

Professor Misir Mardanov at 80: A Distinguished Scholar, Educational Reformer, and Architect of Academic Development in Azerbaijan

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Abstract

This biographical study examines the scientific, educational, administrative, and public contributions of Professor Misir Jumayil Mardanov on the occasion of his 80th anniversary. Drawing on biographical records, institutional history, and an analysis of his academic and professional trajectory, the article presents Mardanov's multifaceted role in the development of mathematics, higher education, educational governance, and the history of education in Azerbaijan. Particular attention is paid to his research on optimal control, integro-differential equations, and constrained processes with delay, as well as his progression from university researcher and lecturer to senior academic administrator and public official. The article also evaluates his service as Rector of Baku State University and as Minister of Education of the Republic of Azerbaijan from 1998 to 2013. During this period, he contributed to curriculum reform, modern textbook policy, state educational programmes, infrastructure development, teacher preparation, and the integration of Azerbaijan's education system into the European and international educational environment. Beyond his administrative responsibilities, Mardanov produced valuable works on the history of Azerbaijani education and mathematics, thereby connecting scientific inquiry with the preservation of national intellectual memory. The study concludes that his eight decades of life and professional activity constitute an influential model of service to scholarship, education, statehood, and national values.

Keywords: Misir Mardanov; educational reform; mathematics; optimal control theory; educational leadership; higher education; history of education; Azerbaijan.

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Introduction

Professor Misir Jumayil oglu Mardanov, who celebrates his 80th anniversary this year, is a distinguished intellectual, scholar, and statesman who has devoted eight decades of his life to the advancement of Azerbaijani science, education, and national and spiritual values. As Head of Department at Baku State University, a Corresponding Member of the Azerbaijan National Academy of Sciences, an Honoured Scientist, a Doctor of Physical and Mathematical Sciences, and a professor, Misir Mardanov occupies a prominent place among the scholars who have rendered exceptional service to the development of science and education in Azerbaijan.

Misir Mardanov was born into an intellectual family on 3 October 1946 in the village of Goyarcha, Chambarak District, Western Azerbaijan (present-day Armenia). After his family moved to the neighbouring village of Salah in 1953, he began primary school there in 1954. He completed his seven-year education at Salah Village School and continued his secondary education at the neighbouring Polad Village Secondary School until March 1964. In March 1964, he moved to Baku and completed his secondary education as an external student at what is now Secondary School No. 49 in Baku's Sabail District. In the same year, he was admitted to the Mathematics Division of the Faculty of Mechanics and Mathematics at Azerbaijan State University.

During his university years, Mardanov distinguished himself through his intellectual ability, diligence, and broad erudition. In addition to maintaining an outstanding academic record, he developed a serious interest in scientific research from his third year of study. At that time, a research seminar entitled "Mathematical Methods of Optimal Control" was established under the direction of the distinguished mathematician Professor Goshgar Ahmadov, Doctor of Physical and Mathematical Sciences and Head of the Department of Differential and Integral Equations. Young researchers from the faculty and the department actively participated in this seminar.

After acquiring a solid foundation in the principal branches of mathematics during their first two years, students of the Faculty of Mechanics and Mathematics were assigned to specialised groups in their third year according to their academic interests and professional aspirations. Without hesitation, Mardanov selected "Mathematical Methods of Optimal Control" as his specialisation and consequently linked his future academic career to this field.

Over the following three years, he received advanced instruction in this specialised area from Professor Goshgar Ahmadov and Ahmadov's students, Candidates of Physical and Mathematical Sciences Kazim Hasanov and Mammad Yagubov. During this period, Mardanov achieved his first scientific successes and successfully defended his graduation thesis. Even as a student, he presented research papers at conferences for young scholars organised at Azerbaijan State University and the Azerbaijan State Pedagogical Institute.

In 1969, Mardanov graduated with honours from the Faculty of Mechanics and Mathematics at Azerbaijan State University. Following graduation, he was appointed to the Hasan bey Zardabi Ganja State Pedagogical Institute, where he began his professional career. He worked for three months as a senior laboratory assistant in the Department of Mathematical Analysis. In December of the same year, driven by his aspiration to pursue an academic career, he returned to Baku and entered the full-time postgraduate programme of the Faculty of Mechanics and Mathematics at Azerbaijan State University.

In 1970, Mardanov commenced his research under the supervision of Professor Goshgar Ahmadov and Associate Professor Kazim Hasanov. Alongside his postgraduate studies, he was actively involved

in teaching, conducting seminar classes in differential equations for second-year students of the Faculty of Mechanics and Mathematics.

After successfully completing his postgraduate studies, Mardanov defended his Candidate of Sciences dissertation, entitled “Certain Problems in Optimal Control Theory for Systems of Integro-Differential Equations,” before the Dissertation Council of Azerbaijan State University on 30 May 1973. By a decision of the Higher Attestation Commission under the Council of Ministers of the USSR dated 28 September 1973, he was awarded the degree of Candidate of Physical and Mathematical Sciences.

From 1973 to 1980, Mardanov worked as an assistant and subsequently as a senior lecturer in the Department of Geometry at the Faculty of Mechanics and Mathematics. During this period, he taught analytical geometry and differential geometry and delivered specialised courses in the Department of Differential Equations. On 25 November 1981, by a decision of the Higher Attestation Commission under the Council of Ministers of the USSR, he was awarded the academic title of Associate Professor.

From 1978 to 1989, Associate Professor Misir Mardanov served as Deputy Dean of the Faculty of Mechanics and Mathematics, one of the university’s largest faculties.

Discussion and results

From Academic Leadership to National Educational Reform

From 1978 to 1989, Misir Mardanov served as Deputy Dean of the Faculty of Mechanics and Mathematics, one of the largest faculties at Azerbaijan State University. This administrative appointment marked an important stage in his transition from an early-career mathematician to an experienced academic leader. Between 1980 and 1989, he simultaneously worked as an associate professor in the Department of Differential Equations, where he delivered lectures and specialised courses on mathematical methods of optimal control and the foundations of the calculus of variations. His teaching and research during this period were closely connected to optimal-process theory, delayed systems, and advanced methods of mathematical control (Mardanov, 1987; Mardanov & Mansimov, 2010).

Mardanov’s scholarly competence, organisational ability, and the confidence he earned within the university community led to his appointment as Deputy Executive Secretary of the Admissions Committee of Azerbaijan State University in 1984 and 1985. He subsequently served as Executive Secretary in 1986 and 1987. In these roles, he successfully managed a highly complex and demanding admissions process requiring administrative precision, institutional accountability, and sound judgement. During the same period, he supervised the selection and placement of approximately 200 Azerbaijani students at leading higher education institutions across the Soviet Union. This responsibility reflected both the institutional trust placed in him and his growing involvement in the strategic development of national academic capacity.

Despite his extensive administrative and teaching responsibilities, Mardanov continued his scientific research. On 6 June 1989, he defended his doctoral dissertation, entitled “The Investigation of Constrained Optimal Processes with Delay,” at the Institute of Mathematics of the Academy of Sciences of the Ukrainian SSR. On 3 November 1989, shortly after the defence, the Higher Attestation Commission of the USSR awarded him the degree of Doctor of Physical and Mathematical Sciences. His research during this stage contributed to the mathematical theory of delayed optimal processes and established the foundation for his subsequent studies in optimal control, differential inclusions, and related areas (Mardanov, 1987; Mardanov & Melikov, 2017, 2018). On 2 October 1991, he was

elected Professor in the Department of Mathematical Methods of Control Theory at Baku State University.

Beginning in the late 1980s and early 1990s, Mardanov's professional trajectory underwent a significant transformation. His commitment to public service and statehood led him to assume progressively more senior positions in educational administration. From 1989 to 1991, he served as Head of the Higher Education Department at the Ministry of Public Education. From 1991 to 1992, he was Deputy Minister of Public Education of the Republic of Azerbaijan. Between 1992 and 1996, he served as First Vice-Rector and Vice-Rector for Academic Affairs at Baku State University, then named after Mammad Amin Rasulzade.

Mardanov served as Acting Rector of Baku State University from 1996 to 1997 and as Rector from 1997 to 1998. During his university leadership, the Heydar Aliyev School and the Heydar Aliyev Museum were established at the university at his initiative—the first such institutional projects of their kind in Azerbaijan. These initiatives demonstrated his understanding of the university not only as a centre of teaching and research but also as an institution responsible for preserving national memory, political history, and civic values.

Leadership of Azerbaijan's Education System, 1998–2013

Professor Misir Mardanov served as Minister of Education of the Republic of Azerbaijan from 1998 to 2013. His fifteen-year tenure represents one of the most consequential periods in the modern history of Azerbaijani education. He entered the country's educational history as a scholar-administrator and reform-oriented minister distinguished by substantial scientific expertise, extensive institutional experience, modern strategic thinking, and a sustained commitment to educational renewal.

Under his direct leadership and with his active participation, the national education strategy established by the Azerbaijani state was translated into institutional programmes and reform initiatives. His work focused on introducing effective innovations across all levels of education, modernising educational content, strengthening management mechanisms, and renewing the wider education system. Particular emphasis was placed on aligning national education with contemporary international developments while maintaining a foundation grounded in national, moral, and universal values.

During this period, Azerbaijan's education system increasingly came to be administered through scientifically grounded programmes and long-term development frameworks. Mardanov's leadership contributed to curriculum reform, the renewal of textbook policy, the implementation of state education programmes, the modernisation of educational infrastructure, and the expansion of Azerbaijan's engagement with European and global educational structures. His approach connected administrative reform with scholarly reflection on the historical development of Azerbaijani education, a field to which he also made a substantial academic contribution through his multivolume work *History of Education in Azerbaijan* (Mardanov, 2011–2012).

Taken together, Mardanov's academic, administrative, and ministerial activities illustrate a sustained relationship between scientific expertise and public leadership. His career demonstrates how experience in mathematical research, university governance, and strategic planning can inform the management of complex national education systems. Accordingly, his contribution should be evaluated not only through the positions he held but also through the institutional reforms, intellectual traditions, and professional capacities that developed under his leadership.

Institutionalising Reform and Modernising Azerbaijan's Education System

On 30 March 1998, by a presidential order, Professor Misir Mardanov was appointed Chair of the State Commission on Education Reform in the Republic of Azerbaijan. In this capacity, he directed his efforts toward addressing structural deficiencies in education, introducing effective innovations at every level, implementing fundamental reforms in educational content, and modernising the national education system. These reforms sought to facilitate Azerbaijan's integration into European and global education systems while preserving a firm foundation in national, moral, and universal values.

During Mardanov's leadership, the education system increasingly came to be governed through scientifically grounded policies and development programmes. For the first time in Azerbaijan's educational history, sixteen development-oriented state programmes were approved and implemented. Each programme was formulated on the basis of an assessment of existing conditions and the specific needs of individual educational sectors.

Implementation of these programmes produced important structural and institutional changes. Azerbaijan's educational infrastructure was progressively aligned with contemporary requirements, while curricula and teaching content were substantially renewed. The *Concept of General Education in the Republic of Azerbaijan (National Curriculum)* was approved, and a new national textbook policy was implemented. New models and mechanisms for assessing student achievement were introduced, while the preparation and allocation of qualified personnel were increasingly coordinated with labour-market needs.

Educational institutions were also provided with information and communication technologies, supporting the broader digitalisation of the education system. Significant progress was achieved in preschool education, technical and vocational education, higher education, study-abroad opportunities, support for gifted children, inclusive provision for children requiring special assistance, and deinstitutionalisation. These policies reflected a strategic shift in which national economic resources were increasingly directed toward the development of human capital.

During the same period, the construction and comprehensive renovation of educational institutions expanded considerably through public funding. The resulting improvements in physical infrastructure created more appropriate learning environments and strengthened the material and technical foundations of the national education system.

International Education, Human Capital, and Academic Mobility

Professor Mardanov supervised the preparation and implementation of the *State Programme on the Education of Azerbaijani Youth Abroad for 2007–2015*. The programme was designed to enable talented Azerbaijani students to pursue education at internationally recognised universities and subsequently contribute their acquired knowledge and professional expertise to the country's development. It became an important instrument for strengthening human capital, promoting academic mobility, and preparing specialists in fields of strategic national importance.

The systematic and consistent reforms implemented under Mardanov's leadership—including the renewal of educational infrastructure and content and the alignment of the national system with progressive international practices—constitute an important chapter in the contemporary history of Azerbaijani education. His organisational role was also closely associated with three congresses of Azerbaijani teachers: the 11th Congress in 1998, the 12th Congress in 2003, and the 13th Congress in 2008. These congresses provided major national platforms for reviewing education policy, discussing professional challenges, and identifying priorities for subsequent reform.

Acting under the authority granted to him by presidential orders, Mardanov signed agreements on behalf of the Government of Azerbaijan with various state bodies, governmental institutions, and

international education organisations. To examine international experience in education-system administration, general education standards, and curriculum development, he undertook official visits to the United Kingdom, the Netherlands, the People's Republic of China, Germany, Greece, Austria, Norway, Northern Ireland, Latvia, France, Italy, and other countries.

These international engagements supported the comparative study of education policies and facilitated the adaptation of relevant international practices to Azerbaijan's national context. In Paris, Mardanov also participated as a member of the Azerbaijani delegation in an event organised at UNESCO to commemorate the 110th anniversary of the prominent Azerbaijani writer and scholar Mir Jalal Pashayev.

Public Service and National Commemorative Activities

In 1998, Professor Mardanov organised and addressed a major meeting at the Republic Palace—now the Heydar Aliyev Palace—between President Heydar Aliyev and Azerbaijani graduates who had studied at leading higher education institutions of the Soviet Union between 1970 and 1982. Mardanov both coordinated the event and delivered a comprehensive report. The meeting highlighted the long-term contribution of highly qualified Azerbaijani specialists educated outside the republic to the country's scientific, educational, economic, and institutional development.

Mardanov's activities extended beyond education administration into the broader spheres of public, political, scientific, and cultural life. By presidential order, he was appointed to organising committees responsible for commemorating major national and international anniversaries. These included the 800th anniversary of Nasir al-Din al-Tusi; the 90th anniversary of Mohammad-Hossein Shahriar; the 175th anniversary of Ashig Alasgar; the 80th anniversary of the Azerbaijan Democratic Republic; the 125th anniversary of the establishment of secular professional theatre in Azerbaijan; the 75th and 80th anniversaries of the Nakhchivan Autonomous Republic; the 100th anniversary of Jafar Jabbarli; the 90th anniversary of Sabit Rahman; the 90th anniversary of Rasul Rza; and the 50th anniversary of the United Nations Universal Declaration of Human Rights.

His participation in these organising committees demonstrates the breadth of his public responsibilities and the close relationship between education, historical memory, cultural heritage, and state policy in his professional activity. Mardanov's contribution was therefore not confined to administrative leadership within the education sector. It also encompassed the preservation and promotion of Azerbaijan's intellectual heritage, literary traditions, national history, and cultural identity.

Leadership in Mathematical Research and Scholarly Publishing

From 2013 to 2026, Professor Misir Mardanov served as Director of the Institute of Mathematics and Mechanics of the Azerbaijan National Academy of Sciences. He currently serves as a department chair at Baku State University. During his directorship, he initiated and supported the institutional development of the journal *Proceedings of the Institute of Mathematics and Mechanics, National Academy of Sciences of Azerbaijan*, contributing to its inclusion in international indexing systems and strengthening its visibility within the global mathematical community.

Mardanov's scientific achievements have earned him recognition from several national and international academies. In 2000, he was elected a full member of the Russian Academy of Pedagogical and Social Sciences, followed by his election as a foreign member of the Russian Academy of Education in 2005. In 2014, he became an academician of the International Teacher's Training Academy of Science in Moscow. In 2017, he was elected a Corresponding Member of the Azerbaijan

National Academy of Sciences in mathematics. From 2011 to 2014, he also served as President of the Turkic World Mathematical Society.

Professor Mardanov has made a particularly significant contribution to the development of successive generations of mathematicians and mathematics teachers. From 1996 to 1998, he chaired the Doctoral Dissertation Council in Mathematics at Baku State University. Between 2015 and 2025, he served as Chair of Dissertation Council D.01.111 at the Institute of Mathematics and Mechanics of the Azerbaijan National Academy of Sciences. He currently chairs the relevant Dissertation Council operating at Baku State University. Through these responsibilities, he has contributed to maintaining academic standards, evaluating advanced mathematical research, and preparing highly qualified scientific personnel.

His editorial leadership has likewise encompassed education and mathematics. At different stages of his career, he served as Editor-in-Chief of *Education News* from 2007 to 2013, *Curriculum* from 2008 to 2013, and *Higher Education and Society* from 2012 to 2013. Since 2015, he has served as Editor-in-Chief of the *Proceedings of the Institute of Mathematics and Mechanics, National Academy of Sciences of Azerbaijan*. Since 2014, he has also been a member of the editorial boards of *Chebyshevskii Sbornik*, the *Azerbaijan Journal of Mathematics*, and the mathematics issue of the *Transactions of the Azerbaijan National Academy of Sciences, Series of Physical-Technical and Mathematical Sciences*.

National and International Recognition

Professor Mardanov's public, scientific, and pedagogical service has received substantial recognition from the state and the academic community. In 2000, by decree of the President of the Republic of Azerbaijan, he was awarded the honorary title of Honoured Scientist of the Republic of Azerbaijan for his achievements in science and education. In 2001, he received the Golden Pen Media Award. In 2011, in recognition of his contribution to strengthening scientific cooperation between the Republic of Dagestan and the Republic of Azerbaijan, he was awarded the honorary title of Honoured Scientist of the Republic of Dagestan.

In 2006, Mardanov was awarded the Order of Glory by an order of the President of the Republic of Azerbaijan for his contribution to the development of education. In 2021, he received the First-Class Order "For Service to the Fatherland." His academic service was further recognised through commemorative distinctions: in 2019, he received the "100th Anniversary of Baku State University (1919–2019)" Jubilee Medal, and in 2023, he was awarded the "100th Anniversary of Azerbaijan State Pedagogical University (1921–2021)" Jubilee Medal.

These distinctions reflect the breadth of Mardanov's contribution across scientific research, education policy, university administration, scholarly publishing, and the preparation of academic personnel. They also demonstrate the sustained national recognition of a professional career combining scientific excellence with public responsibility.

Principal Directions of Scientific and Pedagogical Research

Professor Misir Mardanov is a scholar whose intellectual profile encompasses several distinct yet interconnected fields. Despite holding senior government and administrative positions for many years, he consistently continued his scientific and pedagogical research. During the 1980s and 1990s, he became known as a specialist in the mathematical methods of optimal control and the calculus of variations. In subsequent decades, his scholarship expanded to include educational content, the history of education, national and moral values, educational governance, and related areas.

The principal directions of his scientific and pedagogical work may be classified as follows.

1. Mathematical Methods of Optimal Control

Mardanov's research in optimal control theory has focused on deriving first-, second-, and higher-order necessary optimality conditions for processes described by ordinary differential equations, partial differential equations of the Goursat–Darboux type, differential equations with delayed arguments, and discrete systems. He has also investigated the existence of optimal controls and established sufficient optimality conditions for particular classes of control problems (Mardanov, 1987; Mardanov & Mansimov, 2010).

His 1973 Candidate of Sciences dissertation, entitled “Certain Problems in Optimal Control Theory for Systems of Integro-Differential Equations,” investigated optimal-control problems governed by neutral-type differential equations with delayed arguments. When the neutral component entered the equation nonlinearly, he derived the Pontryagin maximum principle for systems in which the control function contained a finite number of mutually independent delays. This constituted an important contribution to the analysis of delayed control systems. For several special cases, he also proved the existence of an optimal control and obtained sufficient conditions for optimality.

In his subsequent research, Mardanov examined problems involving singular controls and established new, stronger second-order necessary conditions for optimality. These studies advanced the analysis of extremal controls in situations where classical first-order conditions were insufficient to determine optimality.

During the late 1970s and early 1980s, he turned his attention to optimal-control problems involving different classes of constraints. By developing and applying a new methodological approach, he obtained more precise and stronger optimality results than those available through established methods. The results of this research were published in leading scientific journals of the former Soviet Union and subsequently formed the foundation of his doctoral dissertation.

Mardanov defended his doctoral dissertation at the Institute of Mathematics of the Academy of Sciences of the Ukrainian SSR in Kyiv in 1989. The dissertation addressed a broad class of optimal-control problems involving different constraints. It introduced a unified method for proving the Pontryagin maximum principle and deriving second-order necessary and sufficient optimality conditions.

The proposed method made it possible to overcome several fundamental difficulties associated with conventional analytical approaches. These included the incommensurability of delays appearing in the control function, the failure of the investigated extremal to satisfy a normality condition, the presence of state constraints, the measurable dependence of the equation's right-hand side on time, and problems in which the terminal time was not fixed. The theoretical results obtained in the dissertation received favourable assessments from prominent specialists in optimal-control theory.

After 2000, Mardanov continued investigating optimal control for continuous processes described by systems of equations containing delays in the control function. He developed a revised version of the transformation method for spaces of variations and used it to establish higher-order optimality conditions expressed in different recurrent forms.

For processes involving delayed control functions, Mardanov and his collaborators derived sequences of necessary optimality conditions of the Kelley, Kopp–Moyer, Gabasov, and equality types. These results extended the theoretical apparatus available for analysing singular and delayed optimal-control problems and provided stronger criteria for evaluating the optimality of control functions (Mardanov & Melikov, 2017, 2018).

The significance of this research lies in its systematic treatment of delayed and constrained optimal processes. By combining rigorous variational analysis with new methodological constructions, Mardanov contributed to the development of a unified framework for identifying necessary and sufficient conditions in complex optimal-control systems.

Further Advances in Discrete Optimal-Control Theory

In his subsequent research, Professor Mardanov developed an effective method for solving a broader class of optimal-control problems characterised by discrete systems. By introducing new analytical concepts and applying this method, he derived stronger first- and higher-order necessary optimality conditions. He also demonstrated that analogous results could be obtained for control problems governed by distributed-parameter Goursat–Darboux equations.

In recent years, Mardanov has continued investigating new optimality conditions for control problems described by discrete equations. For discrete optimal-control systems, he introduced the concepts of γ -convex and γ -convex sets. Using these concepts, he established a new discrete analogue of the Pontryagin maximum principle and derived second-order multipoint necessary conditions. He also reformulated the concepts of zero-, first-, and second-order variations of a functional, thereby obtaining stronger and more constructive optimality conditions (Mardanov & Melikov, 2018).

For optimal-control problems governed by discrete systems, the Pontryagin maximum principle has traditionally been established under the assumption that the set of velocities is convex. Mardanov introduced a componentwise analytical method that weakens this convexity requirement. Through this approach, he proved new constructive first- and second-order necessary conditions for optimality.

He also investigated discrete-control problems involving delays in the control function. By applying his newly developed method, he established the Pontryagin maximum principle for this class of problems. The methodological novelty lies in replacing the classical requirement that the entire velocity set be convex with a more limited convexity condition imposed only at the delay point. This substantially broadens the class of discrete delayed-control systems to which maximum-principle techniques may be applied.

Mardanov's more recent work has additionally addressed nonsmooth problems in the classical calculus of variations. He established new first- and second-order necessary and sufficient conditions for weak and strong extrema. He analysed various degeneracy cases involving the Weierstrass and Legendre conditions and derived equality- and inequality-type necessary conditions for weak and strong extrema in such settings.

2. Existence and Uniqueness of Solutions to Problems with Nonlocal Boundary Conditions

Boundary-value problems for ordinary differential equations constitute one of the most important areas of differential-equation theory because of their theoretical significance and wide range of practical applications. Problems involving nonlocal boundary conditions arise in numerous scientific fields, including gas dynamics, the theory of infinitesimal surface bending, mathematical biology, demography, and related disciplines.

A substantial part of Professor Mardanov's research has focused on differential equations subject to nonlocal boundary conditions. In such problems, conventional boundary conditions are supplemented or replaced by algebraic relations imposed on the unknown solution throughout a prescribed domain. These relations may involve the values of the solution at specific points or integrals of the solution over particular parts of the domain.

In his initial research in this area, Mardanov examined a nonlocal boundary-value problem for a first-order ordinary differential equation. The boundary condition was formulated as a linear combination of the solution's values at two points and its weighted integral over a prescribed interval. Through a sequence of equivalent transformations, the boundary-value problem was reduced to a nonlinear integral equation.

By applying Banach's contraction-mapping principle, he established a theorem concerning the existence and uniqueness of the solution. He subsequently used Schaefer's fixed-point theorem and the Leray–Schauder nonlinear alternative to derive sufficient conditions for the existence of at least one solution.

Impulsive and Fractional Differential Systems

The theory of impulsive differential equations provides a natural mathematical framework for describing processes affected by disturbances whose duration is negligible in comparison with the overall evolution of the system. Such phenomena occur in physics, engineering, biology, economics, and other areas of the natural and applied sciences. Their mathematical models may be formulated through ordinary differential equations or equations of fractional order.

Within this context, Mardanov investigated a nonlocal boundary-value problem for a system of fractional-order impulsive differential equations. The boundary conditions combined linear two-point conditions with nonlinear integral conditions. The original boundary-value problem was transformed into an equivalent fractional integral equation.

The right-hand side of the resulting integral equation was treated as an integral operator. Under appropriate assumptions concerning the initial data, this operator was shown to be contractive, thereby establishing the existence of a unique solution. Mardanov and his collaborators subsequently demonstrated that the same integral operator satisfied the hypotheses of Schaefer's fixed-point theorem, which guaranteed the existence of at least one solution to the original boundary-value problem. These studies contributed to the development of rigorous existence theory for nonlinear impulsive integro-differential systems with nonlocal conditions (Mardanov et al., 2019).

Three-Point and Multipoint Boundary-Value Problems

Mardanov also investigated a system of first-order ordinary differential equations subject to three-point nonlocal conditions. He constructed the Green's function associated with the problem and used it to transform the boundary-value problem into an equivalent integral equation.

Several researchers—including K. N. Murty, S. Sivasundaram, M. Mohamed, H. B. Thompson, and M. Jusoh—had previously examined related problems and obtained important results. Mardanov's findings extended these earlier contributions by establishing conclusions under broader parameter conditions. He subsequently applied the same analytical framework to more complex classes of boundary-value problems.

In later studies, he examined the existence and uniqueness of solutions to multipoint, nonseparated boundary-value problems for systems of first-order ordinary differential equations. Using Banach's fixed-point principle, he derived sufficient conditions ensuring the existence of a unique solution. By verifying all the hypotheses of Schaefer's fixed-point theorem, he also established the existence of at least one solution under more general assumptions.

These ideas were subsequently extended to different systems of integro-differential equations. In addition to existence and uniqueness results, Mardanov and his collaborators proved theorems

concerning the continuous dependence of solutions on initial data. This property is essential to demonstrating the stability and mathematical reliability of the models under consideration.

Nonlocal -Difference Equations

Another significant direction of Mardanov's research concerns the theory of α -difference equations with nonlocal conditions. Such equations arise in quantum and nuclear physics, biology, demography, and other scientific disciplines.

In this field, he studied systems of two-point α -difference equations and two-point impulsive α -difference equations subject to nonlocal conditions. The contraction-mapping principle was used to establish existence and uniqueness results, while Schaefer's fixed-point theorem provided conditions guaranteeing the existence of solutions under more general assumptions.

In subsequent research, Mardanov investigated a two-point boundary-value problem for a α -fractional difference equation involving a α -Laplacian operator. He established theorems concerning both the existence and uniqueness of solutions, thereby extending nonlocal boundary-value theory to nonlinear α -fractional systems.

Optimal Control with Multipoint Nonseparated Boundary Conditions

In his recent work, Mardanov has studied optimal-control problems governed by systems of ordinary differential equations with multipoint, nonseparated boundary conditions. He first derived sufficient conditions ensuring that the boundary-value problem admits a unique solution for every fixed admissible control.

He then calculated the increment of the objective functional through a standard variational procedure and established first-order necessary conditions for optimality in the form of the Pontryagin maximum principle. For particular classes of systems, he demonstrated that these necessary conditions were also sufficient.

The resulting framework is sufficiently general to encompass several important special cases, including systems with conventional two-point and three-point boundary conditions. By integrating nonlocal boundary-value theory with optimal-control analysis, this research connects two major areas of Mardanov's scientific work and extends the applicability of maximum-principle methods to systems governed by complex boundary structures.

The Content of Mathematics Education

Alongside his research into the theoretical foundations of mathematics, Professor Misir Mardanov has devoted considerable attention to its practical and educational dimensions. He has conducted studies on improving the content of mathematics education in general and higher education and has contributed substantially to the preparation of textbooks and teaching materials.

Under his academic supervision and with his direct authorship, textbooks were produced in mathematics for Grade 6; geometry for Grades 7–10; algebra for Grades 7–9; algebra and the foundations of analysis for Grade 10; and informatics for Grades 5 and 6. He also contributed to university-level textbooks, including *Additional Chapters in Elementary Mathematics and Olympiads* (2014) and *Higher Mathematics* (2020). These publications reflect his sustained interest in curriculum coherence, the systematic organisation of mathematical knowledge, and the intellectual development of learners across different levels of education.

3. The History of Mathematics Education

The historical development of mathematics and mathematics education in Azerbaijan occupies an important place in Mardanov's recent scholarship. His works in this field document the lives, institutional contributions, and intellectual legacies of the scholars who shaped the development of mathematical science in the country.

Among his principal publications are *Precursors of Modern Mathematics in Azerbaijan* (2016), published in Moscow in collaboration with Professor Ramiz Aslanov; *My Teacher Goshgar Ahmadov* (2017); *Azerbaijani Mathematicians* (2019); and *The Institute of Mathematics and Mechanics of the Azerbaijan National Academy of Sciences—60* (2019). These studies reconstruct important stages in the institutional and intellectual development of Azerbaijani mathematics and preserve the scientific heritage of its leading representatives.

Mardanov's contribution in this area extends beyond conventional biographical writing. By placing individual scientific careers within their institutional, educational, and historical contexts, his research reveals the connections between scholarly mentorship, academic schools, national scientific institutions, and the transmission of mathematical knowledge across generations.

4. Theoretical and Historical Problems of Education

Professor Mardanov was among the first Azerbaijani scholars to subject the educational ideas developed by the Azerbaijani people over many centuries to systematic historical and theoretical analysis. These ideas, preserved in collective memory and transformed over time into national and moral values, became the subject of his scholarly interpretation and conceptual generalisation.

His major works in this field include *Azerbaijani Education During the Years of the Democratic Republic, 1918–1920* (2003), *Azerbaijan's Education Policy* (2 vols., 2005), *Congresses of Azerbaijani Teachers, I–IX* (2008), and *The Thirteenth Congress of Azerbaijani Teachers* (2009). These publications examine the relationship between education, state policy, national development, and institutional change.

Although trained as a mathematician, Mardanov has increasingly become recognised as a scholar of education. Through intensive research and the publication of monographs, books, booklets, and series of articles, he has created a substantial body of scholarship on educational history, policy, reform, and administration.

His publications in this area include:

- *Azerbaijani Education During the Years of Reform* (2001);
- *Education Is the Future of the Nation* (2002);
- *The State Symbols of the Republic of Azerbaijan* (2002);
- *Monitoring and Evaluation in the Education System* (2003);
- *Azerbaijani Education During the Years of Independence* (2003);
- *Azerbaijani Education: Yesterday, Today, and Tomorrow* (2006);
- *Sustainable Development and Education* (2007);
- *President Ilham Aliyev and the Development of Education in Azerbaijan, 2003–2008* (2008);
- *Azerbaijani Education at a New Stage of Development* (2009);
- *The 50 Best Schools and 100 Best Teachers* (2009); and
- *Azerbaijani Education: Successful Outcomes of the Reforms, 2009–2010* (2010).

These works constitute significant contributions to education studies because of their theoretical value, historical relevance, and extensive documentary content.

Mardanov's *Ministers of Education of Azerbaijan*, his four-volume *History of Education in Azerbaijan*, and the seven-volume *Azerbaijanis Who Studied at Higher Education Institutions Before 1920*, co-authored with Professor Adalat Tahirzade, document and historicise his engagement with the country's educational development. They also establish his position as an authoritative scholar in the fields of educational history and education studies.

In his historical research, Mardanov analyses the Azerbaijani people's intellectual traditions, perceptions of life, and educational achievements through documented events and verifiable historical evidence. His studies demonstrate that writing educational history requires not only the collection of information but also the critical reconstruction of institutions, ideas, personalities, and social transformations. In this respect, the writing of history may be regarded as a task almost as demanding as the making of history itself.

5. Pedagogical Journalism and Intellectual Portraiture

Professor Mardanov has written extensively about distinguished scholars, researchers, educators, and public and political figures whose work has shaped the history of Azerbaijani science, education, and culture. His essays examine the distinctive contributions of major representatives of classical Azerbaijani pedagogical thought, including Hasan bey Zardabi, Ali bey Huseynzade, Alexei Chernyayevsky, Firidun bey Kocharli, Nasib bey Yusifbeyli, Haji Zeynalabdin Taghiyev, Uzeyir Hajibeyli, and Sultan Majid Ganizade.

He has also written about prominent scholars and intellectuals such as Hasan Aliyev, Zahid Khalilov, Ibrahim Ibrahimov, Ashraf Huseynov, Lotfi A. Zadeh, Azad Mirzajanzade, Faramaz Magsudov, Majid Rasulov, Goshgar Ahmadov, Hashim Aghayev, Arif Pashayev, Yusif Mammadov, Murtuz Alasgarov, Huseyn Ahmadov, Afad Gurbanov, Mehdi Mehdizade, Suleyman Mammadov, Mirabbas Gasimov, Jalal Allahverdiyev, Akif Hajiyev, Akif Alizade, Rauf Huseynov, Abdul Alizade, Nizami Jafarov, Kazim Hasanov, Sasun Yagubov, Yusif Seyidov, Farrukh Rustamov, and others.

These intellectual portraits explore the distinctive features of their scholarship, their place in Azerbaijan's educational history, and their influence on successive generations of teachers and researchers. Mardanov interprets their work through the perspective of contemporary pedagogical thought while preserving the historical and personal dimensions of their achievements. The respect and intellectual generosity evident in these essays also reveal important aspects of Mardanov's own scholarly character.

6. Socio-Political Scholarship

Articles addressing social and political questions occupy a distinct place in Mardanov's body of work. These publications reflect his commitment to the Azerbaijani state and to the study of the political leadership, state-building processes, and national ideas that have influenced the country's modern development.

His monograph *Heydar Aliyev: A Life Dedicated to the People* (2023) examines the principal dimensions of Heydar Aliyev's political and state-building activity, with particular attention to his contribution to the development of education. The work presents Heydar Aliyev as an architect of Azerbaijan's development, a principal author of its independence strategy, and a symbol of national political identity.

In *The Road to Victory* (2024), Mardanov analyses the multifaceted activity of President Ilham Aliyev, including Azerbaijan's economic, political, and diplomatic achievements. Particular attention is paid to the military-strategic dimensions of his leadership during the Patriotic War. Written in a scholarly and publicistic style, the monograph interprets the historic Victory achieved under his leadership as one of the most significant chapters in the history of Azerbaijani statehood. It presents a comprehensive account of the Commander-in-Chief's political determination, diplomatic foresight, and contribution to the development of the country's armed forces.

Conclusion

The achievements and extensive scholarly legacy of Professor Misir Mardanov's eight decades represent far more than the professional trajectory of a single individual. They constitute an exemplary record of service to Azerbaijani science, education, statehood, and national and moral values. At every stage of his life, dedication to science, commitment to education, loyalty to the principles of statehood, and openness to innovation have remained defining features of his work.

His fundamental contributions as a mathematician, the generations he trained as an educator, the large-scale reforms he implemented as an educational administrator and minister, and his research into the history of Azerbaijani education collectively define the multidimensional character of his intellectual legacy. His career demonstrates a sustained ability to connect mathematical research, university teaching, institutional governance, public policy, historical scholarship, and national cultural responsibility.

Professor Mardanov's 80th anniversary should therefore be understood not solely as the commemoration of a distinguished scholar's personal milestone. It is also an occasion to evaluate a long and consequential period of service to Azerbaijani science and education. His name is closely associated with significant chapters in the development of mathematical science, the study of national educational history, and the construction of Azerbaijan's modern education system.

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