

## **What trends do Turkish biology education studies indicate?**

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The aim of this study is to determine what trends Turkish biology education studies indicate. To achieve this aim, the researchers examined online databases of the Higher Education Council and open access archives of graduate thesis in web sites of Turkish universities. Finally, totally 138 graduate theses were elicited to analyze in regard to following matrix: year, research interest, research methodology and sample. The results show that descriptive study for research interest and survey for research methodology are highly dominant in the graduate theses under investigation. Also, even though learning involves an interaction amongst student, teacher, parent and administrator, there is no study on investigating what the student parents think about their learning responsibility. It is suggested that further studies should be undertaken to emerge Turkish biology education trend.

**Keywords:** biology education, graduate theses, content analysis

### **Introduction**

Because biology education has confronted with serious problems, i.e. overloaded and outdated curricula/text books, insufficient time to cover contents, insufficient “real” practical work, limitations of the scope of biology, perception of biology as a “soft” subject (Moore, 2007), biology education studies have different drivers from those of science, technology, engineering and mathematics. Indeed, new Turkish Biology Education curriculum has gradually developed and then released to overcome such deficiencies, but related literature emphasizes that 10-15 years are at least necessary to see outcomes of the newly released curricula (e.g. Çalık & Ayas, 2008). This means that it is too early to decide effects of the newly released Turkish Biology Education curriculum on overcoming the foregoing issues. Phrased differently, some of the foregoing issues are still common for Turkish context, except for outdated curricula and textbooks. Moreover, unfortunately, biology education currently possesses less public support, charitable and private funders as compared with particularly the physical sciences (Page & Reiss, 2010). For this reason, what trends the biology education studies have pointed out is not only crucial to keep up with present developments and trends but also to afford biology and science teachers to adapt these trends into their classroom practice. Moreover, such a review will encourage possible future studies to focus on unexplored features (Chang, Chang, & Tseng, 2010).

In contrary to the international developments, research in science education hardly goes back to 1990 in Turkey (Sözbilir, Kutu & Yaşar, 2012). Some science education studies have been reviewed related studies and/or trends (e.g. Bağ, Kara, & Uşak, 2002; Balcı, 2004; Balım, Evrekli, İnel & Deniz, 2009; Balkan Kıyıcı, Atabek Yiğit, Kirman, & Üstündağ, 2010; Chang et al., 2010; Çakmakçı, 2007; Çalık, Ünal, Coştu & Karataş, 2008; de Jong, 2007; Evrekli, İnel,

Deniş & Balım, 2011; Sözbilir & Canpolat, 2006; Sözbilir, Kutu, Yaşar & Arpacık, 2010; Sozbilir & Kutu, 2008; White, 1997). In detail, White (1997) who investigated science education research articles from 1965 to 1995 in the Education Resources Information Center database and journal "Research in Science Education", found that science education research tended to shift from laboratory style experiments to observations and description of classroom practice. Also, he emphasized that 'interview' as a data collection became very common. Also, de Jong (2007) who adopted themes from The National Association for Research in Science Teaching (NARST) conferences and European Science Education Research Association (ESERA) conferences into three selected journals (*Journal of Research in Science Teaching*, *International Journal of Science Education*, *Science Education*) to elicit science education trends, reported that small-scale research design and qualitative data collection methods were mostly employed. Chang et al, (2010) who used scientometric methods to conduct an automatic content analysis on the development trends of science education research from the published articles in four journals (*International Journal of Science Education*, *Journal of Research in Science Teaching*, *Research in Science Education*, *Science Education*) from 1990 to 2007, addressed that conceptual change and concept mapping were the most studied topics. Likewise, Sozbilir and Kutu (2008), Çalık et al. (2008) and Sözbilir et al. (2010) applied similar review process to Turkish science education studies. Sozbilir and Kutu (2008) who reviewed 413 papers from 28 different Turkish science education journals whilst Sözbilir et al. (2010) examined 1249 papers published in 67 different journals (30 national and 37 international) by Turkish science educators. Sozbilir and Kutu (2008) identified an opposite case between international and national science education trends. That is, they depicted that there was an increasing trend in using qualitative and mixed method research designs in international perspective but quantitative research methods were highly dominant in Turkish science education perspective. Similarly, Sözbilir et al. (2010) pointed out that the descriptive and inferential statistics method trend was also available for Turkish science education papers.

Apart from the earlier studies, Balkan Kıyıcı et al. (2010), Çalık et al. (2008) and Evrekli et al. (2011) went over graduate theses (master and doctoral theses) submitted by Turkish Science Educators. Çalık et al. (2008) revealed two general trends in Turkish science education research: (1) introducing science education between 1990 and 2000 (2) keeping up with new perspectives in the line of international trends, whereas Balkan Kıyıcı et al. (2010) drew out that 78% of the graduate theses was quantitative research method design. Moreover, Evrekli et al. (2011) who determined proficiency levels and drawbacks of the science education graduate theses (from 2005 to 2009) concerning purposes, significance, problem statement, premises, limitations and methodology, stated that the graduate theses had shortcomings for some criteria, i.e. significance, sample selection, validity and reliability and data analysis. Also, some of the earlier studies, i.e. Bağ et al. (2002) and Çakmakçı (2007), only listed the titles of the studies under investigation. For instance, Çakmakçı (2007) did this for science education studies whereas Bağ et al. (2002) listed the titles of the chemistry and physics education studies.

As seen from the foregoing studies, some of the science education studies, somewhat covers biology subjects since science education is multidisciplinary and integrated version of physics, chemistry and biology subjects. However, because Turkish science educators have showed a great ascending effort in both national and international perspectives, there is a need to go over Turkish biology education studies. Needless to say that Turkish science/biology educators are gradually scratching top of the most published papers in journals and graduate theses.

Presenting trends in Turkish biology education studies provides biology educators to capture insights of the studies and to refrain from replicated studies in the same context. Likewise, they enable us to create our own new trends within a better creative effort. The researchers hypothesize that the best way to identify trends in biology education is to concentrate on graduate

theses since each one must study original aspects to fulfill them. Thus, the aim of this study is to determine what trends Turkish biology education studies indicate.

### **Methodology**

This study followed content analysis research design (Ary, Jacobs, Razevieh & Sorensen, 2006; Erdogan, Marcinkowski & Ok, 2009) meaning systematically analysis of graduate theses at Turkish biology education. That is, similar data were brought and presented together under specific concepts and themes.

#### *Data Collection*

The researchers examined online databases of the Higher Education Council (YÖK) and web pages of Turkish universities that are open access to graduate thesis archive. When enough information about any graduate thesis was not obtained, the researchers sent informative e-mails to both author of thesis and his/her advisor to clarify the matrix. Finally, totally 138 graduate theses were elicited to analyze them in regard to the following matrix (Year, Research Interest, Research Methodology and Sample) used by Çalık et al. (2008). Despite such efforts, unfortunately the researchers did not retrieve the relevant matrix from minority of the graduate theses and called them 'missing data'. Since the dissertations accepted in 2011 have not been published yet, the current study excluded them from scope of the research.

#### *Data Analysis*

What research interests mean is outlined in Figure 1 (adapted from Çalık et al., 2008). By the way, the descriptive study may also overlap some of scientific literacy, measurement and assessment, science curriculum study and environmental education, but the researchers took their principal aims into account to decide which one was dominant or highly relevant. In analyzing data, two of the researchers separately categorized the graduate theses in regard to the relevant matrix. Inter-rater consistency was very high (about 90%) and also, any disagreement was solved by negotiation.

### **Findings**

As seen in Table 1, frequency of the descriptive study in graduate theses in regard to the research interest is 111 whilst frequencies of studies on the intervention, the computer aided instruction; the environmental education and the teacher education in graduate theses in regard to research interest are 10, 5, 5 and 3 respectively. However, none of the graduate theses concerning the research interest has focused on the scientific literacy and the measurement and assessment.

<b>Research interest</b>	<b>Definition</b>
Descriptive study	Research that has no other purpose than description of phenomena and is not intended to intervene the existing case or alternative conceptions.
Intervention	The purpose of intervention is to overcome the existing case (i.e. alternative conceptions or conceptual change) rather than identifying them.
Teacher Education	The goal of teacher education is to enhance pre-service and/or in-service teacher's skill (i.e. understanding or informing about new contemporary approaches) by means of preservice and in-service education, workshop etc.
Computer Aided Instruction	Computer Aided Instruction is primarily concerned with using computers for teaching purposes to afford students or student teachers to capture a better learning by means of animation, internet, website, information-communication-technology (ICT), hypertext, educational games and so forth
Scientific Literacy	Scientific literacy contains not only the scientific content knowledge but also holds accurate views on the ' <i>nature of science</i> ' involving in its reliance on inquiry. This category incorporates in both scientific literacy and nature of science.
Measurement and assessment	Measurement and assessment contain both alternative and traditional manner to determine either what is known or how it influences. This category incorporates in both alternative/traditional measurement and assessment.
Biology Curriculum Study	Biology curriculum study compares new curriculum with old one or describes development of biology curricula. Further, it includes what teachers or students thought about their effectiveness or deficiencies.
Environmental Education	This category includes in the studies of students'/teachers'/student teachers' attitudes and consciousness as well as interventions which attempt to enhance their mentioned virtues.

Figure 1. Research interests with their decriptions

As can be seen from Table 2, frequency of the studies using survey research design is 55, while that for experimental research design is 43. Frequency of the studies using document analysis method is 7 whilst that for mixed method design (a combination of qualitative and quantitative methods) is 6. Further, frequencies of the studies employing case studies and qualitative research designs are 6 and 5 respectively. Meanwhile, none of the studies under investigation has employed meta-analysis, action research and phenomenografic research designs.

As seen from Table 3, frequencies of the study samples are varied. For example, frequency of the studies whose samples were science teachers /primary teachers/biology teachers is 39 whilst that for grade 9 is 37. Also, frequency for student teachers/undergraduate students is 32, frequencies for grade 10, grade 11 and English Preparing Class are 25, 22 and 2 respectively. Frequencies for academic staffs/faculties and school administers are equal to each other (f=2). Since document analysis is not applicable for grade or study sample, its frequency is 14.

As seen from Appendix, the number of the graduate theses submitted for MSc degree is 119 whilst that for PhD degree is 19. Moreover, the graduate theses were submitted to 15 different universities from various parts of Turkey.

Table 1. Frequencies of the graduate theses in regard to the research interest

RI	DS	I	TE	CAI	SL	MAA	BCS	EE	TN
1995	1	-	-	-	-	-	-	-	1
1996	2	-	-	-	-	-	-	-	2
1998	3	-	-	-	-	-	-	-	4
1999	1	-	-	-	-	-	-	-	1
2000	5	-	-	-	-	-	1	-	6
2001	14	1	-	-	-	-	3	1	19
2002	19	2	-	-	-	-	-	-	21
2003	11	1	-	-	-	-	-	-	12
2004	2	-	-	-	-	-	-	-	2
2005	5	1	-	-	-	-	-	-	6
2006	12	-	-	2	-	-	-	-	14
2007	8	3	1	-	-	-	-	-	12
2008	8	2	2	1	-	-	-	1	14
2009	18	-	-	1	-	-	-	2	21
2010	1	-	-	1	-	-	-	1	3
<b>TN</b>	<b>111</b>	<b>10</b>	<b>3</b>	<b>5</b>	-	-	<b>4</b>	<b>5</b>	<b>138</b>

*Key note:* **RI:** Research interest; **DS:** Descriptive study; **I:** Intervention; **TE:** Teacher Education; **CAI:** Computer Aided Instruction; **SL:** Scientific Literacy; **MAA:** Measurement and Assessment; **BCS:** Biology Curriculum Study; **EE:** Environmental Education; **TN:** Total number

### Discussion and Implications

Turkish Biology Education has two popular trends, i.e. descriptive study and intervention like those in Turkish Science Education. In fact, it is an expected case because Turkish Biology Education has also been introduced as a new research field in mid of 1990s (see Table 1). The fact that the descriptive studies seem to have been quite dominant in Turkish Biology Education may stem from its adaptation procedure into Turkish context. As pointed out by Çalık et al. (2008), Years 2001 and 2009 acted as turning points for Turkish Biology Education like Turkish Science Education (see Tables 1-2). Since the descriptive studies are very common in Turkish Biology Education, it is obvious that survey research methodology has been mostly used. Because Turkish Biology Education seems to have delayed to study this research field, most of the biologists have attempted to learn what biology education meant and what research areas were available. This may have increased to use the survey research design. The fact that the second frequently employed research methodology has been experimental research design, may result from a lack of Turkish biology educators holding their PhDs in biology education. That is, most of the biologists have changed their research interests into biology education. Therefore, they may have tended to use their well known research methodologies, i.e. experimental research design. This means that such changing trends or earlier habits in the research interest may have affected newly adapted research fields. Furthermore, even though two concepts 'scientific literacy' and 'measurement and assessment' are most outstanding issues within the newly released biology curriculum since 2007, none of the graduate studies has concentrated on these issues.

When we have a look at the results of Çalık et al. (2008), Turkish Science Education has more extensive research interest, methodology and sample than Turkish Biology Education. For example, there is no graduate thesis for meta-analysis, action research and phenomenographic study in Turkish Biology Education.

Table 2. Frequencies of the graduate theses in regard to research methodology

<b>RM</b>	<b>CoS</b>	<b>S</b>	<b>ES</b>	<b>CaS</b>	<b>DA</b>	<b>MA</b>	<b>ACOQM</b>	<b>AR</b>	<b>QM</b>	<b>PS</b>	<b>MD</b>	<b>TN</b>
1995	-	1	-	-	-	-	-	-	-	-	-	<b>1</b>
1996	-	2	-	-	-	-	-	-	-	-	-	<b>2</b>
1998	-	3	-	-	1	-	-	-	-	-	-	<b>4</b>
1999	-	-	-	-	-	-	-	-	1	-	-	<b>1</b>
2000	-	3	2	-	-	-	-	-	-	-	1	<b>6</b>
2001	-	9	3	1	1	-	1	-	-	-	4	<b>19</b>
2002	-	8	8	1	-	-	-	-	-	-	4	<b>21</b>
2003	-	8	1	-	-	-	1	-	-	-	2	<b>12</b>
2004	-	-	2	-	-	-	-	-	-	-	-	<b>2</b>
2005	-	1	-	-	-	-	-	-	-	-	5	<b>6</b>
2006	-	4	5	1	3	-	-	-	1	-	-	<b>14</b>
2007	-	1	5	2	2	-	2	-	-	-	-	<b>12</b>
2008	-	5	5	1	-	-	-	-	3	-	-	<b>14</b>
2009	-	8	12	-	-	-	1	-	-	-	-	<b>21</b>
2010	-	1	1	-	-	-	1	-	-	-	-	<b>3</b>
<b>TN</b>		<b>55</b>	<b>43</b>	<b>6</b>	<b>7</b>	<b>-</b>	<b>6</b>	<b>-</b>	<b>5</b>	<b>-</b>	<b>16</b>	<b>138</b>

*Note:* RM: Research Methodology; CoS: Comparative Study; S: Survey; ES: Experimental Study; CaS: Case study; DA: Document Analysis; MA: Meta-Analysis; ACOQM: A combination of qualitative and quantitative methods; AR: Action Research; QM: Qualitative method; PS: Phenomenographic study; MD: Missing data; TN: Total number

This may result from an integrated structure of science education covering biology, chemistry and physics subjects. This means that Turkish Biology Education should study on some qualitative research methods such as phenomenography and action research to get a deeper focus on related research interest. In a parallel with this knowledge claim, Sozbilir et al. (2012) found that qualitative research methods such as ethnography, phenomenography, critical studies, grounded theory, historical analysis and metasynthesis, and mixed methods were rarely used in Turkish science researches.

Why grade 9 is viewed as mostly preferred sample may be result from the fact that the secondary students firstly introduce with 'biology' subject as a separated course from science. Further, since the students generally pay more attention to focus on a national summative examination at grade 11 in order to sit down elit universities, the studies with grade 11 sample are the lowest frequency in comparison with those at grades 9-10. Because teachers are very crucial components in biology education, a significant proportion of the graduate theses have studied with biology/science/primary teachers/student teachers.

Table 3. Frequencies of the graduate theses in regard to grade (the study's sample)

G	G9	G10	G11	EPC	GiS	ST/US	ST/PT/BT	GuS	AS/F	SP	SA	NA	MD	TN
1995	1	1	1	-	-	-	1	-	-	-	-	-	-	4
1996	-	-	-	-	-	-	2	-	-	-	-	-	-	2
1998	1	1	1	-	-	1	2	-	-	-	-	1	-	7
1999	-	-	-	-	-	-	1	-	-	-	-	-	-	1
2000	-	1	1	-	-	1	2	-	1	-	-	-	1	7
2001	9	7	7	-	-	1	8	-	1	-	-	1	4	38
2002	9	6	5	-	-	1	6	-	-	-	1	1	4	33
2003	4	2	2	1	-	1	4	-	-	-	1	1	2	18
2004	-	-	-	-	-	1	1	-	-	-	-	-	-	2
2005	-	-	-	-	-	1	-	-	-	-	-	-	5	6
2006	2	-	1	1	-	4	1	-	-	-	-	5	-	14
2007	2	3	2	-	-	4	3	-	-	-	-	1	-	15
2008	4	1	-	-	-	5	5	-	-	-	-	1	-	16
2009	4	3	2	-	-	10	3	-	-	-	-	3	-	25
2010	1	-	-	-	-	2	-	-	-	-	-	-	-	3
<b>TN</b>	<b>37</b>	<b>25</b>	<b>22</b>	<b>2</b>	<b>-</b>	<b>32</b>	<b>39</b>	<b>-</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>14</b>	<b>16</b>	<b>191</b>

*Key note:* G: Grade; G9: Grade 9; G10: Grade 10; G11: Grade 11; EPC: English Preparing class; GiS: Gifted students; ST/US: Student teachers/undergraduate students; ST/PT/BT: Science teachers /Primary teachers/Biology Teachers; GuS: Graduate students; AS/F: Academic Staffs/Faculties; SP: Students' parents; SA: School Administrators; NA: Not applicable; MD: Missing data; TN: Total number

\*Since some of the studies contain more than one grade and also document analysis, total number of them may exceed the numbers of studies presented in Table 3.

Such a sampling trend may come from the idea that the biology curriculum and text books may be changed over time to keep up with contemporary educational trends, but teacher is principal source of knowledge, thinking and enthusiasm. Furthermore, even though the graduate students and academic staffs (faculties) are academically interested in biology education, few studies have been conducted with them. This may come from framework of the graduate theses implemented by these sample groups (academic staffs and graduate students). It is possible that they may tend to prioritize other samples instead of their own ones. Furthermore, trends in Turkish biology education show that there is no study on investigating what the student parents think about their learning responsibility even though learning process involves cooperation amongst student, parent, teacher and administrator (Aslanargun, 2007).

As seen in Appendix, 15 different universities have played a significant role for graduate biology education. This may be viewed as a significant step for distributing responsibility for training graduate students or academicans (faculties)—from centralized universities to others. Howev-

er, this is quite low as compared to a total of 168 universities in Turkey. Otherwise, this shows a shortage of the number of biology educators. That is, only 19 PhD theses submitted to fulfill 'Biology Education' degree. Indeed, by sharing graduate program responsibility, quality of the graduate thesis should not be omitted. A review of the graduate theses has emerged several gaps in related literature. For example, most of studies in Turkish biology education are on 'learning and teaching' practice, however, almost none of the studies has concentrated on philosophy and history of biology in Turkey. This indicates that further studies should be undertaken to emerge Turkish biology education trend in light of their acquired research experiences

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**Türk Biyoloji Eğitimi Araştırmaları Hangi Eğilimleri Göstermektedir?**

Bu çalışmanın amacı Türkiye'deki biyoloji eğitimi çalışmalarındaki genel eğilimi tespit etmektir. Bu amaç doğrultusunda YÖK'ün lisansüstü tez veri bankasında ve üniversitelerin web sitelerinde yer alan lisansüstü tez arşivleri incelenmiştir. Toplamda 138 lisansüstü tez; yıl, araştırma ilgi alanı, araştırma metodolojisi ve örneklem bakımından ele alınmıştır. İncelenen lisansüstü tez sonuçları, araştırma ilgi alanında betimsel çalışmaların ve araştırma metodolojisinde de tarama metodunun kullanımının baskın olduğunu göstermektedir. Öğrenmenin öğrenci, öğretmen, veli ve yönetici arasındaki işbirliğini içermesine rağmen, velilerin öğrenmedeki sorumlulukları hakkında ne düşündüklerini araştıran bir çalışmaya rastlanmamıştır. Türk biyoloji eğitim eğilimini ortaya çıkarmaya yönelik çalışmaların yapılması önerilmektedir.

**Anahtar Kelimeler:** Biyoloji Eğitimi, Lisansüstü Tez, İçerik Analiz

