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A Comparison of Mathematics Teacher Training and Elementary Mathematics Curricula in Finland, South Korea and Türkiye

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ABSTRACT

The aim of this study is to carry out a comparative analysis of the student selection for mathematics teacher training institutions pre-service education, employment conditions, in-service training activities in Finland, South Korea and Türkiye as well as that of the curricula used in these countries for elementary mathematics teacher training courses. Document analysis as a qualitative research method and Bereday's comparative model in education were used. The data has been organized, assigned to sub problems and analysed as to the Bereday Method. According to the findings, the importance that Finland and South Korea gives to the selection of applicants for teacher training institutions; their meticulousness for professional development and the place of problem solving and thinking skills in mathematic curricula as of elementary level bring success in mathematics at international exams. In Türkiye, it is recommended to introduce additional criteria covering social work activities and other sorts of activities conducted in high school in addition to the calculation of exam scores for student admission to education faculties, and to enhance teaching practices in terms of both duration and quality. In addition to this, it is considered that it is insufficient to make teacher appointments according to scores obtained, and accordingly, it is necessary to add applied course presentations to the existing appointment criteria.

Keywords: Comparative education, Bereday model, mathematics teacher training, mathematics curriculum

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Introduction

Although students think of mathematics as only a lesson learnt at school, it is actually a discipline that is intertwined in every aspect of our life such as architecture, art, literature, economics, science and technology. Mathematics helps individuals develop their higher-order thinking skills like problem solving, curiosity and critical thinking. Thus, just like every country Türkiye gives great importance to mathematics education.

Since 2006 in Türkiye, the aim has been to develop mathematical reasoning skills and problem-solving skills with the mathematics curricula prepared with a constructivist approach. It has been found that the importance of these skills was underlined in the curriculum revision of 2013 (Bukova Güzel et al., 2016) and descriptions related to the learning outcomes related to these skills were inserted in 2018 (Ministry of National Education [MoNE], 2018a, 2018b).

It's crucial that teachers as individuals who implement the curricula in the classroom can organize the curricula according to the cognitive skill levels of the class. Therefore, the teacher must have subject-matter content knowledge, pedagogical content knowledge and curricular knowledge (Shulman, 1986). While subject-matter content knowledge depends on the teachers' competence in the field, their pedagogical field knowledge is part of the teacher's pedagogical reasoning process between their teaching field knowledge, way of associating pedagogical knowledge and field knowledge (Cochran, DeRuither and King, 1993). According to Shulman (1986), curricular knowledge consists of four components. The first component of curricular knowledge (Programs and materials) contains the existing curriculum and related material knowledge which is used for teaching the given content. The second component (indications and contraindications) is the knowledge of different curricula and materials and their awareness that contain information on the curriculum and material's efficiency and their effects for certain contexts. The third component (lateral) consists of the content for the other courses (lateral curriculum knowledge) and the knowledge of the relevant materials; the fourth component (vertical) refers to the knowledge on how these subjects are taught under a certain curriculum (vertical curriculum knowledge). Blömeke et al. (2015) included the cognitive processes which shape the teachers' behaviour and actions in the classroom. PID skills, the model named after perception (perceive), interpretation and decision (decision-making) skills create a balance between content knowledge and teaching behaviour in class (Metsäpelto et al., 2022).

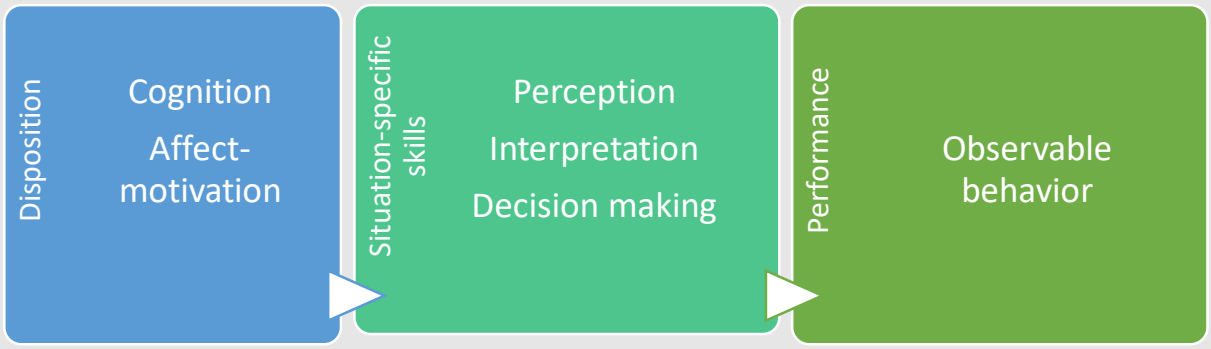

Figure 1. A model of competence

A Multidimensional Adapted Process Model of Teaching-MAP put forward by Metsäpelto et al. (2022) and A model of competence by Blömeke et al. has been reviewed in detail, as shown in Figure 1.

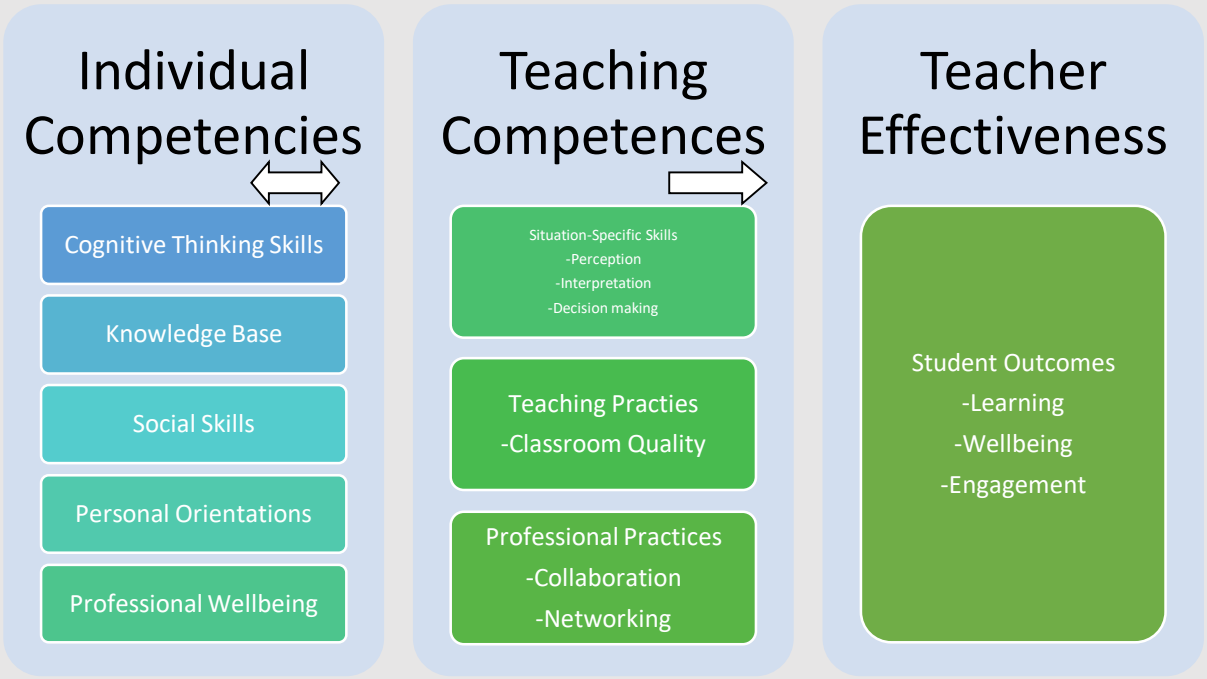

Figure 2. A Multidimensional Adapted Process Model of Teaching-MAP

The term teacher effectiveness in Figure 2 refers to the student's learning outcomes and objectives as well as enabling the motivational, social, and affective outcomes and student's participation (Seidel and Shavelson, 2007). Besides process and summative assessments, assessments that reflect a student's in class experience can also be indications of teacher effectiveness. Because of this, alongside teacher subject matter knowledge, the skill to transmit the subject matter in the best way and manage the learning process also comes into prominence (Goe et al., 2008). With these skills, it is thought that not only the individuals cognitive and affective background but also their university training has a huge impact.

It stands out that there is a low average especially in mathematics in Türkiye while passing from elementary to secondary education and from secondary education to higher education. For example, the mathematics average in the 2022 High School Entrance Exam is 4,74 out of 20 questions (MoNE, 2022). In the 2022 Higher Education Institutions Examination (HEIE), in the first session- the Basic Proficiency Exam- the mathematics average is 8,17 out of 40, in the second session- Field Qualification Test- the average is 7,72 out of 40 questions (Measuring, Selection and Placement Center- [ÖSYM], 2022). According to the results taken from the results evaluation of the education process guided by curricula prepared with constructivist education, it is obvious that there are some deficiencies. When examined Türkiye's TIMSS (Trends in International Mathematics and Science Study) and PISA (Programme for International Student Assessment) exam results, as per the TIMSS 2019 report in the 4th grade mathematics Türkiye ranked the 23rd out of 58 countries and for the 8th grade it was the 20th out of 39 countries (MoNE, 2020). According to the 2018 PISA (Programme for International Student Assessment) report Türkiye ranked the 42nd place out of 79 countries for mathematical literacy. In comparison with the ranking of other participating countries, Türkiye's average in mathematics is at a good level. While researching the reason for Türkiye's ranking in these exams, it is thought that firstly the teacher training for mathematics must be reviewed. Because teachers are key to implementing curricula effectively. While technology may become a superior vehicle for transmitting knowledge, the

relational aspects of teaching – being a good coach, a good mentor – will remain human capacities of enduring value (Schleicher, 2018) Thus the teacher teaching these mathematic curricula, must be an individual who has communicative skills, general knowledge, professional education and skills at a high level, who is open to development, who can use technology and work in collaboration. Through education and evaluation- unlike the traditional learning- in the modern teaching model which encourages student participation, learning is constructed with the student. By this, the student attains a sense of purpose and takes ownership for their learning. In order to achieve this, teachers need support in undergraduate education to design environments which support effective student participation (OECD, 2019).

Due to the leaps in technology and the global pandemic, the 21st century in which education has changed characteristics, in Türkiye, like every other country, teacher education has been dwelled on. A teacher education which includes educational software and web tools in educational environments and with these technologies enables student participation and can promote teacher qualifications and increase these qualifications, is a matter which must be emphasized (Saracaloğlu, 2022). Like in every other area with the rapidly developing technology and science has a direct and indirect effect on the field of education. Not staying idle by such effects increases a country's level of development. In order to form educational forms of higher quality with the self-proving change movements and to determine solutions for potential problems, comparative education studies are utilized (Yıldırım and Türkoğlu, 2018). Comparative educational studies are important so as countries can gain a different perspective on countries and have clearer view of their current situation in comparison to the other countries (Saracaloğlu, 1992). When the success in mathematics for school students at elementary and secondary education level in Türkiye is considered, making comparisons with countries that have proved themselves in this field will enable us to develop a different perspective to the existing problem.

Consequently, in this study the countries South Korea and Finland which stand out with their high level of student performance for mathematics in international exams like TIMSS and PISA have been examined in terms of mathematics teacher selection, their teacher training and education system and their primary and middle schools' mathematics curricula compared to Türkiye and it is aimed to reveal the similarities and differences. For this aim, answers have been searched for the questions below:

1. How is the selection process for institutes training mathematics teachers in Finland, South Korea and Türkiye?
2. How is the pre-service education process for training mathematics teacher candidates in Finland, South Korea and Türkiye?
3. How are the employment conditions for the mathematics teacher candidates in Finland, South Korea and Türkiye?
4. How are the in-service training activities for mathematics teachers in Finland, South Korea and Türkiye?
5. What are the similarities and differences in mathematics curricula for primary and middle schools in Finland, South Korea and Türkiye?
6. What are the similarities and differences in mathematics teacher training systems and mathematics curricula in Finland, South Korea and Türkiye?

Method

Research Model

This study is a comparative education research. This is a comparative educational study which aims to reveal the similarities and differences between Finland and South Korea which have proved their success in TIMSS and PISA exams and Türkiye in terms of mathematics teacher selection and training systems, employment conditions and elementary school mathematics curricula. Comparative education study is a field which researches the education systems of different countries in order to find solutions for potential problems in the field of education in a society (Cramer and Browne, 1965). The constant change in education depending on the changing dynamics and technology enabled research on education to develop in this direction. Thus accordingly, there are various approaches which are used in comparative educational research and depending on these approaches there are different models and methods (Silova, 2019). When looking at the literature, the approaches used in comparative education research in general are examined under eight headings as quantitative (statistical), descriptive, sociological, analytical, synthetic (Özdil, 2021), historical and juxtaposition approaches. Depending on these approaches, it is seen that Jullien, historical, problem analysis, Bereday model, quantitative-statistical, functional, eclectic, Bray and Thomas cube models and methods are used (Saracaloğlu, 2022).

The three countries' mathematics teacher training and educating institutions student selection, the undergraduate education, teacher employment, the in-service training and primary, middle school curricula in the study have been analyzed with the quantitative research method document analysis method and the Bereday model from the comparative education approaches. In the Bereday model, the relevant subject is analyzed by going through the four steps description of data, interpretation, juxtaposition and comparison (Bereday, 1964; Bray, Adamson and Thomas, 2007. *Description step:* In this step the data belonging to each variable is categorized clearly and described. *Interpretation step:* The collected data is analyses with different methods. While analyzing the variable must be evaluated according to their environment. *Juxtaposition step:* In this step, the data collected for two or more countries must be juxtaposed and they must be compared in terms of similarities and differences. *Comparison step:* In this last step, in order to make a final comparison, the aim is to reveal all the data and reach an objective conclusion (Bereday, 1967).

Collection of Data and Analysis

In this study, the data has been collected with the document analysis method of quantitative research models. Document analysis method is a qualitative research method used to analyze written documents systematically (Wach, 2013).

Table 1. 2015, 2018 PISA and 2015, 2019 TIMSS mathematics results

	PISA 2015		PISA 2018	
Country	**Average score**		**Average score**	
Finland	511		507	
South Korea	524		526	
Türkiye	420		454	
OECD average	490		489	
	TIMSS 2015		**TIMSS 2019**	
Country	**4th grade average**	**8th grade average**	**4th grade average**	**8th grade average**
Finland	535	-	532	509
South Korea	608	606	600	607
Türkiye	483	458	523	496
OECD average	500	500	500	500

Source: TIMSS (2015, 2019) and MoNE (2015, 2019)

In Table 1 results from the two terms PISA and TIMSS exams, Finland and South Korea were included in this study because of their ranking and their location, being in different geographical regions. The written documents used in this study are the theses, books, articles, seminars on Finland, South Korea and Türkiye's mathematics teacher selection, training-education systems and the mathematics curricula, the OECD reports and these countries' Ministry of Education official websites. According to Bogdan and Bilken (2007), curricula and guidelines can also be sources of data to be used in the document analysis. Following the literature review, the relevant documents have been compiled into every sub problem. To analyse the data obtained, the comparative education research model: Bereday model was used. With the Bereday model, the variables included in the research have been examined in great detail and compared (Yüksel and Sağlam, 2012). There are four steps: description, interpretation, juxtaposition, comparison (Bray, Adamson and Thomas, 2007). In the first step, data on the mathematics teacher training systems and primary education mathematics curriculum of the selected countries were collected and presented descriptively. In the second step, the relevant variables of the three countries were analyzed. In the third step, the collected data were brought together and tabulated to determine their similarities and differences. In the last step, a final comparison was made from all the data obtained and recommendations were made. Finland, South Korea and Türkiye's mathematics teacher selection and education system, employment conditions, in-service training and current elementary school curricula has been analyzed.

Results

In this part of the research, information has been given on the three countries' mathematics teacher candidate selection for teacher education and training institutions, the employment conditions, in-service training, and current primary and secondary school curricula.

The student selection process for mathematics teacher education in Finland, South Korea and Türkiye

Students who want to become a teacher in Finland enter a university entrance exam called Marticulation Examination which is held twice a year one in spring and one in fall term. This exam which is prepared by the Board of University Entrance Exam consists of five tests. Mother tongue (Finnish, Swedish), second national language, foreign language, mathematics, humanities and natural sciences. The mother tongue language exam is compulsory, then the candidate must complete four more test from at least three other area's tests (Ylioppilastutkintolautakunta, 2022). Following the competency exam, the students enter another exam which consists of three stages. The first stage of this exam measures the student's research, critical thinking and interpretation skills, while the second stage is an interview in which it is decided whether the candidate has a character suitable for being a teacher as a profession. The last stage of the exam is towards evaluating the student's trial lesson, diction and presentation skills (Abbasioğlu, 2017). The candidates who complete the three exams successfully are accepted to the education faculties. Only 10-15% of the candidates to the faculty of education get accepted to the program (Sahlberg, 2007). Out of the 14 universities in Finland, 8 of them have a Faculty of Education (Abbasioğlu, 2017).

In South Korea, like the other countries there is an exam candidate must enter, this exam called “Daehak Suhak Neungluk Siheom” (College Scholastic Aptitude Test- CSAT) is held every November (National Centre for Entrepreneurship in Education [NCEE], 2015). This exam prepared by Korea Institute for Curriculum and Evaluation (KICE) consists of six tests: language arts, mathematics, history of Korea, English, social sciences/physical sciences/ professional education and second foreign language. The students enter the tests according to which field they would like to specialize in (KICE, 2021). For acceptance to the universities not only CSAT points but also their high school averages, portfolios, out of class activities, recommendation letters are taken into consideration (Nuffic, 2016). In South Korea there are 13 Education Institutions for primary School (Gülsoy Kerimoğlu, 2019), for middle school there are 368 in total (Ingersoll, 2007) and 4 different institutions for secondary schools (Kim, 2007, in Altıntaş, 2016). There are 41 universities with mathematics teaching programme in the faculties of education (Kwon, 2004).

In Türkiye, for a student to be placed in a mathematics teaching programme, with the change made in 2018, the candidates must enter HEIE, a two-stage exam which consists of Basic Proficiency Test (BPT) and Field Qualification Tests (FQT) and is held in June once a year. Students who want to enter the first step of HEIE which is prepared by ÖSYM must enter the BPT exam which consists of 40 Turkish, 20 social sciences, 40 mathematics and 20 science questions; students who want to enter FQT must enter an exam of a 40-question mathematics test and a 40-question science test. The students' high school grade point average is multiplied by 0,12 and added their points they receive from the exam; the candidates get placed in the mathematics teacher training undergraduate programmes according to their superiority of points. In 1997 the mathematics education was separated as elementary and secondary school mathematics teacher programmes (Higher Education Council**)** [YÖK], 2017). In Türkiye while there are 13 universities with secondary mathematics teacher training programmes, in 104 universities there are elementary mathematics teacher training programmes (YÖK Atlas, 2022).

Table 2. Comparison of countries' mathematics teacher training systems

	Finland	South Korea	Türkiye
Exam name	Matriculation Examination	College Scholastic Aptitude Test	Higher Education Institutions Examination
Institution Responsible for Examination	Board of University Entrance Exam	Korea Institute for Curriculum and Evaluation	Measuring, Selection and Placement Center
Subtests of the Exam	It consists of five tests. *Mother Language (Finnish, Swedish) Test *Second National Language Test *Foreign Language Test *Humanities and Natural Sciences Test *Math Test	It consists of six tests. *Language Arts Test *Math Test *Korean History Test *English Test *Social Sciences/Physical Sciences/ Professional Education Test *Second Foreign Language Test	In TYT, which is the first stage and compulsory for all students, *Turkish Test *Social Sciences Test *Maths Test *Science Test in AYT *Math Test *Science Test
Type of University Admission	The mother tongue test is compulsory for all applicants, after which they must complete four more tests, which must belong to at least three different groups. After the proficiency exam, students take another three-stage exam. *The first step measures students' research, critical thinking and interpretation skills. *The person's suitability for the teaching profession is decided by the interview made in the second step. *The last step measures the diction and presentation skills of students with sample lectures. Candidates who successfully complete all three exams are accepted to education faculties.	High school grade point averages, portfolios, extracurricular activities, letters of recommendation are also taken into account in addition to the score obtained after taking the desired test from the College Scholastic Aptitude Test.	It is compulsory for all students in TYT, which is the first stage of YKS. For mathematics teaching, it is necessary to take the mathematics test and science test at AYT. Students choose a university with the total score obtained by multiplying the secondary education success score by a coefficient of 0.12 and adding it to the numerical score obtained from the exam.
Number of Education Faculty	Eight of the 14 universities in Finland have a Faculty of Education.	In South Korea, there are 13 Education Institutions for primary School, for middle school there are 368 in total and 4 different institutions for secondary schools' field of study. There are 41 universities with mathematics teaching programme in the faculties of education.	While 13 universities have secondary school mathematics teaching programs, 104 universities have elementary mathematics teaching programs.

Mathematics Teacher Candidates Pre-service Education Process in Finland, South Korea and Türkiye

In Finland there are two models used consecutively and simultaneously for mathematics teacher training at primary and secondary school level. In the consecutive model that lasts 5-6 years, the teacher candidates who have completed their master's degree in the mathematics field can then apply to the education department. After completing pedagogical work, they can receive their teaching certificate. In the simultaneous model, the teacher candidate applying for the mathematics field education can also apply for the teacher education programme. Pedagogical lessons start at the end of the second year. In both models the education process ends with a master's degree (Sahlberg, 2021). The middle school and high school mathematics education is given by a branch who has been educated in Mathematics and Natural Sciences Faculty. In the faculty, students get education in teaching mathematics, physics and information technologies. For middle school mathematics teachers, mathematics undergraduate training doesn't have to be their main field. Teacher training candidates accumulate 180 ECTS and 120 ECTS master's degree credits, adding up to total of 300 ECTS (Sahlberg, 2015). Their education process ends in a master degree of their own field (Malaty, 2004). 80% of the 300 ECTS (240 ECTS) are mathematics field lessons, 20% (60 ECTS) are based on pedagogical education (Çınar and Doğan, 2019). In Finland's teacher training system, there is just as much emphasis put on theoretic lesson as application lessons. The teacher candidates have application training for two years, consisting of four stages: three in faculties of education and one in state schools (Aras and Sözen, 2012). With a decision taken in 1974, teacher training in Finland has been restricted to education faculties only (Abbasioğlu, 2017).

In South Korea the faculties of education (Teacher Colleges), the teacher training classes at universities, education departments and education institutes train secondary education mathematics teachers (Kim, 2007). Education lasts four years. The variety in institutes for secondary education create small differences in curricula. However generally the core curriculum consists of pedagogical knowledge, mathematics field knowledge, pedagogic content knowledge, general knowledge and teaching practice (Kim, Ham and Paine, 2011). In the education colleges, the necessary credits for graduating for the secondary education mathematics teaching curriculum is between 130- and 150-hour credits; 20% are liberal arts, 60% are mathematic branch field (mathematics curriculum study, pedagogical content knowledge, general pedagogic and teaching practice) and 20% is elective lessons. For example, while at Seoul National University which is one of the most prominent universities in South Korea there are 18 field lessons (78.26%), 5 pedagogical knowledge lessons (21.74%), Ewha Women's University has 12 field lessons (60%), 8 pedagogical knowledge lessons (40%) that are taught (Kwon, 2004). The teaching practices vary depending on the university, ranging from 6 to 9 week with credits varying between 3 to 5 credits. In teaching application lessons, lessons observation, classroom management and lecturing skills are practiced (Ingersoll, 2007).

In Türkiye there are three types of programmes that train mathematics teachers: 4-year elementary school level mathematics teaching programme, with YÖK's 18.04.2014 dated decision as of 2014-2015 academic year the secondary mathematics teaching programmes was reduced from 5 years training to 4 years (YÖK, 2020) and the pedagogical formation/ teacher professional knowledge certificate programme which lasts at least two terms.

Table 3. The professional knowledge, general culture and field subject lesson at secondary and elementary mathematics teaching undergraduate programs

Mathematics Teacher Training Programs	Professional Knowledge	General Culture	Field Education
Elementary Mathematics Teacher Training Programme	56 (34%)	28 (18%)	69 (48%)
Secondary Mathematics Teacher Training Programme	56 (34%)	28 (18%)	71 (48%)

Source: YÖK (2018a)

The secondary mathematics teaching and elementary mathematics teaching programmes are divided into three: professional knowledge, general knowledge and field education. As seen in Table 1, both programmes have a curriculum based on field education. There are field and education lessons with the 240 ECTS taken in the four years. In both undergraduate programmes the teaching practice lesson is given in the last year under the names of Teaching Practice 1 and Teaching Practice 2 and is two hours a week in theory, six hours in practice with an trainee at state schools (YÖK, n.d). Until 2014 the pedagogical formation certificate programme had 20 hours theoretical and 10 hours practical lessons adding up to 30 hours of lessons (25 credits), however with the Rules and Procedures of Pedagogical Formation Education dated 27.09.2021, this pedagogical formation education was updated to 24 hours theoretical and 12 hours practical lessons adding up 36 hours of lessons (30 credits-60 ECTS) (Turan, 2021). In order to work as a teacher at any level, being a undergraduate is sufficient. There is no obligation for postgraduate education. However, it is optional for elementary and secondary education mathematics teacher to take their postgraduate education in their own field, in educational administration, assessment and evaluation with or without a thesis.

Table 4. Comparison of pre-service education processes of mathematics teacher candidates in countries

	Finland	South Korea	Türkiye
Institutions/ Programs with a Teaching Diploma	Education faculties	Education faculties (teacher colleges), teacher training classes in universities, education departments and training institutes	Education faculties, pedagogical formation training programs
Education Time	In teacher training, which has two models, sequential and simultaneous, only in education faculties and the education period is 5-6 years.	In education faculties (teacher colleges), teacher training classes in universities, education departments and training institutes, the education period is four years.	In education faculties, primary and secondary education mathematics teaching continues for 4 years, and formation / teaching professional knowledge certificate programs continue for at least two semesters.
Postgraduate Requirement at the End of Education	In both models, at the end of the education process, they have a master's thesis prepared in their field of teaching process.	There is no postgraduate thesis requirement at the end of the education process.	There is no postgraduate thesis requirement at the end of the education process. A teacher who graduates optionally can continue postgraduate education.

Content of the Instruction	Mathematics teaching in secondary and high schools is given by branch teachers trained in the Faculty of Mathematics and Natural Sciences. In this faculty, students study for teaching mathematics and teaching physics or information technology. Mathematics teacher candidates complete 300 ECTS credits, 180 ECTS undergraduate and 120 ECTS postgraduate education. In addition, 80% (240 ECTS) of these 300 ECTS includes mathematics courses and 20% (60 ECTS) pedagogy education.	The diversity of institutions for secondary education branches creates small differences in the curriculum. But in general, the core curriculum; It consists of pedagogical knowledge, mathematics content knowledge, pedagogical content knowledge, general culture and teaching practices. The required credits for graduation from the secondary mathematics teaching curriculum of the colleges of education range from 130 to 150 hours; 20% liberal arts, 60% mathematics major (mathematics curriculum study, pedagogical content knowledge, general pedagogy and teaching practice) and 20% elective courses.	In the mathematics teaching program, the courses are divided into three as vocational knowledge, general culture and field education. Of the 240 ECTS courses taken, 34% consists of vocational knowledge, 18% general culture and 48% field education. In pedagogical formation education certificate programs, there are a total of 36 hours of courses (30 credits-60 ECTS), 24 hours of theory and 12 hours of practice.
Internship Period	For two years, teacher candidates participate in practical training, which consists of four stages, three of which are in practice schools affiliated to education faculties and one is in public schools.	Teaching practices vary from university to university, generally lasting six to nine weeks and having three to five credits. In practice courses, studies such as observation, classroom management and lectures are carried out.	In the undergraduate program, the teaching practice course is given in the last year as "Teaching Practice 1" and "Teaching Practice 2", two hours of theory and six hours of internship in public schools.

Mathematics Teacher Candidates' Employment Conditions in Finland, South Korea and Türkiye

In Finland an employment exam doesn't exist unlike Türkiye. The provinces and local administration are responsible for employing teachers and in some school connected to the municipalities the teacher selection process is done by the school principal or school institutions. In the employment of mathematics teachers, the teacher's teaching skills, a postgraduate degree and traineeship training play an important role (Aksoy and Karagözoğlu, 2021). To become a teacher, the mathematics teacher candidates, apply directly to the local administration or schools. Although the candidacy period changes according to the local administration, it is at least one year (Kalkan, 2021).

In South Korea, the mathematics teacher candidates have to enter a two-stage employment exam prepared by the state/province education offices in order to work in public enterprises. While the first stage (30%), of the exam consists of educational sciences and field subjects the second stage (70%) of exams assessing article writing knowledge, interview, classroom management and informatics knowledge (Mete, 2013). Similar to Türkiye, after the Ministry of Education has determined the number of teachers to be hired from the branch of mathematics, the teacher candidates apply and get appointed according to their points superiority (Boran Yılmaz et al., 2019). In South Korea, there is no obligation for postgraduate education in order to work as a teacher. The trainee teachers starting to teach have a two-month education in the schools. In the first six months of starting their traineeship, trainee teachers have to take an education which includes teaching practice, classroom management and guidance (NCEE, 2015). The novice

teachers in South Korea have a second-degree teaching certificate. After 3 years of teaching experience and 15 credits in-service education and training they become entitled to receiving a first degree certificate.

In Türkiye the mathematics teacher candidates must enter a Public Personnel Selection Exam (PPSE) prepared by ÖSYM in order to start working for public service the exam consists of General Culture (15%), General Ability (15%), Educational Sciences (20%) and formation knowledge for mathematics field (50%) tests. According to the candidate points, they get invited to an interview. The selection is done with the total score taken by adding the candidate's exam score and interview score. The teacher candidates are placed by the Ministry of National Education according to their score superiority. As per the Law on Teaching Profession enacted on the 3rd of February 2022; teachers have four different career steps which are novice teacher, teacher, chartered teacher and head teacher. (Republic of Türkiye Official Gazette, 14 February 2022, issue: 31750). The candidacy period for the teacher candidates who have been appointed is less than a year and within no longer than two years they are subject to a Novice Teacher Training Programme. The novice teacher status for teachers who are found to be successful is removed by the Candidacy Evaluation Commission.

Table 5. Comparison of employment conditions of mathematics teacher candidates in countries

	Finland	**South Korea**	**Türkiye**
Employment Exam	There is no employment exam.	A two-stage employment exam prepared by state/provincial education offices is taken. The first stage (30%) consists of educational sciences and main subjects, while the second stage (70%) consists of exams that measure article writing, interview, classroom management and informatics knowledge.	The mathematics teacher candidates must enter a Public Personnel Selection Exam prepared by ÖSYM in order to start working for public service, the exam consists of general culture, general ability, educational sciences and formation knowledge for mathematics field tests. According to the candidate points, they get invited to an interview.
Getting Started	While state and local governments are responsible for teacher employment, in some municipal schools, teacher selection is made by school principals or school boards. Teaching skills, graduate, and internship training play an important role in the employment of prospective mathematics teachers. Mathematics teacher candidates apply directly to local governments or schools in order to become a teacher.	After the number of teachers to be recruited from the Mathematics branch is determined by the Ministry of National Education, teacher candidates are appointed and applied according to their score advantages.	The selection is done with the total score taken by adding the candidate's exam score and interview score. The teacher candidates are placed by the Ministry of National Education according to their score superiority.
Time of Candidate Teaching	Although the duration of candidacy varies according to local governments, it is at least one year.	Trainee teachers who start teaching receive two-month training within the school. In addition, trainee teachers have	The candidacy period for the teacher candidates who have been appointed is less than a year and

	to receive training on teaching practices, classroom management and guidance for the first six months of their employment.	within no longer than two years they are subject to a Novice Teacher Training Programme. The novice teacher status for teachers who are found to be successful is removed by the Candidacy Evaluation Commission.
Career Ladder	A new teacher in South Korea holds a second-degree certificate. After 3 years of teaching experience and 15 credits of in-service training, a first-degree certificate is awarded.	According to the Teaching Profession Law, mathematics teachers; It is organized in four different ways as candidate teacher, teacher, expert teacher, and head teacher.

The In-Service Training for Mathematics Teachers in Finland, South Korea and Türkiye

In Finland the professional development programmes are usually school orientated. In addition to the schools, municipalities, occupational organizations, and universities are responsible for planning in-service training (Mete, 2013). The National Government makes it obligatory that every municipality has a fund for a minimum three days of compulsory professional development programme. Furthermore, the government doesn't organize the content and the type of this professional development which is provided to the teachers (NCEE, 2015). In Finland teachers gather for at least an hour in order to share their opinions on curricula development, effective teaching methods and techniques (Hazır, 2015). In Finland, in-service training is generally based on collaboration between teacher and with this in-service continuing training the aim is that the teachers develop themselves and thus great importance is given to these trainings. According to TALIS 2018 Data: 9% of the teachers participated in a collaborative professional learning at least once in a month (OECD average is 21%) and 34% of the teacher participated in the team teaching at the same frequency (OECD average is 28%) (OECD, 2018).

The in-service training in South Korea is prepared by the government. These trainings last at least 180 hours and 30 days and it is compulsory to take these in-service trainings. After every training, the teachers who completes the training following the evaluation held in a scale of 100 points is given a certificate. With these certificated teachers can get additional points and an increase in salary (Orakçı, 2015). According to TALIS 2018 Data: 13% of the teachers participated in a collaborative professional learning at least once in a month (OECD average is 21%) and 19% of the teacher participated in the team teaching at the same frequency (OECD average is 28%) (OECD, 2018).

As of 2011 the General Directorate of Teacher Training (ÖYGM) is responsible for in-service training in Türkiye (ÖYGM, 2019). There are two types of in-service trainings: central and regional activities. In our country, participation for the in-service training planned in many different areas, at the beginning of the school year, is voluntary or obligatory. There is compulsory one-week in-service training in September, November, April and June. Also, the appointed teacher is given compulsory in-service training of 645 hours which is under *the Novice Teacher Training Programme* (MoNE, 2021). According to TALIS 2018 Data: 29% of the teachers participated in

a collaborative professional learning at least once in a month (OECD average is 21%) and 23% of the teacher participated in the team teaching at the same frequency (OECD average is 28%) (OECD, 2018).

Table 6. Comparison of in-service training practices of mathematics teachers in countries

	Finland	**South Korea**	**Türkiye**
Institution(s) Responsible for In-Service Training	Professional development programs are often school-centered. Apart from schools, municipalities, professional organizations and universities are also responsible for in-service training planning for professional development.	In-service trainings are prepared by the government.	The General Directorate of Teacher Training and Development has been responsible for in-service training since 2011.
Whether in-service training is compulsory or not	The national government requires each municipality to fund at least three days of compulsory professional development each year. At least one hour a week, teachers meet among themselves to share their views on effective teaching methods and techniques and improving curricula.	These trainings are at least 180 hours and 30 days, and it is obligatory to take these in-service trainings.	Two types of in-service training are planned as central and local activities. Participation in in-service activities planned at the beginning of the academic year in our country is either optional or compulsory.
In-Service Training Process	In-service training generally aims to improve teachers' self-development through continuous on-the-job training based on cooperation between teachers, and such training is given great importance.	At the end of each training, a certificate is given to the teachers who complete the program as a result of the evaluation with a 100-point scale. With these certificates, the teacher receives additional points and increases their wages.	There is one-week compulsory in-service training in September, November, April and June. In addition, there are 645 hours of compulsory in-service training for the novice teachers who are appointed within the scope of the Novice Teacher Training Program. GDoTT organizes trainings in various fields. Teachers can participate in optional trainings in areas where they feel lacking.
Participation In In-Service Training	According to TALIS 2018 data; it is reported that 9% of teachers participate in cooperative professional learning at least once a month (OECD average 21%) and 34% participate in team teaching at the same frequency (OECD average 28%).	According to TALIS 2018 data, 13% of teachers report that they participate in collaborative professional learning at least once a month (OECD average 21%) and 19% participate in team teaching at the same frequency (OECD average 28%).	According to TALIS 2018 data, 29% of teachers report that they participate in collaborative professional learning at least once a month (OECD average 21%) and 23% participate in team teaching at the same frequency (OECD average 28%).

The Mathematic Curricula in Finland, South Korea and Türkiye

In this section during the compulsory education period in Finland, South Korea and Türkiye, because the mutual period for all three countries is elementary school (primary school and middle school), the objectives, tasks and learning domain of all three countries' elementary mathematic curricula have been introduced.

The objectives of mathematics lesson according to Finland's educational understanding.

- To support the student's development in thinking mathematical in a logical, accurate and creative.
- To create a foundation through teaching and learning to improve their problem-solving skills, to comprehend the mathematical concepts, structures and to process information.
- To advance in teaching systematically due to mathematics cumulative nature.
- A concrete and functional approach forms the basis while teaching and learning mathematics.
- Learning is supported through the use of information and communication technologies.
- Mathematics teaching supports students to have a positive attitude towards mathematics and their positive self-image.
- Communication enhances interaction and co-operative skills.
- Studying mathematics is a permanent search towards a goal.
- Students take responsibility for their own learning.
- Education guides students to understand the benefit of mathematics in their own life and in a wider perspective for the society.
- Teaching and learning processes improves student's capacity of using and applying mathematics in multiple ways (FNBE, 2014).

Table 7. The mathematics teaching mission according to class level in Finland

Primary School (1st and 2nd Grades)	**Primary School (3rd -6th Grades)**	**Middle School (7th -9th Grades)**
***** The Mathematics teaching mission is to provide various experiences which help the students build a foundation for the mathematical concepts and the structures formulation. * Teaching and Learning use different senses. * Teaching and Learning develop the students' skills to express their mathematical thoughts through concrete tools, speaking, writing, drawing and interpretation. *Mathematics education builds a strong foundation to comprehend numbers and the decimal system concept and learn arithmetic skills.	* Mathematics teaching and learning provides experiences in which students are able to improve their understanding of mathematical concepts and structures. * The education supports the development of skills for presenting their mathematical thinking and solution in different ways with different tools to others. * Solving various problems independently and in a group, comparing the different solutions is crucial for teaching and learning. * Students are enabled to widen their understanding and comprehension of numbers and the decimal system. * Students can also improve their fluency in arithmetic skills.	* Mathematics education's mission is to strengthen general knowledge and talent in mathematics. * Education encourages students to help deepen their understanding of mathematical concepts and the relations between one another, to discover mathematics in their own life and use it. * It helps them acquire mathematical modeling and problem-solving skills to relate mathematics to their own lives. * Students are encouraged to present their solutions and discuss in group work.

Source: National Core Curriculum for Basic Education (FNBE, 2014)

Table 8. Mathematics content areas by grade level in Finland

Grades 1-2	Grades 3-6	Grades 7-9
* Thinking skills	* Thinking skills	* Thinking skills and methods
*Numbers and operations	* Numbers and operations	* Numbers and operations
*Geometry and measuring	* Algebra	*Algebra
* Data processing and statistics	* Geometry and measuring	*Functions
	*Data processing and software, statistics, and probability	*Geometry
		*Data processing, statistics and probability

Source: National Core Curriculum for Basic Education (FNBE, 2014)

Table 9. Purposes of primary school (1st and 2nd grades) mathematics teaching in Finland

Objectives of instruction	Content areas related to the objectives
Significance, values, and attitudes	
Support the pupil's enthusiasm for and interest in mathematics and the development of his or her positive self-image and self-confidence	All Content Areas
Working Skills	
Guide the pupil to improve his or her ability to make mathematical observations and to interpret and use them in different situations	All Content Areas
Encourage the pupil to present his or her solutions and conclusions through concrete tools, drawings, speech, and writing, also using information and communication technology	All Content Areas
Guide the pupil to develop his or her reasoning and problem-solving skills	All Content Areas
Conceptual objectives and objectives specific to the field of knowledge	
Guide the pupil to understand mathematical concepts and notations	All Content Areas
Support the pupil in developing an understanding of the concept of numbers and the principles of the decimal system	Numbers and operations
Familiarize the pupil with the principles and features of basic arithmetic operations	Numbers and operations
Guide the pupil to develop fluent basic arithmetic skills using natural numbers and to use different mental arithmetic strategies	Numbers and operations
Familiarize the pupil with geometric shapes and to guide him or her to make observations on their characteristics	Geometry and measuring
Guide the pupil to understand the principle of measurement	Geometry and measuring
Familiarize the pupil with tables and diagrams	Data processing and statistics
Support the development of the pupil's competence in formulating step-by-step instructions and following instructions	Thinking skills

Source: National Core Curriculum for Basic Education (FNBE, 2014)

Table 10. Purposes of primary school (3rd -6th grades) mathematics teaching in Finland

Objectives of instruction	Content areas related to the objectives
Significance, values, and attitudes	
Maintain the pupil's enthusiasm for and interest in mathematics and to support a positive self-image and self-confidence	All Content Areas
Working skills	
Guide the pupil to perceive and understand connections between the things he or she has learned	All Content Areas
Guide the pupil to develop his or her skills in posing questions and making reasoned conclusions based on his or her observations	All Content Areas
Encourage the pupil to present his or her conclusions and solutions to others through concrete tools, drawings, speech, and writing, also using information and communication technology	All Content Areas
Guide and support the pupil in developing his or her problem-solving skills	All Content Areas
Guide the pupil to develop his or her skills in assessing whether the solution is reasonable and meaningful	All Content Areas
Conceptual objectives and objectives specific to the field of knowledge	
Guide the pupil to use and understand mathematical concepts and notations	All Content Areas
Support and guide the pupil to strengthen and expand his or her understanding of the decimal system	Numbers and operations
Support the pupil in expanding his or her understanding of the concept of numbers to positive rational numbers and negative integers	Numbers and operations
Guide the pupil in achieving fluent mental and written arithmetic skills, making use of the properties of operations	Numbers and operations
Guide the pupil to observe and describe the geometrical properties of objects and figures and to familiarize the pupil with geometrical concepts	Geometry and measuring
Guide the pupil in estimating the magnitude of a measured object, selecting a suitable tool and unit for the measurement, and considering whether the result is reasonable	Geometry and measuring
Guide the pupil in preparing and interpreting tables and diagrams and using statistical key figures as well as to offer experiences of probability	Data processing and software, statistics, and probability
Inspire the pupil to formulate instructions in the form of computer programs in graphic programming environments	Thinking skills

Source: National Core Curriculum for Basic Education (FNBE, 2014)

Table 11. Purposes of primary school (7^{th} -9^{th} grades) mathematics teaching in Finland

Objectives of instruction	Content areas related to the objectives
Significance, values, and attitudes	
Strengthen the pupil's motivation, positive self-image, and confidence as a learner of mathematics	All Content Areas
Encourage the pupil to take responsibility for learning mathematics both independently and together with others	All Content Areas
Working skills	
Guide the pupil to perceive and understand connections between the things he or she has learned	All Content Areas
Encourage the pupil to develop his or her verbal and written mathematical expression	All Content Areas
Support the pupil in solving mathematical assignments that require logical and creative thinking and in developing skills needed in it	All Content Areas
Guide the pupil to evaluate and develop his or her mathematical solutions and to examine critically whether the result is reasonable	All Content Areas
Encourage the pupil to also mathematics also in other subjects and in society	All Content Areas
Guide the pupil to develop his or her information management and analysis skills and to instruct him or her in critical examination of information	Thinking skills and methods Functions Data processing, statistics, and probability
Guide the pupil to apply information and communication technology in learning mathematics and problem-solving	All Content Areas
Conceptual objectives and objectives specific to the field of knowledge	
Guide the pupil to strengthen his or her reasoning and mental arithmetic skills and to encourage the pupil to use his or her arithmetic skills in different situations	Thinking skills and methods Numbers and operations
Guide the pupil to develop his or her ability to calculate basic arithmetic operations using rational numbers	Numbers and operations
Support the pupil in expanding his or her understanding of the concept of numbers to real numbers	Numbers and operations
Support the pupil in expanding his or her understanding of percentage calculation	Numbers and operations Data processing, statistics, and probability
Guide the pupil to understand the concept of the unknown and to develop his or her skills in solving equations	Algebra Functions
Guide the pupil to understand the concept of the variable and to acquaint him or her with the concept of the function. To guide the pupil to practice interpreting and producing the graph of a function	Algebra Functions
Support the pupil to understand geometric concepts and connections between them	Geometry
Guide the pupil to understand and utilize properties related to the right-angle triangle and the circle	Geometry
Encourage the pupil to develop his or her skills in calculating circumference and volume	Geometry
Guide the pupil in determining statistical key figures and calculating probabilities	Data processing, statistics, and probability
Guide the pupil to develop his or her algorithmic thinking and skills in applying mathematics and programming in problem-solving	Thinking skills and methods

Source: National Core Curriculum for Basic Education (FNBE, 2014)

The four targets in the mathematics curriculum of South Korea

1. Through representation of mathematics and discussion, through reflection actions and explaining ideas, students acknowledge the importance of communication in learning and using mathematics.
2. In order to develop mathematical thinking and reasoning skills, students use induction or analogy to reveal mathematical facts and provide justification or prove them.
3. So as to feed mathematical creativity, students are encouraged to think differently and use mathematical tasks for generating different ideas.
4. For the purpose of cultivating the student's character, the students respect different solution methods and views that are presented by their peers (Pang, 2014).

Table 12. Mathematics content areas by grade level in South Korea

Grades 1-6	Grades 7-9
*Numbers and Operations	*Numbers and Operations
*Shapes	*Geometry
*Calculation	*Probability and Statistics
*Probability and Statistics	*Variables and Expressions
*Pattern and Problem Solving	*Functions

Source: Hwang and Han (2013)

Table 13. The content of learning domain in primary school mathematics curriculum in South Korea

	1st Grade	2nd Grade	3rd Grade
Numbers and Operations	*Numbers up to 100 *Comprehension of addition and subtraction with one digit and double-digit numbers	*Numbers up to 1000 *Addition and subtraction with two digit and three-digit numbers *Understanding the term fraction	*Numbers up to 10000 *Addition and subtraction with four-digit numbers *Division and multiplication *Fractional and Decimal Numbers
Shapes	*Recognition of 2D and 3D shapes	*2D shapes *Building solid shapes	*The term angle *The conversion of a flat shape * Properties of circle
Measurement	*Comparison of amounts *Reading	*Time, Hour, length calculation	*Length, time, capacity, weight calculation
Probability and Statistics	*Grouping objects	*Creating graphic and table	*Information characteristics *Organizing information
Patterns and Problem Solving	*Understanding the concept of patterns *Create a pattern according to a certain rule *Making a pattern with numbers up to 100 *Finding the missing parts of pattern *Solving problems by using various ways	*Making a pattern with different variables *Creating a pattern with times table *Using structural expressions *Finding the unknown	*Creating a pattern according to rules *Problem solving according to tables

Source: Altıntaş (2014)

Table 14. The content of learning domain in primary school mathematics curriculum in South Korea (Continued)

	4th Grade	5th Grade	6th Grade
Numbers and Operations	*Five-digit numbers *Addition and subtraction for fractions *The term decimal fraction *Addition and subtraction with decimal fractions *Basic arithmetic operations with natural numbers	*Multiplication and division *Decimal numbers and fractions *Addition and subtraction with fractions *Multiplication and division with decimal numbers	*Division with fractions and decimal numbers *Four operations with fractions and decimal numbers
Shapes	*Types of angles and triangles *The term polygon	*The features of the geometric shapes rectangle, parallelogram, cube * The term symmetry *Congruent	*The features of prism, cylinder and other solids
Mesaurement	*Calculating angles *The area of a rectangle and square *Calculating an approximate value	*Area calculations	*Surface area *Area of a Cylinder
Probability and Statisctics	*Reading graphics *Line graphics	*Average *Use of symbols	*Introduction to graphic types
Patterns and Problem Solving	*Creating different patterns *Filling the gaps in the pattern *Pattern and compatibility *Expressing the problem-solving process *Logical reasoning	*Ratio and Proportion *Finding different solution to problems *Solving probability problems *Recognizing the information concerning the solution in the problem sentence	*Disequilibrium *Ratio expressions *Creating a new problem from problem features *Comparing problem solving methods

Source: Altıntaş (2014)

Table 15. The Content of learning domain in middle school mathematics curriculum in South Korea

	7th Grade	8th Grade	9th Grade
Numbers and Operations	*Understanding prime factorization *Finding the greatest common divisor and the least common multiple *The terms whole number, rational number, the comparisons and four operations	*Understanding repetitive decimal numbers *The relation between rational numbers and repetitive decimal numbers *Approximated values' expressions	*Understanding square roots *Understanding irrational numbers *Comparing real numbers *Four operations with real numbers
Geometry	*Understanding points, lines, faces and angles *The geometric relation between points, lines and planes *The features of parallel lines *The term Triangle and its features	*The features of isosceles triangle *Understanding the perimeter of a triangle and its center *Features of tetragons *Features of Similar shapes	*Understanding Pythagoras theorem *Finding Trigonometric ratios *Chord of a circle and tangent features *Features of inscribed angles

	*The features of polygons, finding central angle, arc-length and area *Finding surface area and volume of solids	*Similar Triangles conditions *Finding the length of parallel lines and their ratio *Feature and operations of similar shapes	
Probability and Statistics	*Drawing Stem and Leaf Diagram *Histogram *Finding averages from frequency distribution tables *Understanding Dependent frequency distribution	*Understanding probability terms *Calculating probabilities	*Understanding Median modulo and average *Finding variance and standard deviation
Variables and Expressions	*Using variables *Statement values *Adding and subtracting linear statements *Operation of linear equations	*Features of exponential numbers *Adding and subtracting polynominals *Division and multiplication of polynominals *Solving linear equations and linear disequilibrium	*Factorization *Second degree equation
Functions	*The term function *Consecutive pairs and coordinates *Functions operations	*Drawing linear functions and understanding their features *Operations with linear functions *The relation between linear functions and linear equations	*Quadratic functions *Drawing quadratic functions' graphics and understanding their features

Source: Hwang and Han (2013)

The special objectives of the mathematic curriculum in Türkiye;

- The students will improve their mathematical literacy skills and are able to use them.
- They will be able to use mathematical concepts in daily life.
- They will be able to use their reasoning skills while solving a problem and express them.
- They will be able to use mathematical terminology correctly in order to express their ideas.
- They will be able to manage the learning process with their metacognitive knowledge and skills.
- They will be able to express the concepts using different forms.
- They will understand the relationship between mathematics, art and aesthetic.
- They will develop characteristics which enable them to be systematic, patient, and responsible (MoNE, 2018a).

Table 16. Mathematics content areas by grade level in Türkiye

Grades 1-4	Grades 5-8
*Numbers and Operations	*Numbers and Operations
* geometry	*Algebra
*Measuring	*Geometry and Measurement
*Data processing	*Data processing
	*Possibility

Table 17. Goals in mathematics curriculum by grade level in Türkiye

Primary School (1st -4th Grades)	Middle school (5th -8th Grades)
**Numbers and Operations;* Natural numbers, fractions and four operations are aimed to be taught. **Geometry;* The student is expected to recognize geometric shapes and angles, use expression used while giving direction in daily life and discover patterns. **Measurement;* The student is expected to use the correct measurements in Daily life for length, area, time, liquids weights and recognize money(coins/notes). **Data Processing;* The student is expected to Show different data with various graphic types and deduce from the graphics.	**Numbers and Operations;* The student is expected to be able to make sense of integers, real numbers and irrational numbers from the new set of numbers together with natural numbers, fractions and decimal numbers, and to be able to make operations, and to solve percentage, Greatest common divisor, least common divisor problems. * *Algebra*; expand their operations skills to the concepts of equality and equations with their algebraic expressions and use these expressions in a meaningful way **Geometry and Measurement*; Adding polygon, rectangle, parallelogram, rhombus and trapezoid to the geometric shapes learned in primary school is expected to be able to calculate the perimeter, area and volume of these shapes, and to solve problems related to the circle, Pythagorean relation, translation and reflection. **Data Processing;* It is required to collect data, show it with column and line graphs, and use different statistics related to graphs. **Probability;* this is only for the 8th grades; The students are expected to be able to calculate the probabilities of simple events.

Source: MoNE (2018a)

Conclusion and Suggestions

In this study the mathematics teacher training institutions student selection system, pre-service training process, employment conditions, in-service training and mathematics curricula in Finland, South Korea and Türkiye has been analyzed. Depending on the findings comparative results were given, the interpretation and results suggestions were put forward.

The Similarities and Differences Between the Teacher Training System and Mathematics Curricula in Finland, South Korea and Türkiye

In the three countries examined, in order to be placed in a mathematics teacher training programme students in Finland take a Marticulation Examination, in South Korea students take a College Scholastic Aptitude Test and in Türkiye students take the Higher Education Institutions Examination. The central examinations held once a year in South Korea and Türkiye are held twice a year in Finland. Students who want to get placed in teaching training programmes in the three countries have to pass different stages. Following the Marticulation Examination, the students in Finland must enter another exam which consists of three stages. The first stage of this exam measures the student's research, critical thinking and interpretation skills, the second stage is an interview which checks whether the candidate has a character suitable for being a teacher as a profession and in the last stage of the exam evaluates the student's trial lesson, diction and presentation skills. Those who complete the three stages successfully shall be placed in the Education Faculties. In South Korea for acceptance to the universities not only CSAT points but also their high school averages, portfolios, out of class activities, recommendation letters are taken into consideration. The students' high school (secondary) grade point average is added to their points they receive from the exam and with the total score the candidates get placed in the education faculties according to their superiority of points. It can be said South Korea and Finland which are successful in PISA, TIMSS exams are much more meticulous while selecting teacher candidates. Especially in Finland while selecting teacher candidates, the fact that the teaching skills are taken into consideration and the undergraduate/ postgraduate education is built on the basis of these skills plays a fundamental role in designing learning environments which support student participation in professional life and brings out curiosity or in other words plays an essential role in the quality of education.

In Türkiye mathematics teacher training programmes are based on field lessons and are programmes which last four years. The teacher candidates take 240 ECTS lessons in the four years and while taking pedagogical lessons they additionally take teaching practice lesson in their final year. As part of this lesson, there is a two-hour theoretical lesson and a six-hour traineeship in state schools. Apart from education faculties, students graduated from the mathematics department can also become a mathematics teacher with a 36-hour certificate programme consisting of 24 hours of theory and 12 hours of practice. In order to become a mathematics teacher in Türkiye, there is no obligation to have a postgraduate education. However, in Finland there is a necessity to have a postgraduate education to become a teacher. In Pre-service training, just like in Türkiye there are two ways that exist. The first is to get a teaching certificate, a teacher candidate, who has completed a master's degree in mathematics, can apply to the education department and after one year of pedagogical work and become a teacher; in the second way the teacher candidate, who has applied to education in the field of mathematics, can simultaneously apply to a teacher training programme and take the pedagogical lessons which start at the end of the second year to receive a teaching certificate. The training lasts 5-6 years and consists of 180 ECTS undergraduate and 120 ECTS master's degree credits. The difference between Türkiye is that the candidates have a four stage

traineeship, for two years they have work at three practice schools connected to the faculty and at one state school. By this result, it is seen that the school experience in Türkiye and the fact that the teaching practice is left to the last year results in the teacher candidates in Türkiye being insufficient in self-development in comparison with Finland. South Korea similar to Türkiye has an education duration of four years and has no obligation for postgraduate education. In South Korea, different from the other two countries there are more institutions that train mathematics teachers: teacher colleges, the teacher training classes at universities, education departments and education institutes. The number of institutions brings about differences in curricula. Generally speaking, the curricula are made up of pedagogical knowledge, mathematics field knowledge, pedagogical field knowledge, general culture and teaching practice. So as to graduate from the colleges' secondary mathematics teacher training programmes, the necessary credits range from 130 to 150 hours. The teaching practices can also be different depending on the university and usually last between six to nine weeks.

Out of the three countries that were analyzed, in Türkiye and South Korea mathematics teacher candidates have to take an employment exam before starting their duty. However, there are significant differences between these two exams. In Türkiye the exam is centrally prepared, it is a multiple choice test and consists of three sections: general culture-ability, educational sciences and mathematics field knowledge. According to the candidate's score, they are called to the interview and by adding the interview score, they make a selection. In South Korea the exam prepared by the state/province education offices consists of two stages. The first stage consists of the exam on educational sciences and field subjects, the second stage consists of exams assessing article writing knowledge, interview, classroom management and informatics knowledge. With the total score, similar to Türkiye, the candidates are appointed to the announced vacant positions as per score superiority. Finland has no employment examination. The mathematics teacher candidates directly apply to the local administration and schools. The local administration and school principals are responsible for hiring teachers. Whilst hiring teachers, teaching skills, traineeships play an essential role. Mathematics teacher candidates in Finland aren't subject to an exam, this shows the fact that the supply and demand equilibrium in this area has been balanced. In our country, the number of graduates from mathematics teacher training programmes and the lack of number of appointments result in the supply surpassing the demand.

The newly appointed mathematics teacher is given the title Novice Mathematics Teacher. The candidacy/novice period is one year and within a year the teacher must take Novice Teacher Training Programme. The novice teacher’s status as is removed by the Candidacy Evaluation Commission for the mathematics teachers who are found to be successful. During their career teachers must take one-week in-service training every year in September, November, April and June. The teachers voluntarily apply to the in-service training held by ÖYGM centrally and regionally. There is no inspection mechanism for this. In Finland the in-service training is usually school orientated and with this it differs from Türkiye. Each teacher has compulsory in-service training once a year for at least three days. The government doe not organise the type or content of professional development. It is only held obligatory for the municipalities to provide funds for these in-service trainings. In South Korea, there is a difference in term of having the in-service training prepared centrally. At least 30 days in-service training must be taken. After the evaluation held following each training, the teachers are given certificates. Thanks to these certificates, teachers can earn additional points and get an increase in wage. In our country so as to find a solution for teacher and school needs, the in-service trainings aren't prepared centrally but regionally and in fact in some cases they are prepared depending on the schools. Because it is

thought that with this type of preparation, there will be an increase in the teachers' motivation towards the trainings.

Although in Türkiye it is aimed that with the mathematics curricula which is prepared according to the constructivist education understanding, problem solving skills of the students will improve, the learning domain of thinking skills at the primary and middle school level in Finland is remarkable. In Finland and Türkiye there are four learning domains for primary school, whereas in South Korea there are five learning domains. One of these is the learning domain of building and problem solving. While in South Korea this learning domain at primary school level consists of building and problem solving, in our country this is a sub learning domain within primary curricula. Also, while geometry is a learning domain at every grade in both Türkiye and Finland, it is only taken as a learning domain in South Korea as of middle school. When we look at the objectives and content of elementary mathematics education curricula in Finland and South Korea, it can be seen through concrete experience as of the first grade so as to develop problem solving skills a learning by doing learning model approach is used. The mathematical curriculum of our country has the same objective. However, in order to accomplish this, it is thought that in curricula this matter must be included in a clearer manner. Problem solving skills are not only useful in mathematics but every part of our life, these skills are crucial for the peace of the community. Thus, it is thought that the development of this skill is a matter that be emphasized. In PISA and TIMSS exam results it is clear that the students with problem solving and thinking skills are more successful.

As a result, it is thought that the most basic factor affecting Turkey's mathematics achievement is the choice of teacher candidates. Because teacher candidate selection is the first step of the pre-service and in-service training process. Only looking at the Higher Education Institutions Examination results at the entrance to the education faculties is missing in the selection of qualified teacher candidates. The teacher is not only the person who transfers the curriculum. It is the person who is in one-to-one communication with the students, who can create learning environments that are appropriate for the class level and that can increase the internal motivation of the students. Therefore, it is thought that in the selection of teacher candidates, attention should be paid to the selection of people who can carry the teacher qualifications, and to the teacher education practices that reveal and constantly improve these qualifications.

Suggestions

- In this study primary and middle school mathematics curricula has been examined. In relation to this subject high school mathematics curriculum can also be analyzed.
- In Turkey, it is recommended to introduce additional criteria such as social work activities and activities in high school in addition to exam scores for student admission to education faculties.
- The fact that supply exceeds demand in Turkey highlights quantity rather than quality. Teacher candidates should be trained in accordance with supply and demand.
- At the last year of university, teacher candidates go into a busy exam preparation which results in their teaching practice being of secondary importance. Hence it is suggested that in undergraduate education the teaching practice be not just one year but at least two years.
- In addition to exam results, in teacher appointments, choices should be made with practice studies to see communication skills and dominance in the classroom.

- Problem solving skills in mathematics teaching programs should be determined as a learning area starting from primary education and learning activities should be organized in a way to develop this area.

Conflict of Interest

There are no personal and financial conflicts of interest between the authors of the article within the scope of the study.

Author Contributions

Study Design: The study was carried out by the author and his consultant.

Data Collection: It was carried out by the author and his consultant.

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