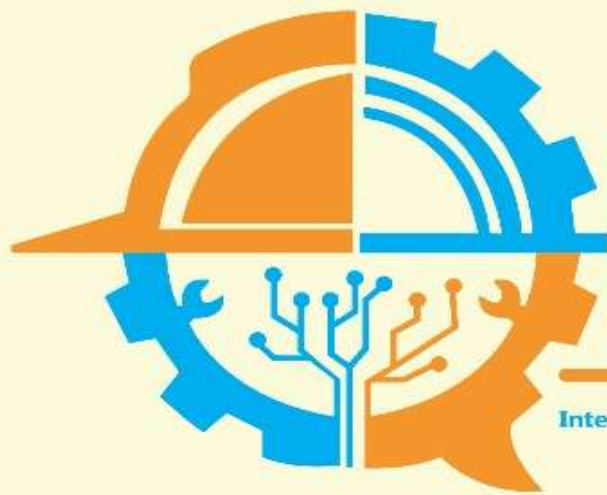


# PROGRAMME BOOK



# 2019

# IC2SE

International Conference on Computer Science and Engineering

## Proceedings International Conference on Computer Science and Engineering

**INDUSTRIAL REVOLUTION 4.0  
OPPORTUNITIES & CHALLENGES**

**26-27 April 2019  
UPI Convention Center,  
Universitas Putra Indonesia "YPTK"  
Padang, Indonesia**

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## DETAILS SESSION PROGRAMME

**Friday, 26<sup>th</sup> April 2019**

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Paper ID	Title of Paper	Author
2	Exploring the interaction's quality attributes of Mobile Government services	Abdulla Jaafar Mohamed, Mohd Khalit Bin Othman, Suraya Binti Hamid
6	Design of Bicycle's Speed Measurement System Using Hall Effect Sensor	Ratna Aisuwarya, Muhammad Azmi Riyan, Rahmi Eka Putri
54	Prediction of Corn Productivity in Indonesia as Anticipation Efforts to Import Using Backpropagation Neural Network	Anjar Wanto, Dedy Hartama, Risma Nurhaini Munthe, Pawer Darasa Panjaitan, Elfina Okto Posmaida Damanik, Agus Perdana Windarto
22	The Framework Accommodation of Systems Recommendation Via Social Media	Doni Ariyanto, Lukito Edi Nugroho, Adhistya Erna Permanasari
37	Practicality of E-Learning as Learning Media in Digital Simulation Subjects at Vocational School in Padang	Monica Fransisca, Yuliawati Yunus, Aminda Dewi Sutiasih, Renny Permata Saputri
Session 2, 04.00 – 05.30 pm Room 1, Ground Floor Session Chair : Billy Hendrik		
Paper ID	Title of Paper	Author
58	Designing a Multimodal Graph System to Support Non-Visual Interpretation of Graphical Information	Deni Setiawan, Bagus Priambodo, Mila Desi Anasanti, Al Hamidy Hazidar, Emil Naf'an, Inge Handriani, Asama Kudr Nseaf, Zico Pratama Putra
42	Breast cancer classification using digital biopsy histopathology images through transfer learning	Ghulam Murtaza, Liyana Shuib, Ainuddin Wahid Abdul Wahab, Ghulam Mujtaba, Ghulam Mujtaba, Ghulam Raza, Nor Aniza Azmi
49	Enhancement of OTP Stream Cipher Algorithm Based on Bit Separation	Arisman, Mahyuddin K M Nasution, Syahril Efendi
53	Online Management System of Praktik Lapangan Kerja (PLK) UPI YPTK Padang	Astri Indah Juwita, Muhammad Ikhlas
60	Implementation and Design User Interface Layout Use Leap Motion Controller with Hand Gesture Recognition	Billy Hendrik, Fauziah, Mardhiah Masril, Yunan Fauzi Wijaya, Silfia Andini.

Session 1, 1.30 – 03.30 pm Room 2, Ground Floor Session Chair : Associate Professor Dr. Maizatul Akmar Ismail		
Paper ID	Title of Paper	Author
12	Supplier Selection by Using Analytical Hierarchy Process (AHP) and Techniques for Order Preference Methods with Similarities to Ideal Solutions (TOPSIS)	Ikhsan Siregar
39	Prediction of Canal Erosion on Tidal Swamp Delta Telang I, Banyuasin Regency, South Sumatra	Achmad Syarifudin, Henggar Risa Destania, Yunan Hamdani
64	Disaster risk management strategy in the environment and disaster mitigation-based school (SWALIBA)	Sindhung Wardana , Herdis Herdiansyah , Adam Wicaksono
68	Smart IoT Flood Monitoring System	Shahirah Binti Zahir, Phaklen Ehkan, Thennarasan Sabapathy, Muzammil Jusoh and Mohd Nasrun Osman, Mohd Najib Yasin, Yasmin Abdul Wahab, Hambali and N. Ali, A.S. Bakhit, F. Husin, M.K.Md.Kamil and R. Jamaludin
73	Shallow Well Water Salinity Viewed from Distance Of Well To CoastLine And Ground Water Level Elevation In Purus Padang Village	M Chairi, W Purba, W Boy, R Imani, J Melasari
54	A Flexible UWB Antenna for 5G Applications	Syuhaimi Kassim, Hasliza A Rahim, MohammedFareq AbdulMalek, Soh Ping Jack, Muzammil Jusoh, Wee Fwen Hoon, Nur Syahidah Sabil, Nurulisma Ismail
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Paper ID	Title of Paper	Author
75	Face Recognition and Age Estimation Implications of Changes in Facial Features: A Critical Review Study	Rasha Ragheb Atallah, Amirrudin Kamsin, Maizatul Akmar Ismail
81	Standard Operational Procedure Fund Distribution System of Zakat Infaq and Shodaqah for Zakat Foundations	Inge Handriani, Bagus Priambodo, Al Hamidy Hazidar , Mardhiah Masril, Zico Pratama Putra , Asama Kudr Nseaf, Emil Naf'an
77	Automatic System to Fish Feeder and Water Turbidity Detector Using Arduino Mega	H Hendri , S Enggari , Mardison , M R Putra, L N

67	The Application of Data Mining in Determining Patterns of Interest of High School Graduates	Dedy Hartama, Agus Perdana Windarto, Anjar Wanto
36	Model Development Measurement of Interests Based on Expert System	Erdisna, Ganefri, Ridwan, Rice Novita, Wanayumini

Session 1, 1.30 – 03.30 pm Room 3, Ground Floor Session Chair : Halifia Hendri		
Paper ID	Title of Paper	Author
43	Bandit algorithms in information retrieval evaluation and ranking	Sinyinda Muwanei, Hoo Wai Lam, Sri Devi Ravana, Douglas Kunda
38	Analysis of Multiple Channel Multiple Phase System for Priorities Queuing Model (N-P) with Simple Adaptive Weighting	Herman Putra Rajagukguk, Muhammad Zarlis, Sutarnan
28	Application Of Ahp Analysis To Increase Employee Career Paths In Decision Support Systems	Julius Santony, Faisal Amir, Sumijan, Rice Novita
23	Text Mining For Hotel Classification Using Naïve Bayes Algorithm	Ahmad Afif, Lukito Edi Nugroho , Adhistya Erna Permatasari
79	Design Of Expert System For Diagnosis Damage Computer Hardware	Retno Devita, Eva Rianti , Sri Rahmawati
Session 2, 04.00 – 05.30 pm Room 3 Ground Floor Session Chair : Dr. Azah Anir Norman		
Paper ID	Title of Paper	Author
19	Electronic Health Cloud as Service to Improve Collaboration in Healthcare Organizations	Shady Gomaa Abdulaziz, Norizan Mohd Yasin, Zeinab AlGamal, Asmaa Hateem and Kalaimagal Ramakrishnan
35	Expert Systems Diagnosing Of Banana Pests And Diseases Use Case-Based Reasoning Method With Android	Hezy Kurnia, Vicky Ariandi, Heriyanto, Yesri Elva
11	Technology Acceptance Among Older Adults With Mild Cognitive Impairment	Nita Rosa Damayanti, Nazlena Mohamad Ali, Ely Salwana Mat Surin



<b>1</b>	Decision Support System In Determining Structural Position Mutations Using The Simple Additive Weighting (Saw) Method	Aulia Fitrul Hadi, Randy Permana, Havid Syafwan
<b>21</b>	Design Chipless Textile Tag For RFID Application	Mirza Anuar, Lee Yeng Seng, M. S. Shakhirul, F.H. Wee, Hong Seng Gan, Muzammil Jusoh, Thennarasan Sabapathy, M.N. Osman

<b>Session 1, 1.30 – 03.30 pm</b> <b>Room 4, Ground Floor</b> <b>Session Chair : Dr. Norizan Mohd Yasin</b>		
Paper ID	Title of Paper	Author
<b>03</b>	A comparative analysis of detection mechanisms for emotion detection	Vimala , Marian Cynthia Martin, Wandeep Kaur, Amir Javed
<b>55</b>	Determination of the Shortest Route Towards the Tourist Destination Area Using the Ant Algorithm	Ni Luh Wiwik Sri Rahayu Ginantra , T , Gita Widi Bhawika , Ida Bagus Ary Indra Iswara , Anjar Wanto
<b>18</b>	Multiple Thresholding Methods For Extracting & Measuring Human Brain And 3d Reconstruction	Sumijan , Pradani Ayu Widya Purnama , Syafri Arlis
<b>44</b>	A Comparative Review of ISMS Implementation Based on ISO 27000 Series in Organizations of Different Business Sectors	Zaidatulnajla Hamdi , Azah Anir Norman , Nurul Nuha Abdul Molok
<b>85</b>	Improving the modelling of Robot Bunker with camera	Emil Naf'an , Riza Sulaiman , Nazlena Mohamad Ali , Bagus Priambodo , Al Hamidy Hazidar , Asama Kudr Nseaf , Zico Pratama Putra , Harry Theozard Fikri, Inge Handriani
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Paper ID	Title of Paper	Author
<b>66</b>	The Impact Analysis Of Flood Disaster In DKI Jakarta: Prevention And Control Perspective	Adam Wicaksono, Herdis Herdiansyah
<b>08</b>	Minimization of Palm Oil Losses on Sterilization Process by Optimization Boiling Pressure and Boiling time	Wetri Febrina , Yusrizal

13	Application of Theory of Constraints in Bottleneck Work Stations Optimization	Ikhsan Siregar
30	Designing Engineering Data Management System in Research and Development Company	Muhammad Nur, Luciana Andrawina
31	Risk Assesment of Housing Reconstruction Project Community-Based Construction after The Earthquake	Wendi Boy, Rafki Imani , Mayozi Chari
48	Industrial Revolution 4.2 Oppourtunity Challenges and Way Forward	Erry Yulian T. Adesta, Rudi Kurniawan Arief

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**Room 5, Ground Floor**  
**Session Chair : Dr. Nor Liyana Shuib**

Paper ID	Title of Paper	Author
46	How Online Media and Technology Inovation Influence Consumer's Purchase Intention	Sitti Rizki Mulyani , Larissa Navia Rani , Dharma Syahrullah Ekajaya , Marta Widian Sari , Vivi Nila Sari
47	Development Database E-Costal For Fishermen's Assistance Program At Terengganu	Dara Aisyah Ali Puteh, Al Hamidy Hazidar , Muhammad Sontang Sihotang
52	Assessment for Seismic Activities in Pesisir Selatan West Sumatra in 2018	R Imani , W Boy , U Dewi , A Sari , W Purba , M Chairi, J Melasari
41	Interactive Map Model of Flat Design for Istano Basa Pagaruyung Tourism Development	T Wiraseptya , R Imani , H Yanto
29	Behavioural Intention to Use MYOB Accounting Aplication Among Accounting Students	Dwi Fitri Puspa, Desi Ilona, Zaitul

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**Session Chair : Dr. Vimala Balakrishnan**

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17	The utilization of learning analytics to develop student engagement model in learning management system	Shahrul Nizam, Suraya Hamid , Haruna Chiroma

57	Backpropagation Neural Network Prediction For Cryptocurrency Bitcoin Prices	Rini Sovia, Musli Yanto ,Arif Budiman
62	Control System Of Microcontroller Based Automatic Milk Coffe Drink	Nofriadi ,Herman Saputra ,Juna Eska , Adi Prijuna , Nuriadi Manurung
24	Factors Influencing The Use Of M-Government Services From The Citizens' Perspective: Examining The Characteristics Of Adopters And Non-Adopters	J. Al-awj , N. Yasin , M. Khalit , S. Al-ammari ,N Kassim
98	Expert System For Disease Diagnosis In Cocoa Plant Using Android-Based Forward Chaining Method	Vicky Ariandi, Hezy Kurnia, Heriyanto, Hilda Mary
20	The Design of Sharia Housing Application In Padang City with CRM Concept	Hadi Syahputra, Raja Ayu Mahessya, Annisak Izzaty Jamhur, Ikhsan

Session 1, 1.30 – 03.30 pm Room 6, Ground Floor Session Chair: Dr. Suraya Hamid		
Paper ID	Title of Paper	Author
27	Social Entrepreneurship Learning Model in Higher Education using Social Network Analysis	Muhammad Hamirul Hamizan Roslan, Suraya Hamid, Mohamad Taha Ijab, Sarah Bukhari
14	Media Effectivity e- module Of Object-Oriented Programming II Based On Problem Based Instruction (PBI) Informatics Engineering Education Program, University Of Putra Indonesia YPTK Padang	Yulawati Yunus, Silky Safira, Monica Fransisca, Renny Permata Saputri, Aminda Dewi Sutiasih
61	Towards Data-driven Education with Learning Analytics for Educator 4.0	Salimah Mokhtar, Jawad A. Q., Ghassan O. A. Shahin
76	The Understanding of Lecturers about The New Literacy in Industrial Revolution Era 4.0: A Study case of University of Putra Indonesia YPTK Padang	Muharika Dewi, Yulia Retno Sari, Shally Amna, Rasmita, Rina Susanti
80	Impact of Learning Motivation, Cognitive and Self-Efficacy in Improving the Quality of Online Learning in the Industrial Age 4.0	Ramdani Bayu Putra, Elfiswandi, Muhammad, Sitti Rizki Mulyani , Dharma Syahrullah Ekajaya, Rio Andhika Putra

Session 2, 04.00 – 05.30 pm Room 6 Ground Floor Session Chair: Dr. Hoo Wai Lam		
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26	The Impact of Age, Gender, and Educational level on the Cybersecurity Behaviors of Tertiary Institution Students: An Empirical investigation on Malaysian Universities	F B Fatokun, Suraya Hamid, Azah Anir Norman, J O Fatokun
77	Automatic System to Fish Feeder and Water Turbidity Detector Using Arduino Mega	Halifia Hendri, Sofika Enggari, Mardison, Muhammad Reza Putra Larissa N Rani
32	Digital Medical data protection compliance among medical staffs	Uning Pratimaratri, Desi Ilona, Zaitul
16	Internet of Things in Monitoring and Notification of Industrial Security Systems	Alkhairunas Riyuska, Julius Santony, Sumijan
15	Identification of Variables in Predicting Trends in Social Entrepreneurship	Nur Azreen Zulkefly, Norjihhan Abdul Ghani, Wajdi Alquliti
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25	A Socio-Technical Mitigation Effort to Combat Cyber Propaganda: A Systematic Literature Mapping	Aimi Nadrah Maseri, Azah Anir Norman
70	Application Of Promotion, Map And Existing Tourism Information Systems In Solok Selatan District Using Androidjava Programming Language	Hari Marfalino, Larissa Navia Rani, Mardison, Ichsan Pribadi
10	The Kindness Behavior Management in Kindness Service Application Using Tree Structure	Luxfy Roya , Lukito Edi Nugroho , Adhistya Erna Permatasari
82	Expert System and Rule-Based Knowledge Based in Analyzing Vitamin Deficiency in the Human Body	Ruri Hartika Zain, Elmi Rahmawati
59	Predicting GDP of Indonesia Using K-Nearest Neighbour Regression	Bagus Priambodo, Sarwati Rahayu , Ahmad , Al Hamidy Hazidar , Emil , Mardhiah masril , Inge , Zico Pratama Putra , Asama Kudr Nseaf , Deni Setiawan
Session 2, 04.00 – 05.30 pm Room 7 Ground Floor Session Chair : Dr. Suraya Hamid		

Paper ID	Title of Paper	Author
5	Prediction of Malaysian stock market movement using sentiment analysis	Low Cheng Kuan ,Maizatul Akmar Ismail , Tasnim M. A. Zayet , Shuhaida Mohamed
56	Decision Support System For Mapping Types Of Timber And Number Of Products For Furniture Handling In The Main Work Service Using Ahp (Analytical Hierarki Process) Method In Increasing The Profits Of Production	Firdaus , Ade Saputra , Mondra Neldi , Ritna ,Novia Yolanda , Usman
80	Impact of Learning Motivation, Cognitive and Self-Efficacy in Improving Learning Quality Elearning in Industrial Era 4.0	Ramdani Bayu Putra, Elfiswandi , Muhammad Ridwan , Sitti Rizki Mulyani , Dharma Syahrullah Ekajaya , Rio Andhika Putra
50	Convergence Analysis of Acceleration and Generalization of E-Learning in the Manifestation of Globalization Education Readiness 4.0	Sitti Rizki Mulyani, Agung Ramadhanu , Desi Permata Sari , Rahmatul Husna Arsyah , Neni Sri Wahyuni Nengsih
97	Expert System Of Intrauterine Insemination	Firna Yenila, Yogi Wiyandra

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7	Exploring Topic Difficulty in Information Retrieval Systems Evaluation	Wei Ting Pang , Prabha Rajagopal , Mengjia Wang , Shuxiang Zhang , Sri Devi Ravana
71	The Effect of Lego Mindstorms as innovative educational tool: To develop students' creativity skills for Creative Society.	Mardhiah Masril , Billy Hendrik , Harry Theozard Fikri, Al Hamidy Hazidar , Bagus Priambodo , Emil Naf'an , Inge Handriani, Zico Pratama Putra , Asama Kudr Nseaf
78	Learning Satisfaction Analysis of Online Learning Readiness with Learning Culture and Character Strength as Antecedent Variables	Agung Ramadhanu , Ramdani Bayu Putra, Hadi, Rahmatul Husna Arsyah , Desi Permata Sari
33	Technology Context and Social Media Adoption Among Small-Medium Enterprise	Desi Ilona, Zerni Melmusi , Hanna Pratiwi, Padang, Indonesia), Zaitul
34	Statistical Software Adoption Behaviour Among Undergraduate Students	Zaitul , Sitti Rizki Mulyani , Muhammad Ridwan , Desi Ilona



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04	Startup Learning Path (SLP): A Learning Model for Startup Employees Using Agile Learning Approach	Egi Endeska Putra, Ridi Ferdiana, Rudy Hartanto
84	Fuzzy Logic Applications To Predict Total Production PKO (Palm Kernel Oil) In PT AAI Pasaman Method Using Web Based Tsukamoto	Devia Kartika, Mutiana Pratiwi, Rima Liana Gema
51	Strengthening Character Education with the Implementation of Machine Learning in the Millennial Era Industrial Revolution 4.0	Ulya Ilhami Arsyah , Rahmatul Husna Arsyah , Mutiana Pratiwi , Novia Lestari
83	Analysis of the Factors Affecting the Quality of Palm Oil Using the Analytical Hierarchy Process Method	Nugraha Rahmansyah , Shary Armonitha Lusinia, Rima Liana Gema
95	Analysis Of Electronically Reconfigurable Beam Steering Antenna Array Using Phase Shifter Technique	Soh Jen Neei, Muzammil Jusoh, Thennarasan Sabapathy, Samir Salem Al-Bawri, M.N. Yaasin, Tariq Abd Latif, Mahmud A. M. Albreem
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86	A Compact MIMO Planar Inverted-F Antenna	Najwa , Mohamed Nasrun Osman , Muzammil , Thennarasan Sabapathy, Thennarasan Sabapathy , M.M. Azizan, Tarmizi Ali
87	Transparent Encryption Technique for Trusted Computing	Gushelmi, Abdullah Mohd Zin
89	University Student Satisfaction Analysis on Academic Services by Using Decision Tree C4.5 Algorithm (Case Study : Universitas Putra Indonesia “YPTK” Padang)	Febri Aldi, Anita Ade Rahma
90	Analysis System of Occupational Health and Safety In coal Underground Mining	Heri Prabowo, I Prengki, A Amran
91	OLAP Approach in Searching Manufacturing Industries in West Sumatera	Eka Praja Wiyata Mandal, Dewi Eka Putri, Dede Wira Trise Putra, Dio Prima Mulya
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<b>Paper ID</b>	<b>Title of Paper</b>	<b>Author</b>
<b>92</b>	Setiment Analysis And Opinion Mining On Tax	Nurul Misyani Binti Mohd Rafie, Kasturi Dewi Varathan, Mohammad Shafenoer Amin
<b>93</b>	Model Of Artificial Neural Networks In Predictions Of Corn Productivity In An Effort To Overcome Imports In Indonesia	Anjar Wanto, Dedy Hartama, Gita Widi Bhawika, Deswidya Sukrisna Hutauruk, Pinondang Hotria Siregar, Ricard Fredrik Marpaung, Salim Efendi, Rusmin Saragih, Imeldawaty Gultom, Agus Perdana Windarto
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# The Effect of Lego Mindstorms as an Innovative Educational Tool to Develop Students' Creativity Skills for a Creative Society

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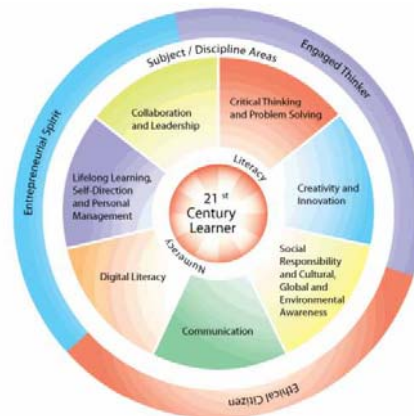
**Abstract.** Creativity is a very important skill that should be possessed by the human resources of a country, especially in this period of the 21st century. Human creativity must be stimulated from various things, including via the field of education to improve the quality of human resources. The goal of this study was to investigate the impact of Lego Mindstorms as learning tools to improve the creativity skills of students, using an experimental methodology. We used a random sampling technique to select 40 students as the sample (N=40) for the study, with age ranging 10-12 years old; the sample was divided 2 groups, 20 students were assigned to the control groups, while the other 20 students formed the experimental groups. The student's creativity skills were taken from a figural creativity test (TKF). This test was conducted before the intervention (pretest) and after the intervention program (posttest). In the intervention program, the experimental group students were given some education about robotic technology via the use of the Lego Mindstorms tools. To analyze the test results, we utilized the Statistical Product and Service Solutions package. The finding showed that there are significant differences between the creativity scores of students in the experimental group and the creativity scores of the control group. The Lego Mindstorms influences the enhancement of student's creativity of around 23.6% in the experimental groups.

## 1. Introduction

In the recent years, robotic technology has been of great interest of exploration by many researches, because as a new technology it is very useful to the human live. Robotics technology has also influenced several developments in the sector of education; hence, educational Robotics is a field of study that aims to improve the learning experience of people [1], some scholars have also ascertained that robotics education is an appropriate and meaningful learning opportunity for children [2]. Furthermore, the use of robotics technology as an educational tool is considered to have a positive impact on students in the form of increasing so many skills such as creativity; that robots can be a tool that can enhance the skills of



children [3]. Researchers have identified new challenges and trends focusing on the use of robotic technologies as a tool that will support creativity and other 21<sup>st</sup>-century learner [4] [5]. Figure 1 shows the important skills in the 21<sup>st</sup>-century learner [4].



**Figure 1.** The Important Skills in 21<sup>st</sup> Century Learner [4]

Based on figure 1, creativity is a very important skill to have and develop in the 21st century. Creativity has been defined in different and numerous ways; also some skills can be developed by creativity, some of which are: divergent thinking ability, having a vast knowledge, communication with other people, as well as personal capacity for critical analysis [6]. Comprehensively, creative thinking has been defined as the thinking that enables students to apply their imagination to generating ideas, questions and hypotheses, to experiment with alternatives and to evaluate their own ideas as well as that of their peers' ideas, final products and processes [7].

Many researchers support robotics as an educational tool, hence, one of the most interesting robotics technologies that can be used as an educational tool is the Lego Mindstorms kit, due to reason being that it can develop many skills of students. Lego Mindstorms can improve students' problem solving and algorithmic skills [8]. More so, a robotic system can bring the possibility of transmitting to children, the basics of technology and helping to give them other kind of human and organizational values. With robotics the students can have a different opportunity for developing their logical ability and their creativity, features at the base of reasoning and critical thought [9]. It has also being discovered that students who studied about robotics, have attained greater metacognitive and problem-solving skills [10].

Furthermore, Lego-based Robotics can allow students to develop different solutions to the same problem, in a bid to provide a learning community [11]. Lego Mindstorms robots has been used to further develop learners to "think out of the box", firstly to further reinforce fundamental computer programming concepts that had been partially developed. Secondly it has been used to increase the interaction between learners and generate higher motivation and interest in computer programming, improve their problem solving or algorithmic skills, simulate creative thought and develop critical thinking, collaborate with peers and learn socially and motivate them to achieve and become creative in their thinking [12]. Lego Mindstorms also gives a positive effect to student's creative problem-solving skills and their post-education performance [13]. Interestingly, the application of Lego Dacta in central Sweden has been able to give a positive effect on students' performance in mathematics [14]. Hence, using robotics and Lego Mindstorms, can also increase the ability of students in physics and in the design of engineering concepts [15], as well as increase the ability of students in the STEM concept [5] [16] [17].

Although many studies have been done on the effect of Lego Mindstorms as an educational tool for creativity skills, more studies still need to be conducted, especially in the aspect of measuring the effects of Lego Mindstorms on creativity with standardized measuring instruments.

The purpose of this study was to investigate the effect of Lego Mindstorms as an educational tool for the creativity skill of students. The results of this study may provide some vital suggestions to the educational sectors, to be able to involve innovative technology in educational processes, so that they can stimulate and develop the personal skills of students.

## **2. Method**

### *2.1 Participant*

The participant in this study were 40 elementary school students (N=40) with age range 10-12 years old from private elementary schools; the selection of schools and students was done by random sampling techniques.

### *2.2 Instruments*

Creativity of students was measured by a Figural Creativity Test (TKF). The Figural Creativity Test (TKF) is an adaptation of the Circle Test made by Torrance, which was then standardized in 1988. The creativity measured in TKF provides an understanding of the ability to form new combinations of given elements reflected in the fluency, flexibility, originality, and elaboration. Some elements that determine the figural creativity of students is also present in literature [18], [19], [20], [21].

### *2.3 Procedure*

The study employed an experimental methodology, wherein a pre-test and post-test repeated measures was designed with a control group, to know the creativity of students before and after the intervention of Lego Mindstorms as a learning tool. Hence, the procedure in this study was divided into 3 phases:

1. The first phase is the pre-test, this step was used to determine the creativity of the students (control group and experimental group) before the intervention. On the TKF, the total score was calculated from the number of characteristics that appeared on each student's answer. Implementation of the figural creativity test involves three steps. In the first step, the students were asked to create an image of a pattern that has a predetermined pattern in a circle. For the second step, students were asked to complete an image based on the pattern that has been provided. With regards to the third step, students were asked to create an image which varies as much as possible and within 10 minutes it should have been determined using a circular pattern that has been given [22].
2. The second phase was an intervention, as such, the experimental groups were given the intervention in the form of learning about robotics technology by using the Lego Mindstorms Tool in four meetings with the duration of each meeting lasting for about 3 hours.
3. The Last phase is the post-test, in this phase, the same pre-test instruments were administered to the students, as this step aims to know the figural creativity of students after the intervention (control group and experimental group).

### *2.4 Intervention*

This section describes the activities that was developed with children about the subject of robotics technology by using Lego Mindstorms. This intervention was done in four meetings.



**Table 1.** Learning Robotics Technology with Lego Mindstorms Schedule

Meetings	Activities	Duration
1	Introduction about robotic technology, specially about Lego Mindstorms, explanation about materials and equipment	2h.30min
2	Introduction about mobile robot, Create Tracker Tank Bot	3h.10min
3	The robots based on student's creations	3h.25min
4	Develop student's creations robot for competition	3h.

The meeting began with the quest for the students to make groups and sit in a circle, the students listened to an introduction about the materials of the robotics technology, via an audio visual media; the activity gave a deeper knowledge about robotics technology and the control system of a robot. The explanation was furthered to the Lego Mindstorms, which was the experiment tool used in this study. This activity was given so that students can distinguish and know the function of each Lego Mindstorms kit based on shape and colour. Lego Mindstorms is an assembly kit that contains building block pieces (construction kits) and a programmable control unit that can enable one to build a number of robots [8] [23][24]. This kit includes all the important components needed to build a robot, such as connectors, axle, busing, beams, frames, tubes, gears, belts, shafts, wheel, motors, sensors, and control center.

Control center in Lego Mindstorms is the Brick. The Brick can send a programme to the motors, receive information from sensors, among other functions. Additionally, the Lego Mindstorms consist of a large motor and a medium one as an actuator. It also comprises of different sensors: the colour sensor, ultrasonic sensor, touch sensor, infrared sensor, gyro sensor, and the temperature sensor. This description was accompanied by displaying each of the components.

**Figure 2.** Teacher explanation about the components of Lego Mindstorms

After introducing the Lego Mindstorms kits and the students were able to understand about the function of each components in the first meeting; the second meeting however focused on the explanation about the mobile robot, also in this meeting, the robot development project commenced. The students were able to get new experiences with the robotic lesson via thee medium of Lego Mindstorms. The projects achieved by the students were, the making of a tracker tank bot, as the students were adequately taught on how to design, construct, build and control a robot.



**Figure 3.** Students make tracker tank bot

In the third meeting, the students were asked to make robots based on their own creations in groups, which was aimed at hoping to improve their skills in creating a new way, creating a new thing, collaboration, teamwork, listening to the opinions of friends in one team, expanding, imagination, as well as modifying.

After that, the students were asked to give presentations on the explanation of the robot they had created, some of which included, the means by which such robots can interact with the environment, and the benefits of their robot. This activity was aimed at stimulating the students' skills to speak in public, convey ideas, learn how to deal with problems, as well as how to make up a story.



**Figure 4.** Students explain their robot

In the last meeting, students were asked to develop their robot and to get prepared to compete with other teams. This activity was aimed at stimulating their teamwork, fluency in thinking, and decision making.



**Figure 5.** Robot competition

### 3. Results

To analyse the results of this study, statistical analyses were done by using the Statistical Product and Service Solutions. The result of the descriptive statistics for the figural creativity test (pre-test) is presented in table 2.

**Table 2.** Descriptive Statistic Creativity of Students in pretest

Experimental Group (N=20)		Control Group (N=20)	
Pretest		Pretest	
M	SD	M	SD
94.95	7.584	94.35	5.696

Table 2 shows that the mean values for creativity on the pre-test, that is the experimental group ( $M = 94.95$ ;  $SD=7.58$ ), and control group ( $M =94.35$ ;  $SD = 5.69$ ), were not significantly different from the mean values on the pre-test.

The next analysis was carried out to find out whether there was a change in the value regarding the creativity of students after the intervention, especially in the experimental group. In accomplishing this, a paired sample test analysis was carried out, and the results of this analysis can be seen in Table 3.

**Table 3.** Paired Samples Test

Group	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre-test Experimental – Post-test Experimental	-22.400	9.098	2.034	-26.658	-18.142	-11.010	19	.000
Pre-test Control – Post-test Control	-9.250	9.547	2.135	-13.718	-4.782	-4.333	19	.000

According to the sig. (2-tailed) value from table 3, the experimental group (sig.2-tailed = .000,  $p < .05$ ); it can be concluded that there were significant differences between the mean values of the students' creativity before (pre-test) and after (post-test) the intervention. For the control group (sig.2-tailed = .000,  $p < .05$ ), it can be concluded that there were also differences between the mean values of students' creativity in the pre-test and post-test. Because both of the group have same sig.2-tailed values, table 4 shown more descriptive statistic details.

**Table 4.** Descriptive Statistic Creativity of Students in pre-test and post-test

Experimental Group (N=20)				Control Group (N=20)			
Pre-test		Post-test		Pre-test		Post-test	
M	SD	M	SD	M	SD	M	SD
94.95	7.584	117.35	9.320	94.35	5.696	103.60	8.120

Based on table 4 shows that the mean values for creativity of the post-test, as given thus: experimental group (M = 117.35; SD=9.320), and the control group (M = 103.60; SD = 8.120), were significantly different from the mean values of the pre-test.

$$\text{Different value} = \frac{\text{Mean posttest} - \text{Mean pretest}}{\text{Mean pretest}} \times 100\%$$

The creativity of students after getting the intervention of Lego Mindstorms, which was used as an innovative educational tool in the experimental group, increased to 23.6%, but the creativity of students in the control group, that is the group where students did not get any intervention only increased to 9.8%. The intervention had an important impact on the creativity of the students, and there was a great significant difference between the experimental group and control group, with a higher increase of creativity in the experimental group.

#### 4. Conclusion and Discussion

Based on the result of this study, integrating technology in the education sector, especially robotics technology has been able to provide a positive impact on students. It has been proved by introducing students to the robotics technology through Lego Mindstorms as an educational tool, to stimulate the creativity of students; of which in the experimental group, creativity had a significant increase of 23.6%.

This is consistent with several studies that have been done before such as the works of Ahmad Khanlari in 2013, where it was revealed that robotics improves some of the students' skills, such as creativity, critical thinking, team work and collaboration skills, self-confidence, sociality, and tendency to help others. The results of the study also reveals that robotics has a great impact on the 21<sup>st</sup> century skills [25], hence, educational robotics is an all-in-one technological learning tool that promotes the future success of the students [5], also, robotics is one way of fun learning that can make students think more creatively in creating something new [26]. Therefore, robot can be used by children as a tool to boost new ideas and stimulate their creativity [27], based on the potentials of educational robotics which has been acknowledged earlier, in particular, the potential to facilitate curiosity and creativity [28].

The ability to come up with creative new ideas are of extraordinary importance to cultural development and the progress of human civilization [29]. Thus, if the individual creative skills that will impact personal quality is getting better, and if there are a lot of creative individuals, it will make the quality of human resources in a country to be better; also the formation of a creative society will improve the competitiveness of a country. A creative society can help in providing a positive impact in improving the economic aspects of a country [30].

It is important to state that creativity skill has a correlation with innovation, because good creativity skills can create innovation. Thus, innovation and creativity are fundamental to all academic disciplines and educational activities, not just the arts. The creative process, as with the reflection considered in the previous sections, is a critical component that deals with making sense of learning experiences. A number of approaches to teaching and learning have been considered in this paper that can help to nurture creativity and innovation [7]. Creativity is one of the most sought-after competencies, due to the move from industrialized economics, wherein the ability to innovate is crucial for the workforce [27]. Hence, a creative society will produce many innovative works.

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# CERTIFICATE

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