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Evaluation of Primary School Mathematics Curricula of Northern and Southern Cyprus for NCTM Principles and Standards

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Abstract: Although the basic knowledge and skills that each generation must acquire vary by country, such knowledge and skills are somewhat standardized depending on the requirements of the modern era. As one of the basic parts of education, curricula are essential in that they include the knowledge, communication and technological developments required by the age. The objective of this study is to analyze the primary school 3rd grade mathematics education curricula in Northern and Southern Cyprus in line with NCTM (National Council of Teacher of Mathematics) principles and standards and to evaluate them according to teachers' opinions. In the research, document analysis and the interview technique, which are both qualitative analysis methods, were used. As a result of the study, it has been observed that the 3rd grade mathematics curricula in Northern and Southern Cyprus have similarities and differences in line with NCTM principles and standards. As a result of this comparison, it has been found that there are differences in NCTM principles in terms of equity, learning and assessment-evaluation. It has also been determined that in terms of standards, there are differences in geometry, measuring and data analysis-probability of the 'content' element, as well as in the notation and expression of the 'process' element. In addition, although the opinions of the teachers were analyzed and a common view was put forward with regard to several topics, it was concluded that there were differences of opinion regarding 'which course content should be used in mathematics lessons' and 'whether the mathematics curriculum should be changed or whether it is satisfactory'.

Keywords: *NCTM Principles, NCTM Standards, Primary School Mathematics Curricula, Northern Cyprus, Southern Cyprus.*

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1. Introduction

Developments in technology and changing living conditions require individuals to be more knowledgeable and equipped than in the past. In particular, the fact that knowledge is continually increasing makes it important that students who are at the age of basic education should be trained in the way they can access information rather than merely being equipped with the information. Particularly in a field shaped around the basic skills of reasoning and problem solving, such as mathematics, the demand to educate students in a better way increases the need for more efficient and effective education and training programs (Bråting et al., 2019; Ministry of National Education and Culture, 2018; Weinberg, 2019).

The purpose of mathematics education is not only to teach the beauty of mathematics, but also to provide experience to the individuals by supporting their development in other fields in solving problems in every contemporary society (Uysal & İncikabı, 2017). For this reason, mathematics is now longer just a computational skill and is rather a function that promotes logical thinking and opinions that will broaden the intellectual horizons of people, which means that mathematics has a special position in education. This special position is reflected in the fact that mathematics lays the foundations for other disciplines (Doğanay, 2007). Based on this fact, there are various principles and standards that can be applied. These principles and standards are gathered under the NCTM, an internationally recognized center for mathematics education (Alshehri & Ali, 2016). The work of this organization is seen as a reference for several researchers in the field of mathematics education in the world today (Umay et al., 2006). In 2018, various documents under the title of "Principles and Standards of School Mathematics" (PSSM) were published by the NCTM (2019a). These documents explain what the general principles of school mathematics should be and what standards mathematical content and processes should meet from kindergarten to the end of 12^{th} grade (NCTM Publications, 2019b).

The NCTM Principles and Standards are divided into different sections. Equity, curriculum, teaching, learning, assessment and technology are included in the NCTM principles (2019a), whereas the standards consist of two main sections, namely content and process. The "content" standard consists of elements such as numbers and operations, algebra, geometry, measurement, data analysis and probability, whereas the "process" standard is formed by criteria such as problem solving, reasoning and proof, communication, representations and associations. These principles and standards are explained in detail below (NCTM, 2019a).

The first of these principles and standards is Equity. It requires strong support and high expectations for all students. All students, regardless of their personal characteristics (such as basic infrastructural and physical issues), can learn mathematics. In addition, within the scope of this principle, when students access high quality mathematics education, they must receive an education that contains appropriate content that is easy to access and provides specific gains.

According to the Curriculum principle, the mathematics curriculum should be enriched with activities, and these activities should be consistent with the subjects and include essential concepts of those subjects. In a coherent mathematics curriculum, topics should be interconnected and broadened in a way that students can easily comprehend. Within the scope of the Curriculum principle, students are expected to continue their studies outside the school in terms of the topics and problem-solving processes (at home, with groups, etc.).

The teaching principle emphasizes that in order to teach effective mathematics, students should be aware of their learning and understanding processes. It also underlines that it is necessary to encourage and support learning by developing their knowledge. Considering that students are shaped by the methods they have developed to perceive mathematics and to use their problem-solving skills, it is emphasized in this principle that teachers should devote themselves to mathematics and their students and that they must constantly renew their knowledge and improve themselves in order to offer effective teaching.

According to the learning principle, students should be able to actively build the new knowledge they learn in mathematics based on previous information they have acquired. It is emphasized that concepts are important for students to be effective learners. The aim is for students to be able to have basic knowledge, reflect their thoughts, and learn from their mistakes.

The assessment principle involves the evaluation of both teacher and student, and the student should be supported to learn the important concepts of mathematics. Assessment is an integral part of mathematics, and teaching is of great importance for students to understand and learn mathematics. Assessment should be informative and guiding for teachers and students alike. Assessment should not only evaluate information, but also performance. In addition, it should support teachers and students and reinforce their own learning.

In the technology principle, it is stated that technology is an integral part of mathematics education and has positive and developing effects on

mathematics teaching. With the proper use of technology, students can understand mathematics, support their research, and help develop their reasoning and problem-solving skills, all of which are among the goals of this principle.

In the Numbers and Operations principle, students should be able to make calculations in different ways, such as with paper and pencil using their own predictions and mental methods, as well as with calculators for accurate performance. Students should be able to explain their own methods as well as their inadequacies.

When the Algebra principle is examined, it is seen that students are asked to understand certain patterns, functions and generalizations. It is important to encourage algebraic reasoning in young children. Using notations, understanding variables, explaining the meaning of symbolic notations, and the development of mathematical ideas come to the fore in this principle.

In the Geometry principle, spatial reasoning, modeling for problem-solving, characteristics of geometric shapes and making geometric shapes mathematical are included. The principle of measurement is widely applied in several aspects of life. It provides opportunities to learn and apply other areas of mathematics. In the Data Analysis and Probability principle, reasoning is statistically important. It includes such topics as learning appropriate statistical methods such as analyzing data, making conclusions, conducting data estimates, and understanding and using basic concepts.

According to the problem-solving principle, problem solving not only has considerable importance in mathematics, but also in our normal life and it is the most important element of mathematics. Students should be encouraged to reflect their thoughts, and they should be able to apply the problem-solving process and adapt their developed strategies to other problems.

According to the reasoning and proof principles, reasoning and proof concepts are important elements in both the real world and mathematics. Making mathematics meaningful offers a powerful way for students who are thinking analytically to observe patterns, structures, and regularity.

In the principle of communication, it is emphasized that mathematical language, both written and verbal, should be clear and persuasive. This principle is important as a means of mathematical communication. The aim of this principle is that students should be given the opportunity to explain and that they should be listened to and helped with clarifying their thoughts. In the Associations principle, emphasis is

placed on ensuring that mathematics is not only a phenomenon in itself, but is also related to other disciplines, that students find mathematics useful, and that they can see areas related to mathematics.

The representation principle provides a basis through which students can understand mathematics via concrete models, figures, pictures, numbers, symbols, electronic tables, etc. These greatly expand students' capacities and their mathematical activities are covered by this principle.

1.1. Mathematics Education in Northern Cyprus

Basic Education mathematics programs in the TRNC have been reorganized with an interdisciplinary perspective and an understanding that places the student at the center in line with 21st century characteristics. The aim of the 3rd Grade Mathematics Curriculum is to provide students with the ability to use mathematical language, methods and processes to make sense of the situations they will encounter in their lives and subsequent education stages, to express themselves and to solve problems (Ministry of National Education and Culture, 2016b; Özreçberoğlu and Çağanağa, 2016).

Within the program outputs, the ability to develop a positive attitude towards mathematics, to appreciate the importance of mathematics, to make calculations mentally, to be able to perform basic operations fluently, to solve problems, to be able to establish (write) problems, to use tools correctly in studies, to use mathematical language effectively, to effectively use the representation forms in the mathematics, to be able to develop reasoning with regard to shapes, places and locations, to comprehend the relations between geometric shapes and concepts, to conduct simple/basic algebraic operations fluently, to establish mathematical models, to use mathematical ways of thinking and to make inference, and to be able to work in groups in mathematical studies can be mentioned (Ministry of National Education and Culture, 2017b).

The process skills included in the basic skills envisaged in the program are problem solving, reasoning and proofing, reflection, using appropriate operational methods and strategies, associating, demonstrating and expressing, using the language of mathematics and communication (Ministry of National Education and Culture, 2018).

1.2. Mathematics Education in Southern Cyprus

The main focus of the Mathematics Curriculum in Southern Cyprus is to prepare students to take basic mathematics lessons. This curriculum follows an integrated structure from primary to secondary education (Çağlar, 2003). It is based on four principles which advocate that: 1. Students'

participation, curiosity and interest in mathematical research should be increased; 2. Problem solving should be given importance; 3. Information technologies should be an integral part of mathematics education; and 4. Students' experiences related to daily life should be developed (Ministry of Education and Culture, 2017a).

In 2016, the Mathematics Curriculum was revised, renewed and enriched to include goals and achievements. With this structure, a "Mathematics Curriculum with the necessary mathematics knowledge to contribute to the development of the student" was prepared as a useful tool for teachers. In addition, materials for 5th grade were developed and applied under the guidance of teachers in schools. These teachers received in-service training two times a year. It was also decided that studies on the preparation of 3rd grade mathematics curriculum materials would continue to be reviewed for 3 years. Finally, the 'Parents and students working together' group program was organized and implemented, and parents were informed about mathematical content (Ministry of Education and Culture, 2016a).

Comparative studies are said to demonstrate how students perform in their country's education systems. Thus, differences between student levels of knowledge between countries can be a starting point for further studies on the effects of regional and national policies. These comparisons aim to understand the problems faced by a country in its education system, to discover the reasons for success of more successful countries and in this way to improve its education system by considering its own conditions. Comparative studies are generally carried out on the basis of countries that are successful in international exams. European countries draw attention with their success in international exams. In this research, Southern Cyprus, which has borders with Northern Cyprus, was chosen as a European country for comparison. Comparing the mathematics curriculum with successful countries will help determine whether the difference in achievement in international exams is due to curriculum. Accordingly, the current research is important in terms of revealing the deficiencies in the program (if any) or the aspects that need to be improved, contributing to making the curriculum more qualified.

When the literature is analyzed, it is seen that there are studies that examine the mathematics achievement to determine whether the curriculum arranged according to NCTM standards is more or less effective than the traditional curriculum (Adams, 1999), or that the current program complies with NCTM standards (Sawada, 1997; Umay et al., 2006). The importance of this study in the international arena is that there are no similar studies in the literature. In addition, the 3rd grade mathematics education program, which

lives in two different parts of the same country and has a similar culture, is the only study compared to the principles of NCTM adopted in the world.

In order for the mathematics curriculum to be successful, the beliefs of teachers about the reform goals related to their applications are of great importance, rather than when and how the curriculum will be implemented (Handal & Herrington, 2003). Northern and Southern Cyprus are populated by people from different cultures with different languages and religions. This study is important in terms of comparing the countries with different structures in the context of NCTM standards and finding out how standardized these standards are by finding similarities and differences. For this reason, to the aim is to compare the Primary School 3rd Grade Mathematics Curriculum in Northern and Southern Cyprus in line with NCTM principles and standards and to evaluate them in line with teachers' opinions.

2. Method of the Study

2.1. Research Method

This research is a comparative study which compares the Primary School 3rd Grade Mathematics Curriculum in Northern and Southern Cyprus in line with NCTM principles. It was conducted with the document analysis and interview technique which are both qualitative approaches. Qualitative research is a study in which qualitative data collection methods are used and the qualitative process is followed in order to reveal perceptions and events in a natural and realistic manner (Şimşek, & Yıldırım, 2011). Document analysis involves the analysis of written materials that contain information about the phenomenon or facts intended to be investigated, and is a data collection technique that is necessary for almost every research (Şimşek & Yıldırım, 2011). In this study, Northern and Southern Cyprus 3rd Grade mathematics curricula were examined separately by the authors and compared in line with NCTM principles and standards. The training programs examined were compared and evaluated by performing document analysis on written documents. The interview technique was also used in the research. The interviews were held on a voluntary basis with the participants. Interviewing is one of the best ways of obtaining in-depth information about the subject in question, and to reveal the experience, attitude, behavior and thoughts of interviewees who participate on a voluntary basis. Since the researchers performed face-to-face interviews with the classroom teachers who were teaching 3rd grade, they also had a lower risk of getting wrong answers from them, and they also exploited the opportunity to observe the

person's attitudes and reactions. In the semi-structured interviews, the aim is to both obtain specified answers and to grasp the depth of the information (Büyüköztürk et al., 2012; Gürbüz & Şahin, 2015).

2.2. Study Group

In order to conduct the qualitative interviews of this research, a study group was formed consisting of 16 teachers, 8 of whom were classroom teachers in the 3rd grade of an elementary school under the Ministry of National Education of Turkish Republic of Northern Cyprus, while the other 8 were classroom teachers reporting to the Southern Cyprus Ministry of Education and Culture in the 2019-2020 academic year. In the research, purposeful sampling method was preferred (Şimşek & Yıldırım, 2011). Attention was paid to the fact that the teachers included in the sample are working in equal and different schools from Northern and Southern Cyprus. In addition, while the classroom teachers were included in the sample, attention was paid to have knowledge about the 3rd grade curriculum. The teachers included in the study group were determined on a voluntary basis.

2.3. Data Collection Tools

In this study, data on the 3rd grade mathematics curricula in Northern and Southern Cyprus were collected based on the existence of equity, curriculum, teaching, learning, assessment and technology criteria in NCTM principles, the existence of number and operations, algebra, geometry, measurement, data analysis and probability criteria among the Content standard, and the existence of problem solving, reasoning and proof, communication, representations and associations criteria within the Process standard. Within the scope of the validity and reliability studies of the research, evaluation according to the criteria was carried out by two different researchers. In this study, the consensus reliability of the two coders was calculated and the reliability was found to be 99% for this evaluation.

In addition, a semi-structured interview form developed by the authors was used in this research. After the form containing the interview questions was prepared, the questions were presented to one Turkish and one Greek language specialist as well as two Assessment and Evaluation specialists. In addition, the necessary corrections and changes were made to the form based on the opinions and suggestions of two other subject experts who had carried out various studies using the interview method. The form was finalized as a result of these changes and arrangements.

In line with the main purpose of the research, the questions posed to the teachers are as follows:

- Does the 3rd Grade Mathematics curriculum offer strong support to all students?
- Is the 3rd Grade Mathematics curriculum considerably supported by activities? Are the activities consistent with the topics?
- Does the 3rd Grade Mathematics curriculum encourage students to improve their knowledge?
- Does the 3rd Grade Mathematics curriculum support or develop the students positively in terms of technology?
- Are the measurements and evaluations made in the mathematics curriculum appropriate? Or should they be changed?
- Which course contents can be used in mathematics lessons?
- Is the 3rd Grade Mathematics curriculum satisfactory in terms of reaching the goals and achievements?
- How satisfactory are the following elements for the current 3rd grade mathematics curriculum?
- Should NCTM (National Mathematics Teachers Council) standards be used in the mathematics curriculum? Why? Why not?
- Is the 3rd Grade Mathematics curriculum satisfactory for students to use their learning experiences and mathematics in daily life? Please explain.
- Do you think this curriculum should be changed? Is it satisfactory? Do certain changes need to be made? Please explain.

The data to be collected were written in detail and sufficient clarity and information was given about how the results were achieved. The opinions of the teachers interviewed were frequently included in the findings by quoting. The results of the research are stated with reference to the opinions of the classroom teachers in the findings. In this way, the validity study of the paper is assured.

The researchers ensured that they did not give any guidance to the classroom teachers interviewed in this study. The answers given by the participants were evaluated by the researcher and various codes and themes were created. To determine the reliability of the coding and themes used in the research, the researchers sought the approval of the experts in the fields of data and themes (Şimşek & Yıldırım, 2011).

The data were subjected to content analysis and classroom teachers' expressions were frequently referenced while presenting the findings. As

part of the validity and reliability studies of the research, a pilot interview was held with two classroom teachers. Then, for the expressions made by eight classroom teachers, the transcription and coding of data, as well as the creation and interpretation of themes and sub-themes were carried out by a different researcher. In this study, the consensus reliability of the two encoders was calculated as 94%, and thus the measurement was considered reliable (Miles & Huberman, 2015).

2.4. Analysis of Data

Content analysis was conducted for the data collected in the study and tabulation was performed. For this purpose, Evaluative Assertion Analysis and Contingency Analysis, which are among the leading types of content analysis, were used. Evaluative Assertion Analysis is used to measure positive and negative attitudes in a message. The theoretical framework of this method, developed by Osgood (1962), is based on a representative understanding of language and it is assumed that the emotions, thoughts and similar features of a person are reflected in the language used, so that information about the message-giver can be obtained by analyzing the message. In this type of analysis, the relationship between the items is examined instead of each item in the message. The relationship analysis developed by Osgood (1962) is preferred by researchers who are not content with simple frequency analysis. In the relationship analysis, the aim is to not to determine how many times the units are seen, but how many times the items are seen with each other, and what form the relationship structure takes. By creating a table with these collected data, arrangements were made and the findings were determined.

2.5. Validity and Reliability

In order to ensure internal validity in the research; Expert opinions regarding the interview questions, research data and comments in the forms were taken. In addition, 25% of the participants (4 teachers) were provided with the confirmation of the participants, after the analysis of the data, by showing the achieved results and comments. In this research, the transferability (external validity) of the research was provided by presenting examples from the sentences that teachers gave opinions. To ensure internal reliability, a specialist was asked to conduct a consistency review. As a result of the analysis, it was determined that the relationships between analysis approaches and the results reached and the data were consistent. In order to ensure external reliability, the raw data obtained in the research and the results and comments made in accordance with these data were presented to

the field specialist for confirmation examination and the field specialist's confirmation was obtained.

3. Findings

In this section, the 3rd grade mathematics curricula in Northern (Ministry of National Education and Culture, 2016b, 2017b) and Southern Cyprus (Ministry of Education and Culture, 2016b, 2017b) are examined by using document analysis technique and evaluated in line with NCTM principles and standards, and their similarities and differences are explained below in the form of items.

3.1. Evaluation as per NCTM Principles

Table 1: *Comparison of Northern and Southern Cyprus 3rd Grade Mathematics Curriculum According to NCTM Principles*

Principles	North Cyprus and South Cyprus
Equity	The 3rd Grade Mathematics Curriculum in Northern Cyprus advocates the principle "All students can learn mathematics". The principle of "Basic mathematics education for all students" is advocated in Southern Cyprus.
Curriculum	The 3rd Grade Mathematics Curriculum in Northern Cyprus is not satisfactory in terms of the variety of activities and important concepts. The subjects are interdependent and they progress according to the level of students in terms of language and expression. However, the activities that the student can undertake with his/her family are not paid much attention. In Southern Cyprus, issues are progressing in an interconnected way. However, it is not satisfactory in terms of the variety of activities. It is important to include activities (child-parent activity drills) that the students can do with their families in the curriculum.
Teaching	In the 3rd grade mathematics curricula of both Northern and Southern Cyprus, it is emphasized that teachers should renew and improve their knowledge constantly so as to be able to offer effective mathematic teaching to students. They should provide an education that is not only based on books and exercise books, but which also enables students to conduct mathematical operations mentally. However, it seems that the Ministries of Education on both sides are lagging behind in terms of technology-supported education.
Learning	In the 3rd Grade Mathematics Curriculum in Northern Cyprus, students can build (structure) new knowledge based on older

	information and become effective learners. In order for the student to be an effective learner, he/she must learn concepts well, have basic knowledge, reflect his/her thoughts, and draw lessons from his/her mistakes. However, in order for the abovementioned criteria to be meaningful, material studies should be prioritized. However, preparatory studies of primary education institutions are not available in this regard. On the other hand, in Southern Cyprus, it is seen that in order for students to become effective learners, they have to learn concepts well, possess basic knowledge, be able to reflect their opinions, and learn lessons from their mistakes. In this regard, the criteria mentioned above have to be supported with material studies and it is seen that elementary schools are making efforts to develop such material support.
Assessment	According to the 3rd Grade Mathematics Curriculum in Northern Cyprus, in order for the student to learn from his/her mistakes, the evaluation should not be limited only to grades and scores. Unfortunately, a performance-based assessment in the Turkish education system is not included in the grade assessment. It ends with teacher evaluation. On the other hand, in Southern Cyprus, evaluation is not limited to teacher grading, and 4th and 6th grade students are included in the TIMSS (Trends in International Mathematics and Science Study) evaluation.
Technology	In the 3rd Grade Mathematics Curricula in both Northern and Southern Cyprus, the technology principle has been relatively neglected, no studies have been made to develop educational software approved by the Ministry of Education, and technology support has not been included in the mathematics education program.

As can be seen in Table 1, the Northern and Southern Cyprus 3rd grade mathematics education curricula show similarities in terms of teaching and technology principles. However, there are differences in the remaining principles, namely equality, curriculum, learning and evaluation principles. The principles of "all students can learn math" and "basic mathematics education should be provided for all students" are advocated in the north and the south, respectively. While child-parent activity studies are not included in the 3rd grade mathematics curriculum in the north, they are available in the curriculum in the south. In the north, it is emphasized that this constructivist approach can be adopted so that students can build new knowledge on old information and become effective learners. However, in

the south, it is underlined that this is not sufficient, and that material development studies are also needed. While the evaluation is limited to assessment by the teacher in the north, students are also evaluated with TIMSS exams in the south.

3.2. According to NCTM Standards:

a). Content Standards

Table 2: *Comparison of Northern and Southern Cyprus 3rd Grade Mathematics Curricula According to NCTM Standards (Content)*

Content Standards	Evaluation
Numbers and Operations	In both Northern and Southern Cyprus 3rd Grade Mathematics curricula, it is ensured that students are able to make calculations in different ways and apply paper-pencil studies using their own predictions as well as mental methods. The numbers and operations standard included in the content is inadequate to explain the students' own methods and inadequacies.
Algebra	In both Northern and Southern Cyprus 3rd Grade Mathematics curricula, reasoning in algebra content should be encouraged. It is very important to use notations in mathematics teaching and to support variables with concrete models in order to make sense of the notation of symbols. Since these models are not used in most sub-topics, mathematical ideas can be prevented from coming to the fore.
Geometry	In Northern Cyprus, the 3rd Grade Mathematics curriculum covers geometry, which is the sub-branch of mathematics, in the second semester. Geometric shapes and basic concepts in geometry are only covered and examined superficially. However, spatial reasoning and modeling should be paid more attention and geometry education should be made more mathematical. On the other hand, in the content of the Southern Cyprus 3rd Grade Mathematics Curriculum, spatial reasoning, modeling to solve problems, properties of geometric shapes and their mathematical states are satisfactorily covered.
Measurement	It can be said that in the 3rd Grade Mathematics curriculum in Northern Cyprus, this section is one of the most important among the standards as it provides the opportunity to learn and apply other areas of mathematics. Unfortunately, this subject is covered superficially and can be presented without being associated with nature and avoiding showing example models.

	In Southern Cyprus, this is another important topic which includes terms commonly used in various aspects of real life.
Data Analysis and Probability	In both Northern and Southern Cyprus 3rd Grade Mathematics curricula, there are topics such as appropriate statistical methods, analyzing data, making conclusions, making data estimates, understanding and using basic concepts, and probability.

According to Table 2, similarities can be seen in the content and numbers, operations and algebra and data analysis and algebra sections in line with NCTM standards in the 3rd grade mathematics curricula in Northern and Southern Cyprus. However, they differ in terms of geometry and measurement standards. In the north, geometry as a branch is emphasized in the second semester of the 3rd grade, while in the south, spatial reasoning, modeling and geometric shapes are prioritized within the geometry content throughout the year. Also, although the measurement topic in the north is one of the most important standards, it is described superficially. In the south, the measurement is covered in terms of daily life, emphasizing that it is common in various aspects of life.

b). Process Standards

Table 3: *Comparison of Northern and Southern Cyprus 3rd Grade Mathematics Curricula According to NCTM Standards (Process)*

Process Standards	Evaluation
Problem Solving	In both Northern and Southern Cyprus 3rd Grade Mathematics Curricula, in studies to improve students' problem-solving skills, (1) understanding the problem, (2) planning the solution, (3) applying the plan, (4) checking the correctness and validity of the solution, and (5) generalization of the solution and similar problem posing processes are followed. In both communities, students can apply the problem-solving process and implement the strategies they have developed to other problems.
Reasoning and Proof	In both Northern and Southern Cyprus 3rd Grade Mathematics Curricula, reasoning and understanding of proofs are important elements. Making math meaningful offers a powerful way for students who are thinking analytically to observe patterns, structures, and mechanisms.
Communication	In both Northern and Southern Cyprus 3rd Grade Mathematics Curricula, the mathematical language of mathematics education programs is clear and persuasive in

	both written and verbal versions. It gives students opportunities to explain and helps them to clarify their opinions.
Connections	In both Northern and Southern Cyprus 3rd Grade Mathematics Curricula, it is ensured that students are able to see that mathematics does not function in isolation, but is also related to other disciplines, that mathematics is beneficial for areas related to mathematics. However, it can be easily seen that cultural values and currencies are different in the two curricula.
Representations	The 3rd Grade Mathematics Curriculum in Northern Cyprus is a basis for students to understand mathematics. For example. concrete models, figures, pictures, numbers, symbols, tables, etc. considerably expand students' capacities. However, adequate space is not allocated to concrete models and material studies. In Southern Cyprus, it is fundamental for students to understand mathematics. For example, concrete models, figures, pictures, numbers, symbols, tables, etc. considerably expand students' capacities. Therefore, material development studies were introduced and developed within the framework of the 3rd grade mathematics curriculum.

When Table 3 is analyzed, we can observe the finding that the 3rd grade mathematics curricula in Northern and Southern Cyprus only differ in the field of representations. In order to explain this difference, while expressions such as figures, pictures, symbols, numbers, and tables are satisfactorily included in the curriculum in the north, concrete models and material studies are relatively neglected. In the south, concrete models and material studies have been introduced and developed as these are believed to significantly expand the students' capacities. In other processes in the standards, the problem solving, reasoning and proof, communication, and associations criteria show similarities.

3.3. Teacher Opinions

In this section, the opinions obtained via the semi-structured interview form applied to teachers who deliver mathematics education to 3rd grade students in Northern Cyprus (N1, N2, N3, N4, N5, N6, N7 and N8: where N denotes teacher) and Southern Cyprus (S1, S2, S3, S4, S5, S6, S7 and S8: where S denotes teacher) are compared by using interview

technique. Content analysis was conducted on their answers in order to explore the differences that emerged with items. Demographic data showed that the professional experience of these participants was in the interval of 10-20 years (N=6) and 30-40 years (N=10).

The findings according to the teachers' views are shown below. Teacher names are coded and opinions are given item by item.

Does the 3rd Grade Mathematics curriculum provide strong support to all students?

N1, N2, N3, N4, N5, N6, N7, N8, S1, S2, S3, S4, S5, S6, S7, S8: Yes, it provides strong support.

Is the 3rd Grade Mathematics curriculum satisfactorily supported by activities? Are the activities consistent with the topics?

N1, N3, N4, N5, N7, N8: It is satisfactorily supported. Activities are consistent with the topics. However, there should be more studies in the form of games that will entertain the students.

N2, N6: Activities are conducted with close intervals, but there should be longer intervals.

S1, S2, S3, S6, S7, S8: Yes, the activities are satisfactorily supported and consistent with the topics.

Does the 3rd Grade Mathematics curriculum encourage students to improve their knowledge?

N1, N2, N3, N4, N5, N6, N7, N8: Yes.

S1, S2, S3, S4, S5, S6, S7, S8: Yes.

Does the 3rd Grade Mathematics curriculum support or develop the students positively in terms of technology?

N1, N2, N3, N4, N5, N6, N7, N8: Yes, it supports and improves students.

S1, S2, S3, S4, S5, S6, S7, S8: Yes, it supports and improves with technology.

Is the measurement and evaluation made in the mathematics curriculum appropriate? Or should it be changed?

N1, N2, N3, N4, N5, N6, N7, N8: Yes, it is appropriate.

S1, S3, S4, S6, S7, S8: Yes, it is appropriate. In addition, the participation of students in TIMSS exams is another international assessment and evaluation factor.

S2, S8: Yes, it is appropriate according to the textbook, but it can be changed.

Which course contents can be used in mathematics lessons?

N1, N2, N3, N4, N5, N6, N7, N8: Turkish, social studies, drawing, and computer.

S1, S4, S5, S7: Technology, science.

S2, S3, S6, S8: Greek, science.

Is the 3rd Grade Mathematics curriculum satisfactory to reach the goals and achievements?

N1, N2, N3, N4, N5, N6, N7, N8: The textbook that is currently being used is satisfactory to reach the goals and achievements.

S1, S2, S3, S4, S5, S6, S7, S8: Yes, it is satisfactory.

How satisfactory are the following elements for the current 3rd grade mathematics curriculum?

Problem Solving:

N1, N4, N5, N8: The problems used are appropriate and satisfactory.

S1, S2, S7, S8: Problems are suitable for the subjects and there are plenty of repetitions.

Reasoning and Proving:

N3, N4, N6, N8: The more there are, the better for the children.

S1, S2, S4, S5, S6, S7: It should be done according to the level of the child.

Communication:

N1, N2, N3, N5, N7, N8: Satisfactory.

S1, S2, S3, S5, S6, S7: Satisfactory.

Association:

N1, N2, N3, N4, N5, N6, N7, N8: By giving examples in the class, associations are made with appropriate topics.

S2, S3, S4, S6, S7, S8 : Association is quite satisfactory.

Notation and Expression:

N3, N4, N6, N7: Satisfactory.

S1, S2, S3, S4, S5, S6, S7, S8: Satisfactory.

Should NCTM (National Mathematics Teachers Council) standards be used in the mathematics curriculum? Why? Why not?

N1, N2, N3, N4, N5, N6, N7, N8: Yes. Because it is appropriate.
S2, S3, S4, S5, S6, S7: Yes, it must be used. Because it emphasizes realistic mathematics teaching.

Is the 3rd Grade Mathematics curriculum;
Satisfactory for students to use their learning experiences and mathematics in daily life? Please explain.
N1, N2, N3, N4, : It is satisfactory.
S1, S2, S3, S5, S6, S7: Yes, it is satisfactory.
S4, S8: Yes, it is satisfactory. However, it can be equipped with activities that reflect daily life.

Do you think this curriculum should be changed? Is it satisfactory? Do certain changes need to be made? Please explain.
N1, N2, N4, N5, N6, N8: It is satisfactory, but there are too many topics and they are too intense.
N3, N7: Certain changes need to be made. The curriculum can be simplified and children can be given plenty of exercises and revision exercises. By associating with other lessons, it can be ensured that they love and learn mathematics more easily.
S1, S2, S3, S4, S5, S6, S7, S8: It is satisfactory. The necessary changes were made in 2016 and their work is still ongoing.

4. Discussion and Conclusions

In line with the obtained findings, the 3rd grade mathematics curricula in Northern and Southern Cyprus have been compared by considering the NCTM principles and standards and similarities have been observed in certain subjects, while differences were observed in others. In addition, in line with the opinions of the teachers, it is revealed that while there are shared opinions on many issues, striking differences prevail in others.

As a result of the findings, Northern and Southern Cyprus 3rd grade mathematics curricula show similarities in teaching and technology items within the principles of NCTM. However, there are differences in the principles of equality, curriculum, learning and evaluation. The principle of

"all students can learn math" is advocated in the north, whereas the principle of "basic mathematics education should be provided for all students" is advocated in the south. In addition, child-parent activities are not included in the 3rd grade mathematics curriculum in the north, while these activities are available in the mathematics curriculum in the south. In the north, it is emphasized that a constructivist approach can be employed so that students can build new knowledge on old information and become effective learners. In the south, however, it is emphasized that the necessity of developing materials is also essential. This result is in agreement with Mink and Fraser (2005), also Blanton et al., (2015) and emphasized that it allows children to learn mathematics. In addition, according to Casa and collaborators (2019) and Boote & Boote (2018), it is very important the information is provided to the students with materials or concrete models before they complete the curriculum. While the evaluation is limited to assessment by the instructor in the north, in the developed south, students are also evaluated through TIMSS exams.

The 3rd grade mathematics curricula in northern and southern Cyprus show similarities in the field of contents of NCTM standards in terms of numbers and operations, algebra and data analysis and algebra topics. However, differences are observed in terms of geometry and measurement standards. In the north, the branch of geometry is emphasized in the second semester of the 3rd grade, while in the south, this branch is covered by giving priority to spatial reasoning, modeling and geometric shapes in the geometry content throughout the year. In addition, although the subject of measurement in the north is one of the most important standards, it is described only superficially. On the other hand, emphasizing that it is common in many aspects of life in the south, the terms of daily life are referenced. This shows that we have reached the same conclusion as Der-Ching (2018), who claimed that mathematics curricula should not be limited to the qualifications formulated based on content; instead, they should be supported with activities that have real-life content so as to improve the mathematics learning of students.

In addition, we have explored the finding that 3rd grade mathematics curricula in Northern and Southern Cyprus only differ in the field of representations in the process standard. If we are to explain this difference, while expressions such as figures, pictures, symbols, numbers, and tables are satisfactorily included in the curriculum in the north, concrete models and material studies are relatively neglected. In the south, on the other hand, concrete models and material studies have been introduced and developed as these significantly expanded students' capacities. According to Weinberg

(2019), notation and expression are the basis of mathematics. The biggest challenge here lies in the development and explanation of logical expressions. Among other processes in the standards, the problem solving, reasoning and proof, communication, and associations criteria show similarities.

Conclusions

When we compare the opinions of teachers in northern and southern Cyprus, it is seen that all educators think that the 3rd grade mathematics curriculum provides strong support to students, that the curriculum is reinforced with several activities that are consistent with the topics, that they encourage students to improve their knowledge, that they support and improve students in positive direction with regard to technology, and that the measurement and evaluation method used is appropriate. In terms of reaching curriculum goals and acquisitions, they share the view that the curriculum is satisfactory in ensuring that students reflect their things they learn in mathematics to their daily lives in terms of problem-solving, reasoning-proving, communication, association, and notation-expression elements. They also agreed with the view that NCTM standards should be used in the mathematics curriculum. However, in response to the question of which course content can be used in mathematics lessons, teachers in Northern Cyprus said Turkish, social studies, drawing and computer while Southern Cyprus teachers responded as Greek and science. This means that the communities living in the two different parts of the same country responded with Turkish and Greek, respectively, due to their language differences.

In addition, in response to the question regarding whether the 3rd grade mathematics curriculum is satisfactory or whether it needs to be changed, teachers in Northern Cyprus said that "*it was satisfactory but there were too many topics, and that the curriculum should be simplified, repetitions and activities should be increased, and related to other courses*". The teachers in Southern Cyprus, on the other hand, responded to the question as follows: "*it is satisfactory, the necessary changes were made in 2016 and the works are still in progress.*" This finding shows that we have reached the same conclusion as the Annual Report 2016 (Ministry of Education and Culture, 2017a).

Recommendations

It can be said that the curriculum is a guide in education. In coordinated curriculum studies, it has been emphasized in several papers

that students have positive potentials in learning mathematics. It is imperative that reforms in mathematics curricula should include the sustainability of activities as they have some effect on the development and change in teaching. It is very important that teachers are given the freedom to develop their own approach, and that students practice and develop their competencies. Today, NCTM standards are considered important in mathematics education in countries such as South Korea, Australia, Finland and Taiwan. The purpose of the studies carried out in the field of education programs is not to harm the program, but to produce results to trigger development. For this reason, while developing mathematics curricula, they can be prepared according to NCTM principles and standards.

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