

Identifying Effective Factors on Educational Reform at the Level of National and Regional Supports for High School Mathematics

Maryam Ziyaei¹, Narges Keshtiaray^{2*}, Hamidreza Kashefi³

1. PhD Student, Department of Curriculum Planning, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.
2. Associate Professor, Department of Curriculum planning, Isfahan (Khorasgan) Branch, Islamic Azad University, Isfahan, Iran.
3. Assistant Professor, Department of Mathematics, Farhangian University, Tehran, Iran.

Article history:

Received date: 2021/10/25

Review date: 2021/11/12

Accepted date: 2022/01/09

Keywords:

Educational Reform, National and Regional Supports, Mathematics, High School

Purpose: This research was conducted with the aim of identifying effective factors on educational reform at the level of national and regional supports for high school mathematics.

Methodology: The present study in terms of purpose was applied and in terms of implementation method was qualitative, which was performed in two stages of synthesis research and content analysis. The research environment in the synthesis research stage were all reference texts about recognizing the needs of the high school mathematics curriculum in the period of 2007 to 2020 years, which number of 47 sources were selected as a sample by purposeful sampling method. The research environment in the content analysis stage were all reference texts of educational reform of the high school mathematics curriculum and national and regional support in the period of 2010 to 2020 years, which number of 7 sources were selected as a sample by purposeful sampling method. The content validity of the data was confirmed by 5 experts in the field of curriculum and education of mathematics and their reliability was obtained by the agreement coefficient method between the two coders 0.88. Data were analyzed by synthesis research and content analysis methods via deductive.

Findings: The results of synthesis research showed that for the effective factors on educational reform were identified 5 components and 12 subcomponents, which the components included the need to review the curriculum, preparation of teachers to change the curriculum, the need for teacher training, supervision of the education system on the teachers' performance and providing curriculum implementation arrangements. Also, the results of content analysis showed that for the effective factors on educational reform were identified 2 components and 7 subcomponents, which the components included preparation teachers to change the curriculum and providing curriculum implementation arrangements. Finally, the diagram of the effective factors on educational reform at the level of national and regional supports for high school mathematics was drawn.

Conclusion: According to the results of this study, planning to improve the education of high school mathematics is essential through the use of effective factors on educational reform.

Please cite this article as: Ziyaei M, Keshtiaray N, Kashefi HR. (2022), Identifying Effective Factors on Educational Reform at the Level of National and Regional Supports for High School Mathematics, *Iranian Journal of Educational Sociology*. 5(1): 183-194.

* Corresponding Author Email: keshtiaray@gmail.com

1. Introduction

Mathematics occupies many hours of the educational program of children and teenagers from the very first years of education, but this subject is still considered one of the most problematic subjects in all levels of the educational system of Iran (Shirani Bidabadi, Nasr Isfahani, Mirshah Jafari & Abedi, 2019). Due to its abstract and subjective nature, mathematics is the most effective tool that can expand and develop logical structures and mental processes (Sandilos, Baroody, Rimm-Kaufman & Merritt, 2020). Mathematics and its application is a part of daily life in order to solve life problems in different fields, which has wide applications in different human activities and will lead to the training of people who can reason logically in dealing with problems, have the power of analysis and abstraction and Build comprehensive theories about the surrounding phenomena (Haghkhab & Davoudi, 2021). Mathematics plays an important role in everyday life, and one of the reasons for this is its role in making a meaning of clear and logical thinking, solving everyday life problems, recognizing patterns of relationships and common experiences, developing creativity and increasing awareness of society (Yiwen, 2020).

In order to be able to use mathematics in daily life, it is necessary to carry out simple and verbal mathematical activities and calculations, to develop mental abilities and coordination between them by increasing abilities and previous knowledge, to expand linguistic concepts and vocabulary and vocabulary of mathematics. Therefore, it is necessary to mentally prepare students to understand some basic mathematical concepts, develop intellectual and cognitive systems and think correctly through familiarity with logical mathematical concepts (Vanden Ham & Heinze, 2018). In the national curriculum document, referring to the importance of mathematics in the school education program, it has been stated that deep learning of mathematical concepts occurs when the students themselves have reached those concepts while solving a significant problem and have made those concepts themselves. This action is similar to a research in mathematics. Therefore, in the process of teaching and learning mathematics, students learn how new concepts occur, how to name them, and how to work with them and generalize them (Mafakheri, 2020).

The reform movement in mathematics education began in the early eighties in response to the call to return to basic principles to address the concerns of society regarding the state of mathematics education. Reform-oriented approaches include a range of processes such as problem solving, reasoning, proof, communication and thinking processes (Berlinski & Busso, 2017). In the real world, educational change and reform, whether it is desirable or not, is influenced by personal and collective experiences that are accompanied by ambiguity and uncertainty. Since all stakeholders and agents of educational changes and reforms are human beings, they can think of more realistic mechanisms for the successful implementation of change and reform programs (Fullan, 2007). Educational changes and reforms are an interactive process between policy makers and implementers that require time and step-by-step planning to show its positive and innovative aspects to all stakeholders (Darragh & Valoyes-Chavez, 2019).

Change, modification and improvement are three concepts related to educational reforms that are linked together. The connection between modification, change and improvement is that the purpose of modification is to improve what is hoped to be improved by implementing change with a specific work plan. Reform as a concept is often formulated as an agenda or a strategy that results from a policy. Such an agenda is like pointing out a problem and then giving recommendations to solve it. In other words, it proposes both the problem and the solutions and includes the goals and ways of research and their justification (Ahtiainen, 2017). Five guiding principles for educational reforms include the process of implementing changes for all people involved in a learning process, implementing changes requiring attention to the old or existing program and persuading stakeholders for new changes, the need to implement changes freely within borders, and the need for time to implement changes. They are aimed at creating transformation and trying to implement changes (Nieveen & Plomp, 2017). Proponents of math education reform want students to value math and have confidence in their ability to perform math-related tasks. In the reform approach, more emphasis is placed on the need for students to create a conceptual understanding of important mathematical ideas and the ability to relate these

ideas to build a style or foundation on which future learning is based (Haghi, Rostamy Malkhalifeh, Behzadi & Shahvarani, 2019).

A few researches have been done about educational reforms for mathematics, which are explained below the results of the most important researches. Haghkhah & Davoudi (2021) introduced solutions to prevent and correct mathematical misunderstandings including three dimensions of effective solutions in the field of knowledge, effective solutions in the field of attitude and effective solutions in the field of method; So that effective solutions in the field of knowledge include paying attention to the hierarchical nature of mathematical materials, paying attention to individual differences in the cognitive development of intelligence and learning style, paying attention to the experience and previous knowledge of students, improving the level of knowledge and experience of the teacher, paying attention to the singleness of mathematics, modifying the content Math book and parent education, effective solutions in the field of attitude including creating motivation and enjoyment of learning math, reducing psychological pressure and math anxiety, creating the attitude that mistakes are an opportunity to learn and creating a positive attitude in students by providing creative and innovative solutions and solutions Effective in the field of method including involving students in identifying and resolving misunderstandings through strengthening metacognitive strategies, assigning the responsibility of mathematical progress to the students themselves, using non-examples and paying attention to similarities and differences, choosing the appropriate strategy and method by the teacher, practical correction of mistakes, making learning meaningful. , peer group training and evaluation were targeted.

Ziaei, Keshtiaray & Kashefi (2021) while researching the effective factors on educational reforms at the level of empowering mathematics teachers, including reforming educational methods (paying attention to students' needs and interests, paying attention to math anxiety in teaching, paying attention to students' motivation in teaching, evaluating math literacy students, playing a guiding role in teaching, using sports and mobility, paying attention to math teaching time, teaching all textbook materials, using practice and repetition strategy with emphasis on creativity and paying attention to students' attitude in teaching, using digital (adopt digital tools and methods in teaching and creating digital literacy), improving learning environments (providing educational materials and resources, designing physical and virtual learning space based on the learning topic, providing a safe and calm learning environment, providing an active and rich learning environment and providing a learning environment along with justice and equality) and increasing learning partnerships (increasing collaboration with colleagues, strengthening skills based on learning partnerships and creating new relationships with students).

Gholamazad (2020) in a research entitled changing the school math curriculum: challenges and needed research concluded that the influential factors for the change and transformation in the math curriculum include the math movement and the change of the national math curricula of different countries, the development of psychology and the design of new theories. In this field, conducting international comparative studies such as the Thames test, the internationalization and globalization of the economy, the generality and inclusiveness of technological growth and the related needs for human resources skills, the purposefulness of educational activities, and the dependence of the math curriculum on industry and commerce were.

Ashraf (2019) in a research titled Experiences and Impact: Teachers' Voices on Math Education Reform in Ontario, Canada concluded that math self-confidence affects the perception and response to math reform, teachers have little active role in the process of math reform, and between Math correction and teachers have a two-way effect. These concepts indicated the importance of respecting teachers' experiences and insights, dealing with teachers as agents of change, and involving teachers in mathematics reform processes.

Berlinski & Busso (2017) in a research titled Challenges in Educational Reforms: An Experiment on Active Learning in Mathematics concluded that the challenges include methods not directly addressing the learning goals and students' needs, not having complementary input to be effective (for example, teaching limited to our teachers about how to effectively use auxiliary and supplementary resources), neutralizing positive effects

and outcomes as a result of inappropriate behavioral responses of teachers and students and the need for a lot of time to learn and exploit.

Eacott & Holmes (2010) in a research entitled *Leading Reforms in Mathematics Education: Solving a Complex Equation* concluded that leading reforms in the mentioned field include educational strategies, strategic management, organization alignment, mathematics content knowledge, mathematics education and professional learning in *They were teaching mathematics*. Although one of the most important subjects in the curriculum of education is the subject of mathematics, but whenever the subject of mathematics is discussed, most people state that they do not have enough skills in the field of mathematics, they are weak and somehow they are afraid of mathematics. Even some students really dislike mathematics and consider mathematics as one of the most difficult subjects and fewer of them perform well in mathematics (Vahedi, Piri & Malekzadeh, 2019).

Also, in the discussion of the importance and necessity of the research, it should be stated that today in the education system, mathematics is a scientific subject and a main field as an integral part of the curriculum in all levels of education, and its examination in the secondary school is due to the preparation of students to enter It is of double importance to the university. Another important point is that mathematics is very important for the scientific and technological development of countries. Because mathematics skills are important for understanding other fields, including engineering, experimental sciences, social sciences, and even art, and it is considered the driving force of many fields of study. The last important point is that mathematics education reform has been emphasized for several decades, but little research has been done about it both inside and outside the country. As a result, this research was conducted with the aim of identifying the factors affecting educational reforms at the level of national and regional support for secondary mathematics.

2. Methodology

The current study was applied in terms of its purpose and qualitative in terms of implementation method, which was conducted in two stages of research synthesis and content analysis. The research environment in the research synthesis stage of all the reference texts about the recognition of the needs of the high school mathematics curriculum was in the range of 2007 to 2020, and 47 sources were selected as a sample using the purposeful sampling method. The research environment in the content analysis stage was the reference texts of educational reform of the secondary mathematics curriculum and national and regional support in the range of 2010 to 2020, and 7 sources were selected as a sample using the purposeful sampling method.

Research synthesis is a qualitative meta-analysis on the concepts and results of past researches in the method of sequential coding. In other words, Meta-Synthesis includes a deep and detailed review and qualitative analysis of past researches and the combination of their information and data in order to create new knowledge and a more comprehensive representation of the desired phenomenon. Also, the purpose of content analysis was to enrich the findings that the aforementioned method is one of the research methods that has been used since the relatively distant past and is widely used in social sciences today. In its simplest form, this method takes out the concepts required by the research from the studied text and organizes the concepts in the form of regular categories. The method of content analysis is based on the assumption that by analyzing messages, it is possible to discover the meanings, priorities, attitudes, ways of understanding and organization of the world.

In this research, the tool for collecting information was note-taking in the library method. For this purpose, fish drawing was used from sources including books and specialized articles in order to identify the components of factors affecting educational reforms. In descriptive text copying, which is a form of archival information gathering method, the maximum possible information was recorded so that maximum necessary information is available at the time of data analysis and coding. Therefore, the necessary information was extracted from selected sources and the findings of the current research were categorized, which included national and regional support for middle school mathematics. Finally, the findings were presented and the

specialists and experts in the field of curriculum and mathematics education were asked to express their opinion about each of the components or effective factors. As a result, the content validity of the data was confirmed by the opinion of 5 specialists and experts in the field of curriculum and mathematics education, and their reliability was obtained by the method of agreement coefficient between two coders of 0.88. The data were analyzed by the methods of research synthesis and content analysis in a comparative manner, and finally, the factors affecting educational reforms at the level of national and regional support for secondary mathematics were drawn.

3. Findings

In Table 1, the results of the research synthesis to identify the effective factors on educational reforms at the level of national and regional support for secondary mathematics were reported.

Table 1. The results of the research synthesis to identify the effective factors on educational reforms at the level of national and regional support for middle school mathematics

Component	Subcomponent
The need to review the curriculum	1. The need to review textbooks and 2. The need to review evaluation methods
Preparing teachers for curriculum change	1. Improving the attitude towards the curriculum change, 2. Increasing the motivation to change the curriculum, 3. Creating commitment and adherence to the implementation of the curriculum change, and 4. Ethical culture of curriculum change.
Necessity of training teachers	1. Trainings based on curriculum content and 2. Trainings based on skills related to teaching
Supervision of the education system on teachers' performance	-----
Providing curriculum implementation arrangements	1. Preparation of education personnel, 2. Paying attention to the opinion of teachers, 3. The need for curriculum experts to pay attention to change, and 4. Adjusting the curriculum for each class.

The results of the research synthesis reported in Table 1 showed that 5 components and 12 sub-components were identified for the factors affecting educational reforms at the level of national and regional support for high school mathematics, which components include the need to revise the curriculum (with 2 sub-components), preparing teachers to change the curriculum (with 4 sub-components), the need to train teachers (with 2 sub-components), supervision of the education system on teachers' performance (without sub-components) and providing curriculum implementation arrangements (with 4 sub-components). In chart 1, the identified factors affecting educational reforms at the level of national and regional support for secondary mathematics were drawn from the research synthesis.

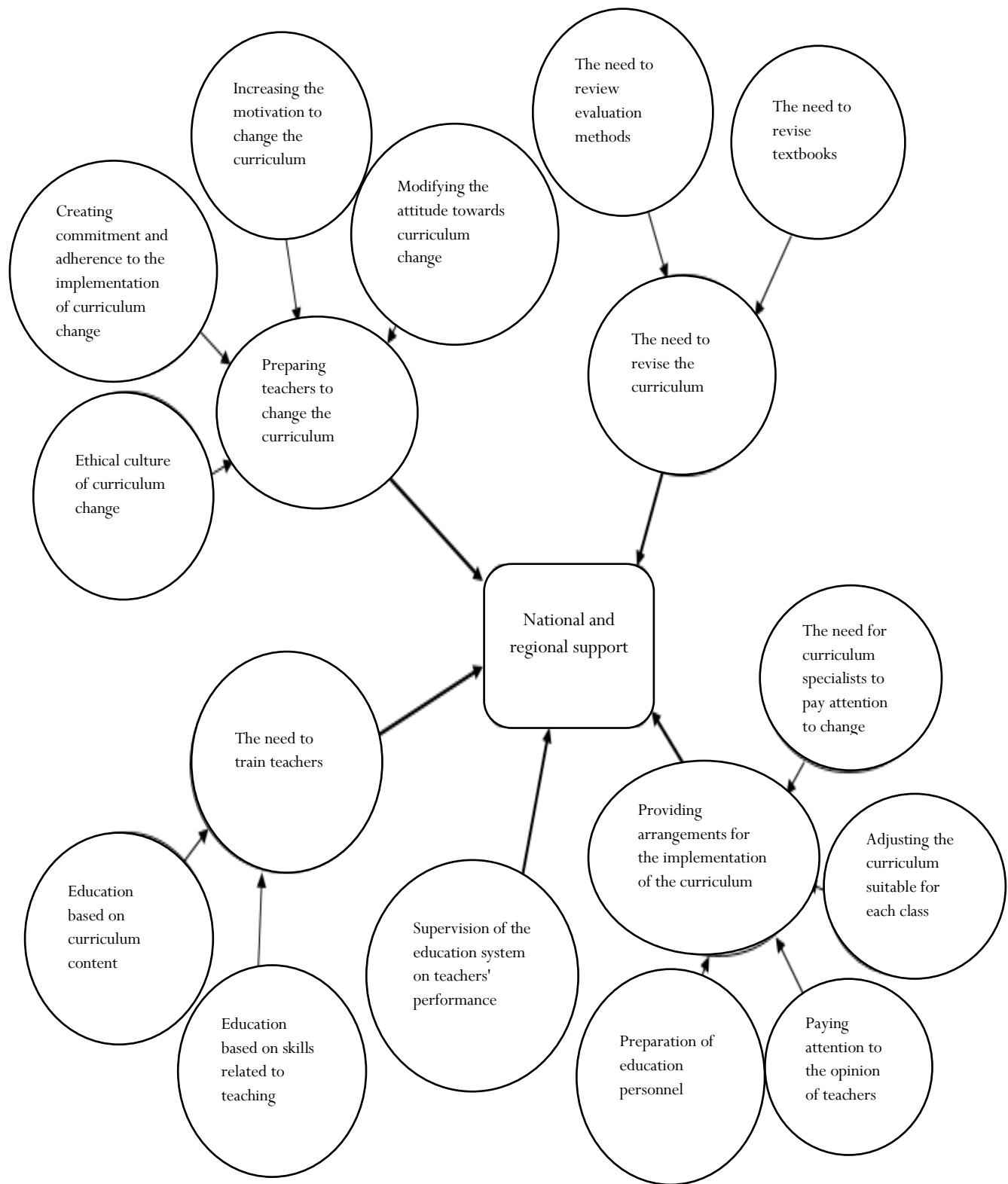


Figure 1. Identified factors affecting educational reforms at the level of national and regional support for secondary mathematics as a result of research synthesis

In Table 2, the results of content analysis were reported to identify the factors affecting educational reforms at the level of national and regional support for secondary mathematics.

Table2. Results of content analysis to identify factors affecting educational reforms at the level of national and regional support for secondary mathematics

Component	Subcomponent
Preparing teachers to change the curriculum	1. Necessity of training teachers and 2. Joint development of norms
Providing curriculum implementation arrangements	1. Assessment of regional needs, 2. Development of common regional curriculum, 3. Forming a supervisory and support board, 4. Emphasizing joint research and 5. Expanding the culture of learning

The results of the content analysis reported in Table 2 showed that 2 components and 7 sub-components were identified for the factors affecting educational reforms at the level of national and regional support for high school mathematics, which components include preparing teachers to change the curriculum (with 2 sub-components) and providing implementation arrangements Curriculum (with 5 sub-components). In Figure 2, the identified factors affecting educational reforms at the level of national and regional support for secondary mathematics were drawn from the content analysis.

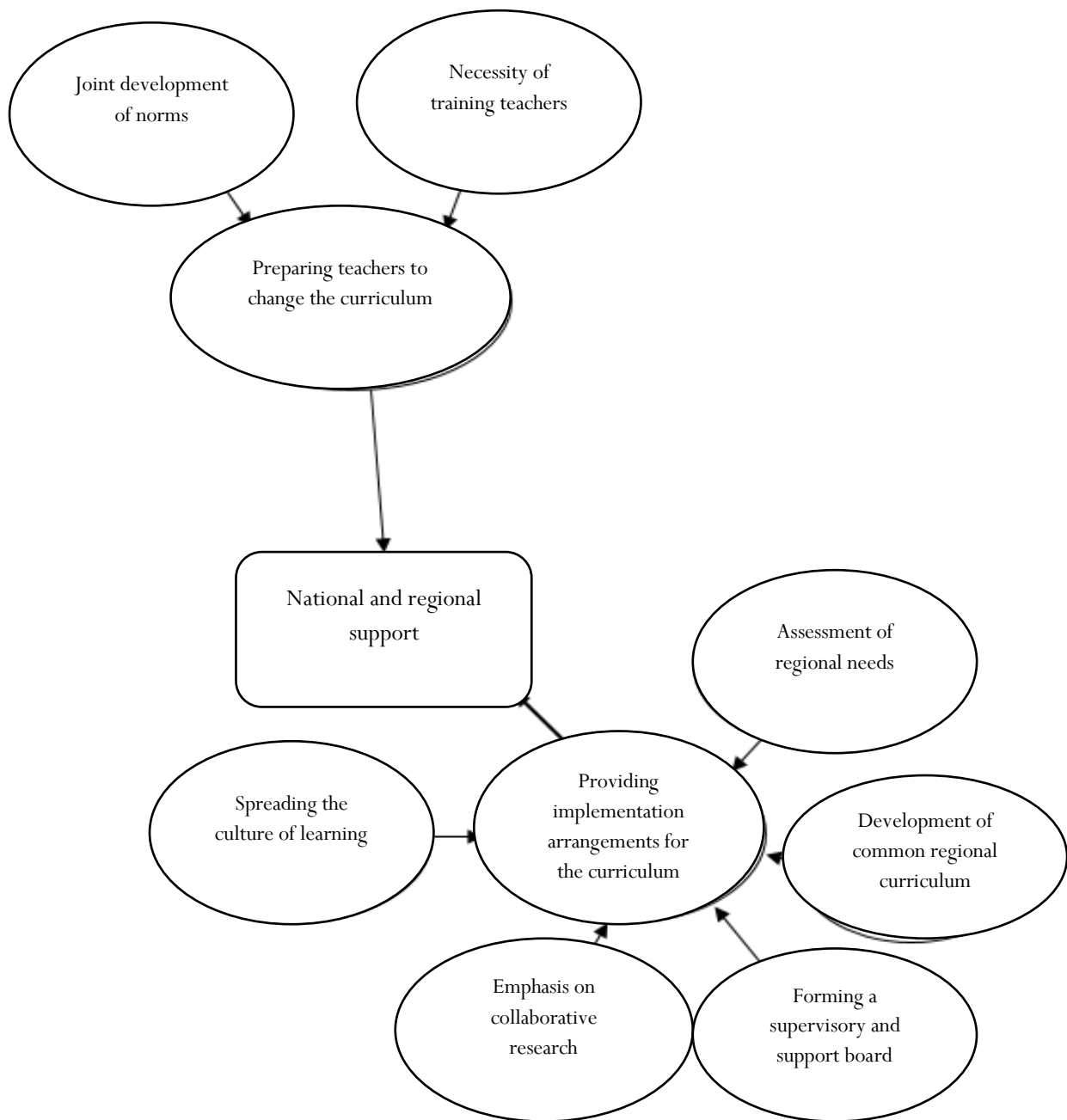


Figure2. Identified factors affecting educational reforms at the level of national and regional support for mathematics in secondary school as a result of content analysis

In diagram 3, the identified factors affecting educational reforms at the level of national and regional support for secondary school mathematics resulting from the combination of research synthesis and content analysis were drawn.

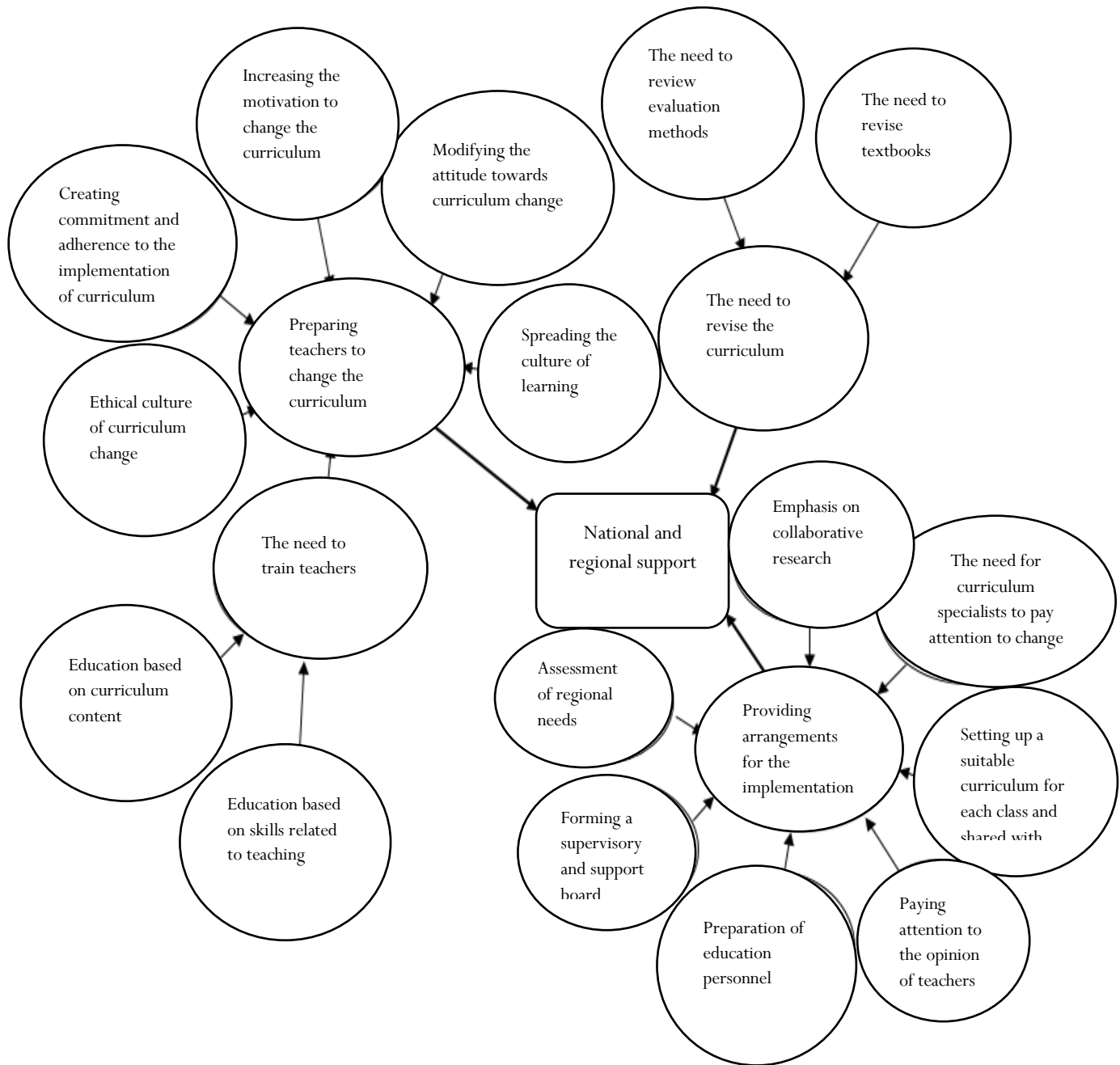


Figure3. Identified factors affecting educational reforms at the level of national and regional support for high school mathematics resulting from the combination of research synthesis and content analysis

The results of the combination of research synthesis and content analysis reported in Figure 3 showed that 3 components and 17 sub-components were identified for the factors affecting educational reforms at the level of national and regional support for high school mathematics, which components include the need to revise the curriculum (with 2 sub-components), preparing teachers to change the curriculum (with 8 sub-components) and providing implementation arrangements for the curriculum (with 7 sub-components).

4. Conclusion

Educational reforms and recognition of the factors affecting it are necessary for curriculum design. As a result, this research was conducted with the aim of identifying the factors affecting educational reforms at the level of national and regional support for secondary mathematics.

The results of the research synthesis showed that 5 components and 12 sub-components were identified for the effective factors on educational reforms, which components include the need to revise the curriculum (with 2 sub-components), preparing teachers for changing the curriculum (with 4 sub-components), the need to train teachers (with 2 sub-components), supervision of the education system on teachers' performance (without sub-components) and provision of curriculum implementation arrangements (with 4 sub-components). Also, the results of content analysis showed that 2 components and 7 sub-components were identified for the effective factors on educational reforms, which components include 2 components and 7 sub-components, which components include preparing teachers to change the curriculum (with 2 sub-components) and providing curriculum implementation arrangements (with 5 sub-components). In addition, the results of the combination of research synthesis and content analysis showed that 3 components and 17 sub-components were identified for the factors affecting educational reforms, which components include the need to revise the curriculum (with 2 sub-components), preparing teachers to change the curriculum (with 8 sub-components).) and providing curriculum implementation arrangements (with 7 sub-components).

The mentioned results were similar to the results of Haghkhah & Davoudi (2021), Ziaei, et al (2021), Gholamazad (2020), Ashraf (2019), Berlinski & Busso (2017) and Eacott & Holmes (2010). In explaining these results, it can be said that in the component of the need to revise the curriculum, it is necessary to revise both textbooks and evaluation methods. In the component of preparing teachers for curriculum change, it is necessary to correct their attitude towards curriculum change, to increase their motivation and motivation about curriculum change, to create commitment and adherence to the implementation of curriculum change, to create a culture for curriculum change, to provide sufficient training to teachers be given and develop common norms. In the component of teacher training, it is necessary to provide both training based on curriculum content and training based on skills related to teaching. Also, for educational reforms and their proper implementation, it is necessary for the education system to monitor the performance of teachers. In addition to that, in providing the implementation arrangements for the curriculum, it is necessary to prepare the education personnel properly, to evaluate the opinion of the teachers, to pay attention to the changes in the curriculum, to adjust and design the curriculum according to each class, to estimate the needs of the region, A joint area should be developed, a monitoring and support board should be formed, emphasis should be placed on joint research, and the culture of learning should be developed and expanded.

In general, the high school mathematics curriculum including textbooks and evaluation methods should be revised, teachers should be sufficiently prepared for curriculum change, teachers' attitude towards curriculum change should be improved, the motivation for curriculum change should increase, commitment and adherence to the implementation of curriculum change It should be strengthened, the ethics of changing the curriculum should be cultured and the learning culture of teachers should be increased, the needs of the region should be assessed, the education personnel should be prepared to implement the curriculum, the experience and opinions of teachers and experts should be taken into account in changing the curriculum, a curriculum should be designed for each class, and at the same time Emphasis on joint research should be formed on the supervision and support board. They consider it necessary to form a monitoring and support board for information, capacity building and allocation of resources and political decisions that support deep

learning, and capacity building comprehensively and continuously focuses on the accuracy of education and includes learning and application cycles in schools. Collaborative research is a process of examining existing practices and hypotheses through interaction with colleagues or peers, and it is a powerful strategy for change. Because it simultaneously promotes professional dialogue and directly helps improve student learning. It is not only a process for solving problems and refining individual practices, but also a systemic approach to use evidence of student learning to build collaborative teams and efficient schools.

In the discussion of the research proposals, it can be stated that a committee was formed in order to assess the needs of the region, prepare educational personnel, collect the experiences of teachers and the opinions of experts in order to change the curriculum, adjust the curriculum suitable for each class and common in each region, monitor and support and conduct joint research. to be Also, in order to master the curriculum content and training based on skills related to teaching, to improve teachers' attitudes towards curriculum change, to increase teachers' motivation for curriculum change, to create commitment and adherence to the implementation of curriculum change, to cultivate the ethics of curriculum change and to expand the culture of learning. In the in-service courses or in the educational courses of Farhangian University, topics should be compiled and presented in a coherent and structured way.

Acknowledgments

In the end, we would like to thank the supervisors and advisors who helped the student a lot in doing this research.

References

- Ahtiainen R. (2017). Shades of change in Fullan's and Hargreaves's models: Theoretical change perspectives regarding Finnish special education reform. University of Helsinki: Unpublished Doctoral Dissertation, Centre for Educational Assessment.
- Ashraf T. (2019). Experiences and impact: The voices of teachers on math education reform in Ontario, Canada. Bulgaria: Bulgarian Comparative Education Society, Annual International Conference of the Bulgarian Comparative Education Society, 101-107.
- Berlinski S, Busso M. (2017). Challenges in educational reform: An experiment on active learning in mathematics. *Economics Letters*. 156: 172-175.
- Darragh L, Valoyes-Chavez L. (2019). Blurred lines: Producing the mathematics student through discourses of special educational needs in the context of reform mathematics in Chile. *Educational Studies in Mathematics*. 101(3): 425-439.
- Eacott S, Holmes K. (2010). Leading reform in mathematics education: Solving a complex equation. *Mathematics Teacher Education and Development*. 12(2): 84-97.
- Fullan M. (2007). *The new meaning of educational change*. New York: Teachers College Press.
- Gholamazad S. (2020). School mathematics curriculum change: Challenges and required research. *Journal of Curriculum Studies*. 15(57): 107-128. [Persian]
- Haghi SE, Rostamy Malkhalifeh M, Behzadi MH, Shahvarani A. (2019). Evaluation of students' performance before and after parent involvement in math education with DEA. *Journal of New Researches in Mathematics*. 5(21): 105-124. [Persian]
- Haghighi S, Davoudi A. (2021). Strategies for preventing and correcting mathematical misunderstandings (a qualitative study). *Quarterly Journal of Education in Basic Sciences*. 6(21): 24-37. [Persian]
- Mafakheri Sh. (2020). An introduction to the necessity of teaching "fuzzy mathematics" to Farhangian University student-teachers and elementary teachers. *Quarterly Journal of Education in Basic Sciences*. 6(19): 22-29. [Persian]
- Nieveen N, Plomp T. (2017). *Five key principle for educational change*. SLO, Enschede: The Netherlands.
- Sandilos LE, Baroody AE, Rimm-Kaufman SE, Merritt EG. (2020). English learners' achievement in mathematics and science: Examining the role of self-efficacy. *Journal of School Psychology*. 79: 1-15.
- Shirani Bidabadi N, Nasr Isfahani AR, Mirshah Jafari E, Abedi A. (2019). Investigating the efficacy of pre-primary school practical math on math competency and learning behaviors of children. *Journal of Research in Educational Sciences*. 13(44): 23-36. [Persian]
- Vahedi Sh, Piri M, Malekzadeh R. (2019). The effectiveness of concept maps in teaching mathematics concepts and mathematics self-concept among elementary school students. *Educational Psychology*. 14(48): 19-36. [Persian]
- Vanden Ham AK, Heinze A. (2018). Does the textbook matter? Longitudinal effects of textbook choice on primary school students' achievement in mathematics. *Studies in Educational Evaluation*. 59: 133-140.
- Yiwen Z. (2020). How do we understand mathematical practices in non-mathematical fields? Reflections inspired by cases from 12th and 13th century China. *Historia Mathematica*. 52: 1-25.
- Ziaei M, Keshtiaray N, Kashefi HR. (2021). Factors affecting educational reforms aimed at empowerment of high school math teachers. *Jundishapur Education Development Journal*. 12(Special Issue): 73-85. [Persian]