |
| Vibration and Waves | 3.9 | Balıkesir (1.0) | 9 Eylül (1.0) | | | |
| Thermodynamic | 2.0 | Uludağ (0.7) | | | | |
| Light and Optics | 2.0 | Balıkesir (1.0) | | | | |

***3.*** *Which research methods are used in published studies?*

It was determined that 66.7% quantitative, 27% qualitative and 6.3% other methods were used as research methods (Table 7). Quasi-experimental designs (59%) and descriptive methods (%34) constitute the majority of the quantitative research methods. True experimental designs, meta-analysis studies, and causal comparative studies were not encountered. Among the qualitative research methods, the most commonly used model is case studies (61.5%). The percentage of evaluation studies is 23%. In two separate studies, action research and content analysis have been performed. Ethnographic and historical studies were not encountered. One review and two test development studies were determined in other categories.

**Table 7.** *Research Methods Used in the Studies*

| | **2004 f(%)** | **2005 f(%)** | **2006 f(%)** | **2007 f(%)** | **2008 f(%)** | **2009 f(%)** | **2010 f(%)** | **2011 f(%)** | **Total f(%)** |
|---|---|---|---|---|---|---|---|---|---|
| ***Quantitative*** | | | | | | | | | |
| Descriptive Studies | 2(40.0) | 1(25.0) | 2(25.0) | 2(50.0) | 1(20.0) | 1(14.0) | 1(8.0) | 1(33.0) | 11(24.0) |
| Pre Experimental Design | | | | | 1(20.0) | | | | 1(2.0) |
| Quasi Experimental Design | 3(60.0) | 1(25.0) | 6(75.0) | | 2(40.0) | 1(14.0) | 5(43.0) | 1(33.0) | 19(40.0) |
| True Experimental Design | | | | | | | | | |
| Correlational Studies | | | | | | 1(14.0) | | | 1(2.0) |
| Causal-Comparative Studies | | | | | | | | | |
| Meta-analysis Studies | | | | | | | | | |
| ***Qualitative*** | | | | | | | | | |
| Case Studies | | | | 1(25.0) | 1(20.0) | 3(42.0) | 3(25.0) | | 8(16.0) |
| Evaluation Studies | | 1(25.0) | | | | 1(14.0) | 1 (8.0) | | 3(6.0) |
| Action Research | | 1(25.0) | | | | | | | 1(2.0) |
| Ethnographic Studies | | | | | | | | | |
| Content Analysis | | | | | | | 1 (8.0) | | 1(2.0) |
| Historical Studies | | | | | | | | | |
| ***Others*** | | | | | | | | | |
| Mix-Methods | | | | | | | | | |
| Review | | | | 1(25.0) | | | | | 1(2.0) |
| Test Development | | | | | | | 1 (8.0) | 1(33.0) | 2(4.0) |
| Material Development | | | | | | | | | |
| Not Specified | | | | | | | | | |
| ***Total*** | 5(100.0) | 4(100.0) | 8(100.0) | 4(100.0) | 5(100.0) | 7(100.0) | 12(100.0) | 3(100.0) | 48(100.0) |

***4.*** *Which sampling procedures and sample sizes are used in published studies?*

The sample size in 41.5% of the studies was 31-100 and following this 101-300 sample size was preferred by 34.1% of studies. Studies with sample size in the range of 301-1000 were 14.6%. The number of studies with sample size higher than 1000, was only three which corresponds to 7.3% of the studies. The sample size in 2.4% of the studies was 11-30. Sampling method was specified in only 7.7% of the studies and not specified in 92.3% of the studies. As sampling method, cluster random sampling method was used only in one study whereas convenience sampling method was used in all others. In this section, the studies non-applicable in terms of sample were excluded from the analysis.

***5.*** *What kinds of instruments are used in published studies?*

Twenty-two percent of the data collection instruments used in the studies was filled by the researchers and 78% was by participants. Among the data collection instruments filled by the researchers, the most commonly used are the interview forms (50%) and observation forms (25%). Rating scale and video record were encountered only once in two separate study. Tally sheet, flow chart, performance checklist and anecdotal records were used in none of the studies examined. Achievement/skill tests constitute the half of the data collection instruments filled by the participants. Twelve point five, eleven, and seven percent of the studies were composed of questionnaire, attitude scales, and self-checklist, respectively. Only in two studies, performance tests were used. Study guidance, problem solving strategies inventory, the Maryland physics expectation (mpex) survey, reasonable thinking ability test, science process skill test, and word correlation test used once in separate studies were coded under the heading of "other". Projective devices (an instrument that allows persons to express their interests, needs, anxieties, etc.) and sociometric instruments (an instrument that allows persons to rate and assess their peers) have not included in any study.

***6.*** *What is the level of samples published studies?*

The level of samples used in the studies was given by years in Table 8. Analysis results showed that most of the studies (89.1%) have one sample level. As a minority, two studies were done at two levels (4.3%), and two studies were done at three levels (4.3%). Studies' sample levels were ranked as university (37.3%), elementary education (37.4%) and high school (25.5%) respectively. Almost each year elementary (6-8) and university levels were preferred to use in these studies. As a remarkable point, there are no studies working with pre-schools, post-graduates, special groups (gifted, impaired, etc.) students.

**Table 8.** *Levels of Samples Used in the Studies*

| | **2004 f(%)** | **2005 f(%)** | **2006 f(%)** | **2007 f(%)** | **2008 f(%)** | **2009 f(%)** | **2010 f(%)** | **2011 f(%)** | **Total f(%)** |
|---|---|---|---|---|---|---|---|---|---|
| Pre-school | | | | | | | | | 0(0.0) |
| Elementary(1-5) | 1(20.0) | | 3 (37.5) | | | 1(14.3) | 1(7.7) | | 6(11.8) |
| Elementary(6-8) | 1(20.0) | 1(16.7) | 2 (25.0) | | 1 (20.0) | 2(28.6) | 3(23.1) | 1(25.0) | 11(21.6) |
| High School | | 2(33.3) | | 1 (33.3) | 3(60.0) | | 4 (30.8) | 3(75.0) | 13(25.5) |
| University | 3(60.0) | 3(50.0) | 2(25.0) | 2 (66.7) | 1(20.0) | 4(50.1) | 4(30.8) | | 19(37.3) |
| Post-graduate | | | | | | | | | |
| In-service teachers | | | 1(12.5) | | | | 1(7.7) | | 2(3.8) |
| Special groups | | | | | | | | | |
| Total | 5(100.0) | 6(100.0) | 8(100.0) | 3(100.0) | 5 (100.0) | 7(100.0) | 13(100.0) | 4(100.0) | 51(100.0) |

***7.*** *Which statistical methods are used in published studies?*

The statistical methods used in the both qualitative and quantitative studies were given by years in Table 9. 40.9% of studies used only descriptive statistics while 56.8% of studies used both descriptive and inferential statistics. In only one study, there were no statistical methods.

**Table 9.** *Descriptive and Inferential Statistics Methods Used in the Studies*

| | 2004 f(%) | 2005 **f(%)** | 2006 **f(%)** | 2007 **f(%)** | 2008 **f(%)** | 2009 **f(%)** | 2010 **f(%)** | 2011 **f(%)** | Total **f(%)** |
|---|---|---|---|---|---|---|---|---|---|
| Only Descriptive Statistics | | 1(25.0) | 1(12.5) | 2(66.7) | 4(80.0) | 3(60.0) | 6(54.5) | 1(33.3) | 18(40.9) |
| Only Inferential Statistics | | | | | | | | | |
| Both Descriptive and Inferential | 5(100.0) | 2(50.0) | 7(77.5) | 1(33.3) | 1(20.0) | 2(40.0) | 5(45.5) | 2(66.7) | 25(56.8) |
| Unused | | 1(25.0) | | | | | | | 1(2.3) |
| Total | 5(100.0) | 4(100.0) | 8(100.0) | 3(100.0) | 5(100.0) | 5(100.0) | 11(100.0) | 3(100.0) | 44(100.0) |
| Not Applicable | | | | 1(25.0) | | 1(16.7 | | | 2(4.3) |
| Overall Total | 5 | 4 | 8 | 4 | 5 | 6 | 11 | 3 | 46 |

Approximately 37% of the studies, which descriptive statistical methods were used, gave frequency or percentage values. Moreover, 27.4% of the studies gave central tendency (mean, median, and mode) values, 28.4% of the studies gave distribution shape of the data, and finally 4.2%of the studies gave correlation coefficients. In studies which inferential statistics were used, t-test (39.2%), ANOVA (13.7%), non-parametric tests (7.8%), and regression (3.9%) analyses were preferred. However, MANOVA, MANCOVA, and MRC were not preferred. There are no any studies to give normal positively and negatively skewness distributions of their quantitative data.

***8.*** *Are covariance and retention test are used and what dependent variables are chosen in published studies?*

In eighty point four percent of the studies, only one dependent variable was used. In these studies "achievement" (37.3%), "misconceptions" (25.5%) and "attitude" (17.6%) were used as dependent variables. Skill, creativity, expectation-opinion, etc. variables are almost non-existing. Covariate variables were not used in any of examined studies. Only in one study, retention was evaluated conceptually. This question is not applicable in 19.6% of the studies.

## RESULTS and DISCUSSION

In this study, research trends in published articles about physics education in TUSED were investigated. The results show that almost all of the researchers were mainly from universities. However, unfortunately only 0.7% of authors were from Ministry of National Education (MONE), which is too small percentage. Thus, especially teachers working at various schools should be encouraged to carry out some educational researches.

The most frequently studied themes were learning approaches and misconceptions/learning difficulties. When we looked at other content analysis studies in international (Chang, Chang & Tseng, 2010; Tsai & Wen, 2005) and national studies (Sözbilir et.al, 2010a), it is seen that similar results have been obtained and researchers in this field studies similar themes. However, some themes were rarely seen such as affective domain and

skills, measurement and evaluation, material development and evaluation, and factors affecting the success. Moreover, universities have preferred to study various themes instead of concentrating on a specific general theme. Determining how the studied themes in the field varying are important as it helps to find out in which areas there is a need to study. Making research in the least studied themes could enhance the field and maintain the originality of the study.

The most frequently studied physics topics were dynamics, electricity and fundamental physics, and following these, 11.8 % of studies did not indicated any physics topic and discussed some common issues in physics education. On the other hand, thermodynamics, light and optics, vibration and waves were the least studied physics topics, and there were no studies about modern physics.

Most studies were quantitative in descriptive and quasi-experimental studies. Few of them were qualitative in nature like case study and evaluation studies. Mixed design studies, causal comparative studies and meta-analysis studies were not seen in the published papers. Similarly, other content analysis studies about education and mathematics education state that the quantitative research is more preferred to qualitative research (Şimşek et al., 2008; Arık & Türkmen, 2009; Çiltaş, Güler & Sözbilir, 2012; Göktaş et al., 2012).

In the analyzed studies, the samples were chosen respectively more from university students. This result is parallel with the results of the studies conducted by other researchers (Çiltaş, Güler & Sözbilir, 2012; Göktaş et.al, 2012). This may because of easiness of reaching this kind of samples as 97% of the authors are from universities. Unfortunately, there were no studies using pre-schools students, post-graduate students, and special education students. In order to increase quality of education, researches about all levels of participants are highly needed. Thus, there should be studies about pre-schools students, post-graduate students, and special education students.

Descriptive and inferential statistics were generally used together. Parametric statistics were used more frequently than non-parametric statistics. In parametric statistics, t-test and ANOVA were the most common statistics. Similar content analysis studies also support this result (Şimşek et.al, 2008; Çiltaş, Güler & Sözbilir, 2012; Göktaş et.al, 2012). MANOVA, MANCOVA, and MRC have not been encountered. There was no study using covariates. Furthermore, learning is not a sort term process so in order to talk about effectiveness of an approach, retention test should be applied. But, when we looked at the analyzed studies, there was only one study that looks for retention.

The study only aims to seek for research trends in articles about physics education published in TUSED. In order to have a broader view of research trends in physics education research in Turkey, other journals should be analyzed and a complete picture of the field should be presented. Also again to have broader view, the articles about other science subject should be analyzed since they are all affected from each other. And in order to have a continuous trends in the area, it is suggested to do more research about trends in physics education and they should be repeated from time to time.

Moreover, this study does not give information about in which physics subjects, which kinds of research methods are preferred, for what educational level of the subjects and etc. For instance, there is not analysis about what mostly preferred research method is in misconceptions and learning difficulties theme and which physics subject is mostly studied in this theme. Making such statistical analysis will give totally explicit idea about research done in the field.

As in other content analysis studies, even it gives an idea to the researchers about quantity of studies in the field, it does not give idea about the quality. There should be studies talks about quality of the researches done beside content analysis studies.

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A publication trend in Physics Education by employing bibliometric analysis leads the researchers to describe current scientific movement. This paper tries to answer â€œWhat do Physics education scientists concentrate in their publications?â€ by analyzing the productivity and development of publications on the subject category of Physics Education in the period 1980â€“2013. The Web of Science databases in the research areas of â€œEDUCATION - EDUCATIONAL RESEARCHâ€ was used to extract the publication trends. The study involves 1360 publications, including 840 articles, 503 proceedings paper, 22 reviews Linguistics and Education is an international peer-reviewed journal that welcomes submissions from across the world that advance knowledge, theoryÂ  CiteScore values are based on citation counts in a given year (e.g. 2015) to documents published in three previous calendar years (e.g. 2012 â€“ 14), divided by the number of documents in these three previous years (e.g. 2012 â€“ 14). Impact Factor: 1.516 â„¹ Impact Factor: 2018: 1.516 The Impact Factor measures the average number of citations received in a particular year by papers published in the journal during the two preceding years. 2018 Journal Citation Reports (Clarivate Analytics, 2019).