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Style Classifications in Biology Teaching: A Systematic Review of Literature*

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Eda Doğan** **Cem Gerçek*****

Abstract

This study aims to analyse systematically the articles on teaching biology and concerning style classification which were published in international and national journals according to criteria set. For this purpose, articles of style classification which were conducted in the period between 1990 and 2022 and directed to teaching biology at pre-school, primary school, secondary school and higher education levels were reached. 48 articles published in international journals and 88 articles published in national journals were put to content analysis within the scope of the study. They were considered in terms of their theoretical framework, key words they had, methods they used, types of data sources used in their sample, the countries where they were conducted and the years when they were conducted and the conclusions they reached according to the criteria set in the sub-problems. It was found accordingly that mostly activity-based styles were examined, that "learning style(s)" were the most frequently used key words, that the research mostly used quantitative methods and that they were mostly conducted with the participation of teachers. It was also found that the articles published in international journals were mostly conducted in Turkey. The articles were observed to increase as of 2013. The results of journal articles research analysed in the final sub-problem were given in detail in four categories. This current study makes various recommendations for style classification studies concerning biology teaching.

Keywords: Style classifications, biology teaching, reviews of the literature, systematic review, descriptive content analysis.

*The paper is an expanded version of the master's thesis prepared by the first author under the supervision of the second author. (Thesis Number: 738386)

**Corresponding Author*: PhD Student, Hacettepe University, Institute of Educational Sciences, Department of Mathematics and Science Education, Ankara, Turkey. E-mail: eda.dogan@hacettepe.edu.tr, https://orcid.org/0000-0001-6985-6358

***Prof. Dr., Hacettepe University, Faculty of Education, Department of Mathematics and Science Education, Biology Education, Ankara, Turkey. E-mail: cgercek@hacettepe.edu.tr, https://orcid.org/0000-0002-7744-3825

Biyoloji Öğretiminde Stil Sınıflandırmaları: Sistematik Bir Alanyazın İncelemesi*

Makale Türü	Başvuru Tarihi	Kabul Tarihi
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Eda Doğan** **Cem Gerçek*****

Öz

Bu çalışmanın amacı, biyoloji öğretimini konu edinen ve stil sınıflandırmalarına yönelik yapılmış olan uluslararası ve ulusal alanda yayımlanan dergi makalelerinin belirlenen ölçütlere göre sistematik incelenmesidir. Bu amaç doğrultusunda 1990-2022 yılları arasında okul öncesi dönemden başlayıp ilköğretim, ortaöğretim ve yükseköğretim düzeylerinde, biyoloji öğretimi çerçevesinde yapılan stil sınıflandırma makalelerine ulaşılmıştır. Çalışma kapsamında uluslararası alanda yayımlanan 48 ve ulusal alanda yayımlanan 88 dergi makalesinin içerik analizi yapılmıştır. Makaleler, alt problemlerde belirtilen ölçütlere göre, kuramsal çerçeveleri, anahtar kelimeleri, yöntemleri, örneklemde kullanılan veri kaynak türleri, ülkeleri, yılları ve sonuçları yönünden incelenmiştir. Bulgular makalelerde en çok etkinlik temelli stillerin çalışıldığını, "öğrenme stil(ler)i" anahtar kelimesinin kullanıldığını, araştırmaların en çok nicel yöntem ile ve öğretmen adayları ile yürütüldüğünü ortaya koymuştur. Ayrıca uluslararası alanda yayımlanan dergi makalelerinde ilgili konuda en çok Türkiye'de çalışıldığı tespit edilmiştir. Makalelerin 2013 yılı itibariyle artış gösterdiği bulunmuştur. Son alt problemde incelenen dergi makaleleri araştırmalarının sonuçları dört kategori halinde detaylandırılmıştır. Bu çalışma biyoloji öğretimini konu edinen stil sınıflandırmaları için çeşitli öneriler sunmaktadır.

Anahtar Sözcükler: Stil sınıflandırmaları, biyoloji öğretimi, literatür incelenmeleri, sistematik inceleme, betimleyici içerik analizi.

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**_Sorumlu Yazar_: Doktora Öğrencisi, Hacettepe Üniversitesi, Eğitim Bilimleri Enstitüsü, Matematik ve Fen Bilimleri Eğitimi Anabilim Dalı, Ankara, Türkiye. E-posta: eda.dogan@hacettepe.edu.tr, https://orcid.org/0000-0001-6985-6358

*** Prof. Dr., Hacettepe Üniversitesi, Eğitim Fakültesi, Matematik ve Fen Bilimleri Eğitimi Bölümü, Biyoloji Eğitimi Anabilim Dalı, Ankara, Türkiye. E-posta: cgercek@hacettepe.edu.tr, https://orcid.org/0000-0002-7744-3825

Introduction

Style is one of the most important concepts involving all the individual differences (Zhang, 2000). Several studies are available in relation to style in both international and national literature. However, they are mostly about specific types of style (e.g. Köroğlu and Sıvacı, 2017; Robinson, 2009; Varughese and Fehring, 2009). Besides, there is a great gap in the literature of studies on classification of style in a specific discipline (such as physics, chemistry, biology and mathematics). On the other hand, many studies in the literature proved that positive results were obtained through teaching processes consistent with styles (Gnanadevan and Balasundaram, 2020; Kauchak and Eggen, 2005; Mayer and Massa, 2003; Yu and Zhu, 2011). Styles should definitely be considered for semantic learning. It is because failure in semantic and deep learning is frequently seen in biology teaching (e.g. Güneş and Güneş, 2005; Tsai and Huang, 2002). Cases such as ignoring the cognitive processes and trying to memorise the knowledge directly through surface learning arise (e.g. Balaban Zor and Güneş, 2023). Therefore, biology is a course- among life sciences- in which achievement is not as high as the desired (Black and Atkin, 1996; Novak and Gowin, 1984; Reed, 2004). It is also necessary to examine the distribution of style-based research about biology- a discipline difficult to understand. The author holds the belief that what style classification is and how to handle it in a way specific to the discipline will be understood better thanks to this article and that it will set an example for how to bring together research on style classification in biology available in international and national literature under the roof of style classification. The fact that the current study makes a style classification of subjects related to teaching biology and does a holistic analysis of the classifications will enable educators in the area to see the critical ideas in the issue, the points of distinction and the limitations. Due to the fact that this paper analyses systematically all the articles investigating style in teaching the subjects of biology from pre-school to higher education levels, it differs significantly from the studies in the literature. Setting out from the above-mentioned reasons, this study investigates the articles concerning style available in the literature in the period between 1990 and 2022. Answers are sought to the following sub-problems in the light of this problem:

1) What thematic codes do the articles published in international and national journals concerning biology teaching and style classification distinguish according to style-based theoretical framework, key words, methods, sample, countries and years?
2) What conclusions do the articles published in international and national journals concerning biology teaching and style classification reach?

Theoretical Framework

The theoretical framework of this study is based on the classification made by Grigorenko and Sternberg (1995)- which is one of the most widely accepted classifications. Zhang and Sternberg (2005) refer to it as "integrative model of three kinds of style" (Figure 1). The classification includes types of styles which emphasise personality, mental processes and learning-based activities and also various dimensions of them. Therefore, this current study analyses it categorises the analyses on the basis of Grigorenko and Sternberg's style classification- one of the integrative classification model.

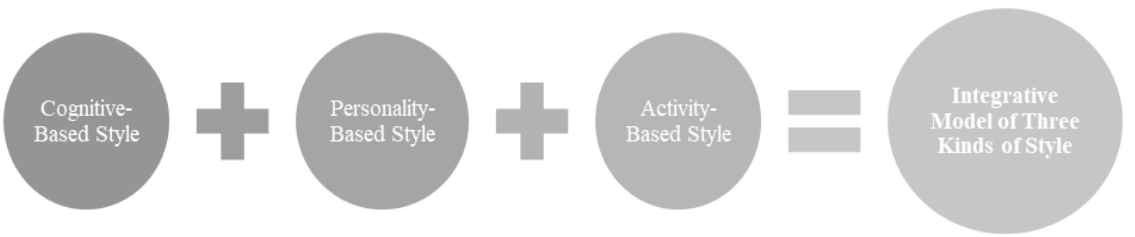

Figure 1. *Grigorenko & Sternberg (1995) style classification*

Method

This study was conducted in qualitative method of analysis and was put to descriptive content analysis in line with the sub-problems. Studies of descriptive content analysis are the systematic analyses which involve examination of research conducted on a certain subject and evaluation of their results (Cohen, Manion and Morrison, 2007; Creswell, 2012; Neuendorf, 2002). The current study analyses the research on a certain subject which were conducted in a period of time on the basis of criteria and goals stated in the sub-problems (Gough, Oliver and Thomas, 2017).

Data Collection

The population for the study is the articles published in international and national journals. In this context, the Academic Search Complete, Education Research Complete, ERIC, EBSCO, Springer Link, Taylor and Francis, Wiley Online Library Full Collection, Science Direct, ProQuest Dissertations and Theses Global, Sage Premier 2013, Scopus, ULAKBIM, Google Scholar indexes were pre-scanned with the key words "style" AND "biology education", "style" AND "biology teaching", "style" AND "science teaching", "style" AND "science education" and "style" AND "science", "style", "intellectual style", "mental self", "cognitive style", "individual learning style", "instructional style", "teaching style", "learning style", "thinking style", "decision making styles", "personality based styles", "reasoning styles". According to the pre-scanning results, the articles published in international and national journals in the ERIC and ULAKBIM indexes were found to be 95% the same articles in other indexes. Thus, all the articles published in journals which were accessible as full texts on Education Resources Information Center (ERIC) and on ULAKBIM Index-e resources were included in the scope of the study. Approximately 1900 articles were scanned in the above-mentioned databases. The articles obtained were made ready for analyses with Miles and Huberman (1994, p. 10) Flow Model. The articles for including and excluding criteria are described in detail below (Figure 2).

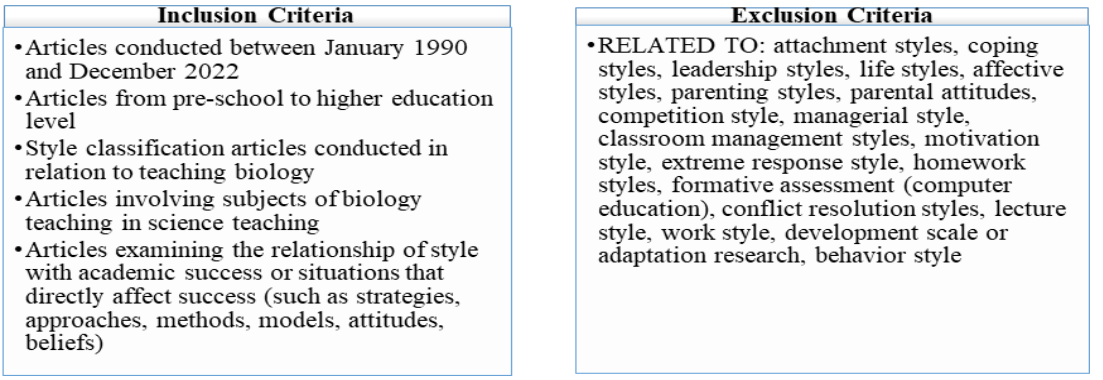

Figure 2. *Inclusion and exclusion criteria*

The headings, abstracts and full texts were analysed respectively by taking the criteria for inclusion and exclusion into consideration. Consequently, 53 out of 1196 ERIC articles were selected and 52 of them were found appropriate. 104 out of ULAKBIM Index articles were selected and 88 of them were considered appropriate. The number of appropriate articles were reduced to 48 because 4 of the ERIC articles had been coded in ULAKBIM Index data.

Coding and Analysis of Articles

"Article Review Form" was used in this study as the tool of data collection. The properties of data collection tools used in Dağhan and Akkoyunlu (2015), Bahar and Kiras (2017) and Gül and Sözbilir (2015) were used in creating the review form and the necessary permissions were obtained in writing. Expert opinion was consulted for the "Article Review Form" prepared by the researcher, and the required modifications were made in accordance with the recommendations. After that, the data were coded on the Excel by numbered and, descriptive analysis was conducted to reach the thematic

codes according to the criteria in the sub-problems. For validity and reliability, the articles were coded independently of each other and at two different times. The codes were examined by two researchers, the deficiencies were discussed and the needed corrections were made. Agreement percentage (Miles and Huberman, 1994) was calculated for the reliability of agreement between coders and it was found as 87%. It is adequate to have agreement above 80% so that the coders evaluation results could be considered reliable (House, House and Campbell, 1981). Then, the data were put to content analysis.

$$\text{Reliability Percentage} = \left[\frac{(\text{Total Agreement})}{(\text{Total Assessment})}\right]*100$$

$$= \left[\frac{48+88}{53+104}\right]*100 = 0.8662*100 = 86.62 \cong 87$$

Results

The themes and the results obtained in accordance with the criteria are listed in what follows:

As is evident from the findings shown in Table 1, the theoretical framework was mostly based on cognitive-based style (24)- which was followed by activity-based style (11)- in the articles published in international journals. Personality-based style (3), on the other hand, was the least studied theoretical basis. Apart from that, it was remarkable in four article that the theoretical basis was not clearly stated. The remaining distributions were as cognitive and personality-based (1), cognitive and activity-based (4) and personality and activity-based (1).

The articles published in national journals, however, were mostly found to be activity-based style (44)- which was followed by cognitive-based style (20). Personality-based style was not studied on its own. Yet, it was remarkable that the theoretical basis was not stated clearly in nineteen article. The remaining distributions were as cognitive and activity-based (4), personality and activity-based (1).

Table 1. *Distribution of style-based theoretical framework in the articles*

Theme	Category	Sub-Category	Code	f	%
Theoretical framework	Classification type	*Cognitive-based style*	*see Sub-Category of "Category: Analysed styles" in Table 5*	44	32
		Personality-based style		3	2
		Activity-based style		55	40
		Cognitive and Personality based style		1	1
		Cognitive and Activity based style		8	6
		Personality and Activity based style		2	1
		Unspecified		23	17
Total				**136**	**100,00**

According to Table 2, the most frequently studied topic was activity-based style in both the articles published in international and national journals (136 article in total), and therefore, "learning style(s)" (63) was the most frequently used key word. It was another finding accordingly that Kolb learning style(s) (11) were the most frequently studied topic in activity-based styles. While the articles published in international journals were conducted mostly with the inclusion of science teachers (pre-service/biology) (11); the articles published in national journals were conducted mostly with the inclusion of teacher candidate(s) (23). It was found that the phrase "academic achievement" was used in different ways among the key words in the articles published in international journals. No key words were used in 6 out of 136 article. Second most frequently studied topic was cognitive-based styles. The key words of thinking style(s) (18), attitude (10), learning strategies (6) and critical thinking (6) were remarkable (Table 2).

Table 2. *Distribution of the key words used in the articles*

Theme	Category	Sub-Category	Code	f
Keywords	Articles	*Top key words in articles*	*Learning style(s)*	63
			Teacher candidate(s)	23
			Academic achievement/ Academic performance	17
			Thinking style(s)	18
			Science teachers(pre-service/biology)	11
			Kolb learning style(s)	11
			Attitude	10
			Learning strategies	6
			Critical thinking	6
			No key words	6
			Learning	5
Total				**136**

As is clear from Table 3, quantitative method was the most frequently used method in the articles published in international as well as in the articles published in national journals- which was followed by qualitative method and then by mixed methods. The most frequently used quantitative methods were survey, descriptive, correlational, experimental and semi-experimental models, respectively. Phenomenology and case study were used as the qualitative methods in the research mentioned. It was found that mixed method research were used less than quantitative and qualitative method research. Besides, it was also remarkable that there were articles for which the research methods or models used were not clearly stated.

Table 3. *Distribution of the methods used in the articles*

Theme	Category	Sub-Category	Code	f	%
Method	Research method	*Pattern/Model*	*Quantitative*	114	84
			Qualitative	13	10
			Mixed	9	7
Total				**136**	**100,00**

According to Table 4, the articles published in international journals were mostly conducted with the participation of university/college students (11)- which was followed by articles that were conducted with the participation of teachers (8), teacher candidates (6), elementary school students (6), secondary school students (6), high school students (5), teachers and students (4), pre-school children (1) and secondary and high school students (1).

The articles published in national journals, on the other hand, were mostly conducted with the participation of teacher candidates (41)- which was followed by articles conducted with the participation of secondary school students (14), high school students (11), university/college students (10), teachers (7), teachers and teacher candidates (2), teachers and students (1), pre-school children (1) and elementary school students (1).

Table 4. *Distribution of samples used in the articles*

Theme	Category	Sub-Category	Code	f	%
Method	Sample	*Data source type*	*Teacher candidates*	47	35
			Teachers	15	11
			Teacher and teacher candidates	2	1
			Teachers and students	5	4
			Pre-school children	2	1
			Elementary school students	7	5
			Secondary school students	20	15
			High school students	16	12
			Secondary and high school students	1	1
			University/college students	21	15
Total				**136**	**100,00**

It was found on examining the articles published in international and national journals according to the countries where they were conducted that all of the articles published in national journals were conducted in different cities. Therefore, the countries where the ERIC articles were conducted are listed here (see Figure 3). Accordingly, the distribution of the country in articles published in international journals are as in the following: Turkey (15), Indonesia (7), the USA (6) Nigeria (5) and India (2). In addition to that, three different articles were conducted with samples taken from "Turkey, Scotland, Netherlands and Germany", "Turkey and the United Kingdom" and "China and the USA".

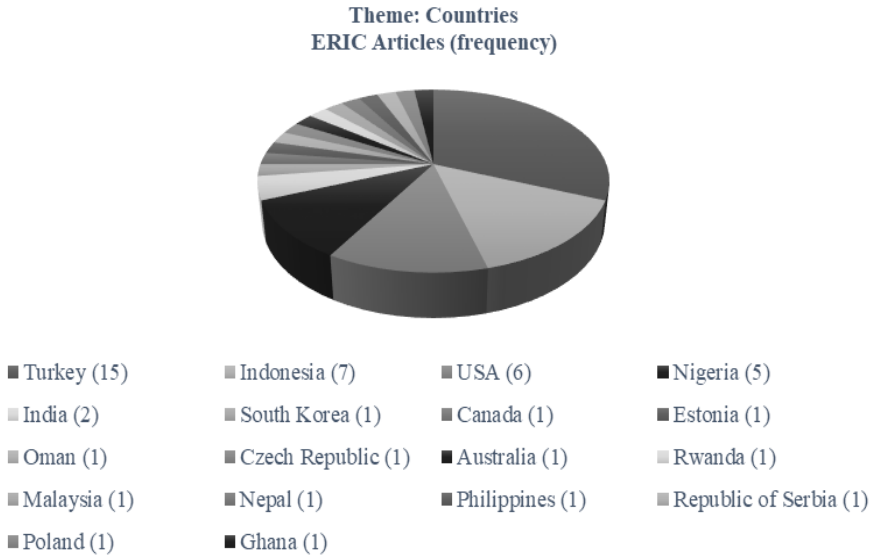

Figure 3. *Distribution of the articles according to the countries*

An analysis of the articles published in international and national journals is shown in Figure 4. Accordingly, the articles published in international journals began with the year 2005. Style-based research were frequently conducted in 2019 (8). Yet, the distribution of the articles conducted in 2005 (1), 2010 (1) and 2011 (1) was low (see Figure 4). The articles published in national journals scale, however, started with the year 2002. Style-based research were frequently conducted in 2013 (10); but the distribution of articles conducted in 2003 (1), 2008 (1) and 2020 (1) was low (Figure 4).

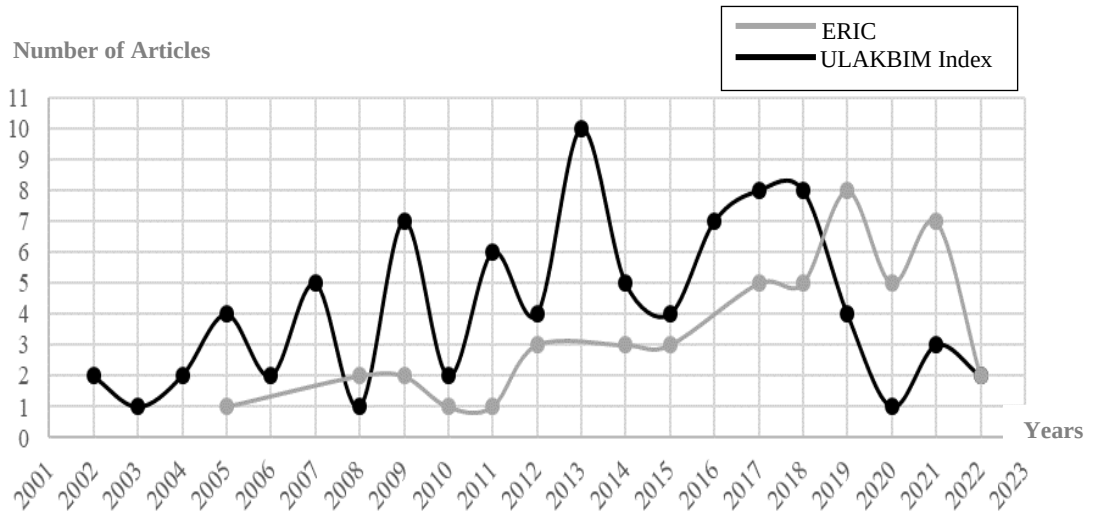

Figure 4. *Distribution of the articles according to the years*

Four categories were distinguished for the themes obtained in the research results of articles published in international and national journals (Table 5). Category one- analysed styles- was divided into six sub-categories and seventeen codes were found. This situation demonstrated that the research concerning style classification and biology teaching varied greatly. Types of style for each sub-category were stated in codes (Table 5). It was observed in the research that different types of styles could be used together. The analyses showed that the number of personality-based research was not as great as cognitive and activity-based research. Thus, the situation was indicative of the fact that personality-based research were not chosen as frequently as cognitive and activity-based styles.

The sub-category for category two, styles with learning and teaching process components about biology, was labelled as "subject related to educational sciences" and ten codes were found for it. Each code was determined according to the subjects which were associated with style types and which were analysed. While some of the research analysed only a certain type of subject (for example, teaching methods only) and type of style, some others analysed different subjects (e.g. such as both attitude and motivation) simultaneously with a type of style. Similar or related subjects were distinguished as a code (e.g. learning and teaching approaches) by taking this situation into consideration. First six codes for category two were found as the subjects chosen for research the most frequently (Table 5). In addition to that, the research which did not state a specific subject of educational sciences analysed "achievement or area, branch and department" along with style types.

Table 5. *Sub-themes of "the results of journal articles research" theme*

Theme	Category	Sub-Category	Code
Results of research	Analysed styles	*Cognitive-based*	*Thinking style* *Cognitive style* *Decision making style* *Image/ perceptual learning* *Intellectual style* *Cognitive and creativity style* *Multiple intelligence*
		Personality-based	*Personality types*
		Activity-based	*Learning style* *Teaching style*
		Cognitive and Personality-based	*Thinking style and personalities traits* *Multiple intelligence and personality*
		Cognitive and Activity-based	*Multiple intelligence and learning style* *Metacognitive and learning style* *Conceptual understanding and learning style* *Cognitive style and learning style*
		Personality and Activity-based	*Personality types and learning style*
	Styles with learning & teaching process components about biology	*Subject related to educational sciences*	*Dispositions and learning skills*
			Teaching methods and techniques
			Learning and teaching approaches
			Teaching strategies
			Attitude and motivation
			Beliefs, awareness, anxiety, perception and images
			Educational phisophies
			Educational technology and resource use (course materials)
			Creativity and teaching barriers
			Pedagogical competence

Style with biology topics	*Subfields of biology*	*cell, food chain, habitats, human system, tissues, photosynthesis, cell respiration, nature of science and scientific inquiry, living world, classification of living things, living things and environmental sustainability, environmental pollution, animal physiology, cell division, nutrition, biological molecules, genetics, anabolic and catabolic reactions, socioscientific issues*
Use of the word style		*Expressing the word "style" with diffrent words* *Confusing "style" with "method" and "approach"*

The sub-category for category three, style with biology topics, was distinguished as "sub-fields of biology" and nineteen codes were distinguished for it. Biology sub-fields were described as eight sub-branches- namely as, cytology, histology, genetics, physiology, anatomy, zoology, phythology and ecology. The codes were written as the fundamental subjects considered in the research within each sub-branch. Thirteen of the articles published in international journals and fourteen of the articles published in national journals stated the subjects of biology they focused on clearly. The articles published in international journals did the analyses for the subjects of: cell biology under four headings formulated as the structure and function of the cell membranes, nucleus-ribosomes-protein synthesis, cell cycles and cell communication; food chain, habitats, animals and plants; a human skeleton, bone reinforcement, joints, muscles, bone disorders, joint disorders and muscle disorders; the basic concepts about biotechnology, describe the conceptual relations, raise consciousness about genetically modified organisms (GMOs) and to evaluate the benefits and harm of GMOs; human organ system, photosynthesis and objects' characteristics; what is science?, differences, scientific knowledge, dinosaur issue, weather forecast, science models and creativeness by means of nature of science (NOS) and the issues of activity characteristic, scientific work, bird issue, characteristics of work, data analysis and evidence of data by means of scientific inquiry (SI); textbook analysis involving the concepts of amphibians and reptiles and teachers' beliefs about amphibian and reptile analysis; socio-scientific scenarios and such subjects as candys and creation of GMO, nutrients and health hazards; sub-acquisitions about introduction to the living world; what is the living thing itself and how its interaction with the environment, living things, biotic and abiotic components, environment and energy, living things mainly on plants and technology which is inspired by it and environmental sustainability; respiration and nutrition; difficult biochemistry concepts to study; and the relevant concepts under the headings of biological molecules, nucleic acids, photosynthesis, cell respiration, homeostasis; cell biology, genetics, plant biology and animal physiology. Learning the biological concepts occupied a significant place in the articles published in international journals. In addition to that, socio-scientific subjects, cell and biological molecules and living world were the frequently studied subjects in the articles.

The articles published in national journals did the analyses for the subjects of: proteins; cell division (mitosis and meiosis division); daily associations about the subject of systems in our body; cells and plant tissues; classification of living things and used the basic concepts of the subject; all the basic concepts of cell division; pre-school children and environmental observation, the habitat of living things in nature, animals, animals' movement and their skeleton; case-based learning and environmental pollution and its consequences; living things; the systems in our body and studied cell and its structure, unicellular and multicellular organisms, blood and muscular tissue specifically; socio-scientific issues (GMO, hydroelectric power plants [HEP] and organ donation). Learning the biological concepts occupied a significant place in the articles published in national journals. In addition to that, cell, tissues and cell division and systems were the frequently studied subjects in those articles.

In category four- use of the word style, it was found that the word style was used along with other words (such as modality, orientation and form) or that it was signalled with different words (such as model, method, approach, skill, disposition). It was more frequent in the articles published in national journals.

Discussion, Conclusion and Recommendations

This study, which examines the articles published in international and national journals which were concerned with biology teaching and which were directed to style classification, distinguishes the codes for themes of theoretical framework, key words, methodology, sample, countries and years. It was remarkable in the theme of theoretical framework that style types were studied together in both the articles published in international and national journals. It might have stemmed from the fact that individuals could not be considered as unilateral in terms of individual differences. Because individuals are rather a whole with their mental processes and personality traits and with their specific ways to actualise learning-teaching based activities (Sternberg, 1997; Zhang, 2000; Zhang and Sternberg, 2005). This provides researchers with opportunity to analyse cognitive-based, personality-based and activity-based styles altogether. Besides, the fact that personality-based styles were studies less often in the articles published in international and national journals might have stemmed from the fact that personality was associated rather with typological theories and thus, from the thought that it was mostly the domain of psychology. Secondly, it might have also thought that personality could be revealed and analysed through cognitive style in the area of education. It may be concluded due to these two reasons that personality-based style was not emphasised. Besides, one of the most important components of individual differences is personality (Jung, 1923). It was found in the literature that researchers had made efforts to understand individuals' perceptive choices by conducting personality-based analyses at the beginning. Cognitive-based and activity-based classifications influence each other substantially and complement each other (Riding and Cheema, 1991). For this reason, some researchers do not consider personality-based classification very important and they argue that such classifications do not contribute much to theories and approaches related to style research (Rayner and Riding, 1997). The findings obtained are also supportive of this. However, personality-based classifications (and personality) also occupy a place in studies of style classification and cannot be disregarded (Allport, 1937; Curry, 1983; Cuthbert, 2005). Twenty-three of the articles which were analysed in this paper, however, did not state their theoretical bases clearly. Theoretical basis is signalled for measurement instruments used or for research purposes. This was detected more in the articles published in national journals in contrast to the articles published in international journals. The main reason for it might be that research were in the format of articles and therefore there was no obligation to make explanations as in theory-based theses. Secondly, the theoretical bases of research might not be determined or research might not have theoretical bases. Another possibility might be that the theoretical basis of a research influenced by more than one theoretical basis was not directly stated. But it is important to state the theoretical framework clearly in style-based research.

In the theme of key words, eleven codes were distinguished. The frequencies of the key words learning style(s) and thinking style(s) were supportive of the results of theme one. It was found according to the codes that the research had worked the most frequently with activity-based styles and second most frequently with cognitive-based styles. The reason for it might be that research had points which were not clarified and considered worth analysing. On the other hand, the frequency of Kolb learning style(s) code supports the fact that the Kolb learning style inventory is frequently used in research of activity-based style as a measurement instrument. It is also a finding supportive of the fact that Kolb experimental learning theory is frequently used as the theoretical framework. Most of the research of teaching styles were found to have adopted teacher-centred styles of teaching (Baran, 2019; Kalyon, 2020). Analysing teaching styles frequently might have stemmed from the fact that the approaches adopted by educators of the area were among the most important elements influential in learners' achievement. Another reason might be the importance of analysing teaching styles- a reflection of individuals' own learning styles. It was found in totally six article that key words were not used. This was found to be more in the articles published in international journals than in the articles published in national journals. The reason for it might be the unnecessity to write key words in journal format or personal attitudes towards writing key words.

On the other hand, both the articles published in international and national journals, used quantitative method the most and mixed methods the least and they used the survey model the most and case study and phenomenology the least in pattern/model selection. The theme of method was analysed in the category of research method and in the sub-category of pattern/model. According to

the findings, not emphasising the use of qualitative and mixed methods in research might have stemmed from the fact that qualitative and mixed method research need more time and more performance in terms of analysis. On the other hand, the fact that quantitative method research suggest more mathematical and therefore clearer results could be a determining factor in terms of methodology.

The theme of method was analysed in the category of sample and in the sub-category of data source type. In both the articles published in international and national journals were mostly conducted with the participation of teacher candidates. The reason for it might be that pre-service teachers were the most easily reached samples. Another reason might be that sample groups' participation in the research or permission for research was a determining factor for the sample groups. Considering the number of students between pre-school and higher education, it may be said that a considerable number of research conducted with the participation of students are also available. Because data source type, which was called teacher candidates, was university students. On the other hand, the number of research conducted with samples of teachers, teachers and students, teachers and teacher candidates and pre-school children was quite small. The reason might be the impossibility to analyse these sample groups altogether and to analyse the data due to difficulties in stages of data evaluation. Another reason might be the determining role that sample groups' participation in the research or research permissions play in the sample groups.

In the theme of countries, the highest frequencies in the articles published in international journals were in Turkey, Indonesia, the USA, Nigeria and India. The extent to which developing and developed countries attach importance to individual differences in education could be considered as a determining factor.

On the other hand, style is a topic which gained popularity in the 1990s. In addition to that, it has not lost its importance since the 2000s. Besides, the theme of years the number of both the articles published in international and national journals increased after the year 2013. It may be attributed to the increase in importance attached to education and also to prominence of individuals and individual properties in education.

Finally, the 136 article were analysed in the theme of "the results of journal articles research". Four categories were distinguished for the theme. The diversity of style types was revealed in the category of analysed styles. The code of intellectual style was found here. The concept of intellectual style was found to be explained on the basis of cognitive-based style. The reason for it might be that the concept had associations related to cognition. A second reason might be that the concept prioritised cognitive-based style and its components in research of style classification. In fact, the concept emerged from the conception of theory involving all style types. It is based on the theory of mental self-government (Sternberg, 1997) and is described as the most general concept containing all of the different types of styles (Zhang and Sternberg, 2009). According to Zhang and Sternberg (2005), the threefold model of intellectual styles involves all style types available and their constructs even though it gives weight to cognitive styles, and it is based on individual differences and personal traits. Therefore, Grigorenko and Sternberg's style classification can also be analysed and explained on the basis of threefold model of intellectual style. It is because Grigorenko and Sternberg's style classification considers mental (i.e. cognitive), personality and activity-based styles altogether and is holistic. Thus, no matter what classification is preferred in style research, different uses of style can be avoided through the concept of intellectual style-which is based on threefold model of intellectual styles. The diversity of style classifications and the differing style types and dimensions cause confusion in the literature. Analysing the dimensions of style through various tools of data collection (style scale, inventory, survey, test or form) naturally increases the extent of confusion. (Even the existence of more than one scale or inventory of learning styles exhibits the variation in this point). The above-mentioned confusion also causes differences in the definition and use of the word style. Thus, it causes incomprehensibility. Especially, incomprehensibility stemming from translations is available in the articles published in national journals. On the other hand, the subject of educational sciences considered along with style was found in research in the category of "style with learning and teaching process components about biology". Styles are a property which is difficult to change or which are closed to changes in a short time (Sternberg, 1997). Because styles are basically a

personality trait (they are not an ability or a skill). The selected subjects were revealed through the codes distinguished in this category while doing analyses in relation to the shaping or change of styles in individuals. Research subjects were uncovered specifically in the category of style with biology topics. Two codes in total were distinguished in the category of "use of the word style". The codes are indicative of the place the word style occupies in the literature. Setting out from the conclusions of this study, new systematic analyses could also be done by revising all the scope and limitations in current study, by using different indexes and by reviewing the relevant theses.

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