วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

In this issue:

Message of Editor:

The ECTI E-magazine has been launched as the first issue since the end of 2007, and now becomes mostly eight years old. It is actually still young, but gradually grows up. The ECTI E-magazine has been originally issued in Thai, and later converted into full international version several years ago. The editor team basically tries to invite many renown researchers around the world, especially in related fields to compose interesting academic articles for our ECTI Assoc members. In fact, it is not so easy, since as we really know most of them are very busy. At least, we try to keep issuing one article in each issue. Please try to contribute in the ECTI E-magazine as possible by submitting your research reports to the editor.

In this issue, we are honoured to issue an article entitled "A Review of Assessments for Digital Game-Based Learning" written by Dr. Banphot Nobaew (MFU, Thailand). Please enjoy reading the article, and find paper list of ECTI-CIT Trans (Vol. 9, No. 1) and report of ECTI-CON 2015.

Kosin Chamnongthai (KMUTT)

Editor of ECTI E-magazine

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

[Article]

A Review of Assessments for Digital Game-Based Learning

Banphot Nobaew

School of Information Technology, Mae Fah Luang University, Chiang Rai, Thailand
Email: banphot@mfu.ac.th

ABSTRACT

The objective of this study is to review methodological assessments of Digital Game-Based Learning (DGBL) in papers published between 2010 and 2014.—This study employs mixed methods of content analysis to investigate research frameworks and learning assessment. Four theoretical foundations were employed: behavioral, cognitive, humanistic (personal learning) and social and situational. The results demonstrate that the main theoretical foundations employed in the papers are behavioral and cognitive. The papers focus on various learning areas: academic education; vocational training; education and training for the disabled; and arts and culture. The DGBL papers investigate learning outcomes in terms of learning efficiency and enhancement in school students from elementary to undergraduate. Analysis of the papers showed that most DGBL assessment employed a variety of analytical tools: pre-course and post-test questionnaires; group interviews; and statistical analysis such as T-test, multivariate analysis of variance and analysis of covariance. A few authors developed their own theoretical frameworks to adapt course curricula and content. Appraisal of DGBL can be classified as Experimental; Player Perception or Engagement; and through framework models. Each appraisal incorporated one or more of six learning domains (outcomes): Knowledge; Cognition; Attitude; Motivation; Soft Skills for Learning, especially communication; and Assessment.

Keywords: Digital Game-Based Learning, DGBL, Theoretical Framework, Learning Assessment

1. BACKGROUND AND OBJECTIVES

Digital video games have been applied in education to improve learning competencies for many years. Prensky (2001) mentions that Digital Game-Based Learning offers an effective and achievable way to improve learning processes. Many theoretical frameworks and methodologies have been developed to conduct research in this field [13]. Gee (2003) formulates 36 principles governing how people can learn through playing video games [5]; subsequently Prensky (2003) took these principles and identified types of gameplay which can be applied to learning [12]. Kirriemuir, McFarlane, et al at NESTA Futurelab (2004) also mention two key themes for developing games in education: ‘making learning fun’ and ‘learning through doing’ [9]. Game-based Learning is an expanding field. Hwang and Wu (2012) studied trends in game-based learning from 2001 to 2014; they found that most studies focused on the players’ dimensions such as motivation, attitudes and perceptions [7]; however, after 2010, many studies emphasised the learning experience [2,3,4], engagement [1,8,10], collaboration [11] and behaviour [6]. Previous studies had shown that most researchers propose distinctive learning frameworks and applications; the assessment model for game-based learning (GBL) is still advocated by a few scholars. [2]. Assessment of GBL is crucial; it helps us trace and evaluate learning competencies and theoretical frameworks.

This study proposes to appraise digital game-based learning: how scholars evaluate their own frameworks and learning outcomes. This study differs from previous investigations which focused on trends in DGBL and classification of research by region.

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

2. METHODOLOGY

This study investigates papers on game-based learning from both journals and conferences from 2010 to 2014. It aims to analyze the assessment methodology of GBL frameworks. The first selection process was to filter out papers of GBL which did not match this study leaving fifty papers. Relevant aspects of these papers are shown in Table 1. The selected papers can be divided into three groups according to authors' objectives:

Theory – testing of new theoretical frameworks or existing frameworks from other fields adapted to GBL.i.

Assessment of course content: acquisition of subject knowledge and skills

ii. Evaluation of soft skills: team work, leadership, thinking, seeking information, interpersonal skills, etc.

The underlined terms will be used in this paper to classify authors' objectives.

Table 1: Papers on GBL from 2010 to 2014

Type of Paper	Journals	Conferences
Theory	12	4
Evaluation	9	6
Assessment	13	6
Total	**34**	**16**

The papers were further divided according to:

i. Frameworks for theory, evaluation and assessment employed by the authors
ii. Methodologies for theory, evaluation and assessment employed by the authors
iii. Sampling groups classified by type of educational or commercial institution, and by extension, age

Ten papers remained *focusing primarily on assessment frameworks for digital game-based learning*; they were published in the following journals: Journal of Computer Assisted Learning; Computers & Education; *IEEE Transactions on Learning Technologies; Educational Technology Research and Development; IEEE Transactions on Affective Computing; Journal on Computing and Cultural Heritage; and the British Journal of Educational Technology.*

3. RESULTS

3.1 Sample Groups

The sample groups in each paper can be categorized as follows:

i. Authors' objectives: to study aspects of theory, evaluation or assessment as defined in 2. METHODOLOGY above.
ii. Type of Course
iii. Focus Group: type of students and, by extension, educational level and age

Further information for each category is shown in Table 2. Focus groups were primarily school students but with undergraduates and employees also represented. Half of the papers researched learning experience, a proportion which has been increasing since 2010. Additionally, most papers concentrate on behavioural and cognitive learning. They typically evaluate change in both behaviour and the internal mental processes of perception and memory.

Table 2 shows that two papers study how game-based learning can be adapted to learning frameworks whereas in another paper, it has been adopted for a course. One paper discusses peer assessment of game learning. The papers cover a broad range of subjects including science, social science, human immunology and the environment. The diverse focus groups vary in size from 18 to 400 students as shown in Fig.1. All

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

of the smaller groups and one larger group (paper 2 with 132 students) were evaluated on their experiences of playing the games. The other larger groups were evaluated cognitively. Section 3.2 will demonstrate how frameworks can be integrated and appraised.

Table 2: *Learning domain and Target group*

No.	Papers aims	Type of Course	Focus group
1	Assessment of students' engagement: flow experience	General Education	Secondary students
2	Assessment learning experience: knowledge acquisition, cognitive process and learning experience	Medicine	Seventh grade and ninth grade students (first and third years of secondary school)
3	Assessment soft skills and leadership skills	Company Training	Employees
4	Assessment learning experience through informative and timely feedback	Commercial Games	Undergraduate students
5	Mapping learning and game mechanics	Pedagogical patterns (learning activities)	Students and game developers
6	Value assessment of gameplay	Commercial games	Undergraduate preservice teacher
7	Assessment a game approach (pedagogical dungeon)	Course curricula or collaborative activities	Undergraduate students
8	Evaluate the effectiveness of peer assessment-based game	Science	Elementary students
9	Assessment cognitive and affective in GBL	Science	Secondary students
10	Learning experience	Cultural heritage	Elementary students

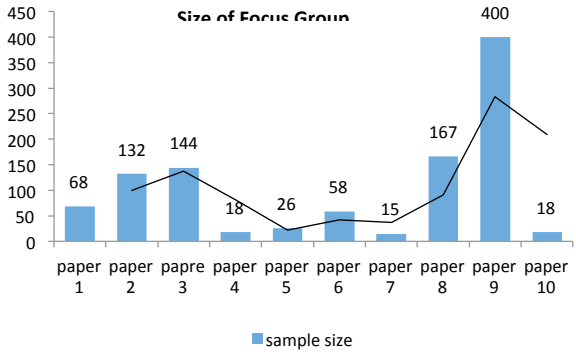

Fig. 1: *Research Design Framework*

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

3.2 Appraisal of Frameworks

The author of each paper employs a different research framework to appraise focus groups and learning domains. The research frameworks are listed in Table 3 and subsequently described.
Regarding the research frameworks listed in table 3, most researchers develop practical frameworks based on quantitative and qualitative analysis. Many researchers develop their own frameworks by adapting extant theory for pedagogy and applying it to the curriculum; for instance, authors of four of the papers propose and design new practical frameworks; another two employ quasi-experimental methods to appraise their research; methodological assessment such as pre and post-test, questionnaires, observation, and interviews are practical methods for their studies. In some studies, T-testing and ANCOVA are applied to compare experimental results. Methodological appraisals of all papers reviewed are summarized in Fig. 2. Eight analytical methods can be identified: Questionnaires; Pre- and Post-test; T-test and ANCOVA; Correlation; Trace-based systems; Multiple Analysis of Variance (MANOVA); Model Frameworks; and User Evaluation. A Model Framework is a set of evaluation tools specifically designed for experimental examination such as the MDA (mechanics, dynamics, aesthetics) method comprising attendance (participation); completion of additional tasks; visiting WebCT; using discussion boards; asking questions in class; and self-testing.

Table 3: *Appraisal of groups in different research frameworks*

Research framework	Appraisal
Mixed method: qualitative and quantitative	• Pre and post research survey; field observation; group interviews to test flow experience (desire of player to continue playing)
Quasi-experimental:	• Testing, pre and post-research • Paired t-tests • Multivariate analysis of variance (MANOVA)
ELESS (e-Leadership and Soft Skills) method: ELESS educational design model	• Best practice model: analysis and synthesis • Building model • Testing with case study
Game-based Feedback: MDA (mechanics, dynamics, aesthetics) method	• Attendance (participation) • Completing additional tasks • Visiting WebCT • Using discussion boards • Asking questions in class • Self testing
LM-GM (learning mechanics–game mechanics) method	• Fitness for educational setting and pre- and post-test • User evaluation – gameplay and perception
Quasi-experimental	• Pre and post-test comparison • T-test
Pedagogical dungeon: game-based learning adapted from frameworks of adventure games	• Questionnaires • Observation • Trace-Based System
Peer assessment-based game development	• Pre- and post-test • T-test • Analysis of Covariance (ANCOVA)
Bayesian Network (to measure probability)	• Questionnaires • ANCOVA (analysis of covariance) • Correlation • K-means clustering
CHSG (Cultural Heritage Serious Game) method	• Questionnaires • Observation • Interactive interviews

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

Of the eight analytical tools (Fig. 2), questionnaires and interviews are most widely employed for game-based learning appraisal (40%). Pre-test/post-test, and T-test/ANCOVA are the second most widely employed tools in these research papers (30% each). The eight analytical tools can be classified into three sets based on the objectives of the research:

Set A – Experiment: pre- and post-test, questionnaires, interviews for analysis by t-test and/or ANCOVA.
Set B – Player Perception and Engagement: statistical analysis of observation and questionnaires.
Set C – Model Framework: appraised with analytical tools such as ELESS, MDA and LM-GM method.

3.3 Assessment Comparing and Results

All three sets of analytical tools were applied separately to examine each author's framework and hypothesis:

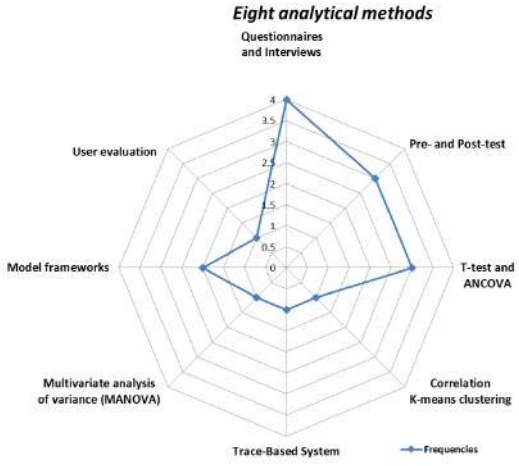

Fig. 2: *Frequency of application of evaluation tools*

Set A: Experiment

- Procedural knowledge and cognitive processes can be constructed and understood through the gameplay rather than web-based content [11].
- Gameplay can be used to change players' attitudes from negative to positive whilst playing games [29].
- Peer assessed games can be used as for education thus helping students acquire in-depth learning and thinking, creativity and motivation [74].
- Positive emotions are directly related to learning and motivation. An enquiring mind and problem-solving skills are directly associated with positive outcomes and continuous interaction [61].

Set B: Player Perception and Engagement

- Gameplay fosters positive attitudes through a flow of experiences [10].
- In game-based learning, motivation, and therefore engagement is crucial; the game can foster motivation. Tracing data allows the teacher to evaluate collaboration in computer games [50].

ISSN: 2286-7074
วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine

- Traditions and history can be the subject of serious games to enhance motivation for learning in school students to achieve higher grades [68].

Set C: Model framework

- The ELESS method is proposed for framing soft skills and leadership including appraisal of game design but it was not used in any of these studies [14].
- Game-based Feedback (GBF) can be applied to course tasks to improve the student performance through rewards [16].
- The Learning Mechanics–Game Mechanics (LM-GM) model proposes a way to integrate pedagogy and game mechanics [21].

Learning domains can be extracted from the three sets: Knowledge, Cognition, Attitude, Motivation, Soft Skills and Learning and Assessment frameworks. Fig. 3 shows the percentage of learning domains in each of the three sets.

Fig. 3, shows that the learning and assessment frameworks were applied most frequently in the learning domain at 21.43%. Motivation was second highest in frequency at 14.29% and was similar in sets A and B. In the learning domain, however, motivation had highest combined frequency of the sets at 28.58%, while the Soft Skills and Learning and Assessment frameworks in the combined sets were second equal at 21.43%. The results show that assessment of game-based learning currently focuses on two sets: B – Player Perception and Engagement and C – Model Framework.

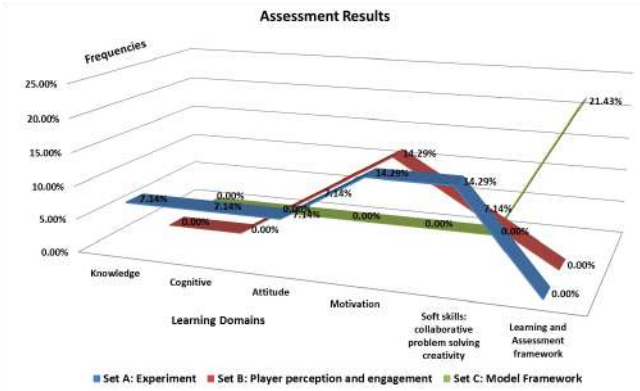

Fig. 3: *Assessment Results*

4. DISCUSSION

This review of digital game-based learning comprises ten selected papers evaluating thirteen games. School students were the primary subjects but some older students were also included. The researchers employed a variety of devices and platforms including desktop PCs, mobile-augmented reality (AR), tablets, web-based programs, Microsoft Xbox, Nintendo Wii and interactive devices.

Their investigations covered several theoretical foundations especially behavioral and cognitive. Most studies stress players' experiences and some included collaboration. The studies examined a variety of content but all ignored linguistics. 20% of the studies examined pedagogy and 10% curricula; this is paradoxical considering that all the studies were about using games in education.

The studies employed broad methodological frameworks with both qualitative and quantitative methods. Pre- and post-research surveys, field observation and group interviews were all applied initially, followed by statistical analysis and T-test and ANCOVA. Only three researchers devised their own frameworks. In the studies which investigated player experience, especially engagement, flow theory was their main theoretical

framework. The studies encompassed various educational levels and aspects of learning: curricula and course pedagogy, learning processes, player's experiences and peer assessment.

Students who learned through playing games were shown to have significantly higher levels of enjoyment and satisfaction and accumulated experiences. They could carry out procedures, cognitive processes, solve problems and collaborate. Not only the games but the devices and platforms enhance learning. These papers confirm the use of devises and platforms such as a vision-based AR game; a study of Humonology, a game using web-based content and studying game feedback from Xbox Live.

These studies commonly consider the game environment to examine the possibility of incorporating it into situated learning and everyday working environments such as in studying of e-Leadership and Soft Skills Educational Design Model (ELESS), the game-based learning management system and Cultural Heritage Serious Game (CHSG). The curious discover, collaborate, are motivated and learn from experience; however, none of studies investigates interaction and between student and student and interactivity between students and game.

This investigation shows that the trend in DGBL research is to focus the experiences and perceptions individual players; some researchers adapt DGBL frameworks for courses and pedagogy. This has opened new opportunities for research into the application of DGBL into learning domains and ways to help individual learners. Future research should integrate qualitative and quantitative analysis to understand how DGBL can be beneficially applied to improve learner experiences and outcomes for all students.

5. CONCLUSION AND IMPLICATIONS

This paper reviews the methodological assessments of digital game-based learning papers published in academic journal from 2010 to 2014. The results show that methodological assessments of papers can be categorized into three sets: experimental assessment, player perception and engagement, and model framework. The three sets encompass six learning domains: knowledge, cognition, attitude, motivation, soft skills and learning and model frameworks. The motivation domain is frequently used for assessment. The trend of DGBL studies increasingly concentrates on the players' experiences and on creating new framework models.

6. ACKNOWLEDGEMENT

I would like to thank Stuart and friends for advising me and helping me gather the papers.

7. REFERENCES

[1] Bouvier, P., Sehaba, K., & Lavoué, E. (2014). A trace-based approach to identifying users' engagement and qualifying their engaged-behaviours in interactive systems: application to a social game. *User Modeling and User-Adapted Interaction*, *24*(5), 413–451.

[2] Bressler, D. M., & Bodzin, A. M. (2013). A mixed methods assessment of students' flow experiences during a mobile augmented reality science game. *Journal of Computer Assisted Learning*, *29*(6), 505–517.

[3] Charles, D., Charles, T., McNeill, M., Bustard, D., & Black, M. (2011). Game-based feedback for educational multi-user virtual environments. *British Journal of Educational Technology*, *42*(4), 638–654.

[4] Cheng, M.-T., Su, T., Huang, W.-Y., & Chen, J.-H. (2014). An educational game for learning human immunology: what do students learn and how do they perceive? *British Journal of Educational Technology*, *45*(5), 820–833.

[5] Gee, J. P. (2003). What video games have to teach us about learning and literacy. *Computers in Entertainment (CIE)*, *1*(1), 20–20.

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

[6] Howard-Jones, P., Demetriou, S., Bogacz, R., Yoo, J. H., & Leonards, U. (2011). Toward a science of learning games. *Mind, Brain, and Education*, *5*(1), 33–41.

[7] Hwang, G.-J., & Wu, P.-H. (2012). Advancements and trends in digital game-based learning research: a review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, *43*(1), E6–E10.

[8] Ke, F., & Abras, T. (2013). Games for engaged learning of middle school children with special learning needs. *British Journal of Educational Technology*, *44*(2), 225–242.

[9] Kirriemuir, J., McFarlane, A., & NESTA Futurelab. (2004). *Literature review in games and learning: a report for NESTA Futurelab*. Bristol: NESTA Futurelab.

[10] Lee, M. J., Ko, A. J., & Kwan, I. (2013). In-game assessments increase novice programmers' engagement and level completion speed. *Proceedings of the ninth annual international ACM conference on International computing education research* (p. 153–160). ACM.

[11] Marty, J.-C., & Carron, T. (2011). Observation of collaborative activities in a game-based learning platform. *Learning Technologies, IEEE Transactions on*, *4*(1), 98–110.

[12] Prensky, M. (2003). Escape from planet Jar-Gon: Or, what video games have to teach academics about teaching and writing. *On the horizon*, *11*(3).

[13] Prensky, M. (-). *Digital game-based learning. 2001*. New York: McGraw-Hill.

Banphot Nobaew received the B.Sc. and MA. from Chiang Mai University, Thailand, in 1996 and 2005 respectively. He completed his Ph.D. degree in Human Centered Communication and Informatics (HCCI), Aalborg University, Denmark, in 2015. His thesis topic is 'the role of visual grammar and player perception in an online game'. He has worked as a lecturer at Department of Multimedia Technology and Animation, School of Information Technology, Mae Fah Luang University since 2006. His interests include Game-based Learning, Digital Literacy, Digital Film and Production: Theory and Practice, Digital Interactivity and Experience and Visual Semiotics and Perception.

Paper List of ECTI-CIT Trans., Vol.9, No. 1, May-2015 issue (by Kosin Chamnongthai, KMUTT)

http://www.ecti-thailand.org/paper/journal/ECTI-CIT

Special issue on Knowledge & Smart Technology:

1. Chun-Hsiung Tseng, "Crowd Aided Web Search: Concept and Implementation ", pp.1-10

2. Thanawut Thanavanich and Putchong Uthayopas, " Scheduling Parallel Workflow Applications with Energy-Aware on a Cloud Platform", pp. 11-21

3. Jaruloj Chongstitvatana and Methus Bhirakit, " Parallel Similarity Join with Data Partitioning for Prefix Filtering", pp.22- 28

4. Pornpawit Boonsrimuang, Kanchana Limwattanacha, Pisit Boonsrimuang and Hideo Kobayashi, "Peak-to-Average Power Ratio Reduction Method for OFDM Signal by Permutation of Subcarriers", pp.29-36

Special section on papers selected from ECTI-CON 2014:

5. M. S. Jayasree, V. S. Parvathy, S. RamaIyer and G. R. Bindu, " Optimum Value for Resistive Fault Current Limiter for Protection of a Power System with Distributed Generation", pp.37-45

6. Poompat Saengudomlert, "Power-Aware Logical Topology Optimization for IP-over-WDM Networks Based on Per-Lightpath Power Consumption Model", pp.46-54

7. Suppakarn Chansareewittaya and Peerapol Jirapong, "Optimal allocation of multi-type FACTS Controllers by using hybrid PSO for Total Transfer Capability Enhancement ", pp.55-63

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

Report from Conferences and Workshops

1. ECTI-CON 2015 (Supattana Nirukkanaporn)

ECTI-CON 2015 is the 12th annual international conference organized by Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI) Association, Thailand. The conference aims to provide an international platform to present technological advances, launch new ideas and showcase research work in the field of electrical engineering, electronics, computer, telecommunications and information technology. Hosted by College of Engineering and Faculty of Information Technology, Rangsit University, during 24-27 June, 2015, the conference was held at HuaHin ChaAm beach, a renowned tourist attraction with a mixture of traditional and new emerging tourist sights, located less than 200 km south of Bangkok.
The conference received 335 paper submissions from 19 countries. Through the double blind peer review process, 216 papers were accepted and included in the technical program that is 65% of the submitted papers. The conference was attended by over 330 delegates from 15 countries.

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

TECHNICAL PROGRAM

8 regular areas:

- Device, Circuits and Systems
- Computers
- Information Technology
- Communication Systems
- Controls
- Electrical Power Systems
- Power Electronics
- Signal Processing

5 special sessions:

- Dynamic Adaptive Systems Design and Applications in Advance Signal, Image and Speech Analysis
- Unified Future Internet and Software Defined Networking
- Earth observation systems for Sustainable Development
- Control Application
- Computation and Technology for Internet of Things

STATISTICAL SUBMISSION DATA

Australia	6	Pakistan	4
China	7	Sri Lanka	1
Germany	1	Taiwan	1
India	28	Thailand	255
Indonesia	1	Turkey	1
Iran	6	United Arab Emirates	1
Japan	11	United Kingdom	1
Korea	1	United States	1
Malaysia	3	Vietnam	5
Myanmar	1		

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

ECTI-CON 2015

Hua Hin, Thailand June 24 – 26, 2015

ECTI-CON 2015 is the twelfth annual international conference organized by Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI) Association, Thailand. The conference aims to provide an international platform to present technological advances, launch new ideas and showcase research work in the field of electrical engineering, electronics, computer, telecommunications and information technology. Accepted papers will be published in the Proceedings of ECTI-CON 2015 and will be submitted for inclusion into IEEE Xplore. Acceptance will be based on quality, relevance and originality.

Advisory Committee
Monai Krairiksh(KMITL)
Prabhas Chongsatitwattana (CU)
(CU)
Arthit Ourairat (RSU)

Steering Committee
Tomoaki Sato (Hirosaki U, Japan)
Japan)
Yoshihiro Matsui (TNCT, Japan)
Kou Yamada (Gunma U, Japan)
Prayoot Akkaraekthalin
(KMUTNB)
Naruemon Wattanapongsakorn
(KMUTT)
Tuptim Angkaew (CU)
Kosin Chamnongthai (KMUTT)

General Chairs
Prayoot Akkaraekthalin
(KMUTNB)
Thammasak Rujirayanyong (RSU)
(RSU)
M.L.Kulthon Kasemsan (RSU)

General Co-Chairs
Duangarthit Srimoon (RSU)
Somchai Lekcharoen (RSU)

General Secretary
Phaisan Ngamjanyaporn (RSU)

Sponsor & Exhibition Chairs
Somboon Sooksatra (RSU)
Chetneti Srisa-an (RSU)

Publication Chairs
Siriwan Wasukree (RSU)
Rong Phupuangphairoj (RSU)

Technical Program Chair
Chuwong Phongcharoenpanich
(KMITL)

Local Arrangement Chairs
Supattana Nirukkanaporn (RSU)
(RSU)
Monruthai Radeerom (RSU)

Information System Chair
Todsanai Chumwatana (RSU)
Suttisak Jantavongsu (RSU)

Finance Chairs
Yannavut Supichayanggoon
(RSU)
Sarawuth Chaimool (ECTI)
Phairin KaewKrui (ECTI)

Area 1) Device, Circuits and Systems:
Semiconductor Devices, Analog Circuits, Digital Circuits, Mixed Signal Circuits, Nonlinear Nonlinear Circuits and Systems, Sensing and Sensor Networks, Filters and Data Conversion Conversion Circuits, RF and Wireless Circuits, Photonic and Optoelectronic Circuits, Low Low Power Design and VLSI Physical Design, Biomedical Circuits, Assembly and Packaging Packaging Technologies, Test and Reliability, Advanced Technologies (i.e. MEMS and Nano-Nano-electronic Devices, Metamaterials), Agritronics, Embedded Systems;

Area 2) Computers:
Computer Architecture, Computational Biology and Bioinformatics, Knowledge and Data Data Engineering, Learning Technologies, Multimedia Services and Technologies, Mobile Mobile Computing, Parallel/Distributed Computing and Grid Computing, Pattern Analysis Analysis and Machine Intelligence, Software Engineering, Visualization and Computer Graphics;

Area 3) Information Technology:
IT Bio/Medical Engineering, Bioinformatics and Applications, Ontology, Business and Information Systems, Information Security and Forensics, Information Retrieval, Data Mining, Knowledge Management, Electronic Commerce, Health and Medicals Informatics, Informatics, Hybrid Information Technology;

Area 4) Communication Systems:
Communication Theory and Information Theory, Antenna and Propagation, Microwave Theory and Techniques, Modulation, Coding, and Channel Analysis, Networks Design, Network Protocols, Network Management, Optical Communications, Wireless/Mobile Communications & Technologies, Green Wireless Networks, Green Radio;

Area 5) Controls:
Control Theory and Applications, Adaptive and Learning Control System, Fuzzy and Neural Neural Control, Mechatronics, Manufacturing Control Systems and Applications, Process Process Control Systems, Robotics and Automation;

Area 6) Electrical Power Systems:
Power Engineering and Power Systems, Electromagnetic Compatibility, Energy Conversion, Conversion, High Voltage Engineering and Insulation, Power Delivery, Power Electronics, Electronics, Illumination, Renewable/Alternative Energy, Energy Policy and Planning;

Area 7) Power Electronics:
Power Devices and Components, Power Quality Control, Harmonic Analysis and Compensations, Switching Circuits and Power Converters, Motor and Drives, Smart Grid, Grid, Distribution Generation and Electrical Vehicles, Photovoltaic Materials and Solar Cells; Cells;

Area 8) Signal Processing:
Signal Processing Theory, Digital Signal Processing Algorithms, Digital Filter Design & Implementation, Array Processing, Adaptive Signal Processing, Audio, Speech, and Language Processing, Image and Video Processing, Medical Signal Processing & Medical Imaging;

Special sessions:
The aim of special sessions is to provide researchers with an opportunity to present their their latest, cutting-edge research within specific fields relevant to the theme of the conference. Prospective organizers should submit proposals to the General Secretary via

Paper submission:
- Prospective authors are invited to submit original full papers **without author's names and affiliations, in English**, of 4-6 pages in standard IEEE two-column format only, reporting their original work and results, applications, and/or implementation in one or more of the listed topics.
- Papers must be submitted only by internet through the submission system of the conference website.
- At least one author of each accepted paper **MUST** register and present paper at the conference in order for the paper to be included in the program. The program will be submitted for inclusion into IEEE Xplore.

Important dates:
- Full paper submission: Jan 31, 2015
- Notification of acceptance: Apr 30, 2015
- Camera-ready paper submission: May 15, 2015
- Authors and Early-bird registration: May 15, 2015

Contact Address:
College of Engineering, Rangsit University
Muang-Ake, Phaholyothin Rd., Lak-Hok, Muang, Pathumthani, 12000 Thailand
e-mail: ecticon2015@rsu.ac.th **website:** www.ecticon2015.org

RANGSIT UNIVERSITY

ECTI Association

IEEE THAILAND SECTION

วารสารอิเล็กทรอนิกส์ ECTI
ECTI e-magazine
ISSN: 2286-7074

ECTI Who's Who

Headquater:

ECTI Association

Sirindhon International Institute of Technology

131 Moo 5 Tiwanon Rd.,Bangkadi

Pathumthani 12000,Thailand

Tel: 02-5012578

E-mail: ecti.secretary@gmail.com