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An examination of the article "Arithmetic (Mathematics) courses in primary schools" within the context of knowledge of mathematics teaching*

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Abstract

This research aims to give an idea of the approach of mathematics teaching in primary schools in the early years of Republic of Turkey and compare it with the current approach of teaching within the context of Mathematics Teaching Knowledge (MTK). Therefore, the sample of the study was the article entitled "Arithmetic (Mathematics) Courses in Primary Schools" published in 1927 in one of the most influential education journals of Atatürk period – "Education Journal". In the study, document analysis method was adapted. In the data collection process, initially, the article was translated from Ottoman Turkish to modern Turkish language. Later, the article was analysed through descriptive and content analysis in relation to the components of MTK. The results revealed that teachers were provided with recommendations referring to MTK components, namely association of mathematics with everyday life, use of materials, knowledge of conceptual relationships, level-appropriate teaching, and active student learning. It was also determined that the article put forward some other recommendations to primary school teachers addressing to the importance of improving advanced-level of thinking skills among students.

Keywords: Mathematics teaching, primary education, teaching knowledge, history of mathematics

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1. Introduction

1.1. Introduce the problem

Early curricula of the Republican era were developed in 1924 (Akbaba, 2004) and initial comprehensive curricula began to be implemented in 1926 (Gömleksiz, 2005). In the 1926 curriculum, primary education was spilt into two independent stages of a total of 5 years. First stage was constituted of 1-3 year-levels and second stage of 4-5 year-levels (Gözütok, 2003). One of the most significant aspects of this curriculum was that it relied on active student participation as its foundation (Akyüz, 2020) and increased contact hours of mathematics teaching.

As known, curricula are essentially important as they guide teachers accordingly (Alabaş, 2020; Gökçek and Baran-Kaya, 2021). Henceforth, it can be stated that teachers' qualities and commitment to curricula matter inasmuch as the approach being adopted in those curricula. Although there is not a consensus on teachers' qualities in the relevant literature, it is widely acknowledged that there need to be certain vocational and personal qualities (Gültekin, 2020).

The Law of Unification of Education that was enacted in 1924 during the Republican era enabled the free and compulsory primary education in Turkey and hence, pointed at the need for improvement of teachers' qualities in teacher training for primary education. Indeed, it is known that there were foundational transformations in primary education teacher training in early Republican era within the framework of reports presented by John Dewey in his visit to Turkey in 1924 and by Alfred Kühne in his visit to Turkey in 1925, and in this scope, "Village Teacher Training Schools" were established in 1927 (Öğretmen Yetiştirme ve Geliştirme Genel Müdürlüğü (ÖYGM), 2017). In the following years, the number of the concerned qualities was increased with such transformations in teaching and education, and has continued to improve since then. Teacher qualities identified by the Turkish Ministry of National Education can be split into three main subjects. Those include vocational knowledge (specialised subject knowledge, subject education knowledge, and statutory knowledge), vocational skills (planning of education and teaching activities, creating learning environments, managing, assessing and evaluating of teaching and learning), and attitudes and values (national, moral and universal values, student treatment, communication, and cooperation, personal and professional development) (ÖYGM, 2017). When those qualities are viewed in terms of vocational knowledge and skills, it can also be argued that they encompass the components of such knowledge that is currently regarded pedagogical content knowledge. The concept

of pedagogical content knowledge coined with Shulman (1986) stresses the importance of teachers' knowledge of the 'how' of teaching rather than the 'what' to teach.

In terms of mathematics teaching in particular, it can be said that the subject knowledge of mathematics and pedagogical content knowledge cannot be separated (Baumert et al., 2010). Indeed, being an effective mathematics teacher, who efficiently delivers the subject knowledge of mathematics to students, requires pedagogical content knowledge of mathematics as well (Leinhardt, 1986). The components of such knowledge that is also termed as knowledge of mathematics teaching are knowledge of student profiles, knowledge of organisation of the course and delivery of the subject, knowledge of special teaching methods and strategies, knowledge of teaching programmes, and knowledge of assessment-evaluation (Baki, 2018). Whilst subject knowledge is a type of knowledge that encompasses concepts, rules, principles, problem-solving methods with regards to the subject to be taught (Shulman, 1986), knowledge of student profiles is defined as the knowledge of contingent difficulties that students may experience whilst learning a new subject, their views on that subject, and aspects that they may comprehend in that subject (Fennema and Franke, 1992). Organisation and delivery of the course can be briefly explained as the knowledge of how to deliver the subject following the identification of in-class activities (Özdemir-Baki, 2017). In other words, it is teachers' knowledge of analogies, representations, examples, and delivery techniques for the most effective mathematics teaching (Shulman, 1987). Knowledge of special teaching methods and strategies requires to have the knowledge of subject-specific strategies (Magnusson, Krajcik and Borko, 1999). Knowledge of teaching programme requires the good comprehension of the curriculum and the appropriate use of curriculum materials, software programmes, and alternative textbooks (Baki, 2008). Consequently, knowledge of assessment-evaluation is concerned with the monitoring whether intended learning outcomes are met and the knowledge of how such monitoring operates.

It is not sufficient to have teachers who have the knowledge of the aforementioned subject areas in order for a teaching programme to achieve its aims; it also necessitates to have teachers who are informed about the programme (Marsh and Willis, 2007). It can be suggested that the studied article of "Arithmetic (Mathematics) Courses in Primary Schools" aims to achieve it as it provides certain recommendations with primary school teachers with regards to the implementation of the 1926 curriculum, which was the then practice in education. Having examined the studies in the relevant literature, it is mostly found that matemathics teaching in the Republican era is examined through various aspects (Deveci and Aykaç, 2020; Konukoğlu, Agaç and Özmantar, 2019; Sezgin-Memnun, 2013). Only Altunay-Şam, Demir and Orbay's (2017) research provides examples of the delivery of mathematics teaching in primary schools during the said period. In addition, Aslan and Olkun's (2013) study includes the evaluation of arithmetic teaching in 1926 Textbooks according to the Reports of "The Inspection Committee of Primary School

Textbooks". This research aims to give an idea of the approach of mathematics teaching in primary schools in the early years of Republic (of Turkey) and compare it with the current approach of teaching within the context of Mathematics Teaching Knowledge (MTK). Henceforth, this research examines the article entitled "Arithmetic (Mathematics) Courses in Primary Schools" published in 1927 in one of the most influential education journals of Atatürk period – Terbiye Mecmuası.

2. Method

2.1. Research design

The research methodology of this research was based on document analysis. Even though document analysis is perceived as a form of data analysis, it is in fact a research method. In this method, the aim is to analyse the written content systematically and in detail (Wach, Ward and Jacimovic, 2013).

2.2. Samples

In the selection of the samples of the study, articles regarding mathematics teaching in primary education published in the early period of Turkish Republic were examined. The research was limited to the period between 1926 and 1936. The reason for taking the year 1926 as a reference is that the principle of collective education get used for the first time in the Primary Schools Program published this year (Akyüz, 2020, s.347). When the content of the 1926 program, which is the second primary school program of the Republican period, is examined, it is accepted as a program in which important developments were made in terms of educational sciences.The 1926 program was implemented until 1936, and a new program was prepared on this date (Ulubey & Aykaç, 2017, s.1176). As a result of the analysis, 8 articles were identified in 3 different journals (Muallimler Birliği, Terbiye and Muallimler Mecmuası) between 1926-1936. Then among the accessed articles, the article titled "Arithmetic (Mathematics) Courses in Primary Schools" published in 1927 in T*erbiye Mecmuası 2*(9) was selected via criterion sampling method, a purposive sampling model as the sample of the study. One of the reasons of selecting that article was that the article comprised detailed information with regards to aims and delivery of mathematics teaching in primary schools. Another reason was that it was useful for teachers despite involving some information for students and guardians (Demir, 2017). It was composed of some practical recommendations and guidance provided by the then Ministry of Education to teachers regarding mathematics teaching in primary education.

2.3. Data collection and Analysis of the data

In the data collection and data analysis process, initially, the article was translated from Ottoman Turkish to modern Turkish language. Later, the article was analysed through

descriptive and content analysis in relation to the components of MTK. In order to enhance the internal reliability of the article and to facilitate coding, a generic framework for coding was devised. Later, the data was coded by the researcher, who is specialised in mathematics teaching. The coding was performed through the most frequently emphasised statements; themes and categories were identified that was followed with another round of coding and the data was arranged in accordance with those codes. Analyses were undertaken through the use of computational programme for qualitative research, i.e. MAXQDA. To ensure the reliability of coding, the entirety of the article was coded by the same researcher 60 days later than the first round of coding. Miles and Huberman (1994) formula was used to calculate intercoder reliability in the analyses. In this study, the reliability between the first and second coding was calculated as 96%. Therefore, it was identified that there was high level compatibility between first and second coding.

3. Findings

Findings of the article of "Arithmetic (Mathematics) Courses in Primary Schools" that is analysed through descriptive and content analysis in relation to the components of MTK are presented below as MAXQDA maps and signposted with citations from the article where applies.

Figure 1 below presents the components of MTK which are addressed in the studied article.

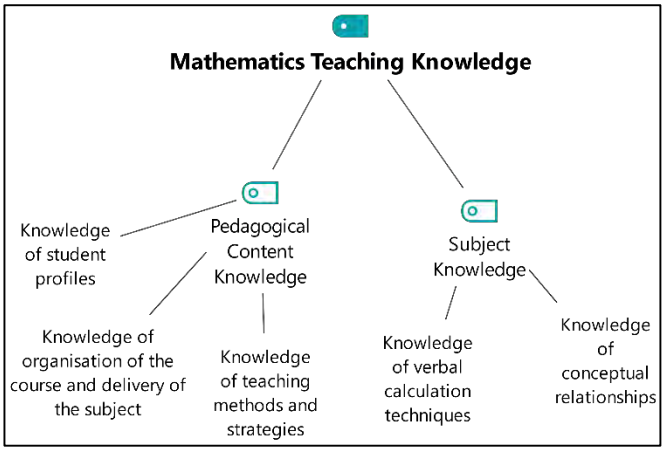

Figure 1. The components of MTK addressed in the article of "Arithmetic (Mathematics) Courses in Primary Schools"

As shown in Figure 1, it is denoted in the studied article that teachers need to have certain components of both subject knowledge and pedagogical content knowledge in mathematics teaching. In terms of subject knowledge, the article solely emphasises to have the knowledge of relationships between mathematical concepts and of verbal calculation techniques. The following statement in the article stresses that it is important for teachers

to know verbal calculation techniques for their students' learning experience: "*However, there are verbal calculation rules (verbal calculation methods) as well as written (by writing) calculation rules, and maybe even more. Our teachers, who do not know these rules, have the conscience of obligation to learn them in a short time and not to waste the strength and abilities of the young minds who are thus handed over (İlk Mekteplerde Riyaziye, 1927, s. 43)*".

In the context of MTK addressed in the article of "Arithmetic (Mathematics) Courses in Primary Schools", the most frequently referred component is the delivery of the subject (Figure 2). Hence, components of delivery of the subject that primary school teachers ought to have and other components of MTK are presented in a different map.

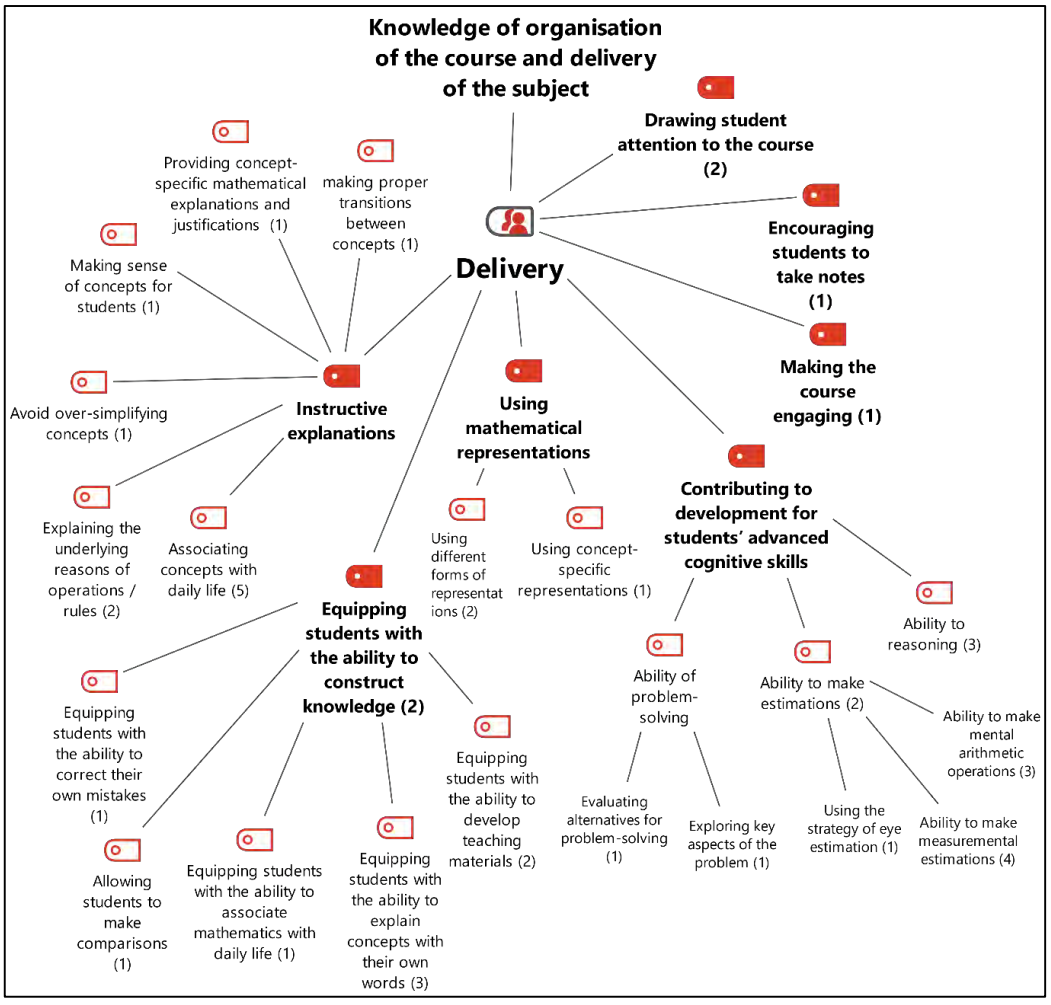

Figure 2. The components of the knowledge of delivery of the subject expected from teachers

In the analysed article, the most frequently referred component of the delivery of the subject is the requirement that teachers shall contribute to students' advanced learning

skills whilst delivering subjects of mathematics. Even though estimation strategies are particularly foregrounded, problem-solving and reasoning are also underlined. For instance, the statement of "*Children measure the distances that they see by eye estimations and then measure them with real measurement and see their mistakes (s. 46)*" means that students are encouraged to use measuremental estimation strategies. There is also the statement in the article as follows, which stresses to equip primary school students with the ability of problem-solving: "*Children should acquire such a skill in the arithmetic courses that they can find through it the important aspects of the problems they encounter, determine the reasons underlying those problems, sort out the right aspects among them, and reach the result they seek by making a proper bridge of ideas from them (s. 41)*".

Another important issue of the delivery of the subject is instructive explanations. Specifically, the need to associate concepts with real life is often emphasised. The statement of "*When geometric objects and shapes are taught, it is necessary to find similar objects from the environment and have children find them. For example: a child should know and show that a box resembles a cube or a prism, and a glass resembles a cylinder (s. 47)*" explicates that teachers are expected to ask students to give examples of geometric objects from their immediate environment. The statement of "*After introducing the geometric objects and shapes to children, it is necessary to make maximum use of the comparison method. For example: To make children examine and observe that the square has four angles, the triangle has three angles, or the square has four, the triangle has three sides (s.47)*" addresses the importance of transition between concepts about different geometric shapes such as angle and side.

Another point frequently addressed for the delivery of the mathematics course in the examined article of "Arithmetic (Mathematics) Courses in Primary Schools" is that classroom teachers shall ensure that students construct the knowledge themselves. The statement mentioned in the article "*The work undertaken and the rule followed must be expected from children to be correctly said in their own words (s. 42)*" refers to students' ability to explain concepts and rules with their own words. The statement of "*The teacher wandering among students examines them and if there are any mistakes, s/he tries to have them correct (self-correct) by examining their notebooks (s. 51)*" stresses students' ability to identify and rectify their mistakes.

The following statement points at the importance of student engagement with the course: "*However, the curiosity of dealing with complex issues must be awakened in children. This curiosity arises from the feeling of pleasure inasmuch as children gain the ability to deal with such complex issues (s. 45)*". What is explained here is to ensure that students are interested, and strive to deal with, complexities when encountered in a number of complex mathematical issues. It is denoted that this can be ensured through student satisfaction gradually developing with more complex problems solved. The article also suggests that involving games in mathematics teaching can enable both teachers and

students to enjoy the course as stated in the following: *"…A teacher who understands the method and purpose of the lesson always prepares these kinds of exercises in the form of games with a little effort and can bring enjoyable moments to the lesson for both him/herself and his/her students by applying those exercises (s. 48)*". In fact, an illustrated calculation game has been added at the end of the article to set an example for primary school teachers. This game and how it is played are presented in Appendix-1.

Other components of mathematics teaching knowledge found in the article are given in Figure 3.

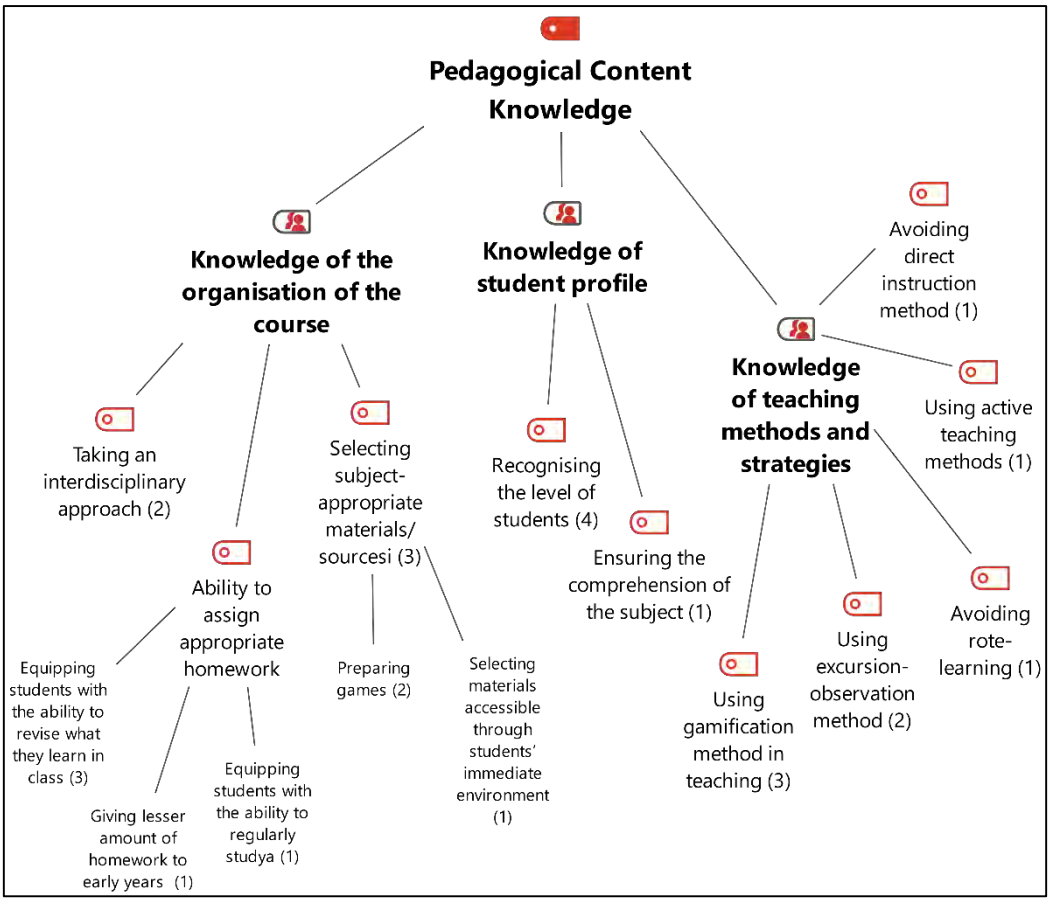

Figure 3. Findings on other components of MTK

As shown in Figure 3, following the delivery of the course subject, another type of information most mentioned in the related article is the knowledge of the organisation of the course. In this regard, the selection of resources or materials appropriate for the relevant mathematical subject has come to the fore. The statement of "*Laboratory activities should be linked together with calculus lessons and handicraft lessons, and children should be asked to make figures of numbers from mud and sand, play games like dominoes, and*

solve riddles that are useful for calculations (s. 46)" suggests that classroom teachers ought to select materials from the lived environment and to adopt an interdisciplinary approach by integrating handicraft lessons and mathematics.

In the concerned article, it is also mentioned that primary school teachers shall include games in mathematics courses. In fact, at the end of the article, a sample game application suitable for Year 1 (Appendix-1) is also given, with the statement that "*We found it useful to add a sample here to our friends for verbal calculation exercises to be undertaken in the early years, to give an idea about the things to be done in this way. By looking at this sample, our teachers can prepare many tools similar to this and have them applied (s. 48)*".

In the context of the organisation of the course, attention is drawn to homework to be given to students, and some suggestions are made to teachers, such as giving less homework to early years students, equipping students with the homework given to develop the ability to study regularly, and enabling them to revise the topics learnt in class. What is meant with the statement of "*Children should acquire habits by using the principles that they learn in the classroom and appropriate them for themselves (s. 44)*", which implies the homework to be given to students, is to contribute to students' adoption of topics learnt by revising them through homework.

Within the scope of knowing the student, it is mentioned that mostly the level of students shall be taken into account when teaching mathematics. An example of this is the statement of *"As children's levels and mental capacities must always be taken into account in education, these aspects should never be overlooked and be taken into consideration whilst undertaking educational duties (s. 46)"*.

In addition, in the context of teaching methods and strategies, the recommendation of *"Early years classes should make maximum use of the help of games (s. 46)"* emphasises that the method of teaching with games shall be used in the early years of education. In addition to teaching with games, another method recommended to primary school teachers is the excursion-observation method. "*Excursions also play an important role in the teaching of arithmetic … During such a trip, for example, how many workers work in an agricultural field, how many of them are men, how many women and children, the amount of seed planted in a given field, the amount of the crop harvested from there, the revenue it brings, and the cost incurred shall be inquired and these issues shall be worked on in class based on this information. (s. 45)"* As can be understood from this citation, the excursion-observation method is mostly recommended to associate mathematics with daily life.

Another point emphasised in terms of teaching methods and strategies is the view that it is improper to use teaching methods, in which the student is a passive receiver, such as the direct instruction method. An example for this situation is illustrated in the following citation: "*Some teachers put a child on the stage for a written task of an example or a*

practice to be worked on the blackboard, and leave other children in the position of audience. This kind of approach is very harmful as it deprives children of activity (s. 43)".

4. Discussion

This study has examined the article entitled "Arithmetic (Mathematics) Courses in Primary Schools", presenting the issues that teachers should consider while applying the teaching programme that is introduced after the implementation of the new curricula in the early years of the Republic. This article is particularly important as it reflects the understanding of the then Ministry of Education with regards to the approach of mathematics teaching in the early years of the Republic.

In the article, it has been explored that the majority of suggestions made to primary school teachers are for the organisation of the course and the delivery of the subject among many components of MTK. In particular, the need to associate mathematics with daily life is frequently stated. This conclusion is in parallel with some other studies (Altunay-Şam et al., 2017). Making appropriate transitions between mathematical concepts, presenting mathematical reasons in accordance with concepts, operations, and rules, and making concepts understandable for students without over-simplifying them are other issues emphasised in the article in the context of instructional explanations. Indeed, Duval (2000) emphasises that teaching mathematics need not only provide practice of certain concepts or operations or apply algorithms, but also be a process that enables students to understand concepts and their applications. In the context of instructional explanations, the issues that are pointed at in the article emphasise such a process. Another suggestion in the article is that primary school teachers, while teaching mathematics, shall create a learning environment in which students construct their own knowledge. Teachers are recommended to ask students to construct their own mathematical knowledge by developing teaching materials, making comparisons, correcting their own mistakes, and associating mathematics with daily life themselves. In short, in the article analysed, teachers are asked to perform meaningful learning without applying rote-learning. As previously argued, when students try to be informed with memorised knowledge instead of meaningful learning, the delivered knowledge will lose its meaning and it will be difficult to deliver the subject in coherence (Padua, 2010). Another interesting point emphasised several times in the article within the scope of the student's structuring of knowledge is the need for teachers to ensure that students express mathematical concepts in their own words. Moreover, one way to ensure meaningful learning is to allow students to express concepts in their own words (Padua, 2010).

The article "Arithmetic (Mathematics) Courses in Primary Schools" also stresses the abilities to use different representations of the concept and select the most suitable representation for the concept among many. According to Even (1998), these skills are at the focal point of conceptual learning in mathematics because the use of different forms of

representation helps to understand the essence of a concept as well as many aspects of it (Even, 1998). Indeed, although it is not often encountered in practice, many mathematics curricula have emphasised the expression of concepts with different forms of representation (MEB, 2013; 2018). Another point stressed in the teaching programmes is the importance of acquiring metacognitive skills to students. As it is known, problem solving skills can contribute to the development of cognitive strategies while learning mathematics (Yıldızlar, 1999), and estimation skill is used in almost 80% of daily life mathematics (Reys and Yang, 1998). Likewise, reasoning is seen as the basic skill of mathematics (Ball and Bass, 2003). Especially in primary school, which prepares individuals for life and further education, it is of great importance to equip students with these advanced cognitive skills (Özsoy, 2005). In the article discussed within the scope of this research, it is often emphasised that teachers need to contribute to the development of advanced cognitive skills among primary school students such as problem-solving skills, estimation skills, and reasoning skills. As known, an approach that requires students to employ their advanced cognitive skills is the interdisciplinary approach (Erickson, 1995), since it is possible in the interdisciplinary approach to integrate knowledge and skills from different disciplines by approaching them from different perspectives (Aydın and Balım, 2005). In the analysed article, it is observed that teachers are encouraged to adopt an interdisciplinary approach. Given that the interdisciplinary approach was first introduced in the 1926 curriculum (Akyüz, 2020) and the article examined was written in 1927, it is understood that primary school teachers were reminded to adopt this approach when teaching mathematics.

Another point that draws attention to the delivery of the course in the article is to make the course enjoyable and engaging for students. In the article, which argues that methods driven by direct instruction and rote need to be avoided, it is frequently mentioned that games should be included in teaching. This suggestion can be regarded to be appropriate considering the use of games in primary education makes mathematics enjoyable (Soylu, 2001), improves success (Beyhan and Tural, 2007; Dinçer, 2008; Tural, 2005; Yücel Soft, 2014), attitude (Dinçer, 2008; Tural, 2005), and permanence of knowledge (Soylu, 2001). In addition to the gamification as a teaching method, another recommended teaching method is the excursion-observation method. It is noteworthy that this method is mostly recommended to associate mathematics with daily life. It is aimed that students learn mathematics by doing and experiencing in their environment. In addition, in the article, it is particularly emphasised that materials suitable for mathematics subjects are selected from the environment in which students live.

In order to perform an effective mathematics teaching, it is of particular importance for teachers to identify the difficulties that students experience and the ways to tackle them, and evaluate their learning as well as selecting the appropriate teaching methods and materials (Ball, Thames and Phelps, 2008). This issue was also taken into account in the article “Arithmetic (Mathematics) Courses in Primary Schools” and the recurrent

attention was drawn to issues such as recognising the level of students while teaching and ensuring the students' comprehension of the subject. Another issue that primary school teachers need to consider in teaching mathematics is a number of issues emerging from assigning homework. It is particularly emphasised that students should be given homework that will enable them to revise what they learn in class. Additionally, it is stated that, by giving homework, students can gain regular study habits and that less homework should be given to students, especially in the early years of primary education. In fact, there are previous studies in the relevant literature suggesting that homework is beneficial (Binbaşıoğlu, 1994; Bursuck, 1994; Büyüktokatlı, 2009; Özben, 2006; Walberg, Paschal and Weinstein, 1985), and not beneficial (Baran, Sevindik and Karademir, 2016; Cooper, 2001; Hoover-Dempsey, Bassler and Burow, 2001; Katz, Kaplan and Buzukashvily, 2011; Kralovac and Buell, 2001). Hence, it is possible to say that this is a contested issue.

Overall, it can be said that the article "Arithmetic (Mathematics) Courses in Primary Schools" from the past teaches us very important lessons about today's and tomorrow's mathematics teaching. At the core of the analysed article, it is frequently emphasised for primary school teachers that they need to avoid rote-learning methods, enable students to construct the knowledge themselves, and create a meaningful learning environment while teaching mathematics, and that it is very important to recognise the level of the students that they teach. From this point of view, contrary to the popular belief, as Konukoğlu, Agaç and Özmantar (2019) state, this conclusion supports the idea that all primary education mathematics curricula in the history of the Republic of Turkey have emphasised learning mathematics in a meaningful way. In addition, it has been stated at every opportunity that the aim is not only to teach mathematics, but also to provide students with advanced skills that will facilitate their daily life such as problem solving, reasoning, and estimation.

Considering the above discussion, it is understood that modern teaching approaches namely constructivist approach and realistic mathematics teaching are desired to adopt in the education system within the early years of the Republic although the names of approaches are not mentioned as such. Teachers have great responsibilities in order to perform meaningful learning that enables students to construct the knowledge themselves by using the advanced cognitive skills, which have not been fully developed since then. Although teaching programmes seem to gradually take on a modern approach, considering that the change can only be realised with the teacher, it is recommended that the primary school teachers who are most likely to affect the school life of students adopt the aforementioned issues as a history lesson. In addition, there is a need for further studies that require the reinterpretation of articles, books, and journals with the current understanding to shed light on our education history in mathematics and other disciplines, such as this study.

References

Akyüz, Y. (2020). *Türk eğitim tarihi (Başlangıçtan 2020'e)*. Pegem.

Akbaba, T. (2005). Cumhuriyet döneminde program geliştirme çalışmaları. *Bilim ve Aklın Aydınlığında Eğitim Dergisi,* 5, 54-55.

Alabaş, R. (2020). Değerler açısından ilkokul ve ortaokul (2018) öğretim programları. In H. Yolcu & S. Oğuz-Haçat (Eds.), *Bilim insanı Dr. Mustafa Eski'ye armağan* (pp.453- 474). Pegem Akademi.

Altunay Şam, E., Demir, G. T. Orbay K. (2017). İlk mekteplere mahsus hendese dersi uygulama örneği: Dikdörtgenin alanı. *The Journal of Social Sciences, 4*(15), 132-144.

Aslan, E., & Olkun, S. (2013). Arithmetic teaching in 1926 textbooks according to the reports of "the inspection committee of primary school textbooks". *Ankara University Journal of Faculty of Educational Sciences (JFES)*, *46*(1), 343-364.

Aydın, G. & Balım, A. G. (2005). Yapılandırmacı yaklaşıma göre modellendirilmiş disiplinler arası uygulama: enerji konularının öğretimi. *Ankara University Journal of Faculty of Educational Sciences, 38*(2), 145-166.

Baki, A., (2008). *Kuramdan uygulamaya matematik eğitimi.* Harf Eğitim Yayınları.

Baki, A. (2018). *Matematiği öğretme bilgisi*. Pegem Akademi.

Ball, D. L. & Bass, H. (2003). Making mathematics reasonable in school. In J. Kilpatrick, W. G. Martin. & D. Schifter. (Eds.), *A research companion to 64 principles and standards for school mathematics* (pp 227-236). National Council of Teachers of Mathematics.

Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education, 59*(5), 389-407.

Baran, B., Sevindik, H., & Karademir, Y. (2016). 6. sınıf bilişim teknolojileri ve yazılım dersinde verilen ev ödevinin öğrencilerin ders başarısına etkisinin incelenmesi. *3. Uluslararası Eğitimde Yeni Yönelimler Konferansı*, 26-29 Nisan 2016, 41-48

Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., ... and Tsai, Y. M. (2010). Teachers' mathematical knowledge, cognitive activation in the classroom, and student progress. *American educational research journal, 47*(1), 133-180.

Beyhan, N. ve Tural, H. (2007). İlköğretim matematik öğretiminde oyunla öğretimin erişiye etkisi. *Dokuz Eylül University Buca Journal of Faculty of Education, 21*, 37-48.

Binbaşıoğlu, C. (1994). Okullarda öğretim sorunları. Eğit-Der Yayınları.

Bursuck, W. (1994). Introduction to the special serious on homework, *Journal of Learning Disabilities, 27,* 466-469.

Büyüktokatlı, N. (2009). *İlköğretimde ev ödevi uygulamalarına ilişkin öğretmen görüşlerinin incelenmesi.* [Unpublished M.A. Thesis] Selçuk University.

Cooper H. (2001). *The battle over homework: Comman ground for administrators, teachers and parents.* Corwin Pres.

Demir, G.T. (2017). *Atatürk döneminde yayınlanan eğitim dergilerinde sosyal bilgiler konularının incelenmesi (1923-1938).* Atatürk Araştırma Merkezi.

Deveci, Ö. & Aykaç, N. (2020). Türkiye Cumhuriyeti'nde uygulanan ilkokul matematik dersi öğretim programlarının incelenmesi. *Bolu Abant İzzet Baysal University Journal of Faculty of Education, 20*(3), 1512-1532.

Dinçer, M. (2008). *İlköğretim okullarında müziklendirilmiş matematik oyunlarıyla yapılan öğretimin akademik başarı ve tutuma etkisi.* [Unpublished M.A. Thesis] Abant İzzet Baysal University.

Duval, R. (2000). Basic issues for research in mathematics education. In: *Proceedings of the Conference of the International Group for the Psychology of Mathematics Education* (PME).

Erickson, H.L. (1995). *Stirring the head, heart, and soul (redefining curriculum and instruction).* Corwin Press, Inc.

Even, R. (1998). Factors involved in linking representations of functions. *Journal of Mathematical Behavior, 17*(1), 105-121.

Fennema, E. ve Franke, M. L. (1992). Teachers 'knowledge and its Impact. In Dauglas A. Grouws (eds.), *Handbook of Research on Mathematics Teaching and Learning,* Macmillan, (pp.147-164).

Gökçek, T., & Baran Kaya, T. (2021). Comparative study between 2009, 2013 and 2018 lower-secondary mathematics education programmes on the use of material and technology. *Osmangazi Journal of Educational Research, 8*(1), 193-219.

Gömleksiz, M. N. (2005). Yeni ilköğretim programının uygulamadaki etkililiğinin değerlendirilmesi. *Kuram ve Uygulamada Eğitim Bilimleri Dergisi, 5*(2), 339-384.

Gözütok, F. D. (2003). Türkiye'de program geliştirme çalışmaları. *Milli Eğitim Dergisi, 160.*

Gültekin, M. (2020). Değişen toplumda eğitim ve öğretmen nitelikleri. *Anadolu Journal of Educational Sciences International, 10*(1), 654-700.

Hoover-Dempsey, K. V., Bassler, O. C., & Burow, R. (1995). Parents' reported involvement in students' homework: Strategies and practices, *Elementary School Journal, 95*, 435-450.

Katz, I., Kaplan, A., & Buzukasshvily, T. (2011). The role of parents motivation in students autonomous motivation for doing homework. *Learning and Individual Differences, 21*, 376-386.

Konukoğlu, L., Agaç, G., & Özmantar, M. F. (2019). Cumhuriyet dönemi ilkokul matematik dersi öğretim programlarının matematik okuryazarlık perspektifinden incelenmesi. *Batı Anadolu Eğitim Bilimleri Dergisi, 10*(2), 79-99.

Kralovac, E., & Buell, J. (2001). End Homework Now, *Educational Leadership, 58*(7), 39-42.

Leinhardt, G. (1986). Expertise in mathematics teaching. *Educational Leadership, 43*(7), 28–33.

Magnusson, S., Krajcik, J. and Borko, H. (1999). Nature, sources and development of pedagogical content knowledge for science teaching. In J. Gess-Newsome and N. G. Lederman (Eds.), *Examining pedagogical content knowledge* (pp. 95-132). Kluwer Academic Publishers.

Marsh, C. J., & Willis, G. (2007). *Curriculum: Alternative approaches, ongoing issues* (4th ed.). Upper Saddle River, NJ: Pearson Education, Inc.

Öğretmen Yetiştirme ve Geliştirme Genel Müdürlüğü (2017). *Öğretmenlik Mesleği Genel Yeterlilikleri.* Retrieved from http://oygm.meb.gov.tr/meb_iys_dosyalar/2017_12/11115355_YYRETMENLYK_MESLEYY_GENEL_YETERLYKLERY.pdf on 22.11.2021.

Özben, G. B. (2006). *İlköğretim ikinci kademe öğrencilerinin fen bilgisi dersindeki başarılarına ev ödevi çalışmalarının etkisi.* [Unpublished M.A. Thesis], Gazi University.

Özdemir-Baki, G. (2017). *Ortaokul matematik öğretmenlerinin matematiği öğretme bilgilerinin gelişim sürecinin incelenmesi: Ders imecesi modeli*. [Unpublished doctoral dissertation], Atatürk University, Erzurum.

Özsoy, G. (2005). Problem çözme becerisi ile matematik başarısı arasındaki ilişki. *Gazi Journal of Faculty of Education, 25*(3), 179-190.

Özyürek, M. (2008). Nitelikli öğretmen yetiştirmede sorunlar ve çözümler: Özel eğitim örneği. T*ürk Eğitim Bilimleri Dergisi, 6*(2), 189-226.

Padua, M. (2010). Ensuring our Children, a Meaningful Life through Moral Education. In Z. Abas et al.(Eds.), *Proceedings of Global Learn 2010* (pp. 1243-1252). Association for the Advancement of Computing in Education (AACE).

Reys, R. E., & Yang, D.-C. (1998). Relationship between computational performance and number sense among sixth-and eighth-grade students in Taiwan. *Journal for Research in Mathematics Education, 29*(2), 225-237. doi:10.5951/jresematheduc.29.2.0225

Sezgin-Memnun, D. (2013). Türkiye'deki Cumhuriyet dönemi ilköğretim matematik programlarına genel bir bakış. *Mehmet Akif Ersoy University Journal of Faculty of Education, 13*(25), 71 – 91.

Shulman, L.S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*, 4-14.

Shulman, L.S., (1987). Knowledge and teaching: Faundations of the new reform, *Harwerd Educational Review, 57*, 1-22.

Soylu, Y. (2001), *Matematik derslerinin öğretiminde (1. devre 1,2,3,4,5. sınıf) başvurulabilecek eğitici-öğretici oyunlar.* [Unpublished M.A. Thesis], Atatürk University.

Tural, H. (2005). *İlköğretim matematik öğretiminde oyun ve etkinliklerle öğretimin erişi ve tutuma etkisi.* [Yayınlanmamış M.A. Thesis]. Dokuz Eylül University.

Ulubey, Ö., & Aykaç, N. (2017). Türkiye Cumhuriyetin ilanından 2005'e eğitim felsefelerinin ilkokul programlarına yansıması. *Mersin University Journal of the Faculty of Education, 13*(3), 1173-1202. doi: https://doi.org/10.17860/mersinefd.335241

Wach, E., Ward, R., & Jacimovic, R. (2013). *Learning about qualitative document analysis*. Institute of Development Studies. Retrieved from http://www.ids.ac.uk/publication/learn ing-about-qualitative-documet-analysis.

Walberg, H. J., Paschal, R. A., & Weinstein, T. (1985). Homework's powerful effects on learning, *Educational Leadership, 42,* 76-78.

Yıldızlar, M. (1999). *İlkokul 1., 2. ve 3. sınıf öğrencilerinde problem çözme davranışlarının öğretiminin problem çözmedeki başarıya ve matematiğe olan tutuma etkisi.* [Unpublished Ph.D. Thesis]. Hacettepe University.

Yücel Yumuşak, E. (2014). *Oyun destekli matematik öğretiminin 4.sınıf kesirler konusundaki erişi ve kalıcılığa etkisi*. [Unpublished M.A. Thesis], Gaziosmanpaşa University.

Appendix A. Picture Calculation Game

How the game is played: For example, the samples given below are reproduced with a chapyrograph (the machine that prints the text written on a typewriter, without a carbon strip on waxed paper with the spirituous duplication technique and is manually operated) and pasted on thick papers like old notebook containers, and the whole (Figure 1 and 2) copies are distributed to children. After a small language practice is done by having them find out and say what the pictures belong to, the items (shapes) in each group are counted by different children. Then, the pieces (figure 3-4) prepared by the teacher and cut with scissors from the striped places are distributed to children and they are instructed to put each piece on the same one. In this way, children count, examine, and compare their parts and put them in their places. Young children will be able to see the whole and focus. In addition, students themselves become accustomed to simple observations and comparisons. The teacher, who wanders around among students, examines them, examines their notebooks if there are any mistakes, and tries to enable students to self-correct their mistakes. By looking at these examples, it is possible to find and prepare many shapes, games, and tools.

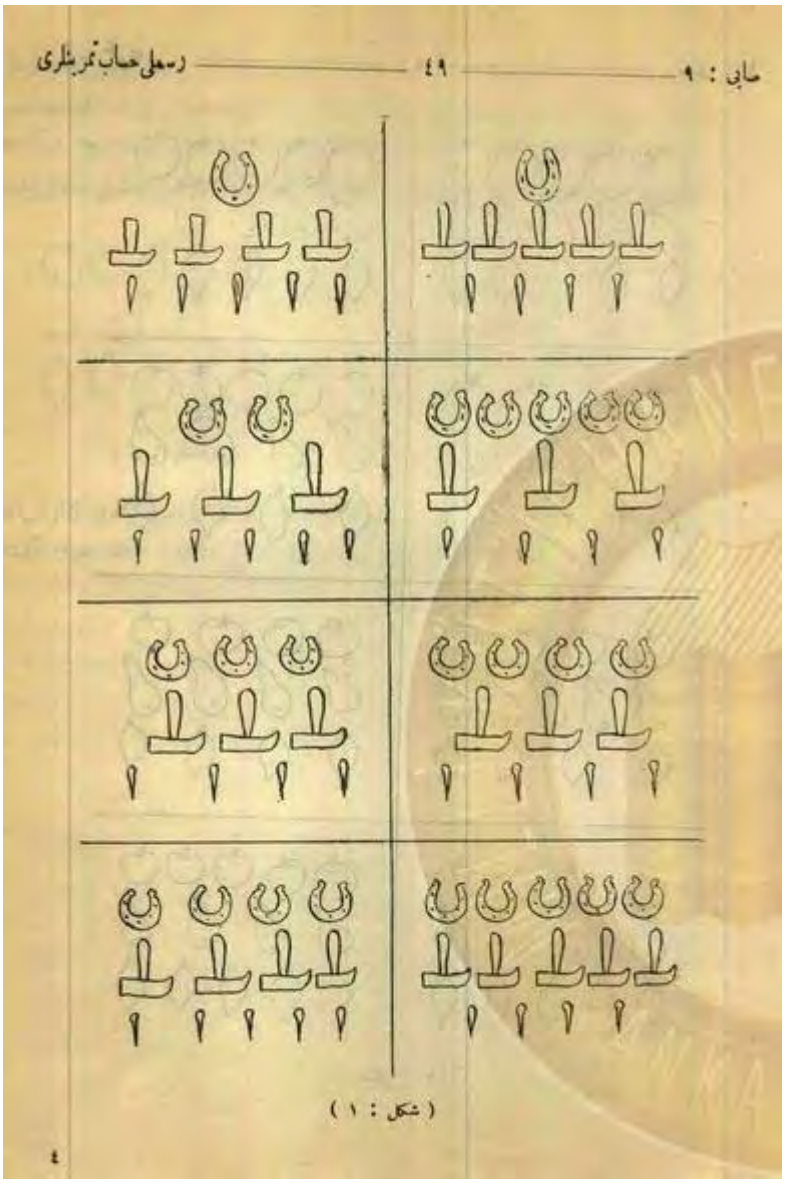

Figure 1.

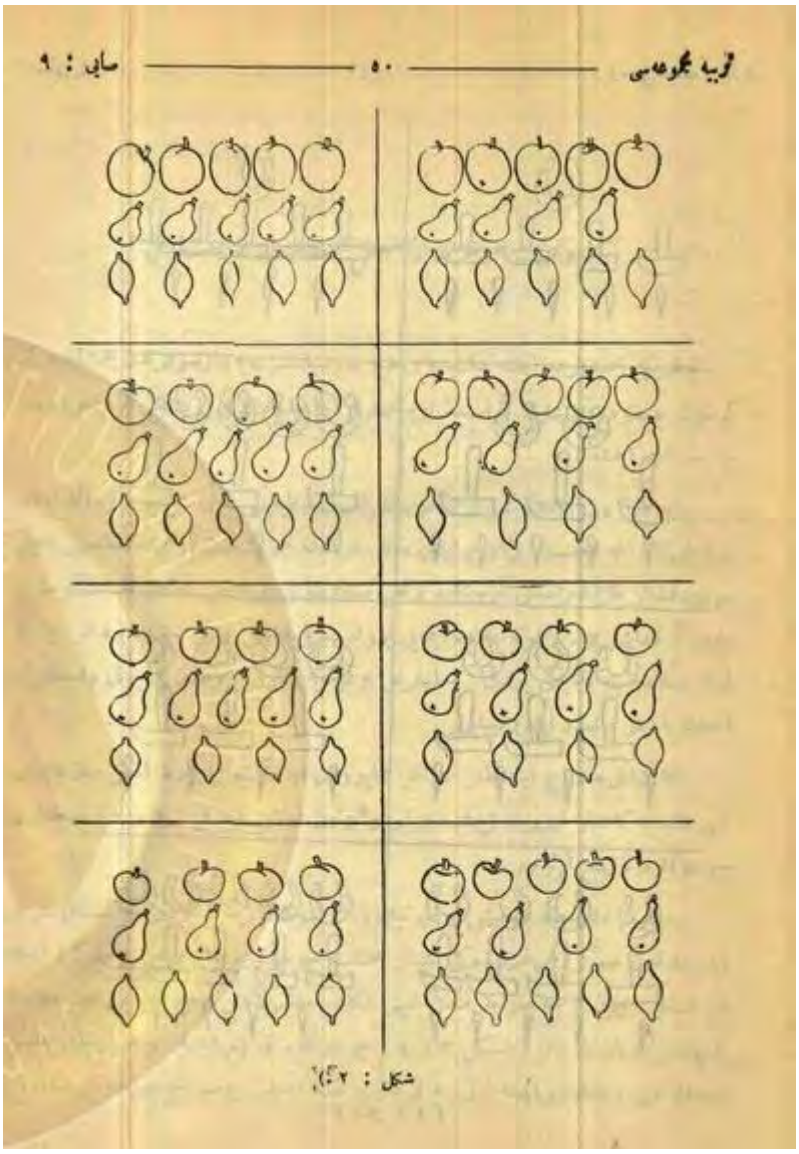

Figure 2.

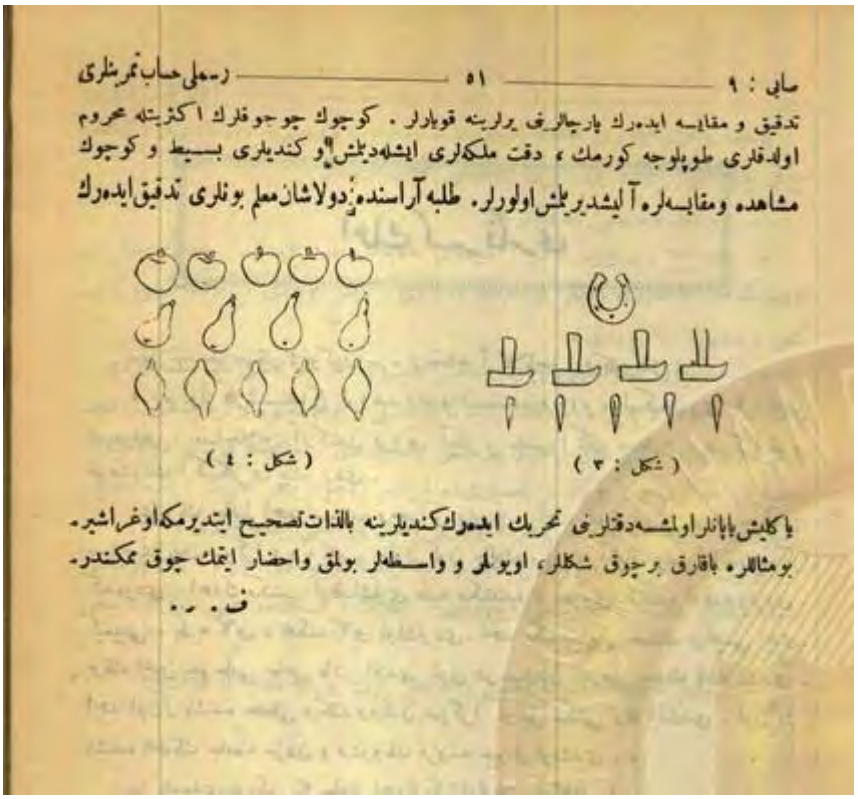

Figure 3.