



Republic of the Philippines  
**CEBU NORMAL UNIVERSITY**  
Osmeña Blvd. Cebu City, 6000 Philippines

**RESEARCH INSTITUTE**  
FOR COMPUTATIONAL  
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## ANNUAL REPORT

(C.Y. 2020)

This report is based on the following goals of the Research Institute for Computational Mathematics and Physics:

- Perform research of high quality in the field of computational mathematics and physics
- Develop tools and methodologies based on computational mathematics and physics for the use in teaching and learning as well as in industries.

Below are the highlights of the accomplishments of the research institute for CY 2020:

- **Perform research of high quality in the field of computational mathematics and physics**
  - The institute has conducted the following training-workshop:

<b>Name of Seminars, Trainings, and Conferences</b>	<b>Date and Venue</b>	<b>Involvement</b>	<b>Acquired</b>
<b>Lecture Series And Training Workshop On Fundamentals Of Quantitative Ecology And Epidemiology</b>	<b>Date:</b> November 3-6, 2020 <b>Venue(Virtual):</b> Zoom	<i>Resource Speaker:</i> <b>Dr. Jomar F. Rabajante</b>	Tools and methodologies in conducting research on quantitative ecology and epidemiology, particularly, on modelling the structure of the ecosystems and epidemiological parameters.

- The researchers of the institute have attended the following seminars, trainings, and conferences:

<b>Name of Seminars, Trainings, and Conferences</b>	<b>Date and Venue</b>	<b>Involvement</b>	<b>Acquired</b>
<b>NRO7, CNU and DOH-7 Teleconference</b>	<b>Date:</b> April 18 and 20, 2020 <b>Venue (Virtual):</b> Microsoft Teams Meeting	<i>Resource Person:</i> <b>DR. ROBERTO B. CORCINO</b> <i>Co-Researchers: Allan Roy Elnar, Gibson Maglasang, Karl Patrick Casas</i> <i>Forecasting the Peak and Flattening of COVID-19 cases in the Philippines and Region 7</i>	RICMP popularity and extension service
<b>Webinar Series on the Innovate Flex Learning Online Academic Training (iFLOAT) on Synchronous and Asynchronous Teaching and Learning</b>	<b>Dates:</b> May 29, 2020, June 3-5, 2020 <b>Venue (Virtual):</b> Zoom	<i>Participants: RICMP Director and Researchers</i>	New approach to Module Development  Neo LMS as Online T-L Platform
<b>Higher Education Connect (HEdConnect) “Reframing The Landscape of Learning: The Leader’s Voices”</b>	<b>Dates:</b> June 30, 2020, <b>Venue (Virtual):</b> CNU PIO Facebook Live	<i>Participants: RICMP Director and Researchers</i>	Updates on the new landscape of learning of different colleges and universities
<b>Google Classroom Training</b>	<b>Dates:</b> September 30, 2020, <b>Venue (Virtual):</b> Zoom	<i>Participants: RICMP Director and Researchers</i>	New approach in delivering instruction through online platform
<b>15<sup>th</sup> Annual Meeting and Scientific Convention of Outstanding Young Scientists, Inc. (OYSI)</b>	<b>Date:</b> July 7, 2020 at 8:00AM – 12:00NN <b>Venue (Virtual):</b> Zoom	<i>Participant: RICMP Director</i>	Updates on new research trends in arts and sciences, particularly, on the solutions to woes of the COVID-19 pandemic

<b>Mathematical Society of the Philippines (MSP) National Board Meeting</b>	<b>Date:</b> July 7, 2020 at 3:00PM – 5:00PM <b>Venue (Virtual):</b> Zoom	<b>Member of MSP National Board:</b> <i>RICMP Director</i>	CNU and RICMP Popularity  Updates on the recent activities of the math community in the country
<b>42<sup>nd</sup> NAST Annual Scientific Meeting</b>	<b>Date:</b> July 8-10, 2020 <b>Venue (Virtual):</b> Zoom	<b>Participant:</b> <i>RICMP Director</i>	Updates on new research trends in sciences and technology, particularly, on the solutions to long-standing concerns
<b>Conducting and Writing Literature Review and Systematic Analyses in the New Normal</b>	<b>Date:</b> October 19-23, 2020 <b>Venue (Virtual):</b> Zoom	<b>Participant:</b> <i>RICMP Director and Division Chairs</i>	Updates on the new strategy in writing literature review and systematic analyses
<b>Lecture Series and Training Workshop on Fundamentals of Quantitative Ecology and Epidemiology</b>	<b>Date:</b> November 3-6, 2020 <b>Venue (Virtual):</b> Zoom	<b>Participant:</b> <i>RICMP Director and Division Chairs</i>	Math modelling tools and methodologies in forecasting the structure of the ecosystems and values of epidemiological parameters
<b>Scientific Session and Business Meeting of the NRCP Division of Mathematical Sciences</b>	<b>Date:</b> October 26, 2020 <b>Venue (Virtual):</b> Zoom	<b>Participant:</b> <i>RICMP Director</i>	Updates on the recent development in the Mathematical Science Division of NRCP and role of mathematics in addressing problems of the country during the pandemic
<b>NRCP Regional Basic Research Caravan</b>	<b>Date:</b> September 30, 2020 <b>Venue (Virtual):</b> Zoom	<b>Participant:</b> <i>RICMP Director</i>	Updates on the R&D niches in Central Visayas Region
<b>2<sup>nd</sup> International Conference on Arts and Sciences (ICAS 2020)</b>	<b>Date:</b> September 29-30, 2020 <b>Venue (Virtual):</b> Zoom	<b>Paper Presenter</b>  Title of the Paper: <b>Higher Order Apostol-</b>	Updates on the recent development of

		<i>Type Poly-Genocchi Polynomials with Parameters a, b, c</i>  Award Received: <b>Best Paper Presenter</b>	research in arts and sciences  Dissemination of research outputs
<b>Forum on Balik Scientist Program</b>  Conducted by Department of Science and Technology (DOST)-PCIEERD	<b>Date:</b> November 17, 2020 <b>Venue (Virtual):</b> Zoom	<b>Participant:</b> RICMP Director	Updates on the Balik Scientist Program in the Philippines
<b>Training-Workshop on the Packaging of Collaborative Research Proposal</b>  Conducted by the Commission on Higher Education (CHED) through the Philippine-California Advanced Research Institutes (PCARI)	<b>Date:</b> November 19, 2020 <b>Venue (Virtual):</b> Zoom	<b>Participant:</b> RICMP Director	Tips on packaging a project proposal for external funding

- The institute has produced the following completed researches and publications in journals indexed by **Web of Science, Scopus and Asian Citation Index**:

<b>Title</b>	<b>Status</b>	<b>Date of Completion/ Publication</b>
<b>1. Asymptotics of Genocchi polynomials and higher order Genocchi polynomials using residues</b>  Cristina B. Corcino and Roberto B. Corcino	Completed  Published online  <i>Afrika Mathematica</i> (2020) <a href="https://doi.org/10.1007/s13370-019-00759-z">https://doi.org/10.1007/s13370-019-00759-z</a>  Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>ESCI</b> ) and <b>SCOPUS</b>	January 2020

<p><b>2. A <math>q</math>-Analogue of Qi Formula for <math>r</math>-Dowling Numbers</b></p> <p>Joy Antonette D. Cillar and Roberto B. Corcino</p>	<p>Completed</p> <p>Published</p> <p><i>Communication of the Korean Mathematical Society</i> <b>35</b>(1) (2020), 21-41</p> <p>Indexed by Web of <b>Science</b> (Clarivate Analytics, Category: <b>ESCI</b>) and <b>SCOPUS</b></p>	<p>January 2020</p>
<p><b>3. A Combinatorial Analysis of Higher Order Generalized Geometric Polynomials: A Generalisation of Barred Preferential Arrangements</b></p> <p>Sithembele Nkonkobe, Beata Benyi, Roberto B. Corcino, and Cristina B. Corcino</p>	<p>Completed</p> <p>Published</p> <p><i>Discrete Mathematics</i> <b>343</b> (2020) Article 111729</p> <p>Indexed by Web of <b>Science</b> (Clarivate Analytics, Category: <b>SCI</b>) and <b>SCOPUS</b></p>	<p>January 2020</p>
<p><b>4. A <math>q</math>-analogue of <math>r</math>-Whitney numbers of the second kind and its Hankel transform</b></p> <p>Roberto B. Corcino, Jay M. Ontolana, Jennifer Canete, Mary Joy R. Latayada</p>	<p>Completed</p> <p>Published</p> <p><i>Journal of Mathematics and Computer Science</i> <b>21</b> (2020), 258-272</p> <p>Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>ESCI</b>) and <b>SCOPUS</b></p>	<p>March 2020</p>
<p><b>5. Fourier Expansions For Genocchi Polynomials Of Higher Order</b></p> <p>Cristina B. Corcino Baby Ann A. Damgo, Roberto B. Corcino</p>	<p>Completed</p> <p>Published Online</p> <p><i>Journal of Mathematics and Computer Science</i> <b>22</b> (2021), 59-72</p> <p>Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>ESCI</b>) and <b>SCOPUS</b></p>	<p>June 2020</p>
<p><b>6. Fourier Expansions for Higher Order Apostol- Genocchi, Apostol-Bernoulli and Apostol-Euler Polynomials</b></p>	<p>Completed</p> <p>Published Online</p> <p><i>Advances in Difference Equations</i> <b>2020</b>, Article 346 (2020)</p>	<p>July 2020</p>

Cristina B. Corcino and Roberto B. Corcino	<a href="https://doi.org/10.1186/s13662-020-02802-x">https://doi.org/10.1186/s13662-020-02802-x</a> Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>SCI-E</b> ) and <b>SCOPUS</b>	
<b>7. A Qi formula for translated r-Dowling numbers</b>  Roberto B. Corcino and Cristina B. Corcino	Completed  Published  <i>Journal of Mathematics and Computer Science</i> , Volume 20 (2020), pp. 88-100  Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>ESCI</b> ) and <b>Scopus</b>	March 2020
<b>8. Approximations of Genocchi Polynomials of Complex Order</b>  Cristina B. Corcino and Roberto B. Corcino	Completed  Published  <i>Asian-European Journal of Mathematics</i> , (2021) 2150083, 14 pages. DOI: 10.1142/S1793557121500832  Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>SCI-E</b> ) and <b>SCOPUS</b>	June 2020
<b>9. On Multi Poly-Genocchi Polynomials with Parameters a, b, and c</b>  Roberto B. Corcino, Mark P. Laurente and Mary Ann Ritzell P. Vega	Completed  Published  European Journal of Pure and Applied Mathematics, Volume 13(3) (2020), 444-458  Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>ESCI</b> )	June 2020
<b>10. The Cubic Lambert W Function</b>  Cristina B. Corcino, Istvan Mezö, Roberto B. Corcino, Raylee Gasparin	Completed  Published  <i>CNU Journal of Higher Education</i> , Volume 14 (2020), pp. 1-6  Indexed by <b>Asian Citation Index (ACI)</b>	October 2020
<b>11. Resolution of the Plane-symmetric Einstein-Maxwell fields with a</b>	Completed  Published	August 2020

<p><b>generalization of the Lambert W function</b></p> <p>Istvan Mezö, Cristina B. Corcino, Roberto B. Corcino</p>	<p><i>Journal of Physics Communications</i>, Volume 4(8) (2020), Article 085008</p> <p>Indexed by <b>Web of Science</b> (Clarivate Analytics, Category: <b>ESCI</b>) and <b>SCOPUS</b></p>	
<p><b>12. Some Formulae of Genocchi Polynomials of Higher Order</b></p> <p>Cristina B. Corcino, Roberto B. Corcino and Joy Ann Cañete</p>	<p>Completed</p> <p>Published</p> <p>Journal of Inequalities and Special Functions, 11(3) (2020), pp. 10-20.</p> <p><b>(Indexed by Web of Science (ESCI))</b></p>	<p>October 2020</p>
<p><b>13. Three-Parameter Logarithm and Entropy</b></p> <p>Cristina B. Corcino, Roberto B. Corcino</p>	<p>Completed</p> <p>Published</p> <p>Journal of Function Spaces Volume 2020, Article ID 9791789</p> <p><b>(Indexed by Web of Science (SCIE) and Scopus)</b></p>	<p>November 2020</p>
<p><b>14. A Second Type Of Higher Order Generalised Geometric Polynomials and Higher Order Generalised Euler Polynomials</b></p> <p>Cristina B. Corcino, Roberto B. Corcino, Sithembele Nkonkobe, Levent Kargin and Bayram Cekim</p>	<p>Completed</p> <p>Published</p> <p>Quaestiones Mathematicae, Published Online  <a href="https://doi.org/10.2989/16073606.2020.1848937">https://doi.org/10.2989/16073606.2020.1848937</a></p> <p><b>(Indexed by Web of Science (SCIE) and Scopus)</b></p>	<p>December 2020</p>

- The institute director, chairs, and researchers have earned the following citation records:

Name	H-Index	i10-index	Number of Citations
Dr. Roberto B. Corcino	13	15	462
Dr. Cristina B. Corcino	9	7	223

Dr. Edward Kiunisala	5	3	62
Mr. Jay M. Ontolan	3	0	17
Mr. Allan Roy Elnar	1	1	10
Dr. Cris Armada	1	0	7

- Awards received by RICMP Director and Researchers:

<b>Name of Awards</b>	<b>Awardee/s</b>	<b>Date Awarded</b>
<p><b><i>Best Paper Presenter</i></b></p> <p>2<sup>nd</sup> International Conference on Arts and Sciences</p> <p>Title of the Paper: <b><i>Higher Order Apostol-Type Poly-Genocchi Polynomials with Parameters a, b, c</i></b></p>	Dr. Roberto B. Corcino	September 30, 2020
<p><b><i>1<sup>st</sup> Place in Research Informercial Competition</i></b></p> <p>CNU VRCon 2020 (Virtual Research Congress) held on October 30, 2020</p> <p>Title of Entry: <b><i>Entropy</i></b></p>	Dr. Cristina B. Corcino, Dr. Roberto B. Corcino, and Mr. Wilson Castañeda	October 30, 2020
<p><b><i>3<sup>rd</sup> Place in Research Informercial Competition</i></b></p> <p>5<sup>th</sup> Central Visayas Health Research and Innovation Conference held on November 16-20, 2020 via Zoom Webinar</p> <p>Title of Entry: <b><i>Entropy</i></b></p>	Dr. Cristina B. Corcino, Dr. Roberto B. Corcino, and Mr. Wilson Castañeda	November 20, 2020

- The institute has two (2) externally funded research projects, which officially started on June 3, 2019. Below are the said research projects funded by CHED-GIA.

<b>Title of the Research Project</b>	<b>Status</b>	<b>Funding Agency/Project Cost</b>
<p><b><i>HANKEL TRANSFORM OF q-ANALOGUE OF r-DOWLING NUMBERS</i></b> by Roberto B. Corcino, Jay M. Ontolan and Istvan Mezo</p>	<p>Produced</p> <p>a. six (6) publications in journals indexed by Web of Science and Scopus</p> <p>On-going</p>	<p><b>CHED-GIA</b> <b>Project Cost: PhP 2,457,961.10</b></p>



<p align="center"><b>THE GENERALIZED LAMBERT W FUNCTION, ITS PROPERTIES AND APPLICATIONS</b></p> <p align="center"><i>by Cristina B. Corcino, Roberto B. Corcino, Wilson Castañeda and Istvan Mezo</i></p>	<p>Produced</p> <ol style="list-style-type: none"> <li>three (4) publications in journals indexed by Web of Science and Scopus;</li> <li>one (1) publication in journal indexed by Asian Citation Index (ACI);</li> <li>one (1) paper submitted for publication;</li> </ol> <p>On-going</p>	<p><b>CHED-GIA Project Cost: PhP 3,142,038.90</b></p>
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- ✓ Conducted the meeting on November 17, 2020 with CHED monitoring team to present the accomplishments of the research projects for evaluation and assessment. The CHED Monitoring Team gave a positive evaluation of the accomplishments of the research project and recommended to submit another research proposal before the on-going research projects end.
- The Institute Director, Dr. Roberto B. Corcino, has been a collaborator of three (3) externally funded research projects (dissertation researches of his three (3) PhD advisees), working with Dr. Mary Ann P. Vega (MSU-IIT Math Professor) as co-adviser. Below are the said research projects funded by CHED and DOST.

Title of the Research Project	Status	Funding Agency/Project Cost
<p><b><i>On Generalized Poly-Genocchi Polynomials and Multi Poly-Genocchi Polynomials with Parameters a, b, and c</i></b></p> <p><i>by Roberto B. Corcino, Mark P. Laurente and Mary Ann Ritzell P. Vega</i></p>	<p>Produced</p> <ol style="list-style-type: none"> <li>One (1) published paper in journal indexed by Web of Science;</li> <li>PhD Math graduate (Mark P. Laurente)</li> </ol> <p>Completed</p>	<p><b>CHED Project Cost: PhP 60,000.00</b></p>
<p><b><i>A Q-Analogue of Genralized Translated Whitney Numbers and Translated R-Whitney-Lah Numbers: Cigler's Approach</i></b></p> <p><i>by Roberto B. Corcino, Jezer C. Fernandez and Mary Ann Ritzell P. Vega</i></p>	<p>Obtained some preliminary results</p> <p>Submitted one paper for publication</p> <p>On-going</p>	<p><b>DOST Project Cost: PhP 60,000.00</b></p>

<p style="text-align: center;"><b><i>A <math>p,q</math>-Analogue of the R-Dowling Numbers and Their Hankel Transform</i></b></p> <p style="text-align: center;"><i>by Roberto B. Corcino, Amerah M. Dibagulun and Mary Ann Ritzell P. Vega</i></p>	<p>Obtained some preliminary results</p> <p>Produce 1<sup>st</sup> draft of the paper</p> <p>On-going</p>	<p><b>DOST Project Cost: PhP 60,000.00</b></p>
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➤ International Research Collaborations/Linkages:

- Dr. Roberto B. Corcino has communicated Dr. Sithembele Nkonkobe from Sol Plaatje University, Kimberly, South Africa, for a research collaboration in the area of combinatorics. This research collaboration has produced two scientific papers:
  - a) *A combinatorial analysis of higher order generalized geometric polynomials: A generalisation of barred preferential arrangements* by Sithembele Nkonkobe (South Africa), Beata Benyi (Hungary), Roberto B. Corcino (Philippines), and Cristina B. Corcino (Philippines)  
**(Published in Discrete Mathematics 343 (2020) Article 111729, indexed by Web of Science and SCOPUS)**
  - b) *A combinatorial analysis of higher order generalised geometric polynomials: A generalisation of barred preferential arrangements* by Sithembele Nkonkobe (South Africa), Levent Kargin (Turkey), Bayram Cekim (Turkey), Roberto B. Corcino (Philippines), and Cristina B. Corcino (Philippines)  
**(Accepted for Publication in Quaestiones Mathematicae, indexed by Web of Science and Scopus)**
  
- Dr. Roberto B. Corcino has communicated Dr. Istvan Mezo (Hungarian) from Nanjing University of Science and Technology of CHINA for continuing research collaboration in the area of combinatorics and special functions. This continuing collaboration has produced two scientific papers:
  - a) *The Cubic Lambert W Function* by Cristina B. Corcino (Philippines), Istvan Mezö (Hungary), Roberto B. Corcino (Philippines), Raylee Gasparin (Philippines)  
**(Published in CNU Journal of Higher Education, indexed by ACI)**
  - b) *Resolution of the Plane-symmetric Einstein-Maxwell fields with a generalization of the Lambert W function* by Istvan Mezö (Hungary), Cristina B. Corcino (Philippines), Roberto B. Corcino (Philippines)  
**(Published in the Journal of Physics Communications, Volume 4(8) (2020), Article 085008, indexed by Web of Science and Scopus)**

➤ Consultancy Services:

- ✓ RICMP has been requested by DOH-7 and NEDA-7 to conduct study on predicting the peak and flattening of COVID-19 cases in Region 7.
- ✓ RICMP has been requested by CNU-FAI President **Dr. Bibiana T. Isok** to conduct a study on "Statistical Presentation of Faculty Electricity Consumption" to support the demand of the faculty for additional interconnectivity assistance in this Work-from-Home scheme.

✓ Dr. Roberto B. Corcino (RICMP Director) served as dissertation adviser of the following PhD Math students of MSU-IIT:

1. **Mr. Mark P. Laurente (CHED Scholar)**

Degree: *Doctor of Philosophy in Mathematics*

School: *Mindanao State University-Iligan Institute of Technology*

Dissertation Title: *On Generalized Poly-Genocchi Polynomials and Multi Poly-Genocchi Polynomials with Parameters  $a$ ,  $b$ , and  $c$*

Status: *Graduated June 2020*

2. **Mr. Jezer C. Fernandez (DOST Scholar)**

Degree: *Doctor of Philosophy in Mathematics*

School: *Mindanao State University-Iligan Institute of Technology*

Dissertation Title: *A  $q$ -Analogue of Generalized Translated Whitney Numbers and Translated  $r$ -Whitney-Lah Numbers: Cigler's Approach*

Status: *Successfully defended the dissertation proposal*

3. **Ms. Amerah M. Dibagulun (DOST Scholar)**

Degree: *Doctor of Philosophy in Mathematics*

School: *Mindanao State University-Iligan Institute of Technology*

Dissertation Title: *A  $p, q$ -Analogue of the  $r$ -Dowling Numbers and Their Hankel Transform*

Status: *Successfully defended the dissertation proposal*

➤ The institute director, Dr. Roberto B. Corcino, has been appointed as member of the Awards Committee of the National Research Council of the Philippines – Division 2 (Mathematical Science Division) Lifetime Achievement Awards on November 17, 2020.

➤ The institute director, Dr. Roberto B. Corcino, has served as reviewer/referee of the following international journals indexed by Web of Science (Clarivate Analytics)/SCOPUS in the year 2020:

- 1) FILOMAT
- 2) Journal of Computational and Applied Mathematics
- 3) International Journal of Mathematics and Mathematical Sciences
- 4) Journal of Integer Sequences
- 5) Notes on Number Theory and Discrete Mathematics
- 6) Periodica Mathematica Hungarica
- 7) European Journal of Pure and Applied Mathematics
- 8) Annales Mathematicae Silesianae

• **Develop tools and methodologies based on computational mathematics and physics for the use in teaching and learning as well as in industries**

1. Modified Susceptible-Infected-Recovered-Dead (SIRD) Model has been developed to predict the peak and flattening of COVID-19 cases in the Philippines and Central Visayas Region

**Proponents:** Roberto B. Corcino, Allan Roy Elnar, Gibson Maglasang, and Karl Patrick Casas

**Outputs:** Policy Brief (Recommendation for Policy Formulation)  
Scientific Paper (Submitted for Publication)

**Clients/Beneficiaries:** NR07 and DOH-7

2. Statistical framework that can be used to analyze the faculty electricity consumption during pandemic (requested by CNU-FAI President **Dr. Bibiana T. Isok** to support the demand of the faculty for additional interconnectivity assistance in this Work-from-Home scheme).

**Proponents:** Cristina B. Corcino and Roberto B. Corcino

**Output:** Recommendation for Additional Interconnectivity Assistance to CNU Faculty

**Clients/Beneficiaries:** CNU Faculty Association Incorporated

3. Developed book titled “The Wonderful Applications of Mathematics in the Modern World” for students taking General Mathematics Education Course: Mathematics in the Modern World (MMW)

**Proponents:** Roberto B. Corcino, Cristina B. Corcino, Ray Ferdinand M. Gagani, Jo Ann M. Petancio, Vincent Theodore M. Balo, Mark L. Caay, Jay M. Ontolan

**Output:** Textbook for Mathematics Modern World students

**Clients/Beneficiaries:** MMW Students

Prepared by:

**ROBERTO B. CORCINO, Ph.D.**

Director, Research Institute for Computational Mathematics and Physics