

İnce, 2018

Volume 4 Issue 1, pp.153-164

Date of Publication: 20th March 2018

DOI-<https://dx.doi.org/10.20319/pijss.2018.41.153164>

This paper can be cited as: İnce, N. (2018). *The Extent of Correspondence Between Curriculum and Science Classifications in the Ottoman State (16th to 19th Centuries)*. PEOPLE: International Journal of Social Sciences, 4(1),153-164.

This work is licensed under the Creative Commons Attribution-NonCommercial 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc/4.0/> or send a letter to Creative Commons, PO Box 1866, Mountain View, CA 94042, USA.

THE EXTENT OF CORRESPONDENCE BETWEEN CURRICULUM AND SCIENCE CLASSIFICATIONS IN THE OTTOMAN STATE (16TH TO 19TH CENTURIES)*

Nazife Nihal İnce

Arabic Language and Rhetoric Department, Akdeniz University, Antalya, Turkey
nihalince@akdeniz.edu.tr

Abstract

To develop an idea about the scientific developments in a particular field of a particular period, it is important to examine the types of sciences handled by scholars as well as the types of sciences involved in the school curriculum. This paper is trying to achieve an idea about the correspondence between the curriculum and the knowledge that had been produced in a specific field, which is Linguistics, and within specific era, which is from 16th to 19th century of the Ottomans. To do this, we are going to give a description about the school curriculum of language sciences and the widely accepted classification of language sciences among the Ottoman scholars, with a study on the extent of correspondence between the two. The examination of the correspondence between what the classification of sciences suggests and the ongoing application within schools would provide information about the Ottomans' approach to Arabic language education and the general concept of linguistics at that era. It was seen that there was not a perfect correspondence between the fields of linguistic studies and the curriculum. One of the sub-outcomes of the research shows that the curriculum reflects only the language sciences which were defined as primary fields. To understand the reasons of this half-corresponding relation, similar studies about other eras need to be done.

Keywords

Classification of sciences, Arabic language sciences, Curriculum, Madrasa, Ottoman State

1. Introduction

The normal processes of resuming all kinds of knowledge begin with producing knowledge first and then spreading it through formal and informal ways. This means that the producers of the knowledge have an indirect influence on shaping the curriculum. But it is unclear to what degree the school curriculum of a period reflects the scientific developments of that period. The primary task of teachers seems to be to maintain the continuity of knowledge, but the majority of the teachers, especially in higher education institutions, were at the same time the producers of knowledge. Here a question reveals itself: Were all types of sciences in a particular period taught as a lesson in the schools of that period?

What is said about science in general is true for language sciences as well. The process, simply, as follows: A study in linguistics leads to the extension of some topics or to the emergence of new fields and naturally, these fields in return are reflected in the school curriculum. A study on such a relationship in language sciences could provide us a data that could be useful in various study fields, especially in linguistic historiography. Considering that there cannot be a ready-made framework for a research on linguistic historiography (Jankowsky, 1995), this study tries to arrange such a suitable framework.

To be able to examine the relationship between the curriculum of language sciences and the current scientific studies of that period, we need data from both sides. Course topics of language sciences taught in actual educational and training activities of any period can be obtained from sources such as history records, degree certificates and autobiographies (Khalidov, 1995). The sources we used here are predominantly based on sources of history and certificate examples. As to the language sciences that have developed in any period can be obtained from history records also, but the more authentic way is to examine the exact works of the scientists by their titles and contents. The direct way of achieving the genres of the sciences is to utilize 'the classification of sciences' that had been established by the scholars in general. Science classification was one of main concerns of the philosophers, but it is known that each discipline tends to develop its own classification as well. In this study we will limit ourselves with the data that had gained from classification literature which has a long history. In sixteenth century, after a period of silence, scholars begun to compile on the classification of the sciences. This revival coincides with the same ages of raised complaints about some aspects of educational system in early seventeenth.

2. About the classification of language sciences

The early works on classification of science in Islamic world dates back to the eighth century AD (Steams, 2011). These works mostly written by philosophers. The division of philosophers, according to the majority of researchers, had developed under the influence of

the ancient philosophers' classification of science (Endress, 2006). Being a continuation of the ancient classification does not mean that the entire classes and thereby the subjects were the same, instead Muslim philosophers took the main idea of classification then build upon it a new scheme. In contrast to Aristotle's classification of theoretical, practical and auxiliary of ancient Greeks; the medieval classification, with little exceptions, has more classes of sciences, e.g. al-Fārābī classifies the sciences to: language sciences, logics, preliminary sciences, physics and metaphysics and the last class for humanities, law and theology (Uyanik, Akyol & Arslan, 2017). The work of Ibn al-Nadīm, among these early works, was different since he was not a philosopher but a bookseller. Ibn al-Nadīm divides the sciences, better to say the works of scholars by the mean of books or treatises, into ten classes; languages and scripts, grammar, literature and history, poetry, theology and sects, philosophy and sciences, myths-magic, beliefs-doctrines, alchemy-craft (Dodge, 1970). In this respect the classification made by Ibn al-Nadīm could be considered as an independent and original classification.

It seems that working on science's classification lost its attraction among the scholars for a while. In sixteenth century, during the Ottoman era, science classification gained the attention of the scholars and they began to compile on this subject. In this paper we will be limit ourselves with three books as an example books which are *Miftāḥ al-Sa'ada* of Tashkopruluzāda, *Kashf al-Zunūn* of Kātip Chalabe and *Tartīb al-'Ulūm* of Sachaklizāda. The common features of these three books is that they all are written in same era by the Turkish scholars.

Among these three, only Tashkopruluzāda's can be considered solely a book on classification. The contents of Tashkopruluzāda's book and the titles demonstrate clearly that the author's main concern was to classify, regardless of the circumstances that led him to compile on science classification (Tashkopruluzāda, 1985). The other two books, of Kātip Chalabe and Sachaklizāda, contain the notion of classification but within different frameworks and from different perspectives. While the former concentrates on the compilations on each class along with their commentaries and annotations; the latter focuses on the levels of the books in each class in terms of their shortness and length or their usability as a textbook in a madrasa (Kātip Chalabe, 1941; Sachaklizāda, 2001).

As to the subdivision of language sciences we cannot see a clear and unified subdivisions in early ages. What could be observed clearly is the increasing number of the branches of language-based disciplines beginning from eighth century until thirteenth century. In early ages the number of branches referred nominally were very few despite the immense number of linguistic and literature related works as we see through bibliographical works like

Ibn al-Nadīm's. The reason behind this was that linguistics was in the proses of emergence and that linguists were trying to capture everything that has a relation with language. Thus, the tremendous efforts of scholars in early ages resulted in the emergence of new branches like *balāgha* along with its subdivisions which later on considered as one of the main branches. These subjects begun their journey of emerging at tenth century and reached their final form by twelfth century. The first explicit attempt to divide the language sciences was by al-Sakkākī (twelfth century) who opened the door of the idea of dividing language sciences into branches in a way that is very similar to nowadays language levels (Larcher, 2013). Then the widely accepted subdivision of language sciences comes, which is the division of Sayyid Sharīf al-Jurjānī who talked about twelve branches of primary and secondary language sciences in his commentary on al-Sakkākī's work (Celik, 2009).

These developments demonstrate that although the classification of the general class has been stopped for some time, the classification movement in the linguistics has been continued. For example, one of the goals of Ali Qushjī (fourteenth century) who had a great influence on forming *Sahn-i Samān* madrasas was to write a book that contains all the twelve branches of Arabic language studies, but he could not reach his goal due to unforeseen reasons (Qushjī, 2001).

It is important to note that the medium teaching in Ottoman Schools was Arabic and therefore the textbooks were Arabic and the language subjects were on Arabic such as *naḥw*, *ṣarf* and *balāgha*. During Ottoman times, the Arabic language was the language of academia. This was what the conception of the continuity of the education and scholarly works in Islamic thought demanded. The education institutes continued their studies, even if the dynasties that govern the land which the institutions stand on change. And this was the case in the Ottoman State as well, like the other Turkic dynasties or Persian and Indian dynasties.

In Ottoman era the subdivision of Arabic language sciences had become stable in some sense. The scholars talked about twelve branches of Arabic language sciences. This number was developed from initial division of al-Jurjani who had divided language sciences into twelve branches that are: *lugha*/lexicology, *ṣarf*/morphology, *ishtiḳāq*/derivation of words, *naḥw*/syntax, *ma'ānī*/semantics-pragmatics, *bayān*/stylistics (including *badī'* which is an art of speech based on the sound-form or meaning-form relation between words), *arūdh*/prosody, *qāfiya*/rhyme, poetry composition, prose composition, lectures and the principles of spelling (Qushjī, 2001). The number of language branches fixed into twelve but the names of the branches slightly differed; so, when they included a new branch into the twelver-category, they either renamed two branches into a single one or left out one or two

from the category. For example, later divisions added the science of *wad'* and took out lectures or prose compositions in return.

As it is mentioned the widely accepted branches were twelve. Although the sources which all these branches depended on in systematizing were common, which is the language and its manifestations, each branch had its own system and therefore had an identical characteristic. We can clearly see the distinction of branches from the diversity of works that had written in the field of language. Hence, theoretically, each branch has the right to be taught independently but in actual practice this was not the case.

3. About madrasas and their curriculums

Madrasa is the most common and wide-spread educational institution in Islamic civilization which teaches, largely, the religious subjects. A student can join these schools only after completing the primary education. The term madrasa dates back to eleventh century, when the structures containing both a mosque and a rest house had been built and funded. Before that, as in all medieval Islamic societies, education was tied to individual scholars. Instruction was therefore not institution-bound and could take place at a variety of locations, including private homes and shops in addition to the mosques (Khalidov, 1995). Madrasas gained more attention through the time for the advantage of being funded and multi-disciplined curriculum. Being built and funded by the local governors and having the most respected scholars, madrasas acquired a sense of formality. If we put the semi-formality of madrasas aside, we can say that almost all educational institutions had the same layout, e.g. the method of teaching, the system of chairing etc. For independent schools being mosques at the same time or buildings connected to the mosques, the continuation of these schools in new states, after passing to another dynasty, was easier, and this is what happened after the Ottoman conquest of Anatolia. On the other hand, state-affiliated madrasas were, also, able to continue because each conquering dynasty was careful to honour scholars. It is important to note that there was not a complete affiliation and the adherence was in the form of encouragement and protection. Until the conquest of Istanbul and the foundation of the formal schools which called *Sahn-i Samān* by Sultan Mehmet the Conqueror the case was that aristocrats or royal family members build a madrasa and set a fund to finance scholars and senior students who serve there. After the foundation of *Sahn-i Samān* the state's control over madrasas increased gradually until the majority of madrasas turned into formal institutions as nowadays schools (Ipsirli, 2003). Ottoman state was needed to formalize the schools because these institutions became the sources of its official workers. But in general, the schools continued their tradition of teaching with their independent curriculums.

The concept of curriculum in medieval Islamic schools whether it was formal or informal, is different from nowadays concept of curriculum. The idea of learning, studying or acquiring any discipline was based on interactive reading of a book on a subject under the guidance of an expert. The expert, depending on the level of learning, could be the scholar himself/herself or a candidate teacher or even a senior student, and the reading activity could be done by the scholar or the student. During reading activity, the teacher progresses the lesson by making explanations or by correcting the readings of the students. But the choice of the textbook that meant to be taught belongs to the teacher. This nature of transmitting knowledge brought with it a continuity of standard texts from earlier periods that contributed to certain uniformity in curriculum throughout the Islamic world. But, regional variations did exist, and new developments in some fields resulted in the addition of new authoritative texts to the curriculum of Islamic higher learning (Khalidov, 1995).

The largest share of the curriculum in madrasas was reserved to religious sciences, followed by the language sciences which had a significant portion. Due to considering language sciences and logics together an auxiliary science, these subjects were generally taught in first levels of the madrasas. However, religious lessons were taught in the first levels also. But the religious sciences taught in first levels were short textbooks containing the bases of belief, catechism and ethics. The system was built upon the idea of acquiring the ultimate knowledge, which is the knowledge of interpretation of the verses of Holy Qur'an. Thus, the first levels' curriculum would be the auxiliary sciences like language and logic. Since some religious subjects cannot be delayed for many years, the solution was to compensate the gap by including some short treatises between the main courses which were language sciences and logics (Sachaliziāde, 2001).

Here we will refer to some sources to figure out an approximate schedule of curriculum of language sciences. Before figuring the approximate curriculum, we should note that the stages of madrasas were not clear until the late seventeenth century. At the mid-sixteenth the eight madrasas of *Sahn-i Samān* was expanded to twelve, which pointed to the stages, but the idea of staging was still not clear. Thus, it would not be wrong to base the approximate curriculum on these stages since the large part of the period covered in this study is after sixteenth century. The stages were divided into *iqtiṣār*, literally means to limit; *iqtiṣād*, literally means to suffice; and *istiṣḡā*, literally means ultimate. Each stage was subdivided into three levels: Elementary, intermediate and high. These stages and the levels within the stages were not period-bounded; instead the completion of a level depends on the completion of the textbook, in which the student would be given an *ijāza* or *tamassuk* (a type of diploma).

4. The adaptation between the classification of Arabic language sciences and the curriculum

The references, with some exceptions, refers to the curriculum by mentioning the name of the subject with its textbook owing to textbook-bounded character of the curriculum. For the sake of simplicity, it would be useful to limit them to subject names. These subjects are *lugha*, *ṣarf*, *naḥw*, *ma'ānī*, *bayān*, *arūdh*, *qāfiya*. Here we will try to apply the approximate curriculum on the stages named *iqtīṣār*, *iqtīṣād*, and *istiṣṣā*, since the stages were applied even if it was implicitly.

The approximate language curriculum of **Iqtīṣār** stage:

Lugha/ Lexicology: some lexicons were recommended at the early levels

Ṣarf/ Morphology taught in all levels (elementary, intermediate and high level)

Naḥw/ Syntax taught in intermediate and high levels

Ma'ānī and bayān/ Semantics-pragmatics and stylistics: a very short textbook taught in high level after completing syntax textbooks.

The approximate language curriculum of **Iqtīṣād** stage:

Ṣarf /Morphology taught in elementary and intermediate levels

Naḥw/Syntax taught in intermediate and high levels

Ma'ānī and bayān/Semantics-pragmatics and stylistics: taught in any level after completing syntax textbooks.

The approximate language curriculum of **Istiṣṣā** stage:

Naḥw /Syntax taught in any level

Ma'ānī and bayān /Semantics-pragmatics and stylistics: in any level.

| | Elementary Level | Intermediate Level | High Level | Optional Subj |
|---------|--|--|--|--|
| İQTİŞAR | TAJWEED: <i>Durr Yetīm</i> LEXICOLOGY: <i>al-Qāmūs, al-Sihāh etc. Arabic Lexicons</i> MORPHOLOGY: <i>al-Amthila, al-Binā, al-Maqsūd, al-'Izzī</i> | SYNTAX: <i>al-'Avāmil, al-'Anmūzec & other very short treatises</i> | (Optional SEMANTICS-PRAGMATICS & STYLISTICS) | Lexicons: <i>Farsihta, Shāhidī on Farsi</i> |
| İQTİŞAD | MORPHOLOGY: <i>al-Marāh, al-Shāfiya</i> SYNTAX: <i>al-Kāfiya</i> | SYNTAX: <i>Commentaries on al-Kāfiya like Molla Cāmī's and 'İsām's</i> | (Opt SYNTAX: <i>Mughnī'-Labīb</i>) SEMANTICS-PRAGMATICS & STYLISTICS: <i>al-Talkhīş a short treatise</i> | PROSODY & RHYME: <i>'Arūdh al-Andalusī, al-Nāblusī, al-Khazrajī</i> |
| İSTİŞA | | SYNTAX: <i>Mughnī al-Labīb and other books</i> | SEMANTICS-PRAGMATICS: <i>al-'İdhāh a commentary on al-Talkhīş and other books</i> | |

Figure 1: A distribution of language curriculum by stages derived from Izgi (1997)

As well-known, the four linguistic levels built upon the modern structuralist views of linguistics (Matthews, 2001) are phonetics, morphology, syntax and semantics. In general, the three levels out of four that had been mentioned by name in the curriculum correspond to the widely accepted levels of nowadays' linguistic studies. Excluding phonetics, the other three level are very explicit in the curriculum. The place of phonetics in madrasa curriculum in the Ottoman era is rather different from today's. In fact, articulatory phonetics was often taught before the *iqtişār* stage, namely, pre-school or primary school, but not as a language subject, instead as a beginning lessons of reciting Qur'an under the subject of *tajweed*. Few Ottoman scholars in late seventeenth century argued that *tajweed* is a language science, but the majority did not give an attention on the class of science that *tajweed* belongs. Due to being in an early stage of learning, *tajweed* lesson's primary goal was to provide a correct acquisition of Arabic sounds and the basic rules of assimilation-dissimilation phenomena of sounds to the pupils. But within the process of madrasa learning an authoritative textbook which contains theoretical studies of phonetics was taught. The phonological issues, on the other hand, covered by *şarf* which always taught in the early levels of the stages.

The lexicology subject took place in the first level of first stage, synchronically with the branch of morphology, then by the sixteenth century gradually a new branch of name *wad' al-lughā* which means linguistic convention added. In nowadays terms *wad'* science is in a place between lexicology and semantics and it deals with form-meaning relationship in terms of priority and aposteriority. Morphology subject was very important in Ottoman

schools for the students were non-Arabic speakers and learning grammar depends on knowing morphology. Although *ṣarf*/morphology and *ishtiḳāq*/derivation considered as separate disciplines by scholars, in practice they were taught together because of the interrelatedness of the two branches. The branch of Arabic linguistics that corresponds to the level of semantics in modern western language studies is *ma'ānī*. In Arabic studies *balāgha* which contains three branches *ma'ānī*, *bayān* and *badī'*, comes after syntax in terms of levels and was learned respectively beginning by *ma'ānī*. This order of *ma'ānī* being after syntax generally mentioned explicitly in the references. This meant that these branches deal with combined words or sentences that are correct according to syntactic rules. Thus, *ma'ānī* is a branch more likely to be equivalent of pragmatics instead of semantics which deals with individual words also (Larcher, 2013). As *ma'ānī* contains some semantic aspects we referred to this field as pragmatics-semantics. Stylistics which is the proper equivalent of *bayān* has been considered as a branch of applied linguistics in western language studies. Thus, due to this concept, stylistics has no place in linguistic levels. In Islamic tradition as a field of study and a subject of teaching *ma'ānī* always followed by *bayān* and altogether considered two aspects of a meaning related studies of combined words, the former focuses on the meaning according to the receiver's situation and the latter on the figurative use of words and phrases to produce slightly different meanings.

As to how the theoretical classification of Arabic language sciences reflects the curriculum of the madrasas, it is obvious that the gap between the numbers of the branches of two side is large. Whereas the approximate number of branches within curriculum were six, if we add the science of *wad'*, or eight if we add the optional subjects, in theoretical studies, precisely the studies which intended to classify, talked about twelve branches. On the other hand, the classifiers of these sciences were the same scholars that had a great influence on shaping the curriculum of madrasas and had composed some of the authoritative textbooks that have been used in madrasas for centuries, thus it would be rather strange that they were unaware of madrasa curriculum.

The idea of ultimate goal of *istiḳā* stage brings to minds that, even if it is possible for a few number of students, some students are going to learn these branches all. To understand whether all the branches of linguistics had been taught in madrasas or had not we will follow two steps. First, we will return to the concept of primary and secondary language sciences and try to reorganize the branches. In the second step we will examine the match between the branches that suggested by scholars and the subject that had been taught in madrasas.

The division of al-Jurjānī, who had been mentioned earlier, on language sciences had been the widely accepted classification until early twentieth century. He also the one who talked about the primary language sciences and secondary language sciences. The primary sciences according to him are *lugha*/lexicology, *ṣarf*/morphology, *ishtiqaq*/derivation of words, *naḥw*/syntax, *ma'ānī*/semantics-pragmatics, *bayān*/stylistics, *arūdh*/prosody, *qāfiya*/rhyme. The secondary branches are poetry composition, prose composition, lectures and the principles of spelling. The key feature of the eight primary branches excluding lexicology, is to have an analytic character. Each branch developed from analysing speeches and texts and meant to be used, mostly, as a tool in analysing again. Whereas the secondary branches' ultimate goal is different. These branches are also tools, but more likely to be used in production rather than analysing. The last branch which is principles of spelling, however, is merely production focused field. Hence, it is obvious that the branches of analytic character are prior to the branches that have productive goals.

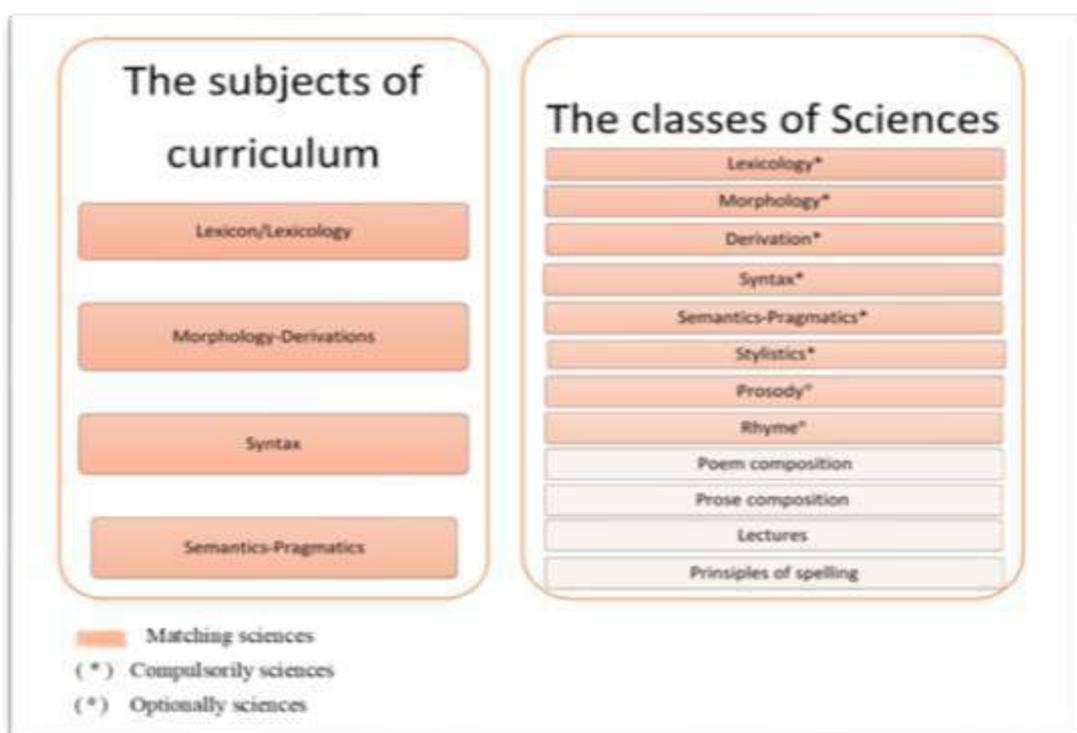


Figure 2: *The categories of language sciences and the language curriculum side by side*

According to this division the sciences that had a place in the curriculum were almost the primary sciences and these branches have an analytical character. But the two branches of prosody and rhyme were optionally taught (Izgi, 1997). As to the lexicology branch, which has the least analytical properties, a basic lexicon recommended to the students. But there is no information on how it was taught. Later the scholars drew more attention to *wad'* science which developed from the science of Islamic jurisprudence methodology and taught, mostly,

integrated with *ṣarf* (Qushji, 2001). It is not clear whether the lexicology branch was replaced by *wadʿ* or not, but according to the analytic character of *wadʿ* we understand that it was an attempt to take the branch of lexicology from analytical perspective. It seems that scholars have given priority to the teaching of analytical sciences. This choice of the scholars seems quite reasonable for the graduates were going to apply what they learned to analyse the religious texts and composing poems or proses was not a necessity for them. It is clear that there is a need for the spelling and preparing lectures courses. The sources show that these lessons have been included in the curriculum in the following centuries.

5. Conclusion

The schools, which known as Madrasas, in Ottoman State were a continuation of the schools of previous states and this continuation has manifested itself precisely in the school curriculum that have relied heavily on the determination of the teachers. To study which Arabic language sciences had been taught and how these courses reflect the scholarly works of the period from 16th to 19th centuries, we utilized the science classification literature. The data on the language courses matched with the data of language sciences' classes. First outcome of the study shows that the widely accepted classes of language sciences were twelve, whereas the maximum branches taught in madrasas were eight, which means that there was not a perfect correspondence between the fields of science and the curriculum. Knowing that language sciences divided into primary and secondary in terms of classes, the branches of language sciences that had been taught in schools did not cover, in any time, what the classifiers called secondary language sciences. The primary branches that were taught were: *Lughah*/lexicon, *ṣarf*/morphology, *ishtiḳāq*/derivation of words, *nahw*/syntax, *maʿānī*/semantics-pragmatics, *bayān*/stylistics, *arūdh*/prosody, *qāfiya*/rhyme. A closer examination of primary language sciences indicates that these branches have an analytical character. This suggests that the curriculum covered the language sciences that enabled the graduates to analyse the Arabic texts.

References

- Celik, Y. (2009). Critical edition of as-Sayyid Sharif al-Jurjānī's work al-Misbah fi sharḥ al-Miftāḥ. (Doctoral dissertation). Retrieved from Yuksekogretim Kurulu Baskanligi Tez Merkezi. (241221)
- Dodge, B. (1970). The Fihrist of al-Nadīm. New York & London: Columbia University Press.
- Endress, G. (2006). The cycle of knowledge: intellectual traditions and encyclopaedias of the rational sciences in Arabic Islamic Hellenism. Endress, G. (Ed.) Organizing knowledge: encyclopaedic activities in the pre-eighteenth century Islamic world (pp. 103-133). Leiden-Boston: Brill.
- Ipsirli, M. (2003). Medrese: Osmanlı donemi. In *Turkiye Diyanet Vakfi Islam Ansiklopedisi* (vol. 28, pp. 327-333). Ankara: TDV.
- Izgi, C. (1997) *Osmanlı medreselerinde ilim 1*. Istanbul: Iz Yayıncılık.
- Jankowsky, K. R. (1995). History of linguistics 1993: Papers from the sixth international conference on the history of language sciences. Konrad Koerner, E. F. Persistent issues in linguistic historiography (pp. 3-25). Washington DC: John Benjamin's Publishing Company. <https://doi.org/10.1075/sihols.78>
- Kātip Chalabe, M. (1941). *Kashf al-zunūn*. Beirut: Dar Ihya al-Turath al-Arabi.
- Khalidov A. & Subtelny, M. E. (1995). The curriculum of Islamic higher learning in Timurid Iran in the light of the Sunni revival under Shāh-Rukh. *Journal of the American Oriental Society* 115(2), 210-236. <https://doi.org/10.2307/604666>
- Larcher, P. (2013). Arabic linguistic tradition ii: pragmatics. J. Owens (Eds.), *the oxford handbook of Arabic linguistics* (pp. 187-207). New York: Oxford University Press. Doi: <https://doi.org/10.1093/oxfordhb/9780199764136.013.0008>
- Matthews, P. (2001). *A short history of structural linguistics*. Cambridge: University Press. <https://doi.org/10.1017/CBO9780511612596>
- Qushji, A. (2001). *‘Unqūd al-zawahir fi al-ṣarf*. Cairo: Dar al-Kutub al-Miṣriyya. (ed. Afifi, A.)
- Sachaqlizāda, M. (2001). *Tartīb al-‘ulūm*. Beirut: Dar al-Bashā'ir al-Islamiyah.
- Stearns, J. (2011). Writing the history of natural sciences in the pre-modern muslim world: historiography, religion, and the importance of the early modern period. *History Compass* 9/12, 923-951. Doi: <https://doi.org/10.1111/j.1478-0542.2011.00810.x>
- Tashkoproluzāda, A. (1985). *Miftāḥ al-sa‘āda*. Beirut: Dar al-Kutub al-Ilmiyyah.
- Uyanik, M., Akyol, A. & ed. Arslan, I. (2017). *Ilimler in sayimi* Ankara: Elis Yayinlari.