# EDUCATIONAL SCIENCES IN THEORY AND PRACTICE

Editor: Assist Prof. Tahir YAŞAR





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Editor

Assist. Prof. Tahir YAŞAR



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# CONTENT ANALYSIS OF THESES AND ARTICLES ON NANOSCIENCE AND NANOTECHNOLOGY IN SCIENCE EDUCATION<sup>1</sup>

# Ayşe BOYRAZ<sup>2</sup>

### Erhan ZOR<sup>3</sup>

#### **1. INTRODUCTION**

The term "nano" is derived from the ancient Greek word "nanos" meaning "dwarf" and expresses one billionth of a given criterion. In other words, the term used to represent one billionth of a meter is 1 nanometer. (Uldrich & Newberry, 2005). As we move towards the nanoscale, a surprising detail emerges. Substances abandon the properties they possess at the macro scale and begin to exhibit extraordinary new behaviours. The reasons for these physical and chemical changes in substances can be attributed to details in atomic structures, the size of the structure, the type of atom attaching to the structure, and the point of its attachment. (Bhushan, 2011; Çıracı, 2007).

Nanoscience and nanotechnology, being at the forefront of modern research, are also considered as the new revolution of

<sup>&</sup>lt;sup>1</sup> This study is based on the master's thesis titled 'Content analysis of theses and articles on nanoscience and nanotechnology in science education,' published in the year 2022.

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the 21st century. (Sebastian & Gimenez, 2016). The concept of nanoscience is defined as the scientific field that studies phenomena and behaviours where materials exhibit significantly different properties at the atomic, molecular, and macromolecular levels (Dowling, Clift, Grobert, Hutton, Oliver, O'Neill,...Whatmore, 2004). Nanoscience proposes а comprehensive theoretical framework upon which a technology can be built. (Ramsden, 2009). In this case, nanotechnology represents a field encompassing the integration of emerging nanostructures into large systems, involving the production and applications of physical, chemical, and biological systems at the sub-micron scales of atoms and molecules. (Bhushan, 2015). When looking at the research and innovations in the field of nanotechnology, it can be said that nano-materials and nanomanufacturing contribute to various areas such as medicine, information technology, biotechnology, automotive, food, national security, agriculture, nano-electronics, energy, textiles, and cosmetics (Bhushan, 2010; Turgut, Keskin & Avsar, 2011; Erkoç, 2012; Aktürk, 2013; Singh, 2017).

Nanoscience and nanotechnology are multidisciplinary fields (Özer, 2008; Porter & Youtie, 2009). Physics, chemistry, biology, engineering. and materials science contribute significantly to advancements in this field by converging towards the same principles and tools at the nanoscale (Roco, 2001). The globally advancing field of nanoscience and nanotechnology inevitably reflects on education, being incorporated into curricula to enhance student interest and prepare them for potential new career opportunities in the coming years (Senel Özer, 2017). The characteristics, dominant forces, and behaviours in the nano-world are inherently different from the macro-world. At this point, students are expected to reconsider their understanding and become individuals who think freely and solve problems (Chang, 2006).

There is a need for individuals to work in the emerging fields created by advancing nanoscience and nanotechnology (Akdeniz, 2017). The significance of nanoscience and nanotechnology in the present era is evident in all educational activities, and with the popularization of nanoscience and nanotechnology education, students should be equipped with knowledge in these fields (Ateş, 2015). However, the literature indicates that we are lacking in nanoscience and nanotechnology education (Karataş & Ülker, 2014). In Türkiye, studies related to nanoscience and nanotechnology, as well as nanoscience and nanotechnology education, have been presented in a certain categorized form.

When examining studies on awareness, it is seen that there are research efforts to reveal nanotechnology awareness (Güzeloğlu, 2015; Harman & Şeker, 2018; Enil, 2019) and studies conducted to expose awareness in nanoscience and nanotechnology (Aslan & Şenel, 2015; Enil & Köseoğlu, 2016; Ateş & Üce, 2017; İpek, 2017; İpek, Atik, Tan & Erkoç, 2020). Other studies on awareness are activity-based studies examining their impact on nanoscience and nanotechnology awareness (Sagun Gököz, 2012; Sagun Gököz & Akaygün, 2014; Şenel Zor, 2017). Besides, there are studies aimed at developing an awareness scale for microtechnology and nanotechnology (Bektaş, 2019; Yavuz & Bektaş, 2020).

When examining studies on attitudes, it is seen that there are studies on examining attitudes toward nanotechnology (Ekli, 2010; Enil & Köseoğlu, 2016; Şenel Özer, 2017), toward nanobiotechnology (Seviş, 2016), towards nanoscience and nanotechnology (Özmen Koç, 2020), and developing an attitude scale for nanotechnology (Kurnaz & Bayraktar, 2012). When examining studies on perception, opinions, and thoughts, it is seen that there are studies on perceptions, opinions, and thoughts about nanotechnology (Şenel, 2009; Kadıoğlu, 2010; Seviş, 2016; Ergün, Ocak, & Ergün 2017; Köseoğlu & Mercan, 2018; Ocak, 2019), views on nanoscience and nanotechnology (Ateş, 2015), views on nanoscience and nanotechnology education (İpek, 2017), and views on nanobiotechnology (Balemen, 2009). Finally, there is a study examining the impact of collaborative learning on views about nanotechnology (Kılınç Alpat, Uyulgan, Şeker, Altaş, & Gezer, 2017).

When examining studies on conceptual understandings, it is seen that there are studies on nanotechnology (Tekelioğlu, 2019), nanoscience and nanotechnology (Sagun Gököz, 2012; Şenel Zor, 2017; Şenel Zor & Aslan, 2018), nanoscience (Işık Erol, 2020), and the development of a conceptual test for nanoscience (Akdeniz, 2017). When determining the level of knowledge, there are studies examining nanotechnology knowledge levels (Ekli, 2010), nanoscience and nanotechnology knowledge levels (Karataş & Ülker, 2014), and studies on nanobiotechnology knowledge levels (Balemen, 2009; Seviş, 2016).

The subjects of nanoscience and nanotechnology become crucial in science education mainly because they cover fields related to science. Examining studies in this field will guide us in determining the approaches to nanoscience and nanotechnology education. The purpose of this research is to conduct content analyses of studies in the field of Nanoscience and Nanotechnology in Science Education (NST-SE). It is aimed to determine the distribution of studies on NST-SE by years, research methods, sampling groups and sampling methods, research designs, data collection tools, research topics, and aims of the studies.

# 2. STUDY CONTENT

# 2.1. Method

In this section of the study, the research model, sample, data collection tools, data collection process, and techniques utilized in the analysis of the data were provided.

# 2.1.1. Research Model

In this study, a qualitative research method was used as the research model, and document analysis was conducted. Document analysis involves examining quotations or full texts obtained from corporate, program records, notes and correspondence, official publications and reports, personal diaries, and surveys or open-ended written responses in surveys (Patton, 2002). Electronically published theses and articles relevant to the research purpose were accessed, and the analysis of these documents was carried out.

### 2.1.2. Research Sample

The sample of the study was created using the purposive sampling method, specifically the criterion sampling method. The criterion sampling method allows researchers to examine all cases that meet predefined specific criteria (Patton, 2002). In this study, criteria such as inclusion of nanoscience and nanotechnology topics, being in the field of science education, being approved by the Higher Education Council for theses, and being published in the Turkish (TR) index for articles were used.

In this study, the theses and articles related to NST-SE in the national literature were examined. Within this scope, no study related to NST-SE was found before the year 2009. The examination included postgraduate theses on NST-SE and articles published in the TR index between 2009 and 2021.

# 2.1.3. Data Collection Techniques

In this study, the data collection tool to be used took into account the themes created and used by Bıkmaz, Aksoy, Tatar, Ö., and Altınyüzük (2013), but the themes were updated to be suitable for the research by utilizing the books "Scientific Research Methods" by Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz and Demirel (2009) and "Scientific Research Methods" by Kasar (2003).

# 2.1.4. Data Collection

In collecting data for this study, articles with the keywords "nano" and "education" were searched on Google Scholar, Web of Science, and ULAKBIM. For theses, the keywords "nano", "nanoscience", "nanotechnology", "nanobiotechnology" were searched on the Higher Education Council National Thesis Center to examine studies related to nanoscience and nanotechnology. Only studies specifically related to NST-SE were included in this examination.

In the conducted research, the studies were searched starting from November 2020 and continued until September 2021. As a result, a total of 21 postgraduate theses and 15 articles published in the TR index related to NST-SE were reached, and these 36 studies were examined within the scope of the research.

# 2.1.5. Data Analysis

Document analysis generally requires a specialized analytical approach called content analysis (Marshall & Rossman, 1999). In this research, the "content analysis" technique was used to analyze the obtained data. In content analysis, data is examined in-depth, collected under specific topic headings, and presented at a level understandable to the reader (Yıldırım & Şimşek, 2006). In the process of analyzing

the data, the years of publication of the theses and articles related to NST-SE, research methods, study groups, sampling methods, research designs, data collection tools, study and and research objectives were coded research topics. appropriately, and then categorized. The obtained data were in numerical values in the presented form of percentage/frequency graphs and tables. During the analysis, in cases where the characteristics of the method were not clearly stated in the studies, it was recorded as "unspecified".

# 2.2. Findings

In this section of the study, the findings obtained from the studies related to NST-SE are presented with percentage and frequency values.

# 2.2.1. Findings Regarding the Distribution of Studies Related to NST-SE by Years

The findings related to the years of publication of the theses and articles on NST-SE are presented in Figure 1.

Figure 1. Distribution of Studies Related to NST-SE by Years.



As seen in Figure 1, there are a total of 36 studies, including 21 theses and 15 articles, conducted in the field of NST-SE. The first publications among these were the theses published in 2009, while the articles began to be published in

2012. The highest number of studies (7 studies) was conducted in 2017, and no studies were found in 2011 and 2013.

# 2.2.2. Findings Regarding the Research Methods of Studies Related to NST-SE

Table 1 shows findings on the research methods of the theses and articles published in the field of NST-SE. When Table 1 is examined, it is observed that 21 theses were published in NST-SE field, in which 5 used qualitative, 3 used quantitative, and 7 used mixed research methods, while in 6 studies, there is no clear expression about the research method used. In the case of the 15 articles published in the NST-SE field, it is seen that 6 studies used qualitative research methods, and there is no clear expression regarding the research method used in 9 studies.

Table 1. Distribution of Studies Related to NST-SE by Research Method

Desserveb Mathada		Thesis	A	rticle	Total		
Research Miethous	f	%	f	%	f	%	
Qualitative	5	24	6	40	11	30,55	
Quantitative	3	14	0	0	3	8,40	
Mixed	7	33	0	0	7	19,40	
Unspecified	6	29	9	60	15	41,65	
Total	21	100	0	100	36	100	

# 2.2.3. Findings Regarding Samples of Studies Related to NST-SE

Table 2 shows the findings related to the samples of the theses and articles published on NST-SE.

Table 2. Distribution of Studies on NST-SE According to Samples

Standar Caroana		Thesis	Art	ticle	Tot	tal
Study Group	f	%	f	%	f	%
Elementary school students	1	4,35	0	0	1	2,56
Middle school students	3	13,04	0	0	3	7,69
High school students	4	17,39	4	25	8	20,51
Undergraduate students	11	47,83	9	56,25	20	51,28

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Teachers	2	8,70	2	12,5	4	10,26
Textbooks	1	4,35	0	0	1	2,56
Scientific articles	1	4,35	0	0	1	2,56
Journals	0	0	1	6,25	1	2,56
Total	23	100	16	100	39	100

When Table 2 is examined, it is observed that in the theses, the samples of the research are predominantly composed of undergraduate students (11), high school students (4), and middle school students (3), while in the articles, they are predominantly composed of undergraduate students (9), high school students (4), and teachers (2).

# 2.2.4. Findings Regarding the Sampling Method of Studies Related to NST-SE

Table 3 shows the findings regarding the sampling methods of theses and articles on NST-SE.

 Table 3. Distribution of Studies Related to NST-SE According to

 Sampling Methods

Sompling Mothed	Tl	nesis	Article		
Sampling Method	f	%	f	%	
Random Sampling	3	14,29	4	26,67	
Non-random Sampling	8	38,09	6	40,00	
Non-sampled*	1	4,76	0	0,00	
Unspecified	9	42,86	5	33,33	
Total	21	100	15	100	

\*Studied on Population

When Table 3 is examined, it is seen that there are 8 theses and 6 articles in which the non-random sampling technique is used. It is seen that there are 3 theses and 4 articles in which the random sampling method is used. In addition, there are a total of 14 studies that did not specify the sampling method.

# 2.2.5.Findings Regarding the Research Design of Studies Related to NST-SE

Table 4 presents the findings regarding the research designs of the theses and articles published on NST-SE. When Table 4 is examined, it is seen that 6 theses use experimental design, and 6 theses use non-experimental design among quantitative designs. In qualitative designs, it is observed that there are 2 theses conducting case studies and 1 thesis conducting document analysis. It is seen that 2 theses use mixed methods and 5 thesis studies do not specify the research design used in the study. It is seen that 2 articles use experimental design among quantitative designs, and 5 articles use non-experimental design. In qualitative designs, it is observed that there are 2 articles conducting case studies and 1 article conducting document analysis. 5 articles do not specify the research design.

Research	Subcategories –			Thesis	Article		
Design				%	f	%	
		True experimental	1	4,55	0	0,00	
	Experimental	Quasi- experimental	3	13,64	2	13,33	
Quantitative		Weak experimental	1	4,55	0	0,00	
		Single-Subject	1	4,55	0	0,00	
	Non- Experimental	Survey	4	18,18	2	13,33	
		Descriptive	1	4,55	2	13,33	
		Correlational	1	4,55	0	0,00	
	Scale Develop	ment	0	0	1	6,67	
		Case study	2	9,09	2	13,33	
Qualitative		Analysis of document	1	4,55	1	6,67	
Mixed		Explanatory	1	4,55	0	0,00	
MIXeu		Triangulation	1	4,55	0	0,00	
Unspecified			5	22,73	5	33,33	
Total			22	100	15	100	

Table 4. Distribution of Studies on NST-SE According toResearch Designs

# 2.2.6. Findings Regarding Data Collection Tools of Studies Related to NST-SE

Table 5 shows the findings regarding the data collection tools of the theses and articles published on NST-SE.

Data collection tool		Thesis	A	Article	Total		
Data conection tool	f	%	f	%	f	%	
Questionnaire	14	29,79	3	17,65	17	26,56	
Test	9	19,15	2	11,76	11	17,19	
Interview	7	14,89	5	29,41	12	18,75	
Source review/document	5	10,64	2	11,76	7	10,94	
Scale	4	8,51	1	5,88	5	7,81	
Forms	3	6,38	1	5,88	4	6,25	
Observation	2	4,26	0	0,00	2	3,13	
Open-ended question	0	0	2	11,76	2	3,13	
Unspecified	0	0	1	5,88	1	1,56	
Other	3	6,38	0	0	3	4,69	
Total	47	100	17	100	64	100	

 Table 5. Distribution of Studies on NST-SE According to Data

 Collection Tools

When Table 5 is examined, it is seen that the most commonly used methods as data collection tools in theses are questionnaire (14), test (9), and interview method (7). In articles, on the other hand, the most commonly used methods as data collection tools are interviews (5) and questionnaires (3).

# 2.2.7. Findings Regarding the Subject of Studies Related to NST-SE

Table 6 shows the findings regarding the topics of theses and articles published on NST-SE.

<b>Table 6. Distribution</b>	of Studies	<b>Related to</b>	NST-SE by	y Subject
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Торіс		Thesis		Article		Total
	f	%	f	%	f	%
Nanoscience	2	9,52	0	0	2	5,56
Nanotechnology	10	47,62	10	66,67	20	55,56
Nanobiotechnology	3	14,29	0	0	3	8,33
Nanoscience and nanotechnology	6	28,57	5	33,33	11	30,56
Total	21	100	15	100	36	100

When examining Table 6, it is observed that a total of 20 studies, 10 theses, and 10 articles, focus on the subject of nanotechnology. There are a total of 11 studies on the topics of Nanoscience and Nanotechnology, including 6 theses and 5 articles. Among the theses, 2 focus on Nanoscience, and 3 are related to Nanobiotechnology. However, there is no article dedicated to the fields of Nanoscience and Nanobiotechnology.

# 2.2.8. Findings Regarding the Research Topic of Studies Related to NST-SE

Table 7 shows the findings regarding the topics researched by theses and articles published on NST-SE.

When Table 7 is examined, it is observed that a total of 15 studies, comprising 7 theses and 8 articles, are conducted on the subject of awareness. In terms of theses and articles on perception/view and thought, there are a total of 8 studies, with 4 in theses and 4 in articles. Regarding studies on attitude, there are 5 works in total, with 3 in theses and 2 in articles.

Dessent Terrise		Thesis	1	Article	Total		
Research Topics	f	%	f	%	f	%	
Awareness	7	23,33	8	38,10	15	29,41	
Conceptual understanding	5	16,67	0	0,00	5	9,80	
Perception/view and thought	4	13,33	4	19,05	8	15,69	
Knowledge level	3	10,00	1	4,76	4	7,84	
Attitude	3	10,00	2	9,52	5	9,80	
Interests	2	6,67	1	4,76	3	5,88	
Exploring the current situation	2	6,67	1	4,76	3	5,88	
Providing Education	2	6,67	1	4,76	3	5,88	
Approach/Acquisition/Difficulty	1	3,33	0	0	1	1,96	
Learning level	1	3,33	0	0	1	1,96	
Perceptions of risk/benefit	0	0	1	4,76	1	1,96	
Nanoliteracy	0	0	1	4,76	1	1,96	
Academic success	0	0	1	4,76	1	1,96	
Total	30	100	21	100	51	100	

Table 7. Distribution of Studies Related to NST-SE by ResearchTopics

# 2.2.9. Findings Regarding the Purposes of Studies Related to NST-NE

Table 8 shows the findings regarding the purposes of the theses and articles published on NST-SE. When Table 8 is examined, it is seen that there are mostly studies on measuring attitudes (2) and examining perceptions/opinions/thoughts (2) about nanotechnology in theses. Most studies on nanoscience were on explaining concepts with activities (2), and most studies on nanobiotechnology were on examining the level of knowledge (2). There are mostly studies on nanoscience and nanotechnology in which awareness is examined (2), awareness change is examined (2), and conceptual understanding changes are examined (2).

Subject	Objective		hesis	Article	
Subject	Subject Objective				%
	Material development and its effect on	1	3,33	0	0
	learning levels				
	Activity/workshop development and its	1	3,33	1	4,76
	impact on their awareness				
	Activity/workshop development and its	1	3,33	0	0
	effect on conceptual understanding				
	The effect of developing activities/	0	0,00	1	4,76
gy	workshops on understanding the subject				
olo	Approach, achievement, and challenge in	1	3,33	0	0
hn	exhibition development				
tec	Awareness scale development	1	3,33	1	4,76
anc	Awareness measurement	1	3,33	4	19,0
Ž	Benefit and risk perceptions review	0	0,00	1	4,76
	Analyzing the level of interest	1	3,33	1	4,76
	Attitude measurement	2	6,67	1	4,76
	Attitude scale development	0	0,00	1	4,76
	Knowledge level review	1	3,33	0	0
	Perception/opinion/thought review	2	6,67	4	19,0
	Place in secondary education	1	3,33	0	0
	Providing training	1	3,33	0	0
Nanoscience	Conceptual understanding test	1	3,33	0	0

Table 8. Distribution of Studies Related to NST-SE According toTheir Purposes

	development				
	Explaining concepts with activity	2	6,67	0	0
	Examining the level of interest	1	3,33	0	0
Nanobio-	Examining the level of knowledge	2	6,67	0	0
Technology	Revealing the views towards	1	3,33	0	0
	nanobiotechnology education				
>	Developing activities/workshops and	0	0,00	1	4,76
60 O	improving their nanoliteracy				
lou	Activity/workshop development and its	0	0,00	1	4,76
sch	impact on academic achievement				
lote	Awareness measurement	2	6,67	2	9,52
Var	Examining the Awareness change	2	6,67	0	0
d D	Examining the change in conceptual	2	6,67	0	0
an	understanding				
nce	Examining the knowledge levels	0	0,00	1	4,76
ciel	Attitude measurement	1	3,33	0	0
IOS	Perception/opinion/thought review	1	3,33	0	0
Var	Examining its place in textbooks	1	3,33	0	0
4	Place in popular science magazines	0	0,00	1	4,76

When we look at the findings regarding the purposes of the articles given in Table 8, there are mostly studies examining awareness (4) and perception/opinion/thought (4) about nanotechnology. Regarding nanoscience and nanotechnology, there are mostly studies examining awareness (2).

### 3. DISCUSSION AND CONCLUSION

In this section of the study, the discussion and conclusions based on the data obtained from studies related to NST-SE are presented. Since no similar study was found during the time frame of the research, the results have been discussed in comparison with studies conducted in the field of science education that employ content analysis.

# 3.1. Results Regarding the Distribution of Studies on NST-SE by Years

According to the research findings, a total of 36 studies related to NST-SE were identified, including 21 theses and 15

articles. The research began to access the initial studies in 2009, and during the research, no study meeting the research criteria before 2009 was encountered. The National Science and Technology Policies-Vision 2023 Strategy Document published by The Scientific and Technological Research Council of Türkiye (TUBİTAK) in 2004, emphasizing the significant achievements of nanoscience and nanotechnology rapidly entering our lives, may have directed researchers to work in this field after 2004 (TUBITAK, 2004). Although there was no proportional increase or decrease in the years examined in the research, it was observed that the number of studies gradually increased. The year 2017 is identified as the year with the highest number of theses and articles published. The abundance of studies in 2017 could be attributed to the inclusion of nanoscience and nanotechnology in the Vision 2023 Strategy Document, or it might be related to the emphasis on the scientific and economic aspects of nanoscience and nanotechnology and their inclusion in priority areas in the 2017-2018 Türkiye Nanotechnology Strategy and Action Plan (TUBITAK, 2005). This aligns with the findings of Calik. Koc, Senel Zor, Zor and Aslan (2021), who conducted content analyses of nano-related news in some Turkish newspapers, identifying 2017 as the year with the highest media coverage on nanoscience and nanotechnology, showing parallelism with this research. In Küçüközer's (2016) study examining doctoral theses in science education, the year with the highest number of studies was found to be 2014. Conversely, Sadak, Incikapi and Pektas (2021), who investigated postgraduate thesis studies on comparative education in mathematics and science education in Türkiye, identified the period between 2009 and 2014 as the years with the highest number of studies.

# **3.2.** Conclusions Regarding the Research Methods of Studies on NST-SE

According to the research methodology, the results indicate that the most commonly used method in theses related to NST-SE is the mixed-method analysis, while in articles, the sole method used is qualitative research. In general, when looking at the overall data, the most preferred research method is qualitative analysis, followed by mixed methods, with quantitative analysis being the least utilized method.

Sadak et al. (2021) and Küçüközer (2016) found qualitative methods to be the most preferred method in their studies involving science education. The predominance of qualitative methods in research, not only in nanoscience and nanotechnology topics but also in other subjects within science education, is consistent with our research findings. However, in contrast, Kiras and Bahar (2021), in their examination of theses in the field of science education, identified quantitative as the most commonly used method, with qualitative methods being the least utilized. Similarly, in their study of articles on science education, Sözbilir and Kutlu (2008) found quantitative methods to be the most preferred. Qualitative research is often used to articulate the main idea through the discussion of the research problem, while quantitative research directs this situation toward the research questions and hypotheses (Creswell, 2017). Considering that this study and other similar studies are likely conducted to articulate the main idea, the preference for qualitative methods may be due to this reason. An important point that stands out in the examined studies is that more than half of the publications reviewed did not specify the research method within the scope of the study.

#### 3.3. Results for Samples of Studies on NST-SE

When examining the results based on samples, it is observed that the most commonly used sample group in the theses and articles related to NST-SE is undergraduate students. The reason for conducting so much research on undergraduate students may be due to their inclusion of prospective teachers, as they represent the future educated minds and communicative individuals. This could aim to determine their levels of knowledge, views. awareness. attitudes. etc., regarding nanoscience and nanotechnology. There is a low incidence of studies using sample groups such as primary school students, middle school students, teachers, and scientific publications in popular science magazines. No studies were found that included preschool students and graduate students as sample groups. It is considered a significant shortcoming that preschool students, who represent the most basic level of education, and graduate students involved in scientific studies have not been included in any research on this topic. In contrast to our study, in research conducted in the field of science education, there are studies on middle school students (Kiras & Bahar, 2017; Sadak et al., 2021) as the most commonly used sample groups and study identified only as "students" (Küçüközer, 2016). In general, in studies in the field of science education, high school students are often used as samples. The preference for using undergraduate students more frequently in this research may be due to the perception that high school students may not be considered sufficient for nanoscience and nanotechnology topics. In another study in the field of science education, regarding the selection of the sample, it was found that universe sampling selection was sufficient and partially sufficient (Evrekli, İnel, Deniş & Balım, 2011).

# 3.4. Conclusions Regarding Sampling Methods of Studies on NST-SE

When the results according to sampling methods were analyzed, it was seen that the most commonly used sampling method in the theses and articles on NST-SE was the purposive sampling method in non-random sampling methods. The reason why purposive sampling is used a lot may be that the sample selected at the stage of identifying and studying the problems in advance is suitable for the purpose of the study. In a study examining studies on lifelong learning, it was concluded that purposive sampling was the most commonly used method (Yüksel et al., 2016). Unlike this study, it was observed that easily accessible groups were preferred in a study conducted in the field of physics (Yılmaz, 2019), random sampling was mostly preferred in a study on theses in science teaching (Köseoğlu & Eroğlu Doğan, 2020), and random sampling was mostly used in a study conducted in the field of chemistry (Uzunbaz, 2019).

It is seen that there are a lot of studies that do not specify the sampling method. Similar to this research, it was revealed that there are many studies in the field of science teaching (Köseoğlu & Eroğlu Doğan, 2020) and chemistry (Uzunbaz, 2019) that do not specify the sampling method. This may be because the methods used are not known or the researcher may not attach importance to this issue.

# 3.5. Results Regarding the Research Design of Studies on NST-SE

When examining the results according to the research design, it was observed that the most preferred designs in the theses and articles related to NST-SE were survey and quasiexperimental designs. In this context, there was a majority of studies that only state the survey design without specifying whether it is descriptive or content-based. Research designs shape themselves according to the purpose since research designs were selected according to the purpose. In the analysis studies conducted in the field of science education, Kiras and Bahar (2017) found that the most commonly used design was the descriptive survey design, Sadak et al. (2021) identified Sözbilir analysis, and Kutlu (2008)document found experimental and Kücüközer (2016)design reported experimental design and case study as the most used designs. Additionally, there were studies in which the research design was not specified in the research results. In studies conducted in the field of science education, some studies do not specify the research design (Küçüközer, 2016; Sadak et al., 2021).

# 3.6. Results Regarding Data Collection Tools of Studies on NST-SE

When examining the results regarding the data collection tool, it was found that the most commonly used data collection tool in the theses related to NST-SE was the survey, while in articles, the interview technique is predominant. In general, the most preferred data collection tool was the survey, followed by the interview technique. The survey may have been the most preferred tool due to its ease of control during the data collection and analysis processes, as well as the clarity of responses. In contrast to this research, studies in science education have found that the most commonly used data collection tools are the test technique (Doğru, Gençosman, Ataalkın & Şeker, 2012; Kiras & Bahar, 2017; Küçüközer, 2016; Sözbilir & Kutlu, 2008) and curriculum (Sadak et al., 2021). Although data collection tools are crucial for a study, there are also studies where the data collection tool is not specified.

# 3.7. Conclusions Regarding the Subject of Studies on NST-SE

When examining the results related to the subject of the studies, it was observed that the most commonly selected topic and articles related to NST-SE in the theses was nanotechnology. Following nanotechnology, topics that involve the study of both nanoscience and nanotechnology were also prevalent. The topics covered in the studies not only were independent but complemented each other, showing a similarity in the subjects of all studies. However, considering that nanotechnology may be a more popular topic due to its focus on products, it can be assumed that the majority of studies were conducted in this area. Additionally, the inclusion of the topic "Nanotechnology" in secondary education textbooks may also be one of the reasons for the concentration of studies in this field

# 3.8. Results Regarding the Research Topic of Studies on NST-SE

When looking at the results related to the research topic, it is evident that the most investigated topic in the theses and articles related to NST-SE is awareness. Considering the development of the fields of nanoscience and nanotechnology, this may have directed researchers to explore the extent of people's awareness about the subject and their thoughts on this emerging science and technology. In contrast to the findings in this research, studies conducted in the field of science education have reported different results. Küçüközen (2016) found that the most studied topic was academic achievement, while Doğru et al. (2012) and Kiras and Bahar (2017) identified curricula as the most studied topic. When examining the international literature, themes in studies conducted in science education differ from the themes in our research. However, the most researched topics in these studies are as follows: Tsai and Wen (2005) between 1998-2002, and Chang, Chang and Tseng (2010) found that between 1990-2007, the most researched topics were concepts, conceptual change, and concept mapping. Lee et al. (2009) identified the most researched topic as learning-context between 2003-2007, Lin, Lin and Tsai (2014) between 2008-2012, and Lin, Lin, Potvin and Tsai (2019) between 2013-2017. On the other hand, Cavas (2015) found that the most studied topic in the 'Science Education International' journal between 2011 and 2015 was articles based on teacher education, learning perception, and learning context.

### 3.9. Results for the Purposes of Studies on NST-SE

When examining the results related to the objectives of the the areas of research in studies. most common nanotechnology were attitude measurement, perception, views, and examination of thoughts in the theses. In the field of nanoscience, there was a focus on conveying concepts through activities, while in nanobiotechnology, studies are often conducted to examine knowledge levels. In the field of nanoscience and nanotechnology, there were studies on measuring awareness, examining changes in awareness, and conceptual understanding change. In articles, the most studied topic in nanotechnology was awareness measurement and the examination of perception, views, and thoughts. In the field of nanoscience and nanotechnology, the emphasis was on measuring awareness.

Additionally, it was observed that approximately half of the theses and about one-fourth of the articles involve applied research. In studies conducted in the field of nanoscience and nanotechnology, the objective of applied research was not only to explore the current situation but also to measure whether gains could be achieved through a factor. The greater focus on examining changes in the topic after the activity in theses compared to articles may be attributed to the possibility of conducting activities during the writing of theses, as the thesis writing process allows for a longer duration. In other words, the emphasis on measuring only the existing situation in articles may be due to the need for articles to be published in a shorter period.

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# EXTENDING VOCABULARY THROUGH LITERATURE: TWO STORIES

### Tahir YAŞAR<sup>1</sup>

#### **1. INTRODUCTION**

Literature is the most ancient art of expressing our thoughts, senses, and inspiration that includes many branches as poetry, drama, short stories, novels, and many other varieties of texts. When we talk about literature a broad field of written and oral literary works appear in our minds. So, very clearly and consciously it can be said that literature has a close relation to language teaching.

The relationship between literature and language teaching dates\_back to the nineteenth century, and generally Grammar Translation Method has been used for teaching a language. Translating a written text from the target language into the mother tongue was the most popular technique. In that way, many works have been translated\_through this method. Thus it can easily be said that literary works provide more materials for grammar practice so that the language learners can promote the level of their language. That is why that method has been popular for a long period. With the advent of new teaching approaches like direct and audiolingual methods, many lecturers and teachers ignored The Grammar Translation method for teaching language. So many ELT teachers began to be against this method. They believed that the literary texts were so complex and that literature was boring for the learners. As stated by (McKay, 1982) many

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teachers against that thought method had a lack of contribution to teaching grammar.

While many ELT lecturers were ignoring Literature as a good source of material for language teaching, after the 1980s the interest in literature as a facilitative way of teaching a language renewed again. In many grammar books texts related to the topic began to appear. (Duff and Maley, 1991) As Povey puts forward many scholars believe that literature extends the readers' vocabulary. One of the most important features of literature is that: it is universal and the literature for all nations in the world conveys themes like love, death, separation, nature, and historical actions. All of those theses are common for everybody living in our world. "Literature is by nature intrinsically appealing as it deals with familiar subject matters in an attractive and interesting way. (Maley, 2001)

### 2. A FEW DEFINITIONS OF LITERATURE

Surfing on the internet to reach some definitions of literature written in research articles or looking at literature books, and dictionaries we encounter so many interesting and really attractive descriptions of literature. In the American Heritage Dictionary, Literature is defined as imaginative or creative writing. (p.486) Anthony BURGESS states that:

"The subject we study at school can be divided roughly into two groups- the sciences and the arts. The sciences include mathematics, geography, chemistry, physics, and so on. Among the arts are drawing, painting, modeling, needlework, drama, music, and literature. The purpose of education is to fit us for life in a civilized community, and it seems to follow from the subjects we study that the most important things in civilized life are Art and Science." (Burgee, 1985. s. 7)

As it is expressed in the dictionary and by Burgees, imagination, and creativity are the two important rules of literature. They are inseparable from each other and also literature includes art and science. Thus *always* literature is the common way of expressing our ideas, feelings, and everything that we want to talk about. "By extending the frontiers of literature, we enlarge imaginative possibilities; we leave our old world forebears alone and search for a new thrill of discovery, discard their static mold and regain a new focus of intensity, a novel turbulence of spirit." Says (Marckwardt.p.318. So literature is a very necessary tool for learning a language. It is not only needed for improving or learning a target language but also very necessary for the promotion of the source language. Reading literary works improves our vocabulary, and causes fluent speaking and comprehension. When a pupil has the ability of a fluent speech he/she is very sure of his/her behavior. As a very important means of teaching and improving English at Teachers Training Faculties, the questions of how and when literature should be used will be discussed in this article. This study aims to offer a better and more illuminating way of using literature for English lecturers while teaching English via literature.

# 3. THE CURRICULUM OF THE ENGLISH DEPARTMENT AND LITERATURE

In the English departments of The Faculties of Education, English Literature classes begin in the 3rd term. As stated by (Maley 1989) students should both be competent enough in the language, and familiar with the literary conventions. Therefore, the students should have a certain level of English language, and they can read and comprehend all kinds of works written in English. That is why the literature classes in the syllabus begin in the 3rd semester of education. Literature classes for students of poor level cannot be proper because *it* could be boring and challenging against language learning. Generally, students of English Departments of Education faculties take prep classes and after that, at the first class of the faculties, they take different lessons of English that are directly related to the improvement of their English language levels. So in the 3rd semester, most of the students of the department have a background in language that would facilitate studying literature. At the Teachers Training Faculty's English department, there are three lessons directly related to Literature: English Literature, Short Story, and Critical reading. A sample lesson on short stories in the 3rd class of the English Teacher Training Department will be discussed in this chapter.

# 4. WHAT IS A SHORT STORY?

A short story is a kind of work of prose fiction that can be read in a sitting taking nearly an hour and approximately has an amount of 7500 words, and focuses on a self-contained incident or series of linked incidents that evoke a single effect or mood. It is quite shorter than a novel and has a few characters. The character can be a person or an animal. It has a simple plot, setting, conflict, and climax. As it is shorter than a novel it doesn't have a complex plot and many characters, thus it is easier to understand and can attract the attention of readers. In this regard, short stories are very beneficial materials to be used in English courses. By reading a short narrative students can extend their vocabulary and talent for critical reading. So it is exactly can be used as a good step for reading before beginning to read a novel or a complex scientific work. Choosing an interesting and attractive story is very important for the first lessons of literature. As it was mentioned before the lecturers who were against literature for ELT have stated that Literature was boring and

complicated for students. (Khatib, Rahimi.p.32) This view may be true when a complicated literary text is selected. So great attention should be paid and the language level of the student has to be in account while choosing a reading text. As stated" learning is not merely an intellectual process; it one that engages the emotions, the ability to explore and be delighted, the ability explore and reflect. It is a fact that a well-selected text can always make the reader curious to explore and learn new things.

### 5. PREPARATION FOR COURSE

The course is about examining a short story by creating a discussion medium in the class by means of asking some questions that create a debate about important facts that have been expressed in the story. The questions were not about some very specific subjects such as setting, time, characters, and plot. Because such types of questions do not need a detailed reading to be answered. They are special questions about certain points that could easily be found in the text. Those kinds of questions do not create a discussion medium that forces the students to be interactive in the class.

Two stories were chosen and given to students a week before lesson hours. The students were requested to read those stories very carefully. The first story was *The Ambitious Guest* by Nathaniel Hawthorne. While delivering the story the lecturer wanted students besides reading it very carefully to pay attention to the atmosphere created by the writer and its relation to the ending. Also, they wanted to see the child's innocence, the environment, and wild nature impact in the story. The second story was *The Lady or the Tiger?* For the second story, the lecturer told students to evaluate the arena culture, and the king's judgment system and to compare it with modern human rights. The Pre-reading requirement aims to provide students with an opportunity for some ideas, and the content of the stories and make them ready for an interactive class discussion. By means of such a project, a fruitful course could be maintained.

# 5.1.Lesson Plan

Level: University student of Teachers Training faculty English Department

Learning Outcomes: Understand how to discuss a subject in the class. Leans the feature of stories and extend the vocabulary of the students. Varieties of Literature and different cultures.

Number of Students: 40 students

Place: Hakkari University Faculty of Teacher training English department

Duration: Two lessons, 45 minutes each

Technique: Reading, content discussion, examining literary texts.

Materials: Printed stories. Story books, Sheets about the writers.

Motivation: A Brief acquaintance about short stories, the importance of reading short stories for extending the vocabulary and the structure of short stories, the benefits of short story reading for learning different cultures, and the application of grammar in text examination were given by the lecturer to facilitate the understandings of students.

## 5.2.Stories

Two stories were studied. Each story took two hours. The first story was The Ambitious Guest written by American writer Nathaniel Hawthorne. Before reading and discussing it in the course hours students were demanded to read the story carefully.

So the students were ready to discuss the content of it. The discussion started with the following questions:

- 1- Can you tell us about the atmosphere created by the writer?
- 2- Can you tell us the relationship between the created atmosphere and the end of the story?
- 3- What kind of a place does the family live?
- 4- What can be said about the medium of the family life and the wishes of the characters?
- 5- What can be said about a child's innocence?
- 6- Please discuss the end of the story.

It was seen that most of the students had made a preparation for the lesson so an interesting discussion was created in the class. The majority of the students attended the debate. They expressed their own thoughts with their own sentences without memorizing the phrases in the story but some new vocabulary was used. In fact, that was the expected and aimed goal. Unfortunately, while many students were declaring their thoughts, a small group remained silent. The responses of some students were very interesting and worth mentioning. Some of them were as follows:

Respond to Q3: "The setting is described as a quiet and remote location, emphasizing the family's isolation from the rest of the world."

Another response to the same question was "The mountains and the nature surrounding their home create a picturesque but harsh environment."

Respond to question 4:" Even though they were in the wild, it was a family wishing sincerity, warmth, hospitality, peace, and happiness" Another student declared that: "The family members, particularly the parents are described as hardworking,

strong, and self-sufficient because they have to live in a very dangerous environment."

Respond to Q 1: "The roaring of the wind, the rolling stones, the isolation of the family, the notch of the valley creates a dangerous atmosphere, and emphasizes a suffering ending"

Respond to. Q 4 "The desire of the small kid of the family asking its parent to leave that dangerous place and go somewhere else, and the grandmother's wishes are clues of innocence."

Many responses as mentioned above were given. The willingness of the majority of the students to attend the course was very encouraging for further learning and teaching English. It was clear that the goal of creating a discussion atmosphere and an interactive lesson was partly succeeded.

The second story studied in the same class was **The Tiger** or The Lady Written by Frank R. Stockton another American famous author. The story is about the criminal punishment of a king who had lived in the medieval age. The king creates an interesting method of trial (judgment) by building a huge amphitheater to exhibit the criminal punishment to his subjects people. There were two rooms the doors of which were opening to the arena. Behind the door of a room there used to be a lady and behind the other door stayed a tiger. When a subject was accused of a sufficiently important crime he would be taken to the arena to be judged in front of the king and gathered people. The accused man has to open one of the doors. If he opens the door of the lady he is supposed to be innocent and should Mary the lady as a gift, but if he opens the door of the tiger a very bloody ending occurs. Because he was proven to be a guilty man who deserved the tiger. Unfortunately, one day the daughter of the king falls in love with a subject of the king and he has been accused of being a criminal and is supposed to be judged in the same way. On the day of judging all the people gather in the arena to watch the

result. Here the writer finishes the story with an open-ended question. "Which door would you want to be opened? You complete the story."

The story was given to students a week before the course, so they read it. It seemed that Many students were eager to discuss it in the course. The judging method of the king, the evolution of democracy in the world from the medieval age up to today, real love, the arena culture and stadiums of our age, and many discussible themes like that were discussed during two hours of the course. It was a great pleasure that many students were active in the class and bravely mentioned their opinions about the subject matter.

## 6. FIRST EVALUATION

The first evaluation was made in the class. By means of the discussion of both stories, it was clearly understood that many students enjoyed the new method of asking discussion-based questions. The majority of the student wanted to be active in the class and joined the discussion by mentioning their opinions in a democratic way without hesitation. Unfortunately, a small group of the student were not ready to join the debate and tried to mention their excuses in different ways. Just after the course many of them tried to express their regrets to the lecturer. They were warned for the mid-term exam and they were demanded to make a good preparation for the exam.

## **6.1.Mid-Term Evaluation**

Two questions for each story were asked in the Mid-Term Exam. The questions were:

- 1- Give a short explanation about the family in the story: The Ambitious Guest.
- 2- Explain the place where the family lived.

- 3- Which door would you like to be opened in the second story? Why?
- 4- What do you think about the judgment of the king?

47 Seven students attended the exam, 33 of them got a grade of more than 70 points and that was a clue of success. The rest 14 students got less than points which were between 70 and 40 points. In fact in general the goal was caught. Many responses to the exam questions were very interesting especially the responses for the second story made me content about the method of creating a discussion and interactive atmosphere in the class. Some responses are:

"If I were the man, I would open the door where the lady was, and I would marry her and be happy." Another response" was: "What kind of a father was the king? I would never let anybody punish my love if I were the daughter of the king."

A student says: "I think it is so unfair. I mean, how your chance can tell you whether you are innocent or not? If the subject was not innocent but lucky at the time the crime would not be punished. So that can't be the right way of judging. I was very barbaric."

Another student states: "I would prefer the door of salvation to be opened because I would like to see the happiness of the lady and the man."

One of the best responses is: "The judgment system implemented by the king is arbitrary and relies on chance rather than a fair trial. The accused individual faces a life-altering decision without potentially fatal consequences based on luck rather than a thorough examination of evidence or a just legal process." Also, there were some sentimental responses as "I would like the door of the tiger to be opened because I don't want my love to marry another man. I am very jealous."

# 7. FINDINGS

1.1. -Most of the students were eager to enter the discussion of the theme and each student has his/ her own point of view.

1.2. -The relations between students and the lecturer are very important for a profitable course

1.3. -Choosing an attractive story is very is crucial for the attention of students.

1.4. -New vocabulary is extended and used in the course.

1.5. -The lecturer leading is necessary.

# 8. LIMITATIONS

It was a crowded class that included 47 students, so all students did not get the chance to be active in the course. Teaching in a crowded course always creates challenges. The target language level of some students was low and it created a disadvantage for discussion. Students' shyness was another barrier challenging the discussion. This is an important problem that needs to be solved by the lecturers. Some students hesitated to speak because they were afraid of mistakes. At the end of the mid-term exam, it was understood that many of those students got lower degrees. But the problem could be solved by establishing close relations with each student and encouraging them to read a lot.

# 9. CONCLUSION

As stated by many writers; (McKay.1982, Maley.2001, Oster. 1989, Hadaway, Wardel, and Young, 2002, Tanritanir and Kandaşoğlu, 2022) literature has a very crucial role in teaching language. Literature language learners are familiarized with subtle vocabulary usage. Another contribution of literature is the motivation of students to get new experiences, also it affects fluent reading and speaking because if students have rich vocabularies it facilitates their speaking and encourages them to be more social in the class and outside of the class. Such an experience for students causes interactive courses and a fruitful learning atmosphere. There is a great variety of language and subject matters expressed in literature which can provide an enjoyable learning medium for students or learners. Besides all of these advantages, learners become more secure about the validity of their interpretations and critical reading. "One of the most important purposes is to provide a comprehensive and realistic source for building language structures and learning new vocabulary." (Tanrıtanır and Kandaşoğlu 2022)

Choosing the right material for literature lessons is very important. Many subtitles of literature such as novels, dramas, poetry, or stories can be chosen while using them for teaching a language. The best thing to be done is to choose good material that is suitable to students' language level, and it should be interesting to attract students' attention, for the lesson of this chapter two modern and interesting stories were chosen. As recommended: "Do not choose a story full of words not yet in the students' vocabulary; they will have to spend too much time looking up words in the dictionary and will lose interest" (Slocum. 226) So while reading and evaluating those two selected stories students easily understood all details as could be seen in their respond above. Also beginning with examining and interpreting a short story provides a fertile medium for teaching language and learning new vocabulary to improve language level and fluent speaking. The majority of students who attended this course had an enjoyable interactive speaking and practicing besides extending their vocabularies and also were encouraged to be more social.

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# THE NATURE OF MANAGERIAL WORK

### Abdullah BALIKÇI<sup>1</sup>

### **BOOK REVIEW**

Mintzberg, H. (1973). *The nature of managerial work*. New York, Harper & Row Publeshers, 298 pages.

The book is based around the author wondering what his father does as a manager. It is confusing for a 6-year-old child that he cannot see what his father does despite everyone at work. However, starting to study the role of manager from an academic perspective contributes to the clarification of the author's views. The question that the author asked himself at a young age became the question that formed the basis of his thesis, which was an important stage of his academic life. What do managers do? In addition, the author's conference titled "The Impact of Technology on Managers" further increased his interest in the subject. In addition, the attitude of professors in thesis jury also increases interest in the subject.

Managers undoubtedly contribute great value in organizations. The manager plans, organizes, motivates, directs and controls. The aim of this book is to explain what managers do - their job description - on a scientific basis. In this context, answers were sought to the following questions:

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- 1. What kind of work does a manager do?
- 2. What type of knowledge processes do managers manage?
- 3. How often does the manager work with whom and where?
- 4. What are the distinguishing features of managerial jobs?
- 5. What is the relationship of managers with the media they use?
- 6. What kind of roles can managers infere from studies on managers?
- 7. What kinds of variables—determinants—are there in managers' jobs?
- 8. To what extent is management a science?

The book includes some inferences about managers. These can be summarized as follows:

- 1. Managers' jobs are remarkably similar.
- 2. Differences in the work of managers are based on their common roles and characters.
- 3. Many managers' jobs can be difficult and unscheduled.
- 4. The manager is both an intellectual and an expert.
- 5. The power of most managers comes from their knowledge.
- 6. The main occupational hazard is superficiality. It is being able to follow the work superficially due to the intensity.
- 7. There is no science in managerial work.
- 8. The manager is in a loop of sorts.
- 9. Management scientist can help break this cycle.
- 10. Managerial tasks have a more complex nature than studies reported in the literature.

The book discusses the duties of managers in four dimensions. Chapter 3 explains the common characteristics of managers. Chapter 4 describes 10 roles expected of managers. Chapter 5 points out the differences in the work of managers. Chapter 6 discusses the management profession as a science. Chapter 7 summarizes the findings and implications of research on management science. As an introduction to defining managerial jobs, Chapter 2 reviews the existing literature. The chapter discusses 8 schools of thought—the classical school, the great man school, the entrepreneurship school, the decision theory school, the leader effectiveness school, the leader power school, the leader behavior school, and the business activity school. These schools, which include various approaches and research methods, also contain different results. But they don't tell us much about the manager's job. Future chapters are researchbased –H. Mintzberg's research explains the job of managers in four points. Part 3: Character of the work; Chapter 4: Content of the manager's job based on the 10 roles of the manager; Chapter 5: Variations in the manager's job – based on common roles and characteristics; Chapter 6: Programming the manager's work suggested by the decision theory school. This chapter also reveals some of the progress management scientists have made regarding the role and areas relevant to manager effectiveness.

Chapter 3 focuses on some distinctive features of managerial jobs. They are:

- 1. The amount and pace of the manager's work
- 2. Examples in the work of managers
- 3. Relationships between managers' actions and reflections on their work
- 4. Different media usage by managers
- 5. Interaction between rights and duties of directors
- 6. Managers' relationships with their various contact

The manager's activities are characterized by brevity, variety, and fragmentation.

Chapter 4 focuses on the working roles of the manager. The 10 roles of the manager are evaluated in 3 categories:

1. Interpersonal Roles: Figurehead, leader, liaison

- 2. Informational Roles: Monitor, disseminator, spokesman
- 3. Decisional Roles: Entrepreneur, disturbance handler, resource allocator, negotiator

It is an important point why managers are needed in organizations. The author discusses this from 5 aspects. These:

- 1. The manager ensures that the organization achieves its basic goals.
- 2. The manager tries to maintain balance and order in the organization's affairs.
- 3. The manager is responsible for the strategy delivery system in his organization. He tries to adapt its organization to its changing environment in a controlled manner.
- 4. The manager strives to serve the people under his control to the fullest.
- 5. The manager is a key between his environment and his organization.

Chapter 5 focuses on diversity in managers' work. This section analyzes the changes in managers' jobs and reviews the subject in line with current findings. Based on the findings, 8 basic types of jobs of the manager are revealed. The manager's job is influenced by key role requirements and personas. The first and most common of these is that the manager's job is affected by and other factors surrounding organizations, sectors environmental variables in management. Secondly, it is affected by work-related factors – the level of work and supervision, etc. Thirdly, one that originates from the employee and is affected by the variables that the employee affects – personal variables. Finally, it is affected by some special conditions - seasonal variables, threats that the organization faces from time to time, etc. - variables. Depending on these variables, 8 types of managerial jobs can be mentioned. These are contact man,

political manager, entrepreneur, insider, real time manager, team manager, expert manager, new manager.

Chapter 6 shows that the previous three chapters show that science is not yet involved in managerial affairs. In other words, managers do not act in line with scientific data. In fact, other than technological tools - machines, planes, telephones, etc. - past practices are followed. Despite advances in science, the trend continues. This chapter discusses 2 aspects of management science. 1. A complete description of managerial work 2. A systematic development of managerial work. From this point of view, the author turned to research on the manager's work schedule and the manager's programs. It explains the administrative work flow in 4 stages. These are the coming of information from various sources - environment, facts, values, etc., the process of scanning and examining information, the process of decision making and storing information, and the process of disseminating information to the environment. Here, the role of the management scientist at the political level is to contribute to the use of research findings and analysis techniques in organizational processes. At this point, planning should be taken into account when rescheduling planned activities, taking into account the manager's time limitations, determining and classifying requests within a certain period of time, and determining the allocated time. In addition, at the manager's time point, it is necessary to reprogram the data collection system monitoring the system and taking into account the data in the official archive, addressing the data dissemination system -, reprogramming the strategy development system - solving the planning dilemma, and taking into account seven areas related to management. These are finding opportunities and problems, cost benefit analysis, model construction, emergency planning, realtime analysis, project monitoring and feasible planning.

Chapter 7 contains explanations for the future of managerial work. It also summarizes the job description and roles of the manager from chapters 3 to 6. For example, a manager is defined as a person responsible for the coordination of the formal organization and its subunits. Management is acquired through formal authority over organizational units. This is a job that serves two main purposes. These are to try to ensure that the organization is effective in the work it does while serving its employees. In this chapter, the 10 roles of the manager mentioned in Chapter 4 are considered important for future research. The manager's activities ara characterized by brevity, variety, and fragmentation. The character of the manager's job expresses a cycle. For effective management, the author wants 10 points to be taken into consideration. These are sharing information, dealing consciously with superficiality, sharing the job if information can be shared, making the most of obligations, freeing self from obligations, emphasizing the role that fits the situation, seeing a comrehensive Picture in terms of its details, recognizing own influence in the organization, dealing with a growing coalition, using the management scientist. The manager must also take into account and develop some of his skills for effective management. These skills are peer, leadership, conflict-resolution, informationprocessing. decision-making, resource-allocation, entrepreneurial, and introspection. The fact that managers have to deal with excessive workload and that there are not yet adequate regulations at this point requires management scientists to assist managers by conducting more research on the subject. At this point, management scientists, planners or analysts need to understand what the manager's job is and decide accordingly.

It can be seen that the book has 3 additional chapters on the subject. The first appendix contains important research on the manager's job. Some of these studies include: Neustadt's study of presidential power Homans's study of leadership Hodgson, Levinson, and Zaleznik's "Executive Role Consellation" Carlson's Leading Diary Study The Ohio State Leadership Studies

In the second additional section, 7 research methods used in researching managerial affairs are mentioned. These methods can be listed as follows:

> Secondary sources Interview and questionnaire Critical incident and sequence of episodes Diary Activity sampling Unstructured observation Structured observation

In the third additional section, there is a research on the work of five senior managers. In this research, findings were obtained regarding the nature of the industry, the nature of the organization, the nature of the manager's style and immediate needs. As a result of the research, the theory based on the working roles of the manager expressed in the 4th chapter was reached.

It can be said that the fact that the source of the book is the author's childhood years and that he references this source in his scientific work contributes to the integrity of the research. The main starting point of the book is the lack of a study covering the duties, roles and characteristics of managers. The researcher believes that this book, which can be considered as an effort towards the nature of managerial work, contributes to the field. The publication of many studies on management since the year the research was published supports this idea. When we look at the book, a total of 4 chapters from the 3rd to the 6th chapter express the steps of the author's theory that he put forward as a result of his research (Figure 19). According to this figure, which reveals the purpose of writing the book, the 3rd chapter explains the characteristics of the manager's work, the 4th chapter explains the manager's roles, the 5th chapter explains the variables in the manager's job, and the 6th chapter explains the manager's schedule and the work he does and the intensity of the work during the day, again based on research data. The positive aspects of the study are that it views management as a whole within the current context, accepts management as a science and subjects it to research, explains the different dimensions of management in detail based on research data, and evaluates the author's own research within the subject.

However, naturally, changes in the nature of management over time and the existence of different studies depending on these changes reveal that the current study should be updated based on data; but this does not negatively affect the value of the current study. On the contrary, it is extremely valuable in terms of shedding light on the research and evaluations that have been done, are being done and will be done. As a result, it is recommended by the researcher that those who want to conduct research in this field should read and understand the book and design new research by taking into account the parameters in the book.

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# PROFESSIONAL VOICE: TONGUE AND LIP TRILLS IN THE CONTEXT OF VOCAL ERGONOMICS

# Alper ŞAKALAR<sup>1</sup> Sevda GÜREL<sup>2</sup>

### **1. INTRODUCTION**

Professional voice is an indispensable resource for people who work in professions that require vocal communication. Voice is a tool that allows people to convey their emotions, thoughts and information. The quality and performance of voice are important for professional success and satisfaction. Professional voice users should adapt to vocal ergonomics principles to use their voices in a healthy and effective way. Vocal ergonomics is a discipline that scientifically examines the anatomical, physiological, psychological and environmental factors that affect voice production and provides recommendations to voice users to protect and improve their vocal health.

Vocal ergonomics enables voice users to recognize their voice production mechanism, to notice the causes and symptoms of voice disorders, to apply voice hygiene rules, to prevent vocal fatigue and excessive voice use, to increase their voice quality and performance, to reduce their occupational risks related to voice and to cope with their voice-related problems. Voice-related

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professions are professions where voice is intensively used or voice quality is important. For example, teachers, singers, sports coaches, call center operators and office workers can be counted among voice-related professions. People who work in these professions may face many problems such as vocal fatigue, voice disorders, musculoskeletal pain, workplace stress, occupational dissatisfaction, performance decline and job loss. These problems can negatively affect the individual's physical and psychological health as well as their occupational efficiency, quality and wellbeing. Therefore, vocal ergonomics is important for protecting and improving the vocal health of people who work in voicerelated professions and as Kenny (2022) stated, "vocal ergonomics plays an important role in protecting and improving the vocal health of people who work in voice-related professions".

Vocal ergonomics is a discipline that scientifically examines the anatomical, physiological, psychological and environmental factors that affect voice production and provides recommendations to protect and improve the vocal health of people who work in voice-related professions. Voice production is a complex process that involves the cooperation of many organs of the human body. The voice production mechanism consists of the respiratory system, vocal cords, resonance cavities and speech organs. The anatomical and physiological foundations of voice production cover the structure, function and relationships of these organs. Voice production is not only a physical event, but also an emotional and cognitive event. Voice is a tool that allows people to convey their emotions, thoughts and information. The functional and emotional aspects of voice include the topics such as the role of voice in communication, the reflection of voice characteristics such as personality, gender, age, culture, the influence and being influenced of voice by mood. Voice is also a social phenomenon. Voice is an important factor in determining

the sense of belonging to social groups, social status and role, social expectation and conformity of people. The psychosocial effects of voice can be defined as the relationship of voice with issues such as social perception, social support, social adaptation, social identity. Voice is also an occupational requirement. Voicerelated professions are professions where voice is intensively used or voice quality is important. For example, teachers, singers, sports coaches, call center operators and office workers can be counted among voice-related professions. The occupational requirements of voice include the topics such as the importance of voice for professional success and satisfaction, the impact of voice on professional performance and efficiency, the occupational risks and problems of voice.

Voice is closely related to environmental conditions. Voice is a phenomenon that is affected by and affects the environment. The environmental conditions of voice include the topics such as how voice is affected by environmental factors (noise pollution, temperature, humidity, ventilation, lighting, dust, chemicals, etc.), how voice affects the environment (acoustics, noise, echo, feedback, etc.). Voice is also a resource that requires education and care. Voice is a talent that people are born with, but need to develop and protect. The education and care of voice include the topics that enable the use of voice in a correct and healthy way, the emergence of the potential of voice, the increase of the quality and performance of voice. Voice is also a product that needs to be evaluated and improved. Voice is a product that allows people to express themselves, but sometimes can be damaged or lost. In this context, the evaluation and improvement of voice can include the topics that enable the measurement of the state of voice objectively and subjectively, the identification of voice disorders, the determination of the causes and consequences of voice disorders, the treatment of voice disorders. Voice needs to be protected and improved. Voice

is an asset that affects the quality of life of people, but sometimes can be harmed or lost. The protection and improvement of voice include the topics that enable the protection of vocal health, the prevention of vocal fatigue, the prevention of excessive voice use, the improvement of voice. Vocal ergonomics deals with these factors holistically and provides appropriate methods and solutions to protect and improve the vocal health of people who work in voice-related professions. These methods and solutions include topics such as voice education, voice therapy, voice hygiene, voice exercises, voice ergonomics, voice care, voice protection, voice improvement, voice optimization. Vocal ergonomics has gained more importance especially during the COVID-19 pandemic period with the widespread use of remote work and education models. Remote work and education have brought many changes that affect the voice use and vocal health of people who work in voice-related professions. Among these changes are topics such as the use of voice for longer and higher intensity, the transmission of voice in digital environments, the lack of feedback of voice, the encounter of voice with technical problems, the influence of voice by posture and environmental conditions, the use of voice under psychological stress. These topics can cause people who work in voice-related professions to face many problems such as vocal fatigue, voice disorders, neck pain, back pain, workplace stress, occupational dissatisfaction, performance decline and job loss. These problems can negatively affect the physical and psychological health of the individual as well as their occupational efficiency, quality and well-being. Therefore, vocal ergonomics examines the effects of remote work and education models on vocal health and provides appropriate methods and solutions to protect and improve the vocal health of people who work in voice-related professions. Kenny (2022), in a study he conducted, stated that "vocal ergonomics examines the effects of remote work and education models on vocal health and provides appropriate methods and solutions to protect and improve the vocal health of people who work in voice-related professions".

The aim of voice education is to enable voice users to use their voices more effectively, efficiently and healthily. An important part of voice education is also warming up the voice. Warming up the voice is the vocal exercises that voice users do to prepare for voice production. Voice warming up increases the flexibility, blood flow and coordination of the vocal cords, enabling voice users to use their voices more easily, comfortably and safely. Voice warming up exercises consist of various vocal movements aimed at improving the frequency, intensity, quality, range, tone, resonance, nuance, vibrato, etc. of the voice. The most common and effective vocal warm-up exercises are tongue and lip trills. Tongue and lip trills are vocal vibrations that voice users use to relax their vocal cords, expand their vocal range and adjust their vocal tone. Tongue and lip trills reduce vocal fatigue and prevent vocal damage by applying minimal pressure to the vocal cords. Tongue and lip trills include the basic principles of voice education such as supporting the voice with diaphragmatic breathing, resonating the voice in the mouth and nasal cavities, shaping the voice with correct articulation. This study was conducted to investigate the benefit of vocal ergonomics practices on how people who work in voice-related professions can protect and improve their voices. In this regard, the study discussed how tongue and lip trills can be used and what advantages they can provide in various methods and solutions within the scope of vocal ergonomics (voice education, voice therapy, voice hygiene, voice exercises, voice care, voice protection, voice improvement, voice optimization, etc.). The assumption of the study is that tongue and lip trills within the framework of vocal ergonomics will contribute to vocal health and increase voice quality. The findings of the study are expected to contribute to the vocal ergonomics literature and provide practical suggestions for

people who use their voices effectively in their profession to protect and improve their voices.

### 2. TONGUE AND LIP TRILLS

Tongue and lip trills are vocal exercises that involve the vibration of the tongue or lips during voice production. For the lip trill exercise, the lips should be held loosely together and the lips should be vibrated while exhaling. The vibration of the lips will help the vibration of the vocal cords. While doing the lip trill, the voice can be raised or lowered, tried with different vowels or a song can be sung by doing the lip trill. While doing the lip trill, attention should be paid to using diaphragmatic breathing and keeping the neck and shoulders in a relaxed position. For the tongue trill exercise, the tongue should be touched to the palate and the tongue should be moved back and forth quickly while exhaling. The movement of the tongue will enable the movement of the vocal cords. While doing the tongue trill, the voice can be raised or lowered, tried with different vowels or a song can be sung by doing the tongue trill. While doing the tongue trill, attention should also be paid to using diaphragmatic breathing and keeping the neck and shoulders relaxed. These exercises are widely used in voice therapy and education because of their possible benefits in improving voice function and eliminating voice disorders. "Semi-occluded vocal tract exercises such as tongue and lip trills, which increase the interaction between the glottis and the supraglottal tract" (Titze, 2006) are especially preferred exercises. In the context of voice therapy, it has been found that tongue trills help "balancing air and muscle coordination, positioning the larynx during voice production and restoring the biomechanical function of the tissues by reducing the collision between the vocal cords" (Menezes et al., 2011).

In the field of voice therapy and education, vocal exercises such as tongue and lip trills are one of the topics that interest researchers. These exercises have been proven to positively affect the functioning of the larynx and pharynx, the vibration of the vocal cords and the activity of the supraglottic region. It has also been shown by various studies that these exercises can be beneficial in the treatment of voice disorders, the improvement of voice functions and the warming up of the voice. In a study by Meerschman et al. (2023), it was determined that tongue and lip trills could cause temporary changes in the movements of the larynx and pharynx observed by strobolaryngoscopy (a method that measures the vibration frequency of the vocal cords) in participants with good vocal health. The same researchers (2021) also found that these exercises could change the vibration of the vocal cords and the activity of the supraglottic region and that there were some differences between tongue trills and lip trills. In addition, according to the study by Cordeiro et al. (2012), the air flow from the lungs should increase while doing lip and tongue trills in order to maintain the vibration of the vocal cords and the lip or tongue. To better understand the effects of these exercises on vocal health and quality, the physiological and acoustic effects of tongue and lip trills on the voice production mechanism were examined. Tongue and lip trills can affect the pressure distribution in the vocal tract, the vibration mode of the vocal cords, the resonance character of the voice, the spectral components of the voice, the harmonic and noise ratio of the voice, the formant frequencies of the voice, the fundamental frequency of the voice, the intensity of the voice and the duration of the voice. These effects explain the reasons for using tongue and lip trills in warming up the voice, treating voice disorders and improving voice functions.

Exercises done with tongue and lip trills improve the functioning of the vocal cords and the supraglottic region, help in the treatment of voice disorders and warm up the voice. In addition, these exercises increase the air flow to maintain the

vibration of the vocal cords and the lip or tongue, reduce the glottal closure rate and regulate the subglottal pressure. It has also been shown by various studies that these exercises create different effects at the vibration source and can change the voice functions. In the field of voice therapy, "semi-occluded vocal exercises such as tongue and lip trills, which reduce the glottal closure rate to a minimum, have been reported to be effective in cases of hyperfunctional dysphonia" (Guzmán et al., 2015). Tongue trills are a common exercise used in the treatment of dysphonia patients and in warming up the voice (Fabron et al., 2017). Lip trills provide benefits such as "controlling the breath flow, regulating the subglottal pressure, relaxing the articulation muscles and preventing the excessive closure of the vocal cords" (Orhon & Malkoç, 2022). Straw phonation, lip vibration and water resistance therapy are also among the semi-occluded vocal exercises. "It has been observed that these exercises create different effects at the vibration source" (Meerschman et al., 2018).

## **3. STUDIES ON TONGUE AND LIP TRILLS**

Professional voice users do various vocal exercises to protect and improve their voice quality and health. One of these exercises is tongue and lip trills. Tongue and lip trills are vocal exercises that involve the vibration of the tongue or lips during voice production. Tongue and lip trills provide many benefits such as preparing the voice production mechanism, increasing the flexibility, blood flow and coordination of the vocal cords, expanding the vocal range, adjusting the vocal tone, reducing vocal fatigue and preventing vocal damage. Tongue and lip trills include the basic principles of voice education such as supporting the voice with diaphragmatic breathing, resonating the voice in the mouth and nasal cavities, shaping the voice with correct articulation. Tongue and lip trills consist of various vocal movements aimed at improving the frequency, intensity, quality, range, tone, resonance, nuance, vibrato, falsetto, belting, twang and distorted (dirty) voice. These trills have been extensively researched and applied in the fields of speech and language therapy and vocal pedagogy. According to Titze (2006), "semioccluded vocal tract exercises such as tongue and lip trills, which increase the interaction between the glottis and the supraglottal tract" are especially preferred exercises. According to Fabron et al. (2017), these exercises "change the acoustic characteristics of the voice by affecting the vibration frequency and amplitude (loudness) of the vocal cords, the vocal tract resistance, the vocal tract shape and the spectral components of the voice". Tongue and lip trills have been shown to make the voice more comfortable, clear, strong and flexible in studies where the voice performances of professional voice users were evaluated. In addition, tongue and lip trills are also considered as an effective method in the prevention and treatment of voice disorders such as vocal fatigue, hoarseness, vocal cord nodules.

Speech and language therapists have emphasized that tongue trills are widely used and have an important place in clinical practice, especially in individuals diagnosed with vocal cord nodules (Cordeiro et al., 2012). Vocal cord nodules, also known as singer's nodules, are benign formations that develop on the vocal cords due to poor or improper use of voice and cause hoarseness, vocal fatigue and other voice-related problems. "Tongue and lip trills increase the vibrational amplitude of the mucosa of the vocal folds and create more vocal balance in phonation by balancing the aerodynamic forces" (Fabron et al., 2017). These exercises are widely used in the rehabilitation of dysphonic voices, including those with vocal cord nodules, as they aim to ensure glottal closure and restore mobility in the vocal cords (Beka and Gimm, 2021). In addition, it has been reported that tongue trills increase the amplitude of vocal cord vibration, reduce the glottal gap and improve the auditory-perceptual and

acoustic analyses, resulting in less shimmer, higher harmonicnoise ratio, increased amplitude of harmonics and decreased noise in individuals with normal voice (Cordeiro et al., 2012). Also, semi-occluded vocal tract exercises, including tongue and lip trills, have been shown to reduce vocal tract discomfort by creating a 'massage-like' effect on the vocal tract by reducing muscle tension, which may be beneficial for individuals with vocal cord nodules (Meerschman et al., 2018). Additionally, the potential benefits of the lip trill exercise include maintaining the breath flow, adjusting the subglottal pressure, relaxing the tongue and other muscles for articulation and preserving the vocal fold configuration by preventing hyperadduction (Orhon and Malkoç, 2022)5. It is important to note that the primary etiological factor in vocal cord nodules is trauma to the vocal tissues (Yılmazer, 2019)6. Therefore, the use of tongue and lip trills in voice therapy for individuals with vocal cord nodules aims to address and alleviate the voice use or misuse that causes the development of nodules. These exercises are designed to improve the health of the vocal cords, improve the vibration of the vocal cords and reduce the vocal tract discomfort and have resulted in the finding that they contribute to the rehabilitation of voice in individuals with vocal cord nodules. In this context, tongue and lip trills provide significant benefits in voice therapy for individuals with vocal cord nodules.

The scientific foundations of tongue and lip trills exercises have been investigated by measuring the vocal fold vibration with the electroglottographic method. Electroglottography is a technique that shows the contact rate and vibration characteristics of the vocal cords. Andrade et al. (2014) and Cordeiro et al. (2015) have shown that the vibration of the vocal cords during tongue and lip trills is different from the vibration seen during the phonation of continuous vowels. These studies also show that tongue and lip trills have different effects on the voice. The acoustic properties of tongue and lip trills have also been investigated by various studies. Dhananjaya et al. (2012) have

performed the acoustic analysis of trill sounds, including tongue trills, in different vowel contexts and have provided acoustic clues for the qualitative analysis of trill sounds. These clues help to identify trill sounds in continuous speech. Orhon and Malkoc (2022) have evaluated the availability of lip trills and tongue relaxation exercises in vocal training programs and have revealed the potentials of these exercises in vocal pedagogy and therapy. contributions These studies provide significant the to comprehensive understanding of the articulatory and phonetic aspects of tongue and lip trills in linguistic contexts. Therefore, the use of tongue and lip trills in professional voice education and therapy is supported by important scientific research. Tongue and lip trills have been studied with interdisciplinary approaches in the fields of speech and language therapy and vocal pedagogy, due to their instantaneous effects on the vocal fold vibration, their effects on the laryngeal and pharyngeal activity and their potentials in vocal pedagogy and therapy, and have presented significant findings in different studies.

Some studies have been done on the effect of tongue and lip trills exercises on singing. These exercises are vocal exercises that involve moving the tongue or lips quickly and repeatedly and mostly the effects of these exercises on vocal behavior and singing performance have been investigated. "Studies have investigated the acoustic and aerodynamic characteristics of the tongue vibration during tongue trill, but the effects of lip trills on vocal behavior have been relatively limited" (Gaskill & Erickson, 2008). Semi-occluded vocal tract exercises, which singers should include in their vocal exercise routines, are important for improving and maintaining vocal health and performance. According to Roe, (2005), vocal warm-up exercises in the choir should include basic vocal exercises that focus on semi-occluded vocal tract techniques. These exercises are designed to work and strengthen the vocal mechanism and prepare the singers for the requirements of the choir performance. At the same time, Cottrell (2017) offers practical suggestions for specific vocal exercises
that can enhance the vocal technique of choir singers and emphasizes the importance of semi-occluded vocal tract exercises in choir rehearsals. The potential benefits of tongue and lip trills, which are semi-occluded vocal tract exercises, in the prevention and treatment of voice disorders such as vocal nodules, postoperative laryngeal microsurgery, presbyphonia and vocal cord paralysis have been discussed, but "there are disagreements on the best performance time" (Menezes et al., 2011). In addition, studies have analyzed the instantaneous effects of tongue-trill technique associated with tonal variations on the vocal range profile of choir singers in terms of time spent on choir singing, voice types and exercises (Lima et al., 2016). In individuals who do not use professional voice, it has been found that tongue trills increase the amplitude of vocal cord vibration, reduce the glottal gap and improve the auditory-perceptual and acoustic analysis results.

According to Webb (2007), tongue and lip trills help to contribute to vocal health by eliminating risk factors for vocal fatigue. In addition, Keller (2005) emphasizes the importance of vocal technique in improving the voice for performance and states that including tongue and lip trills in vocal exercises can contribute to vocal (voice) hygiene and general vocal health. Tongue and lip trills are beneficial for vocal hygiene as they help to relax and coordinate the vocal muscles. These exercises help to relieve the tension in the vocal tract and promote proper air flow, which are the basic elements of vocal hygiene. Keller (2005). Vocal technique emphasizes the importance of relaxing and coordinating the vocal muscles, which are necessary for maintaining vocal health. Including tongue and lip trills in vocal warm-up routines can contribute to the relaxation and coordination of the vocal muscles, thus promoting vocal hygiene. Also, tongue and lip trills are effective in improving vocal resonance and control, which are important aspects of vocal hygiene. These exercises "help to increase the resonance and control of the voice and improve the clarity and articulation of the voice. Webb (2007) has touched on the role of vocal exercises in improving vocal health, including improving vocal resonance and control. By including tongue and lip trills in vocal practice, singers can experience improved vocal resonance and control, thus contributing to vocal hygiene and general vocal comfort. In this context, tongue and lip trills offer various advantages in terms of vocal hygiene, such as preventing vocal fatigue, relaxing and coordinating the vocal muscles, improving vocal resonance and control. These exercises play a very important role in improving vocal health and maintaining vocal hygiene, which makes them the basic components of a singer's vocal practice routine. Including tongue and lip trills in vocal warm-up and training sessions can make a significant contribution to the general vocal well-being and hygiene of singers.

The importance of tongue and lip trills in the context of vocal ergonomics is supported by their effects on vocal tract function and their effects on improving vocal health and efficiency. Semi-occluded vocal tract exercises, such as tongue and lip trills, have been shown to have significant effects on vocal ergonomics because they affect the vocal fold vibration, the vocal tract impedance and the general vocal function. In a study by Andrade et al. (2014), seven semi-occluded vocal tract exercises, including lip trills and tongue trills, and their effect on phonation were investigated. The study provides insights into the interaction between the glottis and the semi-occluded vocal tract and emphasizes the relevance of these exercises to vocal ergonomics. In addition, Fabron et al. (2017) highlighted the importance of tongue trills in creating more vocal balance during phonation by increasing the vibration intensity of the vocal fold mucosa and balancing the aerodynamic forces, thus contributing to vocal ergonomics. Also, semi-occluded vocal tract exercises, including tongue and lip trills, have been associated with improvements in vocal fold elongation, vocal fold collision and phonation threshold pressure (Guzmán et al., 2015; Enflo et al., 2013). These physiological effects are very important for increasing

vocal efficiency and reducing vocal effort in accordance with the principles of vocal ergonomics. A study by Cordeiro et al. (2012) showed that tongue trills increased the amplitude of vocal fold vibration and improved the auditory-perceptual and acoustic analyses, which resulted in increased vocal efficiency and reduced vocal effort. In addition, the use of semi-occluded vocal tract exercises has been associated with improvements in the perceived voice quality, production comfort, vocal tone, vocal clarity and power of the individual (Natale et al., 2022). These subjective improvements in vocal parameters are an indicator of the positive effect of tongue and lip trills on vocal ergonomics, as they contribute to the increase of vocal performance and the reduction of vocal tension. As a result, tongue and lip trills play an important role in vocal ergonomics by affecting the vocal tract function, increasing the vocal efficiency and improving the vocal performance. The physiological and perceptual effects of these exercises underline their importance in supporting vocal health and optimizing vocal function in accordance with the principles of vocal ergonomics.

Some studies present different views and findings that may contradict the current research on tongue and lip trills and vocal ergonomics. One of these studies is a research by Costa et al. (2011) that suggests that phonation based on a straw exercise improves the voice in perceptual-auditory evaluations. This finding contrasts with the potential effects of tongue and lip trills on vocal ergonomics, as it introduces an alternative vocal exercise that may have comparable or different effects on vocal function and ergonomics. In addition, Fadel et al.'s (2016) study discusses the instantaneous effects of semi-occluded vocal tract exercises on singers. This research presents an alternative perspective on the benefits of these exercises for vocal health and efficiency by introducing a different type of semi-occluded vocal tract exercise and its potential effect on vocal ergonomics. Also, a study by Traser et al. (2014) presents findings on the effects of gravity on the vocal tract of untrained subjects in singing phonation. This research reveals the impact of body posture and gravity on vocal tract function and may present opposing views on the factors affecting vocal ergonomics during vocalization. Furthermore, a study by Garcia et al. (2016) evaluates the applicability of cone beam computed tomography (CBCT) in assessing the differences in the vocal tract before and after vocal exercises in healthy individuals. This research brings a different approach to evaluate the vocal tract changes and their potential effects on vocal ergonomics and presents an alternative perspective on the evaluation of vocal exercises. These studies and findings present alternative perspectives and evidence with potential contradiction on the effects of vocal exercises, including tongue and lip trills, on vocal ergonomics. Researchers and practitioners can gain a more comprehensive understanding of the potential effects of vocal exercises on vocal function and ergonomics by considering these different perspectives.

#### 4. CONCLUSIONS AND RECOMMENDATIONS

According to the studies, tongue and lip trills are considered as an important vocal exercise for professional voice users. Tongue and lip trills are part of the semi-occluded vocal tract exercises group that regulate the pressure and flow relationship between the glottis that provides the vibration of the vocal folds and the supraglottal tract (mouth, nose, throat, etc.) where the voice is shaped. These exercises change the acoustic properties of the voice by affecting the vibration frequency and amplitude of the vocal folds, the vocal tract impedance, the vocal tract shape and the spectral components of the voice. Tongue and lip trills have been shown to make the voice more comfortable, clear, strong and flexible in the studies that evaluated the vocal performance of professional voice users. In addition, tongue and lip trills are also accepted as an effective method in the prevention and treatment of voice disorders such as vocal fatigue, hoarseness, vocal fold nodules.

According to the results of the research, the scientific foundations of tongue and lip trills have been investigated by electroglottographic studies that compare the vocal fold vibration during these exercises with the vibration seen during the phonation of continuous vowels. The acoustic analysis of trill sounds, including tongue trills, has been discussed in different vowel contexts, providing valuable information about the qualitative and quantitative analysis of trill sounds and the acoustic clues that help to identify the trills in continuous speech. In addition, the availability of lip trills and tongue relaxation exercises in vocal training programs has been evaluated, contributing to a better understanding of their potentials in vocal pedagogy and therapy. These studies have also contributed to the comprehensive understanding of the articulatory and phonetic aspects of tongue trills in linguistic contexts.

Considering the results and recommendations of the research, the use of tongue and lip trills in professional voice training and therapy is supported by important scientific research. Their instantaneous effects on the vibration of the vocal folds, their effects on the laryngeal and pharyngeal activity and their potentials in vocal pedagogy and therapy highlight their importance in the fields of speech and language pathology and vocal pedagogy. Therefore, the more widespread use of tongue and lip trills in voice training and therapy will be beneficial for individuals who want to maintain and improve their voice quality and health. In addition, the effects of tongue and lip trills on the voice need to be examined in more detail to better understand the mechanisms and effectiveness of these exercises. For this purpose, different methods and tools can be used to measure the effects of tongue and lip trills on the voice. For example, the effects of tongue and lip trills on parameters such as vocal tract pressure, flow, resistance, impedance, stiffness, elasticity, acoustic impedance, acoustic resistance, acoustic stiffness, acoustic elasticity, acoustic reflection, acoustic absorption, acoustic transmission, acoustic resonance, acoustic impedance

spectrum, acoustic resistance spectrum, acoustic stiffness spectrum, acoustic elasticity spectrum, acoustic reflection spectrum, acoustic absorption spectrum, acoustic transmission spectrum, acoustic resonance spectrum can be investigated. Methods and tools such electroglottography, as electromyography, laryngostroboscopy, laryngograph, laryngeal articulograph, electromagnetic laryngeal ultrasonography, laryngeal magnetic resonance imaging, laryngeal computed tomography, laryngeal optical coherence tomography, laryngeal photoacoustic tomography, laryngeal thermography, laryngeal laryngeal doppler, elastography, laryngeal spectroscopy, laryngeal impedanceometry, laryngeal acoustic reflectometry, laryngeal acoustic tomography, laryngeal acoustic microscopy can be used for the measurement of these parameters. The use of these methods and tools will enable a more objective and precise evaluation of the effects of tongue and lip trills on the voice.

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# EXPLORING STUDENT PERSPECTIVES: ROBOTIC CODING TRAINING IN THE KODLAMANISA PROJECT<sup>1</sup>

# Yaşar ALADAĞ<sup>2</sup> Özlem ATES<sup>3</sup>

#### **1. INTRODUCTION**

As technology rapidly advances and information becomes more accessible, it's crucial to develop individuals who can understand, utilize, and apply scientific knowledge and technology that meet the current needs and challenges. Consequently, nations are compelled to strive towards enhancing the standard of science and technology education (Eş & Sarıkaya, 2010). In this context, coding and robotics studies have found widespread opportunities for implementation within science courses.

The recognition of coding as a vital skill for the 21st century has prompted countries to introduce coding courses into primary and/or secondary education curricula. Initiating programming education at an early age holds the potential for positively influencing students' development. Through coding, children stand to gain various advantages, including problemsolving skills, striving for improvement, learning from errors, witnessing tangible outcomes, fostering passion for their work,

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and investing effort into their endeavors. Moreover, incorporating coding into the curriculum serves the purpose of enabling students with a specific interest or aptitude in programming to further advance their skills (Yecan, Özçınar, & Tanyeri, 2017).

Coding presents an opportunity for the development of computational and mathematical proficiencies. Moreover, the coding process fosters an environment conducive to nurturing the capacity to interlink problem-solving concepts, projects, and learning methodologies (Wing, 2006). Recent research indicates that children acquiring coding skills enhance their aptitude for devising solutions when faced with challenges. Furthermore, it's suggested that children adept at using coding techniques exhibit improved capabilities in resolving issues or errors, consequently strengthening their ability to assess outcomes (Resnick & Silverman, 2005).

In Turkey, there are several instances of applications involving robotic coding. Notably, schools sustain robotic coding activities through extracurricular initiatives like maker clubs and weekend courses. Coding education has been part of the Information Technologies and Software curriculum in the country since 2012, commencing from the 5th grade. Additionally, there's a trend abroad where specialized coding training programs tailored for various age brackets, some even starting as young as 5 years old, have been identified (Sayginer & Tüzün, 2017). Studies highlight the significance of early-age coding education, emphasizing its potential to significantly contribute to students' overall development (Demirer & Sak, 2008).

Countries aiming to enhance problem-solving and fundamental educational skills, such as coding, logical thinking, and foundational abilities, have integrated robotics studies, threedimensional design courses, and coding skills into their educational systems. In contrast, developed industrial nations incorporate robotics and coding courses to bolster employability and positively impact their labor markets. In our country, secondary schools include an informatics course in the curriculum, yet shortcomings in these classes and the absence of curriculum guidance hinder achieving desired outcomes. Despite these challenges, efforts are being made through local projects to address these issues. Notably, the KodlaManisa project, initiated in Manisa province, stands out as a pioneering endeavor in Turkey's educational landscape. This project offers students in Manisa districts basic coding workshops, continuing with coding education as an elective course in 7th and 8th grades and integrated into the Information Technologies and Software curriculum for 5th and 6th grade secondary school students.

The KodlaManisa project aims to empower individuals through early-age training in coding, robotics, and threedimensional design, fostering their productivity aligned with 21st century skills and enabling them to contribute significantly to society in professions that resonate with their talents. To achieve this, secondary schools actively engage in providing coding training opportunities through workshops and courses. This initiative intends to cultivate code literacy among students, stimulate innovative thinking, nurture entrepreneurship skills, foster teamwork dynamics by establishing cause-and-effect relationships, and enhance analytical thinking abilities. The implementation involves the coordination of provincial, district, and school project teams, led by the Manisa Provincial Director of National Education. Coding training commenced in schools starting from the 2015-2016 academic year. Teachers of the Information Technologies and Software course underwent instructor training in "Basic Coding Skills," and schools introduced informatics classes. Robotic applications have been initiated within schools, enabling volunteer students to undertake diverse software or design projects under the guidance of mentor teachers in coding workshops established across 17 districts. Therefore, this study seeks to explore the perspectives of students engaged in coding workshops under the KodlaManisa project regarding their experiences with robotic coding training.

### 2. METHOD

#### 2.1. Design of the Research

This research, focused on assessing the viewpoints of students engaged in robotics and coding studies within Manisa province, utilized a survey model, which is a descriptive research method.

#### 2.2. Study Group

The research group comprised 177 students undergoing robotics and coding training across diverse public secondary schools in Manisa. The selection method employed was maximum diversity sampling, a purposive technique enabling a detailed exploration by identifying information-rich situations that align with the study's objectives. (Büyüköztürk et al., 2018). Students were chosen voluntarily from classes taught by dedicated teachers offering robotics and coding training in Manisa's secondary schools, all of whom actively participated in the KodlaManisa festival.

#### 2.3. Data Collection and Analysis

The researchers utilized a survey form specifically prepared for the KodlaManisa project, encompassing 13 questions, as the primary data collection instrument. The data obtained from this research was organized and presented in tables with frequency and percentage values.

#### 3. FINDINGS

#### **3.1. Coding Experiences**

Students were asked about their frequency of participation in robotics studies, with their responses detailed in Table 3.1. The majority of students (58.8%) reported engaging in robotics studies a few times weekly, while 27.6% indicated their participation once per week. A notably lower percentage of students participated either monthly, once per semester, or did not engage in robotics studies at all.

	- un unerpanion in 110,	sources is that the
Items	Frequency (f)	Percentage (%)
A few times a week	104	58.8
Once a week	49	27.6
Once a month	12	6.8
Once a semester	7	4.0
Other	5	2.8
Total	177	100.0

Table 3.1. Students' Participation in Robotics Studies

Responses to the question regarding the programs utilized by students in their studies are outlined in Table 3.2. Predominantly, students favored Scratch (30.6%), followed by Code.org (25%) and M Block (21.6%) for their academic pursuits. Additionally, other programs such as Lego Mindstorms (9.4%), Appinventor (6%), and Code Combat (3.5%) were also reported. The frequency percentage of students mentioning the use of Tinkercad and Arduino programs is 3.9%.

Tuble 0120 Types of Trograms Students ese in Their Studies			
Items	Frequency (f)	Frequency	
	1 5 ( )	Percentage (%)	
Scratch	157	30.6	
Code.org	128	25.0	
M Block	111	21.6	
Lego Mindstorms	48	9.4	
Appinventor	31	6.0	
Other	20	3.9	
Code combat	18	3.5	
Total	513	100.0	

 Table 3.2. Types of Programs Students Use in Their Studies

Student responses concerning their engagement in coding studies beyond workshop hours are displayed in Table 3.3. Approximately 35% of students mentioned consistently or predominantly continuing their coding studies outside the workshop, while 36.2% indicated occasional involvement. In contrast, 29.3% of students stated that they did not pursue coding studies outside the workshop.

Table 5.5. Doing Coung Studies Outside the workshop			
Items	Frequency (f)	Percentage (%)	
Sometimes	64	36.2	
Never	52	29.3	
Mostly	32	18.1	
Always	29	16.4	
Total	177	100.0	

Table 3.3. Doing Coding Studies Outside the Workshop

The summary of students' feedback regarding their satisfaction with coding courses is displayed in Table 3.4 The majority of students (74%) expressed consistent satisfaction with attending coding courses, with 19.8% indicating mostly contentment, and 6.2% reporting occasional satisfaction with the courses.

Table 3.4. Druuellis	Datisfaction with	County Courses
Items	Frequency (f)	Percentage (%)
Always	131	74.0
Mostly	35	19.8
Sometimes	11	6.2
Total	177	100.0

Table 3.4. Students' Satisfaction with Coding Courses

#### **3.2.Sources of Motivation**

Responses to the question regarding students' motivations for coding are detailed in Table 3.5. The frequency percentage of student mentioning self-improvement as their primary reason is 32%, followed by technology relevance (25.1%), for enjoyment (23.2%), participation in competitions and awards (10.8%), and success in science class (8.9%).

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Table 3.5. Students Rea		uing
Itoma	Frequency	Frequency
Itellis	(f)	Percentage (%)
To improve myself	116	32.0
Because it is related to technology	91	25.1
For fun	84	23.2
To participate in competitions and win prizes	39	10.8
To be successful in science class	32	8.9
Total	362	100.0

Table 3.5. Students' Reasons for Coding

Responses regarding the influences or motivations that prompted students to begin coding courses are illustrated in Table 3.6. Approximately 60.9% of student opinions were related to their participation in coding classes driven by their intrinsic motivation. Additionally, some students mentioned joining due to encouragement from teachers (21.2%), friends (8.9%), or family (6.7%), or with the aim of learning to code (2.3%).

Tablo 3.6. Motivators for Participating in Coding Lessons			
Itoms	Engine and (f)	Frequency	
Items	Frequency (1)	Percentage (%)	
Intrinsic motivation	164	60.9	
My teachers' encouragement	57	21.2	
My friends' encouragement	24	8.9	
My parents' encouragement	18	6.7	
Leaning to code	6	2.3	
Total	269	100.0	

Responses regarding the level of support from their teachers are presented in Table 3.7. For a significant portion of students (83.6%), teachers were consistently supportive, while for some (14.1%), teachers were predominantly supportive. Only a negligible number of students mentioned occasional or lack of support from their teachers.

Table 3.7. Students' Opinions on Their Teachers' Support			
Items	Frequency (f)	Percentage (%)	
Always	148	83.6	
Mostly	25	14.1	
Sometimes	3	1.7	
Never	1	0.6	
Total	177	100.0	

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Students' responses concerning the teachers' role in the coding process are illustrated in Table 3.8. Students indicated that teachers offered guidance during (35%) and at the end of the process (14.7%), while some experienced continuous support throughout and after the process (24.9%). Moreover, students engaged in group work (18.4%) or individual work (6.2%) following their teacher's guidance. The frequency percentage of students indicating that teachers continued studies through demonstration is minimal (0.8%).

Table 5.6. Teachers Role in Couning Trocess				
Items	Frequency (f)	Frequency Percentage (%)		
		Tercentage (70)		
Provides guidance throughout the process	135	35		
Provides guidance both during and after the process	96	24.9		
Teacher guides us, we work as a group	71	18.4		
Teacher guides at the end of the process	57	14.7		
Teacher guides us, we work individually	24	6.2		
Teachers does demonstration	3	0.8		
Total	386	100.0		

Tablo 3.8. Teachers' Role in Coding Process

The responses of students regarding individuals providing support besides their teachers are displayed in Table 3.9. It shows that 44.4% and 39.9% of student opinions respectively highlighted support from their families and friends. Furthermore, 14.5% of student responses were associated with receiving support from school principals. However, merely three students specified not receiving assistance from anyone besides their teachers.

Tablo 3.9. People Supporting Students Other Than TheirTeachers During Coding Process

Items	Frequency (f)	Frequency Percentage (%)
My family	110	44.4
My friends	99	39.9
Principal	36	14.5
Anyone	3	1.2
Total	248	100.0

The responses provided by students regarding their intentions regarding coding studies in high school and their prospective career choices are detailed in Table 3.10. A significant majority (68.9%) expressed a definite interest in continuing coding studies in high school, while around one-third (29.9%) mentioned a possibility of pursuing these studies. A small fraction of students expressed disinterest in continuing. Concerning career choices related to coding, a substantial portion of students responded with "maybe" (53.7%) and "definitely" (40.1%), indicating their openness or strong inclination toward a profession in coding. Conversely, only 6.2% expressed a lack of interest in a coding-related career in the future.

Future Career					
Items	H	High School		Future Career	
	Frequency	Percentage	Frequency	Percentage	
	(f)	(%)	(f)	(%)	
Definitely	122	68.9	71	40.1	
Maybe	53	29.9	95	53.7	
I don't want	2	1.2	11	6.2	
Total	177	100.0	177	100.0	

Table 3.10. Students' Plans to Study Coding in High School and Future Career

#### **3.3.**Contributions of Coding Courses

Responses to the question regarding the contributions of coding courses are displayed in Table 3.11. Students indicated various benefits, including learning something new (27.2%), experiencing high enjoyment (23.5%), an increase in curiosity and desires (18.5%), and the creation of new products (16.1%). Some students highlighted contributions related to problemsolving skills (7.7%) and peer teaching (5.5%). A small number of respondents (8 students) mentioned merely following the process without explicitly noting the contributions of coding.

Lessons			
Itoms	Frequency	Frequency Percentage	
Items	(f)	(%)	
I'm learning something new	148	27.2	
I enjoy it very much	128	23.5	
My curiosity and desire are	101	18.5	
increasing	101	18.5	
I am introducing a new product	88	16.1	
I am solving problems	42	7.7	
I teach it to my friends	30	5.5	
I usually watch	8	1.5	
Total	545	100.0	

Tablo 3.11. Students' Views on the Contribution of Coding Lessons

#### **3.4.Difficulties Encountered in the Coding Process**

Finally, students were surveyed about the challenges encountered in their coding studies and processes, and the summarized responses are presented in Table 3.12. Predominantly, students highlighted difficulties such as the scarcity of workshop materials (24.1%), lack of enthusiasm from peers (22.7%), limited access to robot sets (20.8%), and the inability to acquire materials outside the workshop (19.9%). Yet, less frequently mentioned challenges encompassed inadequate knowledge (6.9%) and teachers' constraints in allocating sufficient time (5.6%).

Experienced in Their Studies				
Itoms	Frequency	Frequency		
Items	(f)	Percentage (%)		
Lack of materials in the workshop	52	24.1		
Not having enthusiastic friends	49	22.7		
Not being able to access robot sets at the	45	20.8		
desired time	ч <i>3</i>	20.0		
Lack of materials outside the workshop	43	19.9		
Students' lack of information	15	6.9		
Teachers' lack of time	12	5.6		
Total	219	100.0		

 Table 3.12. Students' Opinions on the Difficulties They

 Experienced in Their Studies

# 4. CONCLUSION, DISCUSSION AND RECOMMENDATIONS

This research aimed to investigate the perspectives of students participating in coding workshops through the KodlaManisa project concerning their experiences with robotic coding training. To achieve this, a survey was administered to 177 students, gathering insights into their coding backgrounds, motivating factors, the impact of coding courses, and challenges faced during the coding process. The obtained findings were analyzed across categories that encompassed coding experiences, sources of motivation, contributions of coding courses and difficulties encountered in the coding process.

The majority of students perceive their teachers as important assets for robotics and coding training. Nearly all students receive substantial support from their teachers, who actively assist and mentor them throughout the educational journey, from start to finish. Consequently, students regard their teachers as their foremost supporters in robotics and coding education, acknowledging the ample and valuable support provided by their educators.

Students expressed that their participation in robotics and coding workshops led to acquiring new knowledge, enjoying the learning process, sparking curiosity, and fostering a greater eagerness to explore. The KodlaManisa project significantly contributed to various areas such as project design, coding proficiency, self-awareness, personal development, structured work approaches, and the creation of original games. Similar to findings in Tağci's study (2019), students in this research also highlighted the usefulness, educational value, and enjoyable aspects of robotics and coding training. Additionally, these workshops notably enhanced students' coding abilities, fostering a sense of enjoyment in creating while coding, and a desire to engage with the games they developed themselves.

One of the primary benefits attributed to robotics and coding training is their ability to facilitate learning and personal development through gamification while ensuring an enjoyable experience. Kasalak (2017) echoed similar sentiments, observing that students found these activities engaging and enjoyable, displaying willingness to actively participate while recognizing the positive impact on their overall development. Moreover, Göksoy and Yılmaz (2018) highlighted the wide-ranging advantages of robotics and coding courses, including improvements in problem-solving, creative and numerical thinking, efficient work habits, systematic and analytical reasoning, and design skills. Similarly, Göncü, Cetin, and Sendurur (2019) emphasized teachers' recognition of the significant advantages of coding education, focusing on its role in enhancing thinking processes, problem-solving abilities. creativity, and algorithmic thinking among students. Kececi's (2018) experimental research reinforced these results by demonstrating that the use of games and activities created on platforms such as Scratch not only assists both teachers and students in achieving success in their courses but also effectively teaches subjects that are commonly considered difficult and unengaging. In essence, these studies collectively emphasize the significant and transformative influence of robotics and coding education, highlighting the power of engaging, enjoyable, and skill-enhancing methods in shaping learning experiences.

Besides highlighting the benefits of coding, students also identified challenges they encountered. Nearly half of the students faced difficulties in accessing resources for their projects, with a majority citing the lack of materials as a significant issue. As a result, the main obstacle observed in robotics and coding education seems to revolve around the insufficiency of materials, resources, and suitable learning environments. Bağra and Kılınç (2019) also identified a parallel issue among secondary school students, noting challenges stemming from the limited availability of materials and applications essential for their coding learning experiences.

Based on the study's findings, several suggestions could potentially enhance and expand the effectiveness of the KodlaManisa project. Recognizing that students highly value their teachers as primary supports in coding education and find their assistance adequate, it's advisable to involve teachers actively by understanding their perspectives, needs, and suggestions. Additionally, fostering parental involvement alongside teachers becomes crucial in maximizing the project's impact. Educating parents comprehensively about the benefits of these trainings and the project itself is vital for raising awareness and ensuring their active participation. Furthermore, optimizing the workshops by providing up-to-date materials and resources, structuring conducive working hours, appointing enthusiastic and proficient teachers, and facilitating effective utilization of materials and resources by students are recommended steps to further enhance the workshops' effectiveness and impact.

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**Educational Sciences in Theory and Practice** 

# A COMPARATIVE OUTLOOK INTO THE PROGRESS AS TO ACHIEVING QUALITY EDUCATION FOR SUSTAINABLE DEVELOPMENT: THE CASES OF FINLAND, LATVIA, TÜRKIYE AND SOUTH SUDAN

#### Gülçin MUTLU<sup>1</sup>

#### Sena SEZGÍN<sup>2</sup>

#### **1. INTRODUCTION**

The term "sustainable development" (SD) was first used by Norwegian Prime Minister Gro Harlem Brundtland in the "Our Common Future" report published in 1987. The term appeared to emerge as a response to a call for a better world in which economic progress should be dealt with a close eye on environmental and natural sensitivity and also with social stability, the well-being of human beings and thus with social progress (Jutvik & Liepina, 2009). In this report which was published by the World Commission on Environment and Development in 1987, sustainable development is defined as "The development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987, p.16). Following the emergence of this definition, several activities were held to promote and further the work on the idea of sustainable development. Some of these activities included the United Nations (UN) Conference on Environment and

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Development in Rio de Janeiro in 1992 (United Nations, 1992), the Millenium Summit in 2000 in New York City (United Nations, 2000), the World Summit on Sustainable Development in 2002 in Johannesburg (United Nations, 2002) and UN Summit on Sustainable Development in 2015 in the New York (United Nations, 2015). In the conference held in New York City, that is, at the 70th Session of the UN General Assembly in 2015, a total of 17 sustainable development goals were introduced in the document entitled "Transforming Our World: The 2030 Agenda for Sustainable Development by 2030", and it was decided that world governments, heads of states, UN representatives, several non-governmental organizations, countries and their leaders should work towards the actualization of these goals that were further clarified with their relevant sub-goals by the year 2030 (United Nations, 2015). The sustainable development goals (SDGs) that were decided in UN Agenda 30 are briefly reported as follows (United Nations, 2015, p. 14):

- No Poverty (SDG #1)
- · Zero Hunger (SDG #2)
- Good Health and Well-Being (SDG #3)
- Quality Education (SDG #4)
- Gender Equality (SDG #5)
- Clean Water and Sanitation (SDG #6)
- Affordable and Clean Energy (SDG #7)
- Decent Work and Economic Growth (SDG #8)
- · Industry, Innovation, and Infrastructure (SDG #9)
- Reduced Inequalities (SDG #10)
- Sustainable Cities and Communities (SDG #11)
- Responsible Consumption and Production (SDG #12)

- Climate Action (SDG #13)
- Life Below Water (SDG #14)
- · Life on Land (SDG #15)
- Peace and Justice Strong Institutions (SDG #16)
- Partnerships to Achieve the Goals (SDG #17)

Although each of these SDGs has significant importance, SDG 4 which is "Quality Education" has been considered as a threshold to actualize all other SDGs and on the way to recognizing this assumption, one of the main results of the Johannesburg World Summit on Sustainable Development in the year 2002, which was mentioned above, was conceptualized as "Education for Sustainable Development" (ESD) in the sense that a specific emphasis was decided to be devoted to education as a key area of action and practice for the promotion of sustainable development (United Nations, 2002). In addition to this new emphasis, in 2002, that is, in the same year UN further decided the period from 2005 to 2015 as the "UN Decade of Education for Sustainable Development" which encouraged educational systems and practices to pay more and a specific attention to sustainability issues (Brunold, 2006; 2015). As was also put forth in the above account, the adoption of a total of 17 SDGs and one of them being particularly devoted to education in the label of SDG 4 "Quality Education" in the context of the UN 2030 Agenda for Sustainable Development (United Nations, 2015) further guaranteed the position and popularity of education among other SDGs.

UN further stated that each sub-goal affiliated with SDG 4 should be realized by the member countries to achieve such an important ultimate goal. The following list includes the titles of the sub-goals of SDG 4 that are relevant to various aspects of

education. These sub-goals are as in the following (United Nations, 2015, p. 17):

- Ensure Free Primary and Secondary Education,
- Ensure Equal Access to Quality Pre-Primary Education,
- Ensure Equal Access to Affordable Technical, Vocational and Higher Education,
- Increase the Number of People with Relevant Skills for Financial Success
- Eliminate All Discrimination in Education,
- Ensure Universal Literacy and Numeracy
- Ensure Education for Sustainable Development and Global Citizenship,
- Build and Upgrade Inclusive and Safe Schools,
- Expand Higher Education Scholarships for Developing Countries
- Increase the Supply of Qualified Teachers in Developing Countries

As is already mentioned above, these 17 SDGs and their sub-targets were agreed upon as key areas of practice and action to achieve sustainable development for the next 15 years as of the year 2015. That is the member states, non-governmental organizations and senior UN representatives, world leaders and shortly all participating bodies and persons were allocated a total of 15 years to manage most of these needs' areas conceptualized within the context of 17 SDGs and thus they are indeed expected to show a particular degree of progress in achieving the aforementioned key goal areas. Accordingly, it is of great importance to regularly check their progress in terms of managing these 17 SDGs in the sense that some improvements and urgent

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actions could be taken in advance to reverse any possible harms and detractions.

Comparative data from different data sources regarding educational processes and variables are of particular importance for the countries or education systems to see and modify their lacking characteristics and needs areas for achieving improvement and change. Hence, it appears that there is a need for some comparative data as to the progress of several countries to gain this comparative feedback to make valuable progress on the way to SD achievement. In this essence, the researchers of this paper aimed to explore some reliable data as to the progress of several world countries to compare and contrast several progress factors among different countries of the world. A particular interest was sought to examine to see where Türkiye is placed and the extent to which Türkiye shows progress and improvement. A particular effort was also devoted to investigating the countries with different levels or profiles of progress, that is, successful, less successful and the least successful countries were further explored.

On the way to achieve this regular progress check and comparative data and feedback from other countries, the UN developed some tools to collect data regarding the above SDGs and their sub-targets. The data from these tools have been gathered under the supervision of the UN and the scores from these data are recorded and analyzed in the context of several resources. One of these resources that are open to the public includes a website called "dashboards.sdgindex.org". Each year, several experts and researchers analyze and report the findings regarding the progress of member countries in achieving each of the SDGs in UN Agenda 30. These researchers report a profile of each of the 193 countries and how well they have accomplished these goals and sub-goals. For the year 2023, Sachs, Lafortune, Fuller, and Drumm (2023) prepared the report entitled *"Sustainable Development Report: Implementing the SDG Stimulus"* in which they provided some comparative data and their relevant figures and graphs showing each of 193 countries' progress in terms of data provided to them by these governments and their relevant authorities and research groups.

The researchers of this progress report grouped the 193 UN member states according to their overall score on accomplishing all 17 goals into five categories and ranked from 1 to 166 by excluding those countries with no relevant data for evaluation. In the first group, there were countries that had scores above 80. Countries with scores between 70-80, 60-70, and 50-60 were placed into the second, third and fourth groups, respectively. Finally, the fifth group included countries with a score of less than 50. As was also pointed out above, there was also a list of countries in which no data can be obtained and thus these countries were not included in the evaluations because of the lack of data to be accessed by the researchers. In addition to grouping the countries in terms of the overall SDG achievement as was mentioned above, detailed piece of information specifically devoted to the evaluation of the progress of countries for each and every SDG was also provided in the progress report prepared by Sachs and his associates (2023). That is, each SDG including the aforementioned education-related one was examined in a detailed manner with regard to the particular sets of indicators determined by the researchers. In this essence, this second type of evaluation in the progress report of Sachs and others (2023) was taken into consideration by the authors of this paper and the progress as to SDG 4, being the main concern area of analysis in this paper, was examined to seek the accomplishment of the countries with relevant data.

#### 2. METHOD

This qualitative study utilized document analysis as a data collection tool and the above report entitled "Sustainable Development Report: Implementing the SDG Stimulus" composed the main data source for the comparative data analysis in this paper. Given the progress of SDG 4 in particular, it was seen that the analyses of the researchers of the progress report yielded four different levels of achievement of progress, a) *SDG achieved*, b) *challenges remain*, c) *significant challenges remain* and lastly d) *major challenges remain* depending on the success rates of each country for the particular indicators each adding to the overall achievement score of SDG 4.

The researchers of this current paper first looked at the profiles of each and every country presented in the world map in the progress report. Then they decided to investigate four different countries each belonging to the four different progress categories identified by Sachs and others (2023). In this sense, when each of the four achievement levels was evaluated to see what countries were placed in the above-mentioned a-d category, it was seen that Finland is in the SDG achieved, Latvia is in the challenges remain. Türkiye is in the significant challenges remain and South Sudan is the *major* challenges *remain* category. Besides, in the process of choosing the analysis countries for this current research reported here in this paper, the researchers wanted to cross-check and corroborate the rankings of a-d countries above in terms of the overall SDG (i.e. total of each 17 SDGs) achievement irrespective of the progress as to SDG 4. In this essence, it was important to highlight that the total SDG score ranking was also taken into account in the final determination of the four countries to be included in the analyses for the purposes of this research paper. Accordingly, the overall SDG scores ranking indicated that Finland ranked first, Latvia fourteenth, Türkiye seventy-second, and South Sudan one hundred and sixty-sixth (Appendix A). Thus, these four countries were confirmed to fit into totally different categories in terms of both overall SDG ranking and particular SDG 4 progress scoring. Therefore, the researchers of this study reported here decided to compare Finland, Latvia, Türkiye and South Sudan to assess how well they have implemented SDG 4 and its relevant indicators of analysis.

It appeared that the data for comparative analysis in the progress report by Sachs and his colleagues (2023) was in fact obtained from UNESCO. Based upon this data, comparisons were carried out by the researchers of this paper according to four main indicators about which all of the selected countries have provided information. These indicators included *participation rate in pre-primary organized learning, net primary enrollment rate, lower secondary completion rate* and lastly *literacy rate* and they all formed the units of analysis to perform document analysis. Overall, the researchers compared the selected four countries with each having a different SDG 4 progress profile in terms of four specific indicators (i.e. units of analyses) that in fact linked to the sub-targets of this particular SDG.

# 3. FINDINGS

# **3.1. Findings regarding the Participation Rate in Pre-Primary Organized Learning**

The first selected indicator to compare the chosen countries is the participation rate in pre-primary organized learning. In the indicator, the percentages of the enrollment rate in the pre-primary students are presented. This indicator refers to pre-primary enrollment, which is usually between the ages of 4-6 in most countries, prior to primary school entrance. The values of the countries are evaluated out of 100.

As is depicted in Figure 1, Finland's value for this indicator is 96.87 out of 100, and it indicates that this sub-goal is achieved. That means that this country has no problems related to preprimary enrollment. Likewise, the value of Latvia for this indicator is 97.72, and it is seen that Latvia experiences no challenges with this indicator as is the case with Finland. However, when the data of Türkiye is examined, it is seen that the value of the country is 79.49, which means that for Türkiye to achieve this specific indicator, significant challenges remain. That is, it can be said that Türkiye should work towards increasing this rate for pre-primary enrollment so as to contribute to the development of its particular SDG 4 performance. Finally, given the data of South Sudan, it is seen that their value is 20.55, which means that major challenges still remain for this country to accomplish an optimal level participation rate for the pre-primary schooling level. It can be said that South Sudan's authorities should consider the issues pertaining to increasing and improving the pre-primary enrollment rate.





*Note.* The above information was elicited from Sustainable Development Report (Sachs, Lafortune, Fuller & Drumm, 2023, p. 241, 311, 439, 477) and the figure was designed accordingly by the researchers.
# **3.2.** Findings regarding the Net Primary Enrollment Rate

The second chosen indicator to compare the four selected countries is the net primary enrollment rate. This indicator aims to provide data on the proportion of children who are officially off-school age and are enrolled in elementary education. The values of the countries are evaluated out of 100.

Figure 2 presents that Finland's value for this indicator is high again, 98.30 out of 100, and it demonstrates that the sub-goal which is related to the net primary enrollment rate is achieved. In Latvia, it is seen that the value is 98.70, and the indicator has been achieved. It shows that the country has no problems with this indicator. When the values of Türkiye are examined as to the net primary enrollment rate, it is seen that the score is 95.11, but the challenges still remain. However, it can be stated that in the near future, the country may become an SDG-achieved country. Lastly, when South Sudan's data are examined, it is seen that the value is 37.64, and the country belongs to the major challenges remain category. The idea of facing support from other countries, those that are SDG achieved, to help South Sudanese authorities is likely to increase the primary school enrollment rate.





*Note.* The above information was elicited from Sustainable Development Report (Sachs, Lafortune, Fuller & Drumm, 2023, p. 241, 311, 439, 477) and the figure was designed accordingly by the researchers.

### 3.3. Findings regarding the Lower Secondary Completion Rate

The third indicator selected to compare these four counties is the lower secondary completion date. The number of total enrolled students (excluding repeaters) in the final grade of lower secondary school is divided by the total number of students who corresponds to the entrance age for lower secondary schooling level in order to calculate this particular indicator. The highest values measured for the countries for this indicator vary. While Finland and Latvia's values are evaluated out of 120, Türkiye's value is evaluated out of 140, and South Sudan's value is evaluated out of 100 (Figures 3-5). A particular limitation was mentioned pertaining to the existence of such varied completion rates when the rates of four countries were compared. That is, the authors of the progress report explained that these high percent values for the total secondary school completion rates (exceeding the ultimate 100 percent for some countries) might result from the fact that all of the children irrespective of their being enrolled to school at earlier or later ages than the common entrance age for lower secondary school or of the fact that they repeat classes were included in the analyses. Therefore, the researchers of this study developed three different figures below by paying attention to Sachs' and other's warnings about the calculations for this particular indicator (see Figures 3, 4 and 5).

As is shown in Figures 3, 4 and 5, Finland's value for this indicator is 102.07 out of 120, and this makes this country to be an SDG-achieved country. In Latvia, the value is 98.35 out of 120, meaning the country has no challenges related to lower secondary completion. In Türkiye, the value is higher than it is in Finland and Latvia. Türkiye's value is 122.52 out of 140, and it signifies that the citizens of this country are successful in completing secondary education. Lastly, the value of South Sudan is 10.23 out of 100 and it shows that the country has a long way to go because it has remaining major challenges.

Figure 3. Lower Secondary Completion Rate for Latvia and Finland



*Note.* The above information was elicited from Sustainable Development Report (Sachs, Lafortune, Fuller & Drumm, 2023, p. 241 and 311) and the figure was designed accordingly by the researchers.

Figure 4. Lower Secondary Completion Rate for Türkiye



*Note.* The above information was elicited from Sustainable Development Report (Sachs, Lafortune, Fuller & Drumm, 2023, p.477) and the figure was designed accordingly by the researchers.



Figure 5. Lower Secondary Completion Rate for South Sudan

*Note.* The above information was elicited from Sustainable Development Report (Sachs, Lafortune, Fuller & Drumm, 2023, p.439) and the figure was designed accordingly by the researchers.

#### 3.4. Findings regarding the Literacy Rate

The fourth and the last indicator chosen for comparison is the literacy rate. In this indicator, the data related to the percentage of people between the ages of 15 and 24 who can both read and write a short simple statement on everyday life with understanding were collected. The values of the countries are evaluated out of 100.

Surprisingly, there is no data for Finland regarding this indicator. This is probably due to the sufficient level of education in the country. Since it is assumed that everyone is literate, researchin this subject may not have been performed in reality. As is presented in Figure 6, the value is 99.82 in Latvia and 99.91 in Türkiye. Therefore, it can be presumed that the population aged between 15-24 in these countries can read and write at least at a basic level. Finally, when examining the literacy rate in South Sudan, unfortunately, the value shows no similarity to other comparison countries. The value for this indicator is 47.90 for the country. It can be suggested that South

Sudan authorities need to do serious studies and spend a particular degree of effort to raise the rate of literacy.



**Figure 6. Literacy Rate for Four Countries** 

*Note.* The above information was elicited from Sustainable Development Report (Sachs, Lafortune, Fuller & Drumm, 2023, p. 241, 311, 439, 477) and the figure was designed accordingly by the researchers.

#### 4. DISCUSSION AND CONCLUSION

As a result of the data analysis, it has been seen that the efforts to realize SDG 4 (Quality Education) have not been performed in equal terms for every country. Although some countries, such as Finland and Latvia seem to have reached the goal, some countries, such as Türkiye appear to have some serious difficulties with various issues, and some countries like South Sudan seem to be at the very beginning of the road to SDG 4 progress and obviously encounters serious problems (see Appendix B). Thus, it would be logical to say that there are considerable amount of discrepancies among countries to employ ESD or to promote educational sustainability, which was previously mentioned by Ohlmeier and Brunold (2015) who especially pointed out the differences among different locations

as to the speed of making changes and implementations to promote sustainable development in educational settings. Given that almost six and a half years have remained before the target year of 2030, it is an alarming and worrying issue that SDG 4, one of the most significant targets, has not yet been accomplished in most of the states. To change this and completely fulfill the intended goals with their sub-goals, each person, community and state must do the things left to their shares. With no pauses, efforts should be made to ensure that no one is left behind and that everyone receives the high-quality education they need.

It should be mentioned that apart from the four indicators chosen by the researchers, there are indicators that Sachs et al. (2023) also examined, but these indicators only existed for OECD countries. These are *tertiary* education attainment, PISA score, variation in science performance explained by socio-economic status and underachievers in science. However, since these data could not be collected from countries other than OECD members. the researchers of this paper included none of these OECD countries-wise indicators in their analyses. Part of the reason stems from the fact that the researchers of this paper wanted to include and compare countries from non-OECD and nonachieving ones like South Sudan. Thus, it was only possible to compare and contrast countries with four different achievement of SDG profiles (i.e. with achievement levels achieved, challenges remain, major challenges remain, and significant challenges remain) for these four variables used in the analyses reported in this work here. However, it should be remembered that the above four variables also deserve further attention and care as they can provide a more detailed outlook on the quality of education in the countries to be evaluated. Those variables especially related to science achievement and international test scores could be used in future studies for different groups of comparison countries as being trending and popular issues today in the education world.

In addition to the indicators given, the researchers suggest that more indicators related to education for sustainable development should be selected and analyzed. The reason for this is that SDG 4 is stated by the UN to play a key role in the realization of other goals. Hence, more detailed data should be collected by examining how countries provide education for sustainable development. To achieve this, different sub-goals, which are mentioned before, of SDG 4 can be turned into indicators and examined for each country. For instance, for the "Ensure Education for Sustainable Development and Global *Citizenship*" sub-goal, an indicator can be designed to examine how and to what extent curricula studied and practiced in world countries include and promote sustainable development ideas and their relevant SDGs. Similarly, for the sub-goal "Increase the Supply of Qualified Teachers in Developing Countries", an indicator could be developed to examine teacher quality in different countries by means of different quality indicators to be identified in line with research and literature in pedagogical sciences. With different indicators such as the ones mentioned above, the realization of SDG 4 might be examined in more detail, and gaps might be better identified and addressed among countries for improvement and innovation purposes on behalf of good quality education.

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## Appendix A

## The Ranking and SDG 4 Progress-Based Classification of the Selected Countries

Country	Ranking the Overall Performance of All 193UN Countries	The countries classification according to SDG 4	
Finland	1	SDG achieved	
Latvia	14	Challenges remain	
Türkiye	72	Significant challenges remain	
South Sudan	166	Major challenges remain	

*Note.* The information related to progress category and ranking of the countries was elicited from Sustainable Development Report (Sachs, Lafortune, Fuller & Drumm, 2023, p. 240, 310, 438, 476).

### Appendix B

Indicator	Finland	Latvia	Türkiye	South Sudan
Participation Ratein Pre-Primary Organized Learning	SDG achieved	SDG achieved	Significant challenges remain	Major challenges remain
Net Primary Enrollment Rate	SDG achieved	SDG achieved	Challenges remain	Major challenges remain
Lower Secondary Completion Rate	SDG achieved	SDG achieved	SDG achieved	Major challenges remain
Literacy Rate	No data	SDG achieved	SDG achieved	Major challenges remain

#### Selected Indicator-Based Classification of the Countries

*Note.* The researchers made the above inferences themselves by using the results from indicators analyzed in the Sustainable Development Report (Sachs, Lafortune, Fuller & Drumm, 2023, p. 241, 311, 439, 477)

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