Exploring the Contributions of Nepalese Mathematicians in the Modern Era with a Specific Emphasis on Research Areas

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Abstract:
This study explores the extensive realm of modern Mathematical research carried out by Nepalese Mathematicians, analyzing their substantial contributions across different Mathematical fields amid Nepal's changing socioeconomic context. Through comprehensive research, it elucidates the development of Mathematical concepts, the emergence of skilled Mathematicians, and the influence of their research on both local and international Mathematical communities. The paper aims to spotlight renowned Nepalese Mathematicians of the Modern era and their doctoral research endeavors, underscoring the pivotal role of Mathematics in shaping the country's path and progress.

1. Introduction

Mathematics is the study of patterns, numbers, quantities, shapes, structure and space using logical processes, rules, and symbols. It is a creation of human mind related mainly with ideas, processes and reasoning. It has progressed because of the human attempts to understand the nature and to lead to truth from careful reasoning. Traditionally, the subject is divided into various branches like Arithmetic, Algebra, Geometry, Calculus, Probability, Statistics. However, it is much more than the sum of these individual components. Mathematics is a way of thinking, logical reasoning and problem-solving. Through its powers of abstraction and logic, it can be used to gain valuable insights and make predictions about future. It is one of the pillars of progress, and development of nations, so learning of Mathematics by future citizens is very crucial **(Boyer, 1968)**.

As the history of Mathematics can be used to identify the situation of the country, the development of Mathematics needs to be viewed in close consonance with the country. Together with the history of Mathematics, identifying the people who made contributions to the advancement of mathematics is equally important **(Acharya, 2015)**.

According to Jha, Adhikari, and Pant, there were no mathematics books written in Nepali 125 years ago **(Jha, Adhikary, and Pant, 2006)**. At that time, Nepali students would go to Kashi (Banaras) to study Sanskrit. Prominent mathematical texts like as *Lilavati* and

Siddhant Siromani of Bhaskaracharya II were taught to them **(Pant, 1980).** Indian Mathematicians had an effect on Nepali students, who attempted to create books.

Pant stated that the first book of Mathematics written in Nepali language is *'Wyakta Chandrika'* which was published in 1883 A.D. **(Pant, 1980).** Many of the questions in this book deal with famous Hindu subjects: Pythagorean triads, surds, arithmetic and geometric progressions, linear and quadratic equations, both determinates and indeterminates, fundamental mensuration, and others like *Lilavati* **(Upadhyay, 2009).**

Well known Mathematicians in modern period in Nepal are Narayan Bahadur Manandhar, Khadak Man Mall, Indra Nath Aryal, Dhup Ratna Bajracharya, Rameswor Prakash Manandhar, Gauree Shankar Shrestha, Ram Man Shrestha, Shankar Raj Pant, Omkar Nath Pant, Hom Nath Bhattrai, Bhadra Man Tuladhar, Santosh Man Maskey, Yoga Ratna Sthapit, Madan Man Shrestha, Govind Dev Pant, Dinesh Raj Pant, Shamba Raj Acharya, Min Bahadur Shrestha, Hira Bahadur Maharjan, Gajendra Bahadur Thapa, Hari Prasad Upadhyay, Siddhi Koirala, Pusparaj Adhikari, Bhanu Chandra Bajracharya, Shanti Bajracharya, Shailendra Mishra, Geeta Bhakta, Joshi, Ramjee Pandit,Yadav Prasad Koirala, Dharani Dhar Regmi and Dal Bahadur Adhikari **(Raikhola, 2022).**

They are known as individuals who have made regular contributions to Nepali Mathematics, Astrological Mathematics, History of Mathematics, Nepali History, Nepali and Sanskrit Literature. They had contributed a lot to Mathematics and Astrological Mathematics. It is imperative to identify the development parameters of Mathematics to learn about the development of language, culture, development, statistics, literature, arts, music, commerce, agriculture, tourism, education, freedom, independence and one's own fundamental values. In order to know about the development of Mathematics, it is essential to know it history **(Acharya, 2015 and Pant, 2010).**

2. Importance of mathematical research and history

The nature of Mathematics is self-evident. It has its own distinctive concepts and also has its own validation procedure, a step-by-step demonstration of what is to be established. These procedures are not empirical, but are demonstrations by an appropriate set of axioms and definitions. It is a cumulative subject. Any new knowledge is based on some related concepts learned earlier.

Logic and creativity are both necessary in mathematics, which is studied for its own sake as well as for a wide range of applied uses. The intellectual difficulty and beauty of Mathematics are what attract certain individuals, not just Mathematicians in the profession. For numerous scientists and engineers, among others, the primary significance of Mathematics resides in its application to their respective fields. Because Mathematics is so important to modern culture, scientific literacy requires at least a rudimentary comprehension of Mathematics. In order to do this, students must understand the nature of Mathematical reasoning and see Mathematics as a branch of science, and become conversant with fundamental Mathematical concepts and techniques **(Rutherford, & Ahlgren, 1990).**

Mathematics plays important role for the progress and prosperity of the language, culture, statistics, literature, infrastructure, liberty, tourism, music, commerce, agriculture, education, politics and economics. To know the development process of Mathematics, it is necessary to know its history. It is also important to identify the contributions of its development. So, we need to seek our history ourselves **(Boyer, 1968)**.

3. Purpose of mathematical research

Mathematics examines the connections between things, not the objects itself. According to Paul Erdos, a Hungerian Mathematician who wrote 1,500 papers throughout his lifetime, mathematics is a tool for converting coffee grounds into theorems **(Erdos, 2000)**.

There are actually two main objectives of Mathematical research: pure and practical.

a. Pure Science (Arithmetic): to comprehend the nature of instruction, learning, and mathematical thinking;

b. Applied (Engineering): To enhance mathematics education by applying such understandings.

Both of these are intricately linked, with the first being at least as significant as the second. The explanation is straightforward: math has been demonstrated to have broad applications in numerous other scientific domains, even without a profound comprehension of thought. This study aims to provide an overview of the various investigations carried out by Nepalese Mathematicians during the Modern Era (1951 A.D. to 2015 A.D.) **(Raikhola, 2022)**.

4. Significance of mathematical Research

The extent of the relevance of Mathematical study to our everyday life is not well acknowledged. Naturally, some Mathematics is quite ancient: we utilize numbers, graphing, addition, and multiplication on a daily basis. It is simple to forget that these were once considered a major discovery. Venice's prosperity in the 14th century is attributed to the adoption of Arabic numbers in place of Roman numerals, which opened up the prospect of a sound bookkeeping system. Noting the significance of pedantry in Mathematics is equally relevant in this context.

The Arabic system makes extensive use of the number zero. Counting the objects in an empty box seems ridiculous at first, and there was a period when emptiness or a vacuum was connected to evil. It surprises people to learn how important zero is to a functional numbering system, since zero serves as a location marker. For millennia, the advancement of mathematics was impeded by the absence of this notion of zero **(Lester, 2007)**.

5. Research Methodology

In these study discoveries in Mathematics and, to a lesser extent, an investigation into the Mathematical area of research, topics of the research work done by Nepalese Mathematicians were   analyzed using descriptive historical and analytical method

6. Results and discussion

This study includes the Ph.D. research areas and research topics of Nepalese Mathematicians during modern period 1951 A.D. till 2015 A.D. Some of renowned Mathematicians of modern period and their PhD Research contribution are listed below.

Table no.6.1. Research areas of Nepalese Mathematicians Contributions in Modern Period
(Bhatta, 2012, Acharya, 2017 and Maske, 2013)

S.N	Name of Mathematician	Research Topics	Area	Research performed in
1	Prof. Ram Man Shrestha	Study of generalized transform	Area: Integral transform	Banarash Vishow Hindu University, in 1965, India.
2	Prof. Rameswor Prakash Manandhar	Study of Meijer-Bessel Transform	Integral Transform	Ranchi University in 1968 Under the Guidance, Prof. K.M.Saxena
3	Prof. Shankar Raj Pant	Generalized Laplace Transform and its Cesaro means	Integral Transform	Rachi State Government University, in 1967, India Under the guidance Prof. K.M. Saxena
4	Prof. Madan Man Shrestha	Curriculum and Instruction in Mathematics.	Mathematics Education	Pennsylvania State University, USA.
5	Prof. Hom Nath Bhattarai	Orbit space geometry and probability groups	Geometric algebra	University of Oregon USA, in 1977
6	Prof. Yog Ratna Stapith	A certain flow problem at low Reynolds's number	Fluid dynamics	University of Locknow in 1965, India. Under theguidance of Prof. F,Datta.
7	Prof. Gajendra Bahadur Thapa	John Constant for polynomials	Complex analysis	University of Wuerzburg, Germany. Prof. Dr. Stephan Ruscheweyh, University of Wuerzburg, Germany and Prof. Dr. Ram Man Shrestha, TU, Nepal
8	Prof. Dharanidhar Regmi	Generalisation of Regular modules	Algebra	Banarash Hindu University (BHU), India in 1987 A.D.
9	Prof. Santosh Man Maskey	A study of Schauder decomposition of Banach spaces	Functional analysis	Delhi University, India Under guidance of Prof. Dr Kumar Jha in 1984
10	Prof. Bhanu Chandra Bajracharya	Extension of some Convolution Transform to distribution	Integral transform	Tribhuvan University, Nepal Under the guidance of Prof. Dr. Rameswor Prakash Manandhar, Nepal, in 1980

11	Prof. Hari Bhakta Shrestha	Study of Integral transform	Integral transform	Tribhuvan University, Nepal guidance of Prof. Dr. Rameswor Prakash Manandhar, Nepal, in 1980
12	Prof. Mana Raja Joshi	A post deployment investigation of a cable connected system in orbit	Applied Physics	
13	Prof: Shanti Bajracharya	Analytical and group theoretic study of some special function	Special function	
14	Prof. Siddhi Koirala	Variants of injectivity and projectivity	Ring and Modules	
15	Prof. Hira Bahadur Maharjan	On the existence of Desarguesian planes satisfying a condition of sutaki	Geometry	
16	Prof. Dal Bahadur Adhikari	On the Cauchy problem for a Sobolev- type system in hydrodynamis with heat transfer	PDE & hydrodynamic	
17	Prof: Basanta Raj Sharma	Certain investigation in the field of generalised hypergeometric series	Special function	
18	Prof. Choodamani Joshi	Applications and theory of special and generalized function and connected integral transformin some problem of applied Mathematics and Mathematical physics	Integral transform	
19	Prof. Krishna Kumar Shrestha	Hankel transform Beurling and Romiee type ultra-distribution	Distribution theory	
20	Prof. Hari Prasad Upadhya	Effectiveness of Constructivism on Mathematics Achievement of Students in Nepal	Constructivism and Learning Theory.	
21	Prof. Puspha Raj Adhikari	Gamma ring method in the study of rings with local unit.	Ring theory	
22	Prof. Bhadra Man Tuladhar.	Construction of equation in the form of Lagrange, Hamilton and Birkhoff according to the preassign properties of motion	Theoretical mechanics	
23	Prof. Shailendra Kumar Mishra	Topic: Sequence spaces and related topics.	Functional Analysis.	
24	Prof. Bhrigu Narayan Singh	Some remarks on summability method of function	Integral transform.	
25	Prof. Geeta Bhakta Joshi	Function space and related topic.	Functional Analysis.	

26	Prof. Prakashmuni Bajracharya	Continuity cort nonlinear dispalement and approximation by infinitely differential vector functions preserving the image	Functional Analysis.	
27	Prof, Chet Raj Bhatta	Behaviour of functions and their Fourier transform	Harmonic Analysis	
28	Prof. Tank Nath Dhamala	A open shop scheduling spaces with algebraic characterization.	Optimization.	
29	Prof. Kedar Nath Upreti	on steady fluid flow in heated tube networks.	Partial differential equation.	
30	Prof. Kanhaiya Jha	some fixed results and its applications to approximation theory	Functional Analysis.	
31	Prof. Binod Dhakal	A study in a summability and approximation theory	Real Analysis.	
32	Prof. Narayan Prasad Pahari	Study of Topological Linear spaces of Generalized Sequences and Functions	Functional Analysis	
33	Prof. Dil Bahadur Gurung	Mathematical study of abnormal thermoregulation in human dermal parts.	Bio Mathematics.	
34	Prof. Eka Ratna Acarya	Nay Raj Pant ka Ganitiya Kritiharuko Adhyayan.	History of Mathematics.	
35	Prof. Lalta Prasad Jaiswal	Study of super symmetry in complex space time.	Applied Physics	
36	Prof. Bishnu Dhungana	on the heat and Meller Kernel approach to generalized functions.	Distribution Theory.	
37	Prof. Gyan Bahadur Thapa	Optimization of just-in-Time Sequencing problems and Supply Chain Logistics.	Operation Research.	
38	Prof. Shiva Prasad Pudasaini	Land slide and Derbies Equations.	Applied Physics.	
39	Prof. Bal Chandra Luitel	Worldwide and Transformative Philosophy of Mathematics Education in Nepal; A Cultural-Philosophical Inqiry	Transformative Mathematics Philosophy	
40	Prof. Lekhanath Sharma	A study on Curriculum Standards; Implications of the Desired and Existing Standards for the reform of Mathematics Education in Nepal	Curriculun Standards and Reform of Mathematics Education.	
41	Prof. Chintamani Pokharel	Convexity preservation for analytic harmonic and plane curves.	Complex Analysis.	

42	Prof. Ram Prasad Ghimire	A study of some queueing and reliability models.	Operation Research.	
43	Prof. Ajaya Singh	properties and structures of factor set and Julia sets	Complex analysis	
44	Prof. Urmila Pyakurel	Evacuation planning problem with contraflow approach.	Operation Research	

Above table shows that there are 44 Nepalese Mathematicians who performed doctoral research in pure and applied Mathematics during the period from 1951 A…D till 2015 AD.

Among them, Ram Man Shrestha's research topic was Integral Transform, focusing on the "*Study of Generalized Transform*" **(Shrestha, 1965).** He has published two dozen of research works in various National and International and he had expressed the views on the development of Lichchhavi and other numeral systems in different civilizations and communities. According to Eka Ratna Acharya, Ram Man Shreshtha had given new and systematic pattern of Lichchhavi numeral systems **(Acharya, 2016).**

The research topics of another Mathematician Rameshwor Prakash Manandher who completed his PhD degree in 1968 A.D., on "*Meijer of Bessel Transform*" **(Manandhar, 1968).** In this study he discussed the convergence and uniform convergence of the transform, defining as,

$$f(s) = \left(\frac{2}{\pi}\right)^{1/2} \int_0^\infty (st)^{\lambda+1/2} k_s\ \lambda(st) \Phi(t)\ dt$$ **(Meijer, 1940)**

He described the proven relationships between the convergence qualities of the corresponding transform and the order properties of the determining function.

He has also published several research papers in different International journals and has participated international seminars, workshops and conferences **(Raikhola, 2022).**

Shankar Raj Pant is also a well-known Mathematician in Nepal. He performed Ph.D. on His *Generalized Laplace Transform and Integral Transform* **(Ghimire, 2013).** With tile "*Generalized Laplace Transform and its Cesaro Mean*" **(Pant, 1967).** His work includes a brief survey of the various generalizations of the Laplace integral in and which he defined as,

$$F(s) = \int_\cdot^\infty e^{-st}\ \emptyset(t)\ dt.$$

In this case, $\emptyset t$ is the determining function and f(s) is the generating function. In short, we write as L $\{\emptyset\}$ = f(s). Pant has studied in his thesis the following generalization,

$$f(s) = \int_\cdot^\infty e^{-\lambda st} (st)^{-m-1/2} M_{k,m}(st)\ \phi(t)\ dt\ \ (\lambda > \tfrac{1}{2})$$ …………………..(i). Its

Stieltjes form is as follows,

$$f(s) = \int_\cdot^\infty e^{-\lambda st} (st)^{-m-1/2} M_{k,m}(st)\ d\phi(t)\ \ (\lambda > \tfrac{1}{2})$$ Where $M_{k,m}(x)$ (s) is the

Whittaker's function. Put λ = 3/2 and – k = m + ½ then studied the following particular case of the transform. $F(s) = \int_0^\infty e^{-\frac{1}{2}st} (st)^{-m-1/2} M_{k,m}(st)\ \emptyset(t) dt$ It is obtained by putting $\lambda = $ 1/2 in (i) and reduces to the Laplace transform for k= m + ½ **(Pant, 1967).**

Thus, Modern Nepalese Mathematicians have performed international level research in Modern Mathematics**.** The mathematical contribution of Nepalese Mathematicians in medieval period was also famous internationally**.** The work of Daibagnya Balbhadra Joshi (1494 A.D.), a resident of Jumla district towards the end of 15th century **(Acharya, 2015),** with Mathematics book named *Balbodhani Bhashwati* was very popular in India. In 1526 A.D. Indian Astrologer Madhav Mishra also wrote the commentary of *Baswati* text. It is to be noted from above discussion that there were many varieties of *Bhaswati* texts with different names in South Asian region. Also, Nepalese Mathematicians had written so many papers based on Nepali Mathematics and published national and internationally **(Raikhola, 2022).**

7. Conclusion

The research's main conclusions are to show the importance of Nepalese Mathematicians contributions to mathematics in the contemporary age. It also highlights how important it is to keep up the recognition and assistance of Nepal's thriving mathematics community.

Furthermore, mathematical research and its historical context are of profound importance, as mathematics' beauty and challenges captivate minds and underpin advancements in various fields. Understanding mathematical concepts is crucial for scientific literacy and societal advancement, necessitating its integration into education curricula.

Contributions of Nepalese Mathematicians play an important role for the development of Mathematics National and Internationally. Ram Man Shrestha, Shankar Raj Pant and Rameshwor Prakash Manandhar were famous Nepalese Mathematicians who performed international level research during Modern era in Nepal. There is still scope for further study and take in depth knowledge on contributions of Mathematicians in Nepal for the new researchers.

Acknowledgments

Conflict of Interest

In relation to this paper's publication, the author states that there are no conflicts of interest.

References

Acharya, E. R. (2015). *Study of Mathematical Treatises of Naya Raj Pant (Naya Raj Pantaka Ganitiya Kritiharuko Adhyayan* (Unpublished Ph.D. Dissertation), Dang: Nepal Sanskrit University.

Acharya, E. R. (2016). *Guru Felicitation and Chariot Program* (29th September, 2016), Organized by Mathematical Sciences Trust.

Acharya, E. R. (2017). *National Conference on History and Recent Trends of Mathematics,* [NCHRTM-2017], June 2-4,

Bhatta, C. R. (2012). *Mathematics Research, Issue and Its Future Perspectives* Proceeding of National Conference on Mathematics, Kathmandu: Nepal Mathematical Society, Pp. 106-113.

Boyer, C. B. (1968). *A history of Mathematics.* New York: John Willy & Sons Inc.

Erdos biography (2000). *School of Mathematics and Statistics*, University of St Andrews, Scotland. January.

Ghimire, S. (2013). Short Biography of *Shankar Raj Pant,* Newsletter, Nepal Mathematical Society, issue No.9: 14-15.

Jha, K., Adhikary, P.R. and Pant, S.R. (2006). *A history of mathematical sciences in Nepal,* Kathmandu Univ. J. Sci. Engg. Tech. (KUSET), 2(1).

Lester, F. (Ed.) (2007). Second handbook of research on *Mathematics* teaching and learning. Charlotte, NC: Information Age.

Manandhar, R. P. (1968). *Study of Meijer-Bessel Transform.* Unpublished Ph.D. Thesis submitted to the Ranchi University for the degree of Doctor of Philosophy. Pp. 245.

Maskey, S. M. (2013). *Mathematics in Nepal* at Instructional Workshop on Applied Mathematics Organized by South Asian University (University Established by SAARC nation) On May 10, 2013 at Akbar Bhavanhanakyapur, New Delhi-110021 from May 6-10.

Meijer, C.S. (1940). *Ubereine Erwelterungler Laplace Transformation.* I and II Koninkli Nederland Academic Yan Watanaehanner, Press, Series Amsterdam, Vol. 43, P599-608, Pp. 702-711.

Pant, N. R. (1980). *Pd. Gopal Pandey and his method of getting Cube Root.* Kathmandu: Royal Nepal Academy.

Pant, P.R. (2010). *Social science research,* Buddh, publication (fifth edition).

Pant, S.R. (1967). *Study on Generalized Laplace integral and its Cesaro Mean,* (Unpublished PhD Dissertation), Rachi State Government University, India: Pp. 200.

Raikhola, S.R. (2022). *A Study on Contributions of Nepalese Mathematicians,* (Unpublished Ph.D. Dissertation), Nepal Sanskrit University, Dang, Nepal.

Rutherford, F. J., &Ahlgren, A. (1990). *Science for all Americans.* New York: Oxford University Press.

Shrestha, R. M. (1965). *Study of Generalized transform,* Unpublished Ph.D. Dissertation, Banaras Vishow Hindu University, India.

Upadhyay, M. (2009). *Ganitgya Gopal Pande and Wyakta Chandrika,* Humanities and Social Sciences Journal, Ratna Rajya TUTA Unit Journal.