

ISBN 978-979-19256-0-0



PROCEEDING

**THE 3RD INTERNATIONAL CONFERENCE
ON MATHEMATICS AND STATISTICS**

BOGOR, 5 - 6 AUGUST 2008

*Mathematics and Statistics: bridge for academia, business,
and government in the entrepreneurial era*

3rd
ICOMS 2008

3RD INTERNATIONAL CONFERENCE ON MATHEMATICS AND STATISTICS



Department of Natural
Sciences, University of Indonesia



MINISTERI
Pendidikan dan
Kebudayaan
Republik Indonesia



Indonesian Mathematical
Society

PROCEEDING

THE 3RD INTERNATIONAL CONFERENCE ON MATHEMATICS AND STATISTICS

BOGOR, 5 - 6 AUGUST 2008

*Mathematics and Statistics: bridge for academia, business,
and government in the entrepreneurial era*

organized by



MSMSSEA (Moslems Statisticians and
Mathematicians Society in South East Asia)



Department of Statistics
Department of Mathematics
Institut Pertanian Bogor



Department of Mathematics
Universiti Malaysia Terengganu,
Malaysia

PREFACE

Assalaamu'alaikum warahmatullaahi wabarakaatuh

Welcome all participants of ICoMS 2008 to Bogor – Indonesia. This event is organized by MSMSSEA in collaboration with Institut Pertanian Bogor (Indonesia) and Universiti Malaysia Terenganu (Malaysia).

We, the organizing committee, are very glad having this international conference due to many reasons.

1. ICoMS is a good avenue for mathematicians, statisticians, and other scientist to communicate.
2. ICoMS 2008 has a theme related to entrepreneurial era which is very important for mathematicians and statisticians, and scientist in general.
3. The event is important venue for business group, government, and academia to communicate and share knowledge as well.
4. Bogor is beautiful place in Indonesia surrounded by many research centers, IPB, Botanical garden, an other point of interest related to research institution.

We are also happy that the Vice President of Republic of Indonesia, Ministry of National Education, Ministry of Energy and Mineral Resources, and Ministry of Communication and Information Technology are supporting to the ICoMS 2008.

This event held on two days, August 5-6, and consist of several parts. We invite 17 outstanding professors to share and discuss topics in mathematics and statistics, including application. As many as 170 paper and 30 posters presented during this two-day conference. We appreciate to all of contributor from various countries who are motivated to participate in this event.

High appreciation is also awarded to companies and agencies which facilitate so that the even could run well.

We really hope all participants can benefit many things from this international event. May God bless you.

Wa'alaikumsalam warahmatullaahi wabarakaatuh.

The Committee of ICoMS 2008

CONTENTS

Preface		ii
Contents		iii
Speech of Director General of Higher Education: Dr. Fasli Jalal		xiii
SESSION A		
Vector-Borne Disease Transmission Model: The Case of Filariasis Transmission in Jati Sampurna	A.K. Supriatna a;ꣳ H. Serviana b E. Soewono	1
Optimization of Dining Table Placement in Restaurant Using Genetic Algorithm	Monika, Arnold Aribowo, Samuel Lukas	11
The Influence of Islamic Mathematics In The Malay World: A Study of Classical Astronomical Tables	Baharrudin Zainal and Mat Rofa Ismail	16
Problem-Based Learning Strategy To Improve Mathematics Skills Among Students	Ismail Abdullah	24
Linear Time Invariant Versus Linear Parameter Varying Reduced Order Controller Design For Aircraft Model	Widowati	31
Scientific Computing Research In The Faculty of Information Science And Technology Universiti Kebangsaan Malaysia	Mohammad Khatim Hasan, Muriati Mokhtar, Riza Sulaiman and Jumat Sulaiman	39
The Functions of Contextual Problems On A Mathematics Instruction Implementing The Realistic Approach	Rini Setianingsih	47
Further Results On The Ramsey Numbers For Star Union Cycle Versus Wheel On Seven Vertices	I Wayan Sudarsana, Edy Tri Baskoro, and Hilda Assiyatun	54
Characteristics of Lecturer That Influences Effective Teaching In Quality Education Based On Tqm Concepts	Khairul Anuar Mohd Ali, Zainol Mustafa, Fazli Idris & Siau Yee	58
Feynman Diagrams And The Tau Function	Zainal Abdul Aziz	66
An Evaluation Of The Efficiency Wage Model: Evidence From Bangladesh Food Industry	Masud Rana, Md. Azizul Baten and Mezbahur Rahman	74
Modeling Self-Potential (Sp) Distribution Groundwater Flow Using Boundary Element Method (BEM)	Muhammad Hamzah, S., Santoso, D., Parnadi, W.W., Sulistijo, B	83
Nonlinear Dynamic Plant Identification Of Waste Heat Boiler Unit Using Adaptive Wavelet - Neural Network (Wavenet) Method	Yuliati	91
A Group Mutual Exclusion Algorithm For Ad Hoc Mobile Networks	Armin Lawi	100
On The Measurement Of Credit Risk: A New Geometric Approach	Alireza Bahiraie, Noor Akma Ibrahim, Ismail bin Mohd, Azhar A.K.M	105

Slide By Slide Method In Solving General Global Optimization Problems	Goh Khang Wen, Ismail bin Mohd, and Yosza bin Dasril	111
The Infinite Divisibility Of Geometric Distribution	Dodi Devianto and Katsuo Takano	120
Tight Immersions And Transnormal Embeddings	B.A.Saleemi	126
Hydromagnetic Flow Over An Impermeable Linearly Stretching Sheet Immersed In A Non-Darcian Porous Medium	Noor Fadiya Mohd Noor and Ishak Hashim	131
Wavelet Analysis Of Solar Mass Ejection During Active And Quiet Sun	Saifuddin Ahmed Jilani and M.Ayub Khan YousfZai	138
Modeling A Determination Of Expected Commercial Value Of A Project In Producing Innovative Products In Smes	Nursafarizah Abd Aziz, Nor Ratna Masrom, Yosza Bin Dasril, and Adi Saptari	144
Modelling Nurse Rostering Using A 0-1 Goal Programming: A Case Study In Hukm	Ruzzakiah Jenal, Wan Rosmanira Ismail, Liong Choong Yeun And Masri Binti Ayob	151
SESSION B		
Enhancing Students' Mathematical Learning through Teacher Professional Development	Yaya S. Kusumah	159
Around Prime And Maximal Ideals Of A Skew Polynomial Ring Over A Dedekind Domain	A. K. Amir, P. Astuti, and I. Muchtadi-Alamsyah	169
The Fuzzy Version Of The Fundamental Theorem Of Semigroup Homomorphism	<u>Karyati</u> , Indah Emilia W, Sri Wahyuni, Budi Surodjo, Setiadji	173
Solving Fourth-Order Parabolic Equations By Red-Black Quarter-Sweep Sor Iterative Methods	J. Sulaiman, M. Othman, and M.K. Hasan	180
25 Years Development Of Knowledge Graph Theory: The Results And The Challenge	Sri Nurdiati and Cornelis Hoede	187
Eigenvalues And Eigenvectors Of Matrices Over Fuzzy Number Max-Plus Algebra	M. Andy Rudhito, Sri Wahyuni, Ari Suparwanto, and F. Susilo	195
The Partition Dimension Of Windmill Graph	Darmaji, Novian Syah, Saladin Uttunggadewa, Edy Tri Baskoro	203
Sorting Process Of Two Sets Of Non-Quantitative Data: Mathematical Method And Analysis	Edi Cahyono, David Taniar, La Ode Saidi, Arman and Natalis Ransi	206
On The Metric Dimension Of $P_2[P_n]$	S. Widosaputro, E.T. Baskoro, A.N.M. Salman, and D. Suprijanto	215
IS-LM In Slow-Fast System	Joice Ruth Juliana, Endah Asmawati	219

A Four-Stage Fifth-Order Runge-Kutta-Nystrom Methods With Dispersion Of High Order	Norazak Senu, Mohamed Suleiman' Fudziah Ismail, Mohamed Othman, and Norfifah Bachok@Lati	224
Logic In Recurrent Hopfield Network	Saratha Sathasivam	232
The Generalization Of Incidence Algebra	Ema Carnia, Sri Wahyuni, Irawati and Setiadji	238
Representation Of Sm-Operators On Product Spaces Of r – Lebesgue Spaces $L_p(E, \Sigma, \mu)$, $1 < p < \infty$	Muslim Ansori ,Soeparna Darmawijaya and Supama	242
Benard-Marangoni Instability In A Rotating Fluid Layer With Feedback Control Strategy	Zailan Siri and Ishak Hashim	252
Interior Point Methods For Solving Linear Programing	Iwan Tri Riyadi Yanto,Julan Hernadi, and Yudi Ari Adi	259
Endo-Prime N-Group	Indah Emilia Wijayanti	266
Modelling Of Budget Allocation For University Library	Engku Muhammad Nazri Bin Engku Abu Bakar, Syariza Abdul Rahman, Noorezatty Mohd Yusop	271
A Novel Natural Approach To Euclidean TSP	Nur Azman Abu, Shahrin Sahib And Nanna Suryana	278
R-Linear Independent Generalization	Suprpto, Sri Wahyuni, Indah Emilia W., Irawati	287
A Study For Hyperbolic Decline Exponent Bound	S. Wahyuningsih, S. Darwis, A.Y. Gunawan, and A.K. Permadi	291
The F -Coloring Of The Corona Product Of Complete Graph With Cycle Graph	Adiwijaya, A.N.M. Salman, E.T. Baskoro, and D. Suprijanto	298
A Modified Explicit Group Iterative Algorithm With Accelerated Over-Relaxation For Solving Poisson Equation	Shukhrat I. Rakhimov, Mohamed Othman	302
Asymptotic Behavior Of Linear Delay Differential Systems	Eti Dwi Wiraningsih, Widodo, Lina Aryati, Syamsuddin Toaha	307
On total vertex-irregular labellings of tP_n a forest constructed from a disjoint union of paths	Nurdin1, E.T. Baskoro, A.N.M. Salman, N.N. Gaos	311

SESSION C

The Effectiveness Of The Contextual Video As A Teaching Tool In The Teaching And Learning Statistics At The Universiti Tun Hussein Onn Malaysia (Uthm)	<u>Nafisah Kamariah Md Kamaruddin</u> , Zulkarnain Md Amin, Norfadzilah Ishak, Wan Mohd Rashid Wan Ahmad, And Maizam Alias	316
The Nonlinear Mechanism Of Tsunami Wave Generation	Nazeeruddin Yaacob And Zainal Abdul Aziz	323
Open Economy Macroeconomics: A Linear Rational Expectations Model	Iman Sugema and Toni Bakhtiar	332
The Range Of Mathematical Capability Of University Math Lecturers In Jakarta Indonesia	Ramir Santos Austria	340
An Application Wavelet Based Preconditioner For The Solution Of Ordinary Differential Equation	Ismail Bin Mohd and Farikhin	347
Research And Statistic Studying Model At Junior High School By Realistic Mathematics Education Application	Yani Ramdani	352
Using The Algebra Of Hypergraph For Reconstruction Phylogenetic Trees	Mulia Astuti, Irawati, Intan Muchtadi-Alamsyah, Ahmad Muchlis, Achirul Akbar Dan Muliana. A. Halim	366
Interval Linear Programming	Herry Suprajitno, Ismail Bin Mohd	374
What Happen With Numbers At Our Primary School?	Mohini Mohamed, Zulkifli, Jasmaniah	382
Determination Of GPS Signal Path Using The Runge-Kutta Method	Mardina Abdullah, Siti Sarah Nik Zulkifli, Mahamod Ismail, Ahmad Mahir Razali And Azami Zaharim	387
A Novel Linguistic Aggregation Method For Group Decision Making	Zamali Tarmudi, Mohd Lazim Abdullah And Abu Osman Md Tap	392
A Series Of Element Shape Functions For Infinite Elements	Sri Mardiyati	399
Promoting Creativity In Learning Mathematics Using Open-Ended Problems	Tatag Yuli Eko Siswono	406
Modeling Traffic Lights In Intersection Using Petri Nets	Dieky Adzkiya And Subiono	412
An Alternative Formulation For Electromagnetic Wave Propagations In Source Free Region	Noraini Md Nusi And Mohamed Othman	418
On The Number Of Families Of Branching Processes With Immigration With Family Sizes	Husna Hasan	424

Marangoni Convection In A Fluid Layer With Non-Uniform Temperature Gradient	Norihan Md. Arifin, Siti Suzilliana Putri Mohamed Isa, Roslinda Mohd Nazar, and Mohd Noor Saad	429
Dubrovin Valuation Rings Of Skew Ploynomial Rings	Intan Muchtadi Alamsyah	435
SESSION D		
The Roles Of Numerical Method And Optimal Control Theory In Cancer Immunotherapy	Ismail Bin Mohd, Arif Bin Mandangan	438
The Development of Applied Statistical Analysis	H. Ahmad Ansori Mattjik	450
Risk Factors For Water Fowl Infection With Avian Influenza H5n1, West Java Province, Indonesia	Etih Sudarnika, Asep Saefuddin, Abdul Zahid And Chaerul Basri	459
Trend Of The Import And Export Of Cocoa In Malaysia	H. J. Zainodin, G. Khuneswari & S.C. Albert Ling	463
Performance Analysis Of Reactive Mobile Ad Hoc Networks Routing Protocols Based On Taguchi Technique	Hazura Mohamed, Muhammad Hisyam Lee, Mazalan Sarahintu, Shharuddin Salleh, And Bahrom Sanugi	472
Optimum Designs Of Multiresponse Surface Models For The First Order Lattice Simplex Designs	Ruslan , Susanti L, Purhadi, Sony S	479
Bayesian Approach For Choice-Conjoint Model In Consumer Preferences	Zulhanif, Ismail Bin Mohd, Noor Akma Ibrahim, Mustafa Bin Mamat	484
Simultan Equation Models Of Gross Domestic Product By Exchange Rate And Money Supply Scenario Analysis For Indonesian Economy	Bagus Sumargo	492
On Designing Algorithm For Sample Selection	L. Muhamad Safiih And Yaya Sudarya Triana	501
Generating Claim Data Of General Insurance Based On Collective Risk Model And Claim Process	Aceng K. Mutaqin, Dumaria R. Tampubolon, Sutawanir Darwis	506
An Application On Multiple-Correspondence Analysis On The Survey For Implementation Of The Profit-Loss Sharing Concept	Novriana Sumarti, Nurdinintya Athari S., And M. Rizka Fadhli	509
GIS Spatial Data Visualization Tools For Artificial Reefs Distribution	Mustafa Man, Md Yazid Mohd Saman, Noor Maizura M. Noor Khalid Samo And W.Aezwani W.A.Bakar	514

An Alternative Approach In Getting A Representative Model In A Mutiple Regression Analysis	G. Khuneswari, H. J. Zainodin, G. Darmesah & S. H. Sim	522
Wireless Internet Usage Among Students In Universiti Malaysia Sabah	Sathissan Ragavan, Darmesah Gabda, Amran Ahmed	531
An evaluation of a software for circular variables: ORIANA	Siti Fatimah Hassan, Abdul Ghapor Hussin and Yong Zulina Zubairi	539
Evaluation Of Some Methods For Estimating Parameters Of Regression Model With Various Zero Observations By Monte Carlo Simulation	Fitria Virgantari, Tjut Awaliyah, I Wayan Mangku, and Siswadi	545
Stability Model's By "Eberhart-Russel's" And Biplot Of Qpm (Quality Protein Maize) Under Central Maize In Indonesia	M Yasin Hg., Sigit Budi Santoso., And Sri Sunarti	553
Increasing Power Of Robust Test Through Pre-Testing In Multivariate Simple Regression Model	Rossita M. Yunus And Shahjahan Khan	559
Application Of Buhlmann-Straub Model On Tectonic Earthquake Insurance Problem	Hasih Pratiwi, Subanar, Danardono, And J.A.M. Van Der Weide	567
Evaluating The Cox-Aalen Model	Danardono	574
Estimation Of Distributed Lag Model With Adaptive Ekspectation And Partial Adjustment On The Distribution Of Fmcd-Based Robust Mahalanobis Distance	Aidawayati Rangkuti	579
	<u>Hazlina Hj Ali</u> , Maman A. Djauhari, and Sharipah S.S. Yahaya	587
Organizational Commitment Of Public Sector Employees In Pakistan: A Statistical Evidence	<u>Dr. M. Rashid Salahria</u> and Qasim Zafar	595
Carbon Based Material Processing Method Using Statistical Application Technique	N. Hashim, A.N. Zainal Abidin, M. Deraman, W. R. Wan Abdullah, A. Mohd Ramli, 6R.M. Yunus	600
SESSION E		
Continuous Time Model For Portfolio Problem Using Dynamic Programming Approach	Sugiyarto, Ismail Mohd., Mustafa Mamat And Yosza Dasril	607
A Comparison of MLE and GEE On Modeling Binary Panel Response	Jaka Nugraha, Suryo Guritno, Sri Haryatmi	612
Bayesian Scan Statistic For Spatial Cluster Detection	Setia Gunawan Wijaya, Dian Lestari, And Yekti Widyaningsih	619
Correlation Coefficient Estimation From Grouped Data	Teti Sofia Yanti	626
The Performance Of Exponential Weighted Moving Average (Ewma) Control Chart Between Classical, Robust And Bootstrap Method	Khalida Binti Oseman, Nazaruddin Omar And Habshah Midi	634

Inventory Model With Gamma Distribution	Hadi Sumadibrata, Ismail Bin Mohd	642
Accuracy Analysis Of Naive Bayesian Anti-Spam Filter	Ruslam, Armin Lawi, And Sri Astuti Thamrin	649
A New Method For Generating Fuzzy Rules From Training Data And Its Application In Financial Problems	Agus Maman Abadi, Subanar, Widodo, Samsubar Saleh	655
The Application Of Laws Of Large Numbers In Convergence Concept In Probability And Distribution	Georgina M. Tinungki	662
An Empirical Bayes Approach for Binary Response Data in Small Area Estimation	Dian Handayani, Noor Akma Ibrahim, Khairil A. Notodiputro, MOhd. Bakri Adam	669
Statistical Models For Small Area Estimation	Khairil A Notodiputro, Anang Kurnia, and Kusman Sadik	677
Maximum Likelihood Estimation For The Non-Separable Spatial Unilateral Autoregressive Model	Norhashidah Awang, Mahendran Shitan	685
Small Area Estimation Using Natural Exponential Families With Quadratic Variance Function (Nef-Qvf) For Binary Data	Kismiantini	691
Using An Extended And Ensemble Kalman Filter Algorithm For The Training Of Feedforward Neural Network In Time Series Forecasting	Zaقياتud Darojah, M. Isa Irawan, And Erna Apriliani	696
Estimation Of Outstanding Claims Liability And Sensitivity Analysis: Probabilistic Trend Family (PTF) Model	Arif Herlambang, Dumaria R Tampubolon	704
Expected Value Of Shot Noise Processes	Suyono	711
Modelling Malaysian Wind Speed Data Via Two Paramaters Weibull	Nur Arina Basilah Kamisan, Yong Zulina Zubairi, Abdul Ghapor Hussin, Mohd. Sahar Yahya	718
Application Of Latin Hypercube Sampling And Monte Carlo Simulation Methods: Case Study The Reliability Of Stress Intensity Factor And Energy Release Rate Of Indonesian Hardwoods	<u>Yosafat Aji Pranata</u> And Pricillia Sofyan Tanuwijaya	726
The Development Of Markov Chain Monte Carlo (Mcmc) Algorithm For Autologistic Regression Parameters Estimation	Suci Astutik, Rahma Fitriani, Umu Sa'adah, And Agustin Iskandar	734
A Note About Dh-Fever Estimation With ARIMAX Models	Elly Ana, Dwi Atmono Agus W	741
Evaluation Of Additive-Innovational Outlier Identification Procedure For Some Bilinear Models	Ismail, M.I., Mohamed, I.B., Yahya, M.S.	745

Interval Estimation For Quantile On One Parameter Exponential Distribution Under Multiple Type-Ii Censoring On Complex Case	Akhmad Fauzy	754
A Detection Measure Of Influential Observation Based On Forward Search Approach For Cox-Regression	Mohamed, I. B., Noh, N. A. M., Taib, N. A. M.	760
Gee-Smoothing Spline For Longitudinal Data	Suliadi, Noor Akma Ibrahim, Isthrinayagy S. Krishnarajah, and Isa Daud	768
SESSION F		
On Some Theory And Applications Of Bayesian Hierarchical Modeling	Kamarulzaman Ibrahim	776
Simultaneous Estimation After Selection And Ranking And Other Procedures :	Suryo Guritno	782
The Negative Exponential Case		
Survival Probabilities Of Genes In Partial Selfing Populations	Muhamad Sabran	789
The Probability Difference Indices And Empirical Sampling Distribution For Dif Indices For Identifying Item Bias In Multidimensional Item Response Theory	Badrun Kartowagiran And Heri Retnawati	799
Volumetric Stem Biomass: A Comparative Study Using Multiple Regression Models	Noraini Abdullah, Zainodin Hj. Jubok And Amran Ahmed	806
An Innovative Approach In Analysing Wind Data Via Graphical Display	Fakhrulrozi Hussain, Yong Zulina Zubairi, And Abdul Ghapor Hussin	815
Denoising Time Series Data Using Daubechies Wavelet Packet Transformation	Samsul Ariffin Abdul Karim, Mohd Tahir Ismail	823
Detection Of Outliers In Circular Regression Model Via Row Deletion Approach	Abuzaid, A. H., Mohamed, I. B., And Hussin, A.G.	828
Implementation Of Classification Predictive Association Rule (CPAR) Algorithm To Diabetes Diagnose	Herwanto, Imas S. Sitanggang	835
Bayesian Survival Analysis Of Acute Leukemia Patients Using Multivariate Adaptive Regression Spline Model	Nurhayati Ulath, Sri Astuti Thamrin, And Armin Lawi	842
Combining Individual Learning And Group Discussion In Calculus Course	Endah Asmawati, And Joice Ruth Juliana	847
PBSTAT: A Web-Based Statistical Analysis Software For Participatory Plant Breeding	Willy Bayuardi Suwarno, Sobir, Hajrial Aswidinnoor, And Muhamad Syukur	852
Reliability Of The Specific Gravity (Sg) Value Of Three Indonesian Hardwoods Using Experimental Test And Monte Carlo Simulation	Yosafat Aji Pranata And Pricillia Sofyan Tanuwijaya	859
Comparison Of Differencing Parameter Estimation From Arfima	Gumgum Darmawan, Nur	866

Model By Spectral Regression Methods	Iriawan, Suhartono	
Application Of Cluster Analysis To Developing Core Collection In Plant Genetic Resources	Sutoro	875
Small Area Estimation With Time And Area Effects Using A Dynamic Linear Model	Kusman Sadik And Khairil Anwar Notodiputro	880
Statistical Analysis Of Wind Direction Data	Ahmad Mahir Razali, Arfah Ahmad, Azami Zaharim And Kamaruzzaman Sopian	886
Generalized Additive Mixed Models in Small Area Estimation	Anang Kurnia, Khairil A. Notodiputro, Asep Saefuddin, I Wayan Mangku	891
Kernel Principal Component Analysis In Data Visualization	Ismail Djakaria, Suryo Guritno, Sri Haryatmi	898
GARCH Models And The Simulations	Nelson Nainggolan, Budi Nurani Ruchjana And Sutawanir Darwis	906
Rainfall Prediction Using Bayesian Network	Hera Faizal Rachmat, Aji Hamim Wigena, and Erfiani	911
Identifying Item Bias Using The Simple Volume Indices And Multidimensional Item Response Theory Likelihood Ratio (Irt-Lr) Test	Heri Retnawati	916
Ordinary Kriging And Inverse Distance Weighting For Mapping Soil Phosphorus In Paddy Field	Mohammad Masjkur, Muhammad Nuraidi and Chichi Noviant	924
K-Means Clustering Visualization On Agriculture Potential Data For Villages In Bogor Using Mapserver	Imas S. Sitanggang, Henri Harianja, and Lailan Syaufina	932
Some Methods To Estimate The Number Of Components In A Mixture	M. A. Satyawan, A. H. Wigena, Erfiani	941
A Probabilistic Model For Finding A Repeat Triplet Region In DNA Sequence	Tigor Nauli	947
Application Of Spherical Harmonics In Determination Of Tec Using Gps Observable	Mardina Abdullah, Siti Aminah Bahari, Baharudin Yatim, Azami Zaharim, Ahmad Mahir Razali	954
Testing Structure Correlation Of Global Market By Statistic Vvsv	Erna Tri Herdiani, and Maman A. Djauhari	961
Exploring the MAUP from a spatial perspective	Gandhi Pawitan	967
Estimation of RCA(1) Model using EF: A new procedure and its robustness	1Norli Anida Abdullah, 2Ibrahim Mohamed, 3Shelton Peiris	996
Second Order Linear Elliptic Operators In The Unit Square	Abdul Rouf Alghofari	1008

POSTER

Study Of Fractional Factorial Split-Plot Experiment	Sri Winarni, Budi Susetyo, and Bagus Sartono	1012
Improving Model Performance For Predicting Poverty Village Category Using Neighborhood Information In Bogor	Bagus Sartono, Bagus Sartono, and Zulhelmi Thaib	1019
Ammi Models On Count Data: Log-Bilinear Models	Alfian Futuhul Hadi H. Ahmad Ansori Mattjik I Made Sumertajaya Halimatus Sa'diyah	1026
Prediction Of Oil Production Using Non Linear Regression By Sdpro Software (Special Program Package) ^{*)}	Budi Nurani R , and Kartlos J. Kachiashvili	1038
An Implementation Of Spatial Data Mining Using Spatial Autoregressive (Sar) Model For Education Quality Mapping At West Java ^{*)}	Atje Setiawan A. , Retantyo Wardoyo , Sri Hartati , and Agus Harjoko	1045
Validation Of Training Model For Robust Tests Of Spread	Teh Sin Yin, and Abdul Rahman Othman	1056
Spectral Approach For Time Series Analysis	Kusman Sadik	1063
The ACE Algorithm for Optimal Transformations in Multiple Regression	Kusman Sadik	1066
The Relation Between The Students' Interaction And The Construction Of Mathematical Knowledge	Rini Setianingsih	1069
Application of Auto Logistic Regression Spatial Model using Variogram Based Weighting Matrix to Predict Poverty Village Category	Utami Dyah Syafitri, Bagus Sartono, Vinda Pratama	1075
Developing Data Mining System Using Fuzzy Association Rules	Imas S. Sitanggang, Arsha Mustika, Aziz Kustiyo	1082

Speech of Director General of Higher Education at ICoMS 2008 At Novotel Corralia, Bogor, 5 August 2008

Dr. Fasli Jalal

The Director General of Higher Education
Ministry of National Education, Republic of Indonesia

Bismillahirrahmanirrahim

Assalamu'alaikum Warrahmatullahi wabaraktuh

Good morning ladies and gentlemen

It is a great honor for me to provide a speech in this important scientific event, the Third International Conference on Mathematics and Statistics of MSMSSEA (Muslim Statistician and Mathematician Society in South East Asia). I can see from here that the audiences are of from various countries. So, let me welcome you to Indonesia, a country of great diversity in unity. I think it likes mathematics and statistics that we always find diversities and similarities. As far as I know that these two terms that make science and technology develop rapidly.

Someday a Germany great scientist, who found the Normal Distribution, Carl Fredric Gauss (1777-1855), had mentioned that mathematics, is the queen and servant of science. It is very reasonable statement, because mathematics plays an important role in developing science and technology and in the same time it must be reconed in all aspects of science production, preservation and dissemination. Hence, it is a servant of science. In the other hand, all scientists, irrespective their domains have to understand mathematics (including statistics) in order to analyze the problems properly. Thus, it is a queen of science. With its two functions, mathematics with its derivatives has narrowed the gap between the so called hard science and soft science. Hence, there is no exact distinctin between soft and hard sciences. Whatever the sciences, they need mathematics and statistics in order to clarify and simplify the issues. In mathematics and statistics, simplicity is the clarity of mind. However, mathematics and statistics can analyze complex issues. The modelling itself is the simplication of complicated real world.

Ladies and gentlemen

Let me talk about about sscience, mathematics and technology which are well-known as the tripod in an unknown area. All scientists who have achieved high standing positions in science reputation always have strong mathematical background. Hence, they can see the things that the other people can't see, also they can predict that the other people can't predict. Their deductive as well as inductive thinking are both adequate. These two ways of thinking are essential in research and science development. Deductive reasoning is considered mathematical way of thinking, while inductive is statistical way of thinking. Both type of reasoning are the key factors of scientific circle, without them the science development is stagnant. The Kuhnian model of scientific revolution occures when the deductive and inductive thinking are accomodated well in a society. Hence, education has to provide great room for student to flourish their reasoning. Their brain for deductive and inductive thinking can develop if the school gives enough space for student creativity. Hence, they can think freely and try to find facts, which are called data in the statistical term, to proof their ideas. A great Indonesian statistician, Prof. Nasoetion (1932-2002), someday mentioned 'In God we trust, all other bring data'.

PROMOTING CREAIVITY IN LEARNING MATHEMATICS USING OPEN-ENDED PROBLEMS

Tatag Yuli Eko Siswono

Department of Mathematics, The State University of Surabaya
Jl. Ketintang, Surabaya, Jawa Timur 60231 – Indonesia
e-mail : tatagyes@yahoo.com

Abstract. *Recently, learning mathematics doesn't enough just find a solution of routine problems. Students should have skills and competence to solve non routine or open ended problems. Open ended problems can promote mathematical creativity, improve their understanding, and motivate students to develop their ideas. Creativity is an important point in education not only in mathematics because it is needed to solve daily problems. The rapidly changing of technological and a limited of natural resources encourage someone to be creative and no surrender in facing daily life. Therefore, it need a tool to practice and direct students especially in learning mathematics by problem solving of open ended problems. This paper will discuss a role of open ended problems to promote mathematical creativity and some example of problems.*

Keywords: *problem solving, open-ended problem, creativity*

1. Introduction

The National Curriculum (2006) stated that mathematics is given to all students from elementary school to carry through them among others to empower the creative thinking ability. Creativity is an important point in education not only in mathematics because it is needed to solve daily problems. The rapidly changing of technological and a limited of natural resources encourage someone to be creative to solve reality problems. Therefore, it need a tool to practice and direct students especially in learning mathematics by problem solving of open ended problems. Problem solving approach was a focus in mathematics teaching and learning that covered closed problems with one solution, open-ended problem with more one solution, and problem with various methods for solving (Content Standard of Mathematics Curriculum, 2006).

Traditional problems in mathematics teaching and learning have a common feature that one and only one correct answer. The problems are also well formulated and the correct answer one is unique. That is called “complete” or “closed” problems. This paper will discuss a role of open ended problems to promote mathematical creativity and some example of problems.

The importance of open-ended problems lies in the fact that they break the stereotype that every problem has one correct solution. They also enable each student to work on the same problem according to his or her abilities. However, the primary importance of problems of this kind lies in the fact that they can be used to learn various strategies and thus deepen the students' mathematical knowledge and develop their creative mathematical thinking.

2. Open-Ended Problems

In mathematics teaching and learning, we commonly accepted definition of a “problem” as one where thinking takes place when a person is confronted with a situation or a question that has no immediate solution and that the problem solver accepts the challenge to tackle it. That definition as said by Bell (1981) that a problem is a situation (a question or issue) which needs to be dealt with. Lester (1980) also stated a problem is a situation in which an individual or group is called upon to perform a task for which

there is no readily accessible algorithm which determines completely the method of solution. Then, problem solving is the set of actions taken to perform the task.

Bell (1981) suggested four characteristics of a problem. First, a person must become aware of a situation in order for it to be a problem for him or her. Second, she or he must recognize the fact that the situation requires some actions. Third, the person must either need to or want to act upon the situation and must actually take some action. Fourth, the resolution of the situation must not immediately obvious to the person who acts upon it. Another word, a situation or question becomes a problem for someone, if they have a previous or initial knowledge, it challenges them, and algorithm of the method of solution is not immediately obvious. We shall use these characteristics to indicate a situation (question or issue) related mathematics as a mathematics problem.

A mathematics problem in teaching and learning process is applied as a task to direct students developing mathematical skills. They could be classified as an open or closed problem. Pehkonen (2007) defined tasks are said to be open, if their starting or goal situation is not exactly given. Open is an opposite to closed, in the sense that a task is said to be closed, if the starting situation is exactly given, i.e. the task is well-defined, and if there is one certain result. In open tasks, pupils are given freedom, possibly even in the posing of the question, but at least in the solving of the task. In practice this means that they may end up with different, but equally correct solutions, depending on the additional choices made and the emphases placed during their solution processes. Therefore, open tasks usually have several correct answers.

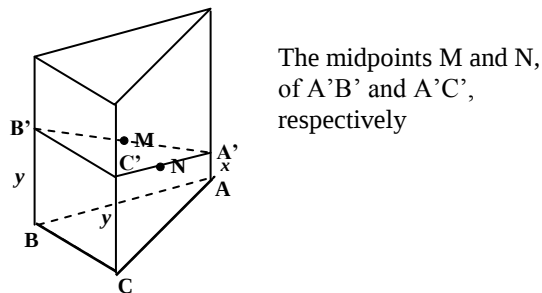
Ejersbo (2003) defines open problems in mathematics learning as: (1) the process is open, which means that you can choose different strategies to reach the goal; (2) the end-products are open, which means that you have several results to choose among; (3) the ways of formulation problems are open, which means that you make the question and tasks yourself. Based on it, we could conclude that open ended problem will have multiple possible answers that can be derived by multiple solution methods. The focus is not on the answer to the problem, but on the methods for arriving at an answer.

In open-ended problem solving, students are responsible for making many of the decisions that, in the past, have been the responsibility of teachers and textbooks. To decide which method, or procedure, to undertake to solve an open-ended problem, students will draw on their previous knowledge and experience with related problems. They might construct their own procedure, trying this and that, before arriving at a solution. Then, they will reflect on and explain to others problem-solving experience, tracing their thinking process and reviewing the strategies. This period of reflection deepens his/her understanding of the problem and helps to clarify their thinking about effective solution methods, and how the problem and methods he/she used relate to other problems or areas of mathematics.

The open-ended problems could be related with the context. de Lange (1987) supposed that the context problem serve both as a source for conceptual mathematization and as a field for application of mathematical concepts. For teaching and learning process, we think that a problem, including open-ended problem, has three roles. They enable as a motivation, a source for conceptualize of mathematics concept, and as a field of mathematics application. As a motivation actually we always use as introduction in teaching and learning process by explain about the importance of subject matter in daily life. As a source for conceptualize of mathematics, we might put a problem as starting point to straight forward students in constructing mathematics concepts. After students understand a mathematical concept, a teacher might extend students' understanding and broaden the relationship of mathematical concepts with other discipline by applying it for contextual problems. de Lange (1987) categorize the uses of context in a problem. They are three order context uses. First order context use if the context in this situation is only used to 'camouflage' the mathematical problem. For example is the frog in the well problem. "A frog is at the bottom of a 10 m well. Each day during the daylight hours the frog climbs up 3 m. At night when it is sleeping it slides back down 2 m. How many days does it take for the frog to get out of the well?". de Lange (1987) has given "the growth of bacteria" problem that is "the growth factor of a bacterium type is equivalent to 6 (per time-unit). At moment 0 there are 4 bacteria. Calculate the point in time when there will be 100 bacteria". Those problems are open-ended problem because students could use multiple strategies to solving them. Second order context use, if a problem is a lot open to the students but there is no conceptual mathematization although that problem related with a context. For example is given starfish growth picture and information: 1 July, 3; 2 July, 7; 4 July, 15; 5 July, 16; 6 July, 18; 7 July, 26, ext. Question: You see one starfish during twelve phases of its growth. Is there interval where growth is exponential? The second and first order context uses are not always distinguishable will be clear. Both are related with a context but they are different in uses. First order is just used commonly to find

mathematical problem and second order is used to construct a mathematical concept. Third order context use, if a problem is used to be a starting point for introducing the mathematical concept. For example is given an actual graph about the growth of aquatic plants (time in weeks). Question is “estimate by means of the graph after how many days there were about 20 m² plants?”. This problem is directed to construct a logarithm concept.

Actually, open-ended mathematics problem is not just related with daily context. We could develop only in mathematics field. As example “What is the next three numbers from the pattern 2, 4, 7? Explain your reasons”. We could classify level of problems based on the openness of problem. First level is a trivial open problem, if the problem just differs in representation and it is commonly recognized or taught in mathematics learning. It is just related with one mathematics concept. For example are “Solve the system of linear equation following” or “Give an expression of quadratics equation”. Those problems are open-ended but they are commonly recognized by students because it is taught in teaching and learning process by using substitution, elimination, or both. Second level is a lot open problem, if the problem sometimes related with “realistic” context and need multiple strategies to solve it or it has various solutions. The frog in the well problem could be an example for this level. Third level is actual open-ended problem, if the problem related with realistic context and it had different strategies or multiple right solutions. If its problem is natural mathematics context, it will connected with other mathematics subject/concepts and had multiple strategies and various solution. As an example is the water-flask problem by Becker and Shimada (1997). “Suppose that we have a water flask in the form of a triangular prism that is half full. The flask is tilted while one side of the base is fixed on a tabletop. Many quantitative or geometric relations involving various parts of the flask are implicit in this situation. Try to discover as many of them as possible and give the reason why such relation hold”.



The findings example of all students groups, such as: (1) $x+2y = k$ ($AA' + BB' + CC'$ is constant), (2) The total area of the side planes under the water level is constant, (3) the water surface passes through a fixed point, (4) the shape the water surface is always a triangle, (5) the areas of the two side faces are equal, (6) Each half of the decrease in AA' is added to BB' and CC' , respectively. Level of open-ended problem determined complexity of problem and the role of problem to assess the instructional goal including to promote creativity in mathematics.

3. Open-Ended Problem and Creativity in Learning Mathematics

The problem originally is used to evaluate students achievement of the higher-order thinking in mathematics education (Becker and Shimada, 1997). The higher-order thinking covered the critical thinking and creative thinking. So, an open-ended problem might be used to indicate students achievement in creative thinking or creativity in mathematics. Researchers at Japan's National Institute for Educational Research conducted a six-year research study that evaluated higher-order mathematical thinking using open-ended problems (problems with multiple correct answers). In a round-table review of the study, Sugiyama from Tokyo Gakugei University affirmed this approach as a means to allow students to experience the first stages of mathematical creativity (Mann, 2005).

Wilensky (1993) pointed that open ended activities are good activities, and allow for many different approaches and solutions. Open-ended activities encourage learners to pose their own problems and make conjectures as to what mathematical relationships obtain.

Klavir and Herkovitz (2007) also expressed that providing a relatively simple evaluation tool for open-ended mathematical assignments can help both teachers and students to evaluate the solutions and can serve as an important means for encouraging creative mathematical thinking.

Pehkonen (1997) explained that the theme “open-ended problems” has very near connections with creativity. In other time, he also said that internationally it is accepted that open-ended problems form a useful tool in the development of mathematics teaching in schools, in a way that emphasizes understanding and creativity. One way to provide pupils with such opportunities that stimulate higher-order thinking is to let them carry out investigations, especially open-ended investigations, where pupils pose the problem to be investigated and design their own procedures to answer the question (Pehkonen, 2007). Based on argument above, we could conclude that an open ended task (problem) enable promote student’s creative thinking or their creativity in mathematics. Then, what is the meaning of creativity in mathematics classroom?

Creativity in mathematics is different with characteristics creativity in arts or others discipline. Creativity in mathematics should involve characteristics and concepts of mathematics. If someone said that $\frac{1}{2} + \frac{1}{3} = \frac{2}{5}$, he/she is not creative; although it is a result of his/her original thought or it is unusual.

There are many definitions of creativity in the relevant literature. Bergstrom (in Pehkonen, 1997) explained that creativity is performance where the individual is producing something new and unpredictable. According Cropley (in Haylock, 1997) that creativity refers to a special kind of thinking or mental functioning, often called divergent thinking. In terms of teaching children in schools, Cropley leans that creativity is the capacity to get ideas, especially original, inventive, and novel ideas. Haylock suggested that Cropley approach of creativity is most prevalent in discussion about creativity in school mathematics. The focus is on identifying the kinds of thinking in mathematical tasks that qualify for description “creative”. To know who are creative, it uses divergent production tasks. In these tasks a student is given open-ended situation to which many possible responses may be made, so we can show divergent thinking in their response.

Some researchers have different approach to identify students’ creativity. Klavir & Hertzovitz (2007) analyze the indices of creativity in the spirit of Guilford and Torrance according to four components: Fluency – A person’s ability to extract a large number of solutions that meet the limitations of the assignment. Flexibility – A person’s ability to shift from one way of thinking to another and extract solutions that refer to different categories. Elaboration – A person’s ability to elaborate the given idea, add details to it, develop it by means of a combination of additional ideas, and/or refine it. Originality – A person’s ability to approach the given problem in a new and unique way and extract unexpected and unconventional solutions. In the mathematical context the fluency dimension can illuminate students’ amount of active and available knowledge with reference to a given mathematical task. The flexibility dimension can examine, as it does in the creativity test, the extent to which learners can shift from one state of thinking to another when solving open-ended mathematical problems. This dimension reflects the learners’ flexibility in utilizing a different mathematical principle every time, the numbers different mathematical properties, and so on. The third dimension, elaboration, can indicate complexity of mathematical thinking: more complex solutions reflect a more complex ability to integrate different pieces of mathematical knowledge. And finally, the fourth dimension, originality, examines creativity from the perspective of identifying what is unique in a particular student’s solution in comparison to the common and prevailing solutions among his or her peers. This dimension can serve as a criterion for student’s original mathematical thinking; their ability to attack an open-ended mathematical problem from new and unexpected angles.

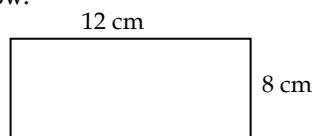
Silver (1997) adapted the Torrance Tests of Creative Thinking to assess the creative thinking of students. He just use the notion of fluency, flexibility, and novelty to applied in domain of mathematics. Problem posing and problem posing tasks have been used to identify creative individuals. In problem solving, students indicate fluency, if they could explore open-ended problems with many interpretations, solutions methods, or answer. Flexibility, if students solve (or express or justify) in one way, then in other ways. Students also discuss many solution methods. Novelty, if students examine many solution methods or answer (expression or justification), then generate another that is different. In problem posing, students indicate fluency if they generate many problems to be solved. Students also share their posed problems. Flexibility, if students pose problems that are solved in different ways or students use “what-if-not” approach to pose problems. Novelty, if students examine several posed problems, then pose a problem that is different. That indicators are appropriate to assess students’ creative thinking in mathematics

because they are suitable with mathematics characteristics and used by many mathematics researcher as identifying student creative performances. Elaboration indicator is not applied because it is covered in others indicator. Another reason because its definition of creativity emphasize to a product of creativity. This approach is applied by Siswono (2007) to develop the level of students creative thinking in problem solving and problem posing. There are five hierarchical levels of students' creative thinking in mathematics with different characteristic for each level. Characteristics based on the indicator of creative thinking (fluency, flexibility, and novelty). Fluency in problem solving refers to a student's ability to obtain various solutions of a problem. Fluency in problem posing refers to student's ability to pose various problems with a correct solution. Flexibility in problem solving refers to a student's ability to solve a problem using many different methods or ways. Flexibility in problem posing also refers to a student's ability to pose or construct problem with divergent solutions. Novelty in problem solving refers to the student's ability to solve a problem with many different solutions and correct answers, especially to find an original solution which is not common for that student's grades or their knowledge level. Some solutions are different if they have a different pattern or are not usual for student grades, such as students can construct a combination of other shapes. Novelty in problem posing refers to a student's ability to pose or construct the different problems with initial problem. The differences might be in contexts or concepts which are used in a problem.

The following is an example task to encourage student's creative thinking.

Area of Rectangle

It is given a rectangle in below.



- a. Construct polygons which their areas are equal with a rectangle above!
- b. Draw at least two another polygons which their area are equal with that rectangle!
- c. Look at one of your polygons. Show different strategies or methods to find your solution.
- d. Write at least two different problems which correlated with given rectangle and give your solutions.
- e. Based on your problems, is there a problem with multiple strategies to find the solution? If you have made it, show another different strategy to solve it. If there is no one a problem, construct another problem which it has multiple strategies or methods.

First question ask student to solve a problem about constructing polygons. If they can overcome the first question, it means they understand the problem solving procedures and show 'fluency'. Second question (item b) is an indicator to identify 'novelty' in problem solving and third question (item c) as indicator of flexibility in solving problem. Fourth and fifth questions are indicators of creativity in mathematics problem posing. Fourth question show indicator of fluency and novelty. Then, fifth question as indicator of flexibility in creating problems.

If that format of open-ended problem is always implemented in mathematics teaching, we believe that will give effect for increasing higher order thinking and understanding mathematical concepts. Based on my research, flexibility in posing and solving problems is difficult aspect to be increased. It might need an enough time to perform flexibility.

4. Summary

In teaching and learning mathematics, creativity still is not implemented or focused by teacher. Teacher do not keep attention to effort improving student's creative thinking. That is happened because some

reasons; first they do not realize that the Indonesian Curriculum (2006) for mathematics empowered the creative thinking ability. They just look at the content standard or subject matters. They think that all subject matter is compulsory finished and taught at recently semester. Therefore, their teaching process only emphasizes recognition or reinforcement. Second, they do not know about creativity in mathematics. Creative commonly related with art or poetry. They think commonly that mathematics and creativity is different perspective. Mathematics ask precisely and exactly in all aspect, but creativity is not logic and just intuition. Third, they do not know how to teach or manage their classroom so that encourage creative atmosphere. Fourth, they do not have a vision how their students future after learning at formal school and going back to real life. Because the national system of assessment just focused at routine problem and used technique paper and pencil test by multiple choice, then they just compassed that in teaching and learning process.

To overcome some problems, we must promote the importance of creativity in mathematics teaching and learning. We could apply an open-ended problem solving and prepare examples how to teach it in mathematics classroom. An open-ended problem request students to solve with multiple strategies or method, and the ended solution is various.

The open-ended problem should be taught step by step for pre-stage using first level problem. Student is given an opportunity to adapt this problem and started by mathematics simple problem. If it is enable, we could use a “camouflage” or realistic context. An open-ended problem could be ranked as level 1, level 2, and level 3. Level one is a trivial problem, and level two contain a lot open problem. Level two has multiple strategies or multiple solutions without both, but level three contain both features.

To promote mathematical creativity, students should be recognized by divergent (open-ended) problems with multiple strategies and various solutions. Teacher also is asked over to be creative in developing lesson plan and must learn to solve challenging mathematics problems.

References

- Becker, Jerry P., Shimada, Shigeru. 1997. *The Open-Ended Aproach: A New Proposal for Teaching Mathematics*. Reston, Virginia: NCTM, Inc.
- Bell, Frederich H. (1981). *Teaching and Learning Mathematics (In Secondary Schools)*. Dubuque, Iowa: C. Brown Company Publisher
- Content Standard of Mathematics Curriculum, 2006 (Standar Isi Kurikulum tahun 2006).
- de Lange Jzn, Jan. 1987. *Mathematics, Insight, and Meaning. Teaching, Learning, and Testing of Mathematics for the Life and Social Sciences*. Rijksuniversiteit Utrecht: Vakgroep Onderzoek Wiskundeonderwijs en Onderwijscomputercentrum
- Ejersbo, Lisser Rye. 2003. *How to Operate Using Mathematical Modelling and Open-Ended Tasks Within the Landscape of Investigations into in-Service Education*. Learning Lab Denmark
- Haylock, Derek. 1997. *Recognising Mathematical Creativity in Schoolchildren*. <http://www.fiz.karlsruhe.de/fiz/publications/zdm> ZDM Volum 29 (June 1997) Number 3. Electronic Edition ISSN 1615-679X. Download 6 Agustus 2002
- Lester, Frank K., Jr. 1980. Research on Mathematical Problem Solving. In *Research in Mathematics Education* edited by Richard J. Shumway. Reston, Virginia: the National Council of Teacher of Matematics (NCTM), Inc.
- Klavir, Rama., Herkovitz, Sarah. 2007. *Teaching and Evaluating ‘Open-Ended’ Problems*. www.cimt.plymouth.ac.uk/journal/klavir. Download 4 July 2008
- Mann, Eric Louis. 2005. *Mathematical Creativity and School Mathematics: Indicator of Mathematical Creativity in Middle School Students*. Dissertation of Doctor of Philosophy, University of Connecticut. <http://www.gifted.uconn.edu/siegle/Dissertation/EricMann.pdf>. Download 7 Mei 2007

- Pehkonen, Erkki. 1997. *The State-of-Art in Mathematical Creativity*. <http://www.fiz.karlsruhe.de/fiz/publications/zdm> ZDM Volum 29 (June 1997) Number 3. Electronic Edition ISSN 1615-679X. Download 6 Agustus 2002
- Pehkonen, Erkki. 2007. *Problem Solving in Mathematics Education in Finland*. www.unige.ch/math/EnsMath/Rome2008/WG2/Papers/PEHKON. Download 6 July 2008
- Silver, Edward A. 1997. *Fostering Creativity through Instruction Rich in Mathematical Problem Solving and Thinking in Problem Posing*. <http://www.fiz.karlsruhe.de/fiz/publications/zdm> ZDM Volum 29 (June 1997) Number 3. Electronic Edition ISSN 1615-679X. Download 6 Agustus 2002
- Siswono, Tatag Y. E. 2007. *Penjenjangan Kemampuan Berpikir Kreatif dan Identifikasi Tahap Berpikir Kreatif Siswa dalam Memecahkan dan Mengajukan Masalah Matematika*. Disertasion of Doctor of Mathematics Education, Surabaya State University, Surabaya.
- Wilensky, Uriel Joseph. 1993. *Connected Mathematics-Building Concrete Relationship with Mathematical Knowledge*. Dissertation of Doctor of Philosophy, Massachusetts Institute of Technology

ISBN 979-19256-0-0

