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Original article

Comparison of the Mathematics Contents of Turkish and Swiss Preschool Curricula

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Abstract

This study aimed to compare the mathematics contents of Turkish and Swiss Preschool Curricula. In this context, the similarities and differences of the outcomes belonging to the learning domains were expressed. The research was designed qualitatively and document analysis was used as the data collection technique. The mathematics contents of the Turkish and Swiss Preschool Curricula were taken into consideration as documents. Content analysis was used as the data analysis method. According to the findings obtained in this study, it was determined that the preschool curricula in Turkey and Switzerland are organized according to developmental areas, the learning domains are similar, and both countries detail the curriculum with indicators depending on the stated outcomes. In both curriculum, the outcomes and indicators for the learning domains of "knowing numbers and using them in daily life, operations and algebraic thinking, recognizing and using patterns, recognizing basic geometric shapes, recognizing basic spatial concepts and using them in daily life, recognizing and using measurement units" were included. In the light of the results obtained depending on these achievements and indicators, it is only in the Swiss curriculum that the indicator of reading and writing numbers for the achievement of knowing numbers and using them in daily life is; It has been determined that Swiss is at a higher cognitive level in terms of operations and algebraic thinking. In the acquisition of recognizing and using patterns, the stage of "creating one's own pattern" is not addressed in the Swiss curriculum; It has been concluded that the Turkish curriculum is in a more positive approach for the acquisition of recognizing and using measurement units.

Keywords: Mathematics curriculum, Learning domains, Preschool education in Turkey, Preschool education in Switzerland, Comparative education.

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INTRODUCTION

Children's natural tendencies to explore and have fun drive them to learn and use what they learn. The outcomes learned in this period have important effects on the child's future life (Baker, Mackler, Sonnenschein, & Serpell, 2001). Mathematics education in preschool aims to contribute to the cognitive development of the child, give children a positive attitude towards mathematics, help children establish a connection between the conceptual information they had before and new information, and help them understand why and how mathematical concepts are used (Ministry of Education, 2013).

Early childhood mathematics education has been an important part of preschool and kindergarten practices in various periods for centuries (Balfanz, 1999). In the 1850s, Froebel created a teaching system that focused on commonly used blocks to help young children to learn basic mathematics, especially geometry (Brosterman, 1997). Working in the slums of Rome in the early 1900s, Montessori (1964) developed a structured set of mathematics activities to encourage young children's mathematics learning. Since then, many researchers have collected evidence that from the time they are born to the age of five, children are in contact with everyday mathematical concepts such as shape, size, position, and things being more or less (Baroody, Lai & Mix, 2006; Clements & Serama, 2007; Ginsburg, Cannon, Eisenband, & Pappas, 2006). In general, if we want to express this evidence, we come across with concrete materials, symbols, language, and pictures. For example, Wynn, Bloom, and Chiang (2002) found that babies can distinguish a number of objects visually and auditorily. Similarly, it was observed that babies make a connection between the number of sounds they hear and the number of materials shown to them (National Research Council, 2009). In addition, preschool children spend a significant part of their time in free play, which is the basis of their mathematical knowledge. Thus, they discover patterns, shapes, spatial relationships, length-weight measures, and counting items (Clements, 1984; Clements, Swatminathan, Hannibal & Sarama, 1999; NRC, 2009). This evidence has helped to dispel the notion that children are not ready to learn math in kindergarten. In fact, mathematical thinking is a phenomenon that should be taught to children in the preschool period and the first stages of primary education. It has been demonstrated that by doing so, individuals can be raised who will be able to rationally explain the situations they experience in their environment (Deniz-Tarım, 2014).

Head Start, the largest state-funded preschool program in the United States, was created to strengthen the mathematics curriculum. The reason for this program is that American children are not successful in mathematics in international exams and they think that it is due to the gaps in preschool education (Ginsburg et al., 2008; Sarama & Clements, 2009). In addition, there are studies suggesting that mathematics ability at entry to kindergarten is stronger than early reading skills and that it is a strong predictor of subsequent academic achievements (Duncan et al., 2007).

When creating their own education and training programs, countries take into account the needs of the present time and their policies regarding their future goals (Bozkurt, Şapul & Şimşekler Dizman,

2020). For this purpose, comparative education can be used. Comparative education is a discipline that helps to define the similarities and differences of two or more education systems in different cultures and different countries, explains the situations that seem similar, and puts forward useful proposals about the ways of educating people (Erdoğan, 2003; Türkoğlu, 1985). In this sense, they analyze the facts related to education in various countries and enable countries to act within a broad perspective while seeking solutions to their own educational problems (King, 1979; Özkaral, 2015). For example, Bozkurt et all (2020) examined the similarities and differences in the mathematics contents of preschool curricula in Turkey and Singapore. According to the findings that were obtained, the Turkish and Singaporean preschool curricula have similar characteristics in terms of purposes; however, it was observed that the Turkish preschool curriculum is based on developmental areas, while the Singaporean preschool curriculum is based on learning domains. In addition, while the mathematics content in Turkey was summarized at the level of outcomes and indicators, six different manuals were prepared according to learning domains in Singapore. In the arithmetic manual consisting of 64 pages, learning objectives, strategies, organizing the learning environment, and observation, and evaluation sections for teaching mathematics are detailed. In both curriculum, children are provided with opportunities to develop pre-number concepts, number sense, shape, and basic spatial concepts. Similarly, Bozkurt, Çırak Kurt, and Tezcan (2020) conducted a study on the Singaporean mathematics curriculum corresponding to the 5th–8th grades in Turkey, and compared both curriculums in terms of sub-learning domains in the context of algebra learning domain, the number of outcomes, the content of the outcomes, the class level in which they are taught, the order in which they are taught, implementation guidelines, and according to the steps they are placed within the Bloom Taxonomy. According to the study findings, the curriculums differed in terms of sub-learning domains, the number, order and content of the outcomes, their classification according to Bloom's taxonomy, and especially the implementation guidelines. The Singaporean mathematics curriculum includes more outcomes in the context of learning algebra, differs in the teaching of the concept of 'variable', which is the basis of algebra, by considering equality and inequality together, incorporates the Turkish mathematics curriculum in terms of context and subjects beyond it. In addition to these, it attaches special importance to daily life problems, includes relatively difficult subjects at secondary school level, emphasizes high-level cognitive skills more, and clearly guides the learning-teaching process by demonstrating suggestions of direct application, software, function machine, use of tables, working in groups, and games in the implementation guidelines. In this sense, not only for Singapore and Turkey; It is important to compare the education systems of different countries.

International exams, such as the Progress in International Reading Literacy Study (PIRLS), Programme for International Student Assessment (PISA), and Trends in International Mathematics and Science Study (TIMSS), are used extensively in the comparison of the education systems of countries. Countries participating in these exams can carry out both their self-evaluations and evaluations and

comparisons of these results according to the results of other countries (Bozkurt et all, 2020). In these exams, it is seen that Turkish students have low levels of mathematical thinking and problem solving skills, while Swiss students are ranked among the top places. In the Organisation for Economic Co-operation and Development (OECD) report of the PISA exam held in 2018, it was seen that Switzerland was in 11th place among 79 countries in the field of mathematics, while Turkey held 42nd place. In Turkey, there are important shortcomings in preparing children for primary education, using Turkish well, and making children aware of mathematical concepts by understanding their physical, mental, and affective development. From this point of view, the example of Switzerland is important for Turkey.

The extensive use of the Singaporean example in Turkey, especially in comparative education studies, is due to the fact that the Singaporean education model and Singapore's education and training programs are clear and accessible. Access to the curricula of most other countries is limited or requires a fee, which causes limitations in research studies. One of the reasons for considering the Swiss example in this study is that apart from its success in international exams, it provides the opportunity to access the curricula of the cantons (state).

In Switzerland, each canton (state) has its own education system (EDK, n.d). While pre-primary education is not part of compulsory education in only a few cantons (it is compulsory in many other cantons), almost all children attend kindergarten for at least one and at most three years, as it forms the basis for primary school. The responsibility of kindergartens falls to the school administration of the region where they are located. These regional school administrations are affiliated to a central administration and inspection is carried out by the inspectors assigned by the center. In other words, in addition to the specific education implemented in the cantons, there is also a central control system (Eurydice, n.d. a). In Turkey, although education is free in preschool education institutions, certain amounts of money can be charged for food, cleaning, and educational materials in a way that does not burden the economic situation of families (Eurydice, n.d. b).

The development of mathematical concepts begins in early childhood with daily experiences. Children form mathematical meanings by interacting with the world around them. It is also known that the mathematical knowledge and concepts that children gain at an early age are reflected positively on children's mathematical thinking and problem solving skills (Akman, 2002). Thus, in this study, it is aimed to compare the achievements of Turkish and Swiss preschool mathematics education. It is believed that analyzing the curriculum, which is accepted as a guide for preschool teachers, according to mathematical outcomes, by comparing it with a successful country in terms of mathematical literacy, and incorporating the obtained results into the literature, will contribute to preschool education practices. Therefore, the answer to the research question, "What are the similarities and differences of Turkish and Swiss preschool curricula in terms of outcomes related to mathematical learning domains?" was sought.

METHOD

The method of this qualitative study was document analysis. Document analysis is a qualitative research method used to analyze the content of written documents meticulously and systematically (Wach, 2013). In this study, the outcomes in the preschool mathematics curriculums of Turkey and Switzerland were examined. Content analysis was performed for the data analysis. Content analysis is a systematic study that covers all published or unpublished studies and evaluates their notions and study results in a descriptive manner (Jayarajah, Saat, & Rauf 2014; Lin, Lin & Tsai, 2014; Suri & Clarke, 2009).

When the preschool schooling rates in Switzerland were examined, it was seen that it was 3% at the age of 3, 41% at the age of 4, and 96% at the age of 5. Similarly, when the preschool schooling rates in Turkey were examined, it was seen that it was 4% at the age of 3, 19% at the age of 4, and 67% at the age of 5 (Aktan & Akkutay, 2014). For both countries, the age group with the highest schooling rate was 5 years of age. For this reason, the curriculum created for 60–72-month-old children was taken into consideration when comparing the programs.

The preschool curriculum in Turkey was created by the Ministry of National Education and this curriculum is implemented throughout the country. Therefore, the Turkish Preschool Curriculum (2013) and Swiss Education Report (2018) (Edk, n.d), which is prepared every 4 years for all cantons (states) on behalf of Swiss preschool education, and the curriculum of the state of Zurich (2019), the largest canton of Switzerland, were examined. In the analysis of the data, both curricula were examined by considering the similarities and differences depending on their mathematical contents. Mathematical subjects and fields were not considered individually in the Turkish preschool curriculum, they were placed under cognitive outcomes. In the Swiss education report, on the other hand, mathematical outcomes were discussed individually. The mathematical contents of these two curriculums were compared via content analysis.

A four-stage analysis process can be followed in the handling of documents within the scope of content analysis. These stages are selecting a sample from the data subject to analysis, developing categories, determining the analysis unit, and digitization (Bailey, 1994). However, data does not always have to be digitized in document analysis (Yıldırım & Şimşek, 2016). In this case, the data can be presented to the reader via reporting (Creswell, 2007). Therefore, in this study, the data were not digitized after the analysis. Instead, the data were conveyed as a report in the final stage.

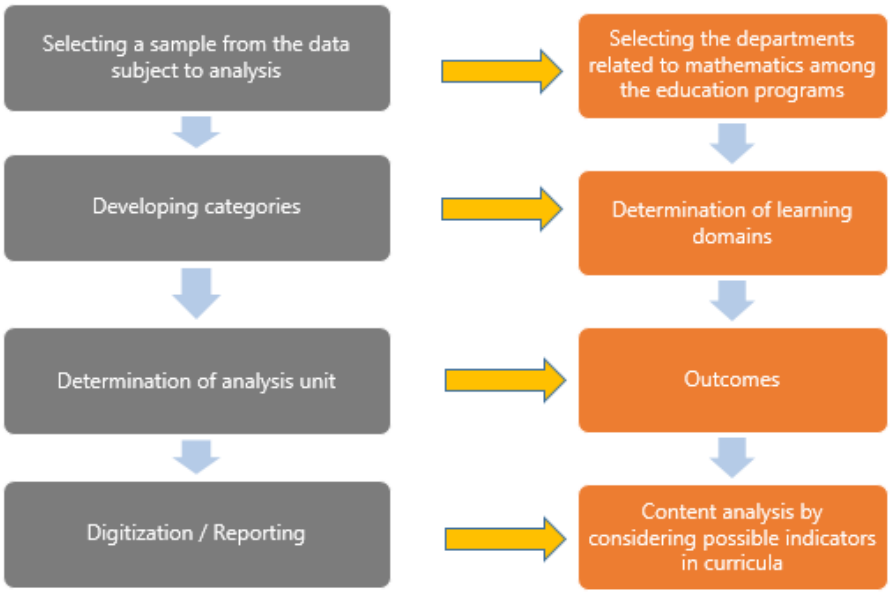

Figure 1. Document Analysis Template Performed in the Study

As can be seen in the document analysis template, the sections related to mathematics in the curricula of Turkey and Switzerland, which were the subjects of the analysis, were examined in detail. The determination of the learning domains expressed in the creation of the categories was included. For Switzerland, which consists of 26 states, there are 26 ministries of education, and educational reports are prepared every 4 years by the Swiss Conference of Cantonal Ministers of Education (EDK), the State Secretariat for Education, Research, and Innovation (SERI), and the Swiss Coordination Centre for Research and Education (SCCRE). Thanks to these education reports, a country-wide general evaluation is made and a common plan for the future is put forth. Finally, the section on preschool education in the education report published in 2018, the Zurich education program, and the studies conducted on Switzerland and the Zurich preschool period were examined (Caluori, 2005; Curriculum-21, 2014; OECD, 2022; Şehitoğlu & Koçyiğit, 2020; Zulauf, Schweiter & Von Aster, 2003). It was observed that learning domains in Turkish preschool education were not clearly specified in the Ministry of Education (MEB) curriculum published in 2013. Thus, studies conducted in Turkey in preschools apart from the MEB (2013) curriculum (Bozkurt, et all., 2020; Çalışkan-Dedeoğlu & Alat, 2012; İncikabı, 2012; Kandır & Orçan, 2010; KKTC-MEB, 2016;) were examined and categories have been put forward by taking the aforementioned studies as reference for both Turkey and Switzerland. Children 60–72 months of age were taken into consideration while presenting these learning domains, which are presented in Table 1.

Table 1. Mathematics Learning Domains for Turkey and Switzerland.

Mathematics Learning Domains
• Knowing numbers and using them in daily life • Operations and algebraic thinking • Recognizing and using patterns • Recognizing basic geometric shapes • Recognizing basic spatial concepts and using them in daily life • Recognizing and using measurement units

Then, the outcomes were discussed as the analysis unit and the results were reported.

RESULTS

While searching for an answer to the research question that formed the basis of this study, the learning domains in the curricula of both countries included in the research topic were revealed and the findings of the analysis that was carried out by taking the outcomes into consideration are presented in this section.

Findings related to learning domain of knowing numbers and using them in daily life are given in Table 2.

Table 2. Knowing Numbers and Using Them in Daily Life.

Turkey	***Switzerland***
Outcomes • Counts objects.	*Outcomes* • Counts and sorts objects.
Indicators • Counts forward/backward by one, rhythmically. • Shows the specified number of objects. • Tells how many objects he/she counts. • Tells the ordinal number. • Tells the number that comes before and after a number in numbers up to 10.	*Indicators* • Counts rhythmically forward and backward in the range of 0–20. • Counts forward and backward by twos in the range of 0–20. • Counts forward and backward by fives in the range of 0–20. • Finds as many images as the said number. • Counts how many objects there are. • Reads and writes numbers. • Indicates the number of objects by means of tally marks, fingers, and blocks. • Makes comparisons based on the number of objects.

When Table 2 is examined, while counting objects as an outcome is available in both countries, sorting them was only stated in Switzerland. In the indicators, counting forward and backward by one was valid for both countries, but up to 20 expressions was only in Switzerland. However, in Turkey, there is no expression as to how far forward the numbers are counted. In addition, it was observed that there was rhythmic counting both forward and backward by two and five in Switzerland. Expressing the number of objects and showing the specified number of objects were included in the curricula of both

countries. Reading and writing numbers were not included in the indicators in the Turkish curriculum, while it was clearly stated in the Swiss curriculum. Another situation in Switzerland, unlike Turkey, was to make comparisons based on the number of objects included in the learning outcome "Counts and sorts objects.", while it was included in the measurement field in Turkey, within "Sorts objects or assets according to their properties." outcome. It was also striking that there was an indicator in the Swiss curriculum that was not included in the Turkish curriculum, which stated that the number of objects can be represented by different symbols.

The outcomes of the operations and algebraic thinking learning domain are given in Table 3.

Table 3. Operations and Algebraic Thinking Learning Domain.

Turkey	***Switzerland***
Outcomes • Performs simple addition and subtraction using objects. • Creates solutions to problems.	*Outcomes* • Performs simple addition and subtraction operations.
Indicators • Adds the specified number of objects to the object group. • Subtracts the specified number of objects from the object group. • Performs addition and subtraction operations using objects. • Solves problems that require addition and subtraction up to the number 10.	*Indicators* • Performs simple addition and subtraction operations using his/her hands (finger patterns). • Makes addition groups of numbers up to 10 (for example, 4 and 1 or 3 and 2 for 5).

When Table 3 is examined, it is observed that the outcome of performing simple addition and subtraction operations was included in the currciculums of both countries. While there was an expression of carrying out operations with objects in Turkey, this expression did not exist in Switzerland. However, in Switzerland, it was understood from the indicators that fingers take the place of objects in operations (Figure 1).

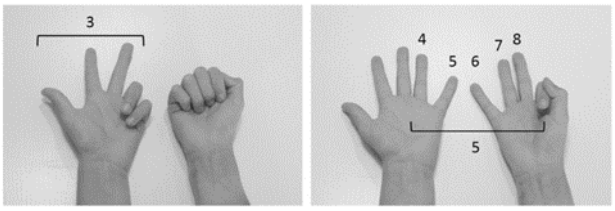

Image 1. *An Example of Finger Patterns.*

Although solving problems that require addition and subtraction in Turkey is among the expected indicators, it was seen that it was not in Switzerland. However, in terms of algebraic thinking, it was

seen that grouping numbers up to 10 was included in a way that when used in addition, they give the predetermined total number. For example, 7 = 6 + 1, 7 = 5 + 2, 7 = 4 + 3. It is noteworthy that although this indicator was present in Switzerland, it was not in Turkey.

The findings regarding the learning domain of recognizing and using patterns are given in Table 4.

Table 4. Recognizing and Using Patterns Learning Domain.

Turkey	***Switzerland***
Outcomes • Creates patterns with objects.	*Outcomes* • Creates a pattern, notices the existing pattern, and continues it.
Indicators • Creates patterns with objects by looking at the model. • Tells the rule in the pattern consisting of three elements at most. • Tells and completes the missing item in a pattern. • Creates a unique pattern with objects.	

When Table 4 is examined, it is seen that both countries included patterns in their outcomes. This outcome was expressed in detail in Turkey but it was not detailed in Switzerland. Although the determination of the rule in a pattern consisting of three elements at most was expressed in the Turkish curriculum, there was no such statement in Switzerland. In addition, while there was an indicator for detecting and completing the missing element in the pattern in Turkey, the indicators for this outcome were not mentioned in Switzerland. In addition, while creating unique patterns was among the indicators in Turkey, there was no expression in the curriculum for creating unique patterns in Switzerland.

Findings regarding the recognition of basic geometric shapes are given in Table 5.

Table 5. Recognizing Basic Geometric Shapes Learning Domain.

Turkey	***Switzerland***
Outcomes • Recognizes geometric shapes.	*Outcomes* • Recognizes geometric shapes.
Indicators • Tells the name of the displayed geometric shape (triangle, circle, square, rectangle, and ellipse). • Tells the properties of geometric shapes. • Shows objects that look like geometric shapes.	*Indicators* • Creates simple and complex patterns by combining geometric shapes. • Finds objects that resemble geometric shapes in the environment. • Uses both two-dimensional (2D) and 3D shapes and understands their properties through concrete experience and creative practice.

When Table 5 is examined, it is seen that the outcome was the same in both countries. However, there were differences in the indicators of the outcome. Although triangle, circle, square, rectangle, and ellipse were clearly mentioned among the indicators in Turkey, these geometric shapes were not specified in the Swiss curriculum. However, while there were indicators of 3D shapes in the Swiss preschool curriculum, there was no data on 3D objects in Turkey. In addition, it was seen that creating simple or complex patterns using shapes was stated in Switzerland, but not in Turkey.

Findings related to recognizing basic spatial concepts and using them in daily life learning domain are given in Table 6.

Table 6. Recognizing Basic Spatial Concepts and Using Them in Daily Life Learning Domain

Turkey	***Switzerland***
Outcomes • Follows the directions about the location in the space.	*Outcomes* • Discovers location and direction in their environment. • Identifies and executes commands (like right/left, up/down).
Indicators • Tells the position of the object in space. • Positions the object in the correct place (near, far, below, above, in front of, behind, beside) in accordance with the instruction. • Positions self in the place. • Uses map and sketch.	

When Table 6 is examined, it is seen that there were outcomes related to location, both in Turkey and in Switzerland. While following the instructions related to the location in the space was expressed as an outcome in Turkey, in Switzerland, discovering the location, direction, and following commands in their environment was included as an outcome. When the examples used for commands were examined, the use of these commands in daily life was emphasized with simple expressions in daily language (such as below, above, down, up, right, left). Although using maps and sketches was included in the curriculum in Turkey, it was not mentioned in Switzerland. When the example of the use of maps and sketches in the MEB curriculum was examined, it was seen that children are asked to make their own drawings with the instructions they learned, of an area they know in daily life (for example, the classroom or the school garden).

The acquisitions related to the learning domain of recognizing and using measurement units are given in Table 7.

Table 7. Recognizing and Using Measurement Units Learning Domain.

Turkey	***Switzerland***
Outcomes • Measures objects. • Sorts objects or assets according to their properties.	*Outcomes* • Measures length, mass. and volume.
Indicators • Predicts the measurement result. • Measures with non-standard units (with materials such as pencils, straws, toothpicks, erasers, Legos, books, paper, or by using natural measurement units such as finger, span, fathom, step, foot). • Compares the measurement results with the predicted results. • Tells what standard measurement tools are. • Sorts objects/assets according to their length, size, quantity, weight, color tones.	*Indicators* • Measures length using non-standard units of measurement. • Makes predictions for weights (such as light, heavy, heavier). • Measures volume using non-standard units of measurement (such as jug, spoon, glass, and bucket). • Solves real-life problems using non-standard units of measurement.

When Table 7 is examined, it is observed that both countries included outcomes related to measurement. Looking at the indicators, it is seen that non-standard measurement units were used for measuring in both countries. In addition to this, knowing the standard measurement tools was among the indicators in Turkey, but in Switzerland, this was not mentioned. Although predicting the measurement results and comparing the measurement results with the predicted results was stated in Turkey, it was understood that estimating only for weight measurement was emphasized in Switzerland. In addition, considering the examples given to non-standard measurement units in the Turkish curriculum, it was thought that only length and weight measurements were considered. However, in Switzerland, measurement-based phenomena such as length, weight, and volume were handled and included in the curriculum individually. Moreover, the use of non-standard measurement units in solving real-life problems was emphasized as well in Switzerland. Apart from these, sorting based on measurement was among the outcomes in Turkey. Therefore, children measuring and sorting objects according to their length and weight, etc., were among the indicators.

DISCUSSION

Examining the curricula that are implemented in different countries is presented as comparative education and has an important place in academic studies (Böke, 2002). The preschool period is seen as the period in which the development of human life is the fastest in all areas (social and emotional, motor, cognitive, language) (Shonkoff & Phillips, 2000). Comparative studies to be carried out in this field will not only bring different and broad perspectives to the curriculum development studies in education but will also help in the evaluation and revision of the current curricula. For this

reason, in this study, the preschool mathematics curricula of Turkey and Switzerland were compared in terms of learning domains and outcomes.

The findings obtained from this study, in which the similarities or differences in the mathematics contents of the Turkish and Swiss preschool curricula were examined, were discussed in terms of learning domains and accordingly, in terms of learning outcomes.

- Knowing numbers and using them in daily life

Counting is one of the basic skills required for the development of mathematical thinking (Olkun, Fidan, & Babacan-Özer, 2013). Counting skills, on the other hand, include understanding numbers and the relationships between numbers, as well as using them meaningfully in daily life (Le Corre & Carey, 2007). A number of counting principles have been put forward in order to carry out counting in a meaningful and correct way (Gelman & Gallistel, 1978). These principles are "stable order (regular counting), correspondence, cardinality, abstraction, and order irrelevance". When these principles and the outcomes of both countries were examined, it can be said that the forward/backward rhythmic counting indicator coincided with the stable order principle. Considering that this rhythmic recitative counting is important for the development of children's counting skills (Taşkın, 2017) and the children's realization that the order of the numbers is stable in the process (Akkaya, 2019), it is important that both countries have this indicator in their curricula.

According to the National Council of Teachers of Mathematics (NCTM) (2000), children's acquisition of a sense of numbers depends on counting by making sense. Counting with understanding for children is that when they count objects, they do not skip counting any object, and they do not count the same object more than once (Polonsky, Freedman, Lesher & Morrison, 1995). Counting the objects in the group, showing the result with a number, or determining the objects as much as the number shown actually ensures counting by making sense. This coincides with the correspondence principle and was included in the curricula of both countries. According to Polonsky et al. (1995), counting skills include knowing the correct rhythm of numbers, knowing that each one is counted only once when counting objects in a group, and knowing that the number given to the last object shows the total number of all. In this sense, the cardinal value principle is also achieved, as counting by making sense was taken as the basis in both countries.

The principle of abstraction, which states that counting can be applied to all entities, was also included, but only in the Swiss curriculum. In the case of this principle, children can represent number quantities with various shapes (objects, fingers, base 10 blocks, decimal cards, tally marks). According to this principle, counting can be done without the relation of the elements that make up a set (Linder, Powers-Costello & Stegelin, 2011). Therefore, it is thought that this principle should be included in the Turkish curriculum as well.

The order-irrelevance principle, which means that the order of objects is unimportant in counting, was not included in the curricula of either country. There was no mention of any outcome or indication of seeing that the quantity of a group of objects was 'the same' regardless of the starting place of counting. Through this outcome, children intuitively feel that the number of objects does not depend on the beginning, and this creates a sense of numbers. Thus, it is thought that both countries should consider this principle in their curricula.

Apart from counting principles, the indicator of reading and writing numbers is clearly expressed in the Swiss curriculum, while it is not stated in the Turkish curriculum. The reason behind this is thought to be related to readiness, since knowing, and writing numbers are dissimilar skills. While writing is expressing with special signs, recognition is the child's correct and complete knowledge of numbers (Taşkın, 2017). If their physiological maturity is not yet completed, children may not be able to write even if they recognize numbers (Dewey & Tupper, 2004). Although the curricula contents of the same age group were compared, physiological maturity may differ regionally. Hence, it is thought that the content about reading and writing numbers was not included in Turkey.

- Operations and Algebraic Thinking

When the indicators of operations and algebraic thinking learning domain in Turkey and Switzerland were examined, it was seen that simple addition and subtraction operations were included in both countries. It was emphasized in the Turkish curriculum that the addition and subtraction operations should be done objects. In addition, in Turkey, the statement: "Addition and subtraction with numbers on wood or paper is not appropriate", is included. It is thought that the reason behind this is that there was no reading or writing numbers indicator in the previous learning domain (MEB, 2013, ss.22). While in Switzerland, the statement: “Throughout their early childhood experience, they develop an understanding of whole numbers using concrete materials. They understand the meaning of whole numbers and recognize, add and subtract by counting the number of objects in small groups”, was included. In other words, the child performs operations with concrete materials, namely objects. Therefore, the child can use an increasing method, for addition, and decreasing the whole for subtraction, in the sorting phase. Apart from this, it was mentioned in the indicators that they also perform addition and subtraction operations by counting with their fingers. The use of the expression "add and subtract as much as the specified number" in Turkey creates the perception that there is no number restriction. However, the use of finger patterns in Switzerland suggested that it is limited to 10 when adding and subtracting. In addition, although reading and writing numbers were in the expected indicators, the curricula did not mention whether these operations can be done with numbers only while adding and subtracting. Separating numbers less than or equal to 10 in different ways (such as $7 = 4 + 3$, $7 = 5 + 2$, $7 = 6 + 1$) was not specified in Turkey, although it was included in the Swiss curriculum. From this point of view, it can be said that the relevant outcome given in Switzerland is at a higher cognitive level.

- Recognizing and Using Patterns

When the outcomes of recognizing and using patterns learning domains of the Turkish and Swiss curricula were examined, it was seen that both countries included it as an outcome in their curricula. In Switzerland, a learning outcome about creating, recognizing, and maintaining the pattern was specified, In Turkey, the details of learning outcomes related to creating patterns with objects were specified by indicators. Hacıibrahimoğlu (2017a) stated that children discover a pattern in four stages. These are recognizing the pattern, defining it, expanding it, and creating their own pattern. When the outcomes of both countries were evaluated according to these stages, it can be said that Turkey considers all stages. The phrase "tells the rule in the pattern" in the learning outcomes of Turkish curriculum corresponds to the stages of recognizing and defining the pattern. "Tells and completes the missing item in a pattern." corresponds to expanding, and "creates a unique pattern with objects." corresponds to the stage of creating their own pattern. However, when the outcome in the Swiss curriculum was examined, it was observed that the stage of creating their own pattern was not addressed. However, since the ability to recognize, maintain, and create patterns is fundamental to seeing mathematical relationships, making generalizations, and understanding the order and logic of mathematics (Hacıibrahimoğlu, 2017a), it is important to include all of the stages in the learning outcomes.

- Recognizing Basic Geometric Shapes

In preschool education, geometric shapes are defined in four basic categories: circles, squares, triangles, and rectangles (Clements, 1998). When the curriculum in Turkey is examined, it is seen that "ellipse" is also included in addition to these four basic geometric shapes. In the curriculum in Switzerland, although there was no information about which geometric shapes were included in the indicators, it was striking that polygons such as pentagons and hexagons were mentioned in addition to the basic geometric shapes in the examples given. In Turkey, the statement: "polygons can also be worked on with children whose developmental level is appropriate", was included (MEB, 2013, ss.22). So, in this sense, it can be said that readiness is taken as the basis. The indicator of identifying objects similar to geometric shapes in the environment in both curricula suggested that, as Hannibal and Clements (2000) stated, giving different sizes and different positions of geometric shapes can contribute to the development of early mathematics skills in children. In addition, studies have shown that the reason for deficiencies in mathematical skills is that in most cases, typical examples are employed in the teaching of geometric shapes (Bozkurt et all, 2020; Sezer & Güven, 2019). While there was no outcome or indicator related to 3D geometric shapes in the Turkish preschool curriculum, they were included in the Swiss curriculum. They were included in the indicator on using 3D shapes and having concrete experience with them. This actually enables children to understand the shape more easily (Cockcroft, 1999). In addition, geometry skills also include skills such as recognizing the relationships between 2D

and 3D shapes (Sezer & Güven, 2016). Therefore, it is thought that 3D geometric shapes should be included in the curriculum in Turkey.

- Recognizing Basic Spatial Concepts and Using Them in Daily Life

Spatial concepts were included in the curricula of both countries. Space is expressed with words such as below, above, inside, outside, over, under, next to, between, on the edge, far, near, at the top, and at the bottom (Ergün, 2003). Location in the space is the relationship that children establish with the people and objects around them (Hacısalihoğlu-Karadeniz, 2014). It is important that this outcome is included in the curriculum as it develops spatial thinking in children. When looking at the curriculum in Turkey, the outcome was explained with the indicators, while in Switzerland it was given only as an outcome. For the "Follows the directions about the location in the space" outcome in Turkey (MEB, 2013, ss.21), there were indicators to tell the location of the object in the environment, to place the object in accordance with the given commands, to move to the appropriate place according to the commands, and to use a map/sketch. Considering these, it was seen that the stages of "proximity, separation, order, and containment", through which Piaget (1950) explained the spatial relationships that children have in the preschool period, were achieved. Considering the outcomes in Switzerland, "Discovers location and direction in their environment" and "Identifies and executes commands (like right/left; up/down)", it is thought that these did not meet the containment stage by Piaget (1950). Because containment means surrounding objects with representations, such as maps or sketches, there were no representations, such as maps or sketches, in the Swiss curriculum. However, children begin to identify spatial relationships in drawings, models, and maps (Hacısalihoğlu-Karadeniz, 2014). For example, children may try to find a toy (for example, a puppet) placed (or hidden) in their classroom with the map provided by the educator. This makes important contributions to the development of the spatial concept, as it makes children active and enables them to create their own experiences (Piaget & Inhelder, 2005). Therefore, it is thought that indicators such as maps/sketches should be included in the Swiss curriculum.

- Recognizing and using measurement units

The "Measures length, mass, and volume" outcome was given in the Swiss curriculum, whereas in Turkey, "Measures objects." and "Sorts objects or assets according to their properties" outcomes were included in the curriculum. When the indicators of both countries were examined, it was seen that using non-standard measurement units stood out. In the context of mathematics education, students with measurement skills are expected to compare situations or objects of the same nature by expressing them with a number. These numbers express physical characteristics, such as weight, volume, length, or height (Charlesworth, 2012). When the Swiss curriculum was examined, it was seen that measuring length, weight, and volume was stated as an outcome. However, in Turkey, there was no measurement statement about volume in the curriculum. Hacıibrahimoğlu (2017b), who examined

measurement skills under five developmental stages based on Piaget's developmental stages, stated that standard measurement units (such as meters, kilograms, and liters) should be used at the end of the abstract operational period. This corresponds to the secondary school level. The fact that this process was limited to teaching the standard measurement tools in Turkey and that it was not mentioned at all in Switzerland can be considered as positive in this respect.

While there was a statement of predicting the measurement results among the indicators given in Turkey, this was not mentioned in Switzerland. Predicting the measurement results contributes to the familiarization of the children with the measurement units, minimizes their mistakes, and enables the measurement to be used more meaningfully (Van de Walle, Karp & Bay-Williams, 2016). Thus, predicting the measurements is important for the learning domain of recognizing and using measurement units and it is thought that it should be included in preschool curricula.

CONCLUSION AND SUGGESTIONS

It was observed that the Turkish and Swiss preschool curricula were similar to each other in terms of the mathematics contents. However, it was determined that there were more detailed indicators in Switzerland for knowing numbers and using them in the daily life learning domain. Considering the counting principles, stable order (regular counting), correspondence, cardinality, abstraction, and order irrelevance, put forward by Gelman and Gallistel (1978), there were indicators for the principle of abstraction in the Swiss curriculum, whereas no statements were included in Turkish curriculum for the principle of abstraction. Revision studies on the principle of abstraction may be carried out in Turkey.

When the education system of Switzerland was considered in general, it was seen that there is no nationwide curriculum for this country with 26 cantons, and that each canton has its own education ministry and creates its own education plan. Preschool has a special importance in this education system, where comparisons between cantons are made by the Education and Training Documentation Center, education reports are prepared, and successful education plans are kept. It was revealed that only 5% of Swiss people go to paid private schools (most of these people are stated to have special needs), have the right to free education at all levels, including preschool period, and because they provide high standards of education, public schools are more preferred (Bhaumik, 2022). In Turkey, the rate of those who go to private schools in the preschool period is 15.8% (Milli Eğitim İstatistikleri, 2021) and preschool education is paid for in public schools. However, the fact that the Ministry of National Education has created a common curriculum for the whole country in Turkey shows that there is a standard education approach in all institutions. The education system implemented in Switzerland, on the other hand, makes us think that there are no set standards. It is thought that there is no equal implementation since the implementation and realization of the education reports are in the hands of the cantonal administration.

This study only included the comparison of Turkish and Swiss preschool mathematics curricula in terms of content. By increasing the number of countries compared in future studies, curricula comparisons can be made, and thus, clues can be found for the mathematics contents of the Turkish preschool curriculum to become more qualified. In addition, making education and training programs of the countries open to access will also have positive results in terms of comparative education studies. Within the scope of the study, the number of outcomes in Turkey can be increased and the content can be revised for the learning domain of knowing the numbers that form the basis of mathematics and using them in daily life.

Additional Statement

The authors contributed equally to the study.

In all processes of the article, the principles of research and publication ethics of JPEE were acted upon.

There is no potential conflict of interest in this study.

Since the study is in the form of document analysis, there is no ethics committee declaration form.

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