TOJET
The Turkish Online Journal of Educational Technology

ISSN 2146-7242

Turkish Online Journal of Educational Technology

Volume 14, Issue 1
January 2015

Prof. Dr. Aytekin İşman
Editor-in-Chief

Prof. Dr. Jerry WILLIS - ST John Fisher University in Rochester, USA
Prof. Dr. J. Ana Donaldson - AECT President
Editors

Assist.Prof.Dr. Fahme DABAJ - Eastern Mediterranean University, TRNC
Associate Editor

Assoc.Prof.Dr. Eric Zhi - Feng Liu - National Central University, Taiwan
Assistant Editor

TOJET
01.01.2015

THE TURKISH ONLINE JOURNAL OF EDUCATIONAL TECHNOLOGY

January 2015
Volume 14 - Issue 1

Prof. Dr. Aytekin İşman
Editor-in-Chief

Editors
Prof. Dr. Jerry Willis
Prof. Dr. J. Ana Donaldson

Assist. Prof. Dr. Fahme Dabaj
Associate Editor

Assoc. Prof. Dr. Eric Zhi - Feng Liu
Assistant Editor

ISSN: 1303 - 6521

Indexed by
Education Resources Information Center - **ERIC**

Copyright © THE TURKISH ONLINE JOURNAL OF EDUCATIONAL TECHNOLOGY

All rights reserved. No part of TOJET's articles may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrival system, without permission in writing from the publisher.

Published in TURKEY

Contact Address:
Prof. Dr. Aytekin İŞMAN
TOJET, Editor in Chief
Sakarya-Turkey

Message from the Editor-in-Chief

Dear Colleagues,

TOJET welcomes you. The Turkish Online Journal of Educational Technology, AECT, Governors State University, Sakarya University, Ohio University and other international universities will organize 15th International Educational Technology Conference (IETC-2015) between May 27–29, 2015 in Istanbul, Turkey (www.iet-c.net). IETC series is an international educational activity for academics, teachers and educators. This conference is now a well known educational technology event. It promotes the development and dissemination of theoretical knowledge, conceptual research, and professional knowledge through conference activities. Its focus is to create and disseminate knowledge about the use of instructional technology for learning and teaching in education.

TOJET is interested in academic articles on the issues of educational technology. The articles should talk about using educational technology in classroom, how educational technology impacts learning, and the perspectives of students, teachers, school administrators and communities on educational technology. These articles will help researchers to increase the quality of both theory and practice in the field of educational technology.

Call for Papers
TOJET invites article contributions. Submitted articles should be about all aspects of educational technology and may address assessment, attitudes, beliefs, curriculum, equity, research, translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations, and integration of subjects. The articles should also discuss the perspectives of students, teachers, school administrators and communities.

The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET.

Prof. Dr. Aytekin İŞMAN
Sakarya University

Copyright © The Turkish Online Journal of Educational Technology

Editorial Board

Editors
Prof. Dr. Aytekin İŞMAN - Sakarya University, Turkey
Prof. Dr. Jerry WILLIS - ST John Fisher University in Rochester, USA
Prof. Dr. J. Ana Donaldson - AECT President

Associate Editor
Assist.Prof.Dr. Fahme DABAJ - Eastern Mediterranean University, TRNC

Assistant Editor
Assoc.Prof.Dr. Eric Zhi - Feng Liu - National Central University, Taiwan

Editorial Board
Prof.Dr. Ahmet Zeki Saka - Karadeniz Technical University, Turkey
Prof.Dr. Akif Ergin - Başkent University, Turkey
Prof.Dr. Ali Al Mazari - Alfaisal University, Kingdom of Saudi Arabia
Prof.Dr. Ali Ekrem Özkul - Anadolu University, Turkey
Prof.Dr. Antoinette J. Muntjewerff - University of Amsterdam
Prof.Dr. Arif Altun - Hacettepe University, Turkey
Prof.Dr. Arvind Singhal - University of Texas, USA
Prof.Dr. Asaf Varol - Fırat University, Turkey
Prof.Dr. Aytekin İşman - Sakarya University, Turkey
Prof.Dr. Brent G. Wilson - University of Colorado at Denver, USA
Prof.Dr. Buket Akkoyunlu - Hacettepe University, Turkey
Prof.Dr. Cengiz Hakan Aydın - Anadolu University, Turkey
Prof.Dr. Chang-Shing Lee - National University of Tainan, Taiwan
Prof.Dr. Charlotte N. (Lani) Gunawardena - University of New Mexico, USA
Prof.Dr. Chi - Jui Lien - National Taipei University of Education, Taiwan
Prof.Dr. Chih - Kai Chang - National University of Taiwan, Taiwan
Prof.Dr. Chin-Min Hsiung - National pingtung university, Taiwan
Prof.Dr. Colin Latchem - Open Learning Consultant, Australia
Prof.Dr. Colleen Sexton - Governor State University, USA
Prof.Dr. Demetrios G. Sampson - University of Piraeus, Greece
Prof.Dr. Dimiter G. Velev - University of National and World Economy, Bulgaria
Prof.Dr. Don M. Flournoy - Ohio University, USA
Prof.Dr. Dongsik Kim - Hanyang University, South Korea
Prof.Dr. Enver Tahir Rıza - Dokuz Eylül University, Turkey
Prof.Dr. Eralp Altun - Ege University, Turkey
Prof.Dr. Feng-chiao Chung - National pingtung university, Taiwan
Prof.Dr. Ferhan Odabaşı - Anadolu University, Turkey
Prof.Dr. Finland Cheng - National pingtung university, Taiwan
Prof.Dr. Fong Soon Fook - Uniiversiti Sains Malaysia, Malaysia
Prof.Dr. Francine Shuchat Shaw - New York University, USA
Prof.Dr. Gianni Viardo Vercelli - University of Genova, Italy
Prof.Dr. Gwo - Dong Chen - National Central University Chung - Li, Taiwan
Prof.Dr. Hafize Keser - Ankara University, Turkey
Prof.Dr. Halil İbrahim Yalın - Gazi University, Turkey
Prof.Dr. Heli Ruokamo - University of Lapland, Finland
Prof.Dr. Henry H.H. Chen - National pingtung university, Taiwan
Prof.Dr. Ing. Giovanni Adorni - University of Genova, Italy
Prof.Dr. J. Ana Donaldson - AECT President
Prof.Dr. J. Michael Spector - University of North Texas, USA
Prof.Dr. Jerry Willis - ST John Fisher University in Rochester, USA
Prof.Dr. Jie-Chi Yang - National central university, Taiwan
Prof.Dr. Kinshuk - Athabasca University, Canada
Prof.Dr. Kiyoshi Nakabayashi - Chiba Institute of Technology, Japan
Prof.Dr. Kumiko Aoki - The Open University of Japan, Japan
Prof.Dr. Kuo - En Chang - National Taiwan Normal University, Taiwan
Prof.Dr. Kuo - Hung Tseng - Meiho Institute of Technology, Taiwan
Prof.Dr. Kuo - Robert Lai - Yuan - Ze University, Taiwan

Copyright © The Turkish Online Journal of Educational Technology

Prof.Dr. Liu Meifeng - Beijing Normal University, China
Prof.Dr. Marina Stock Mcisaac - Arizona State University, USA
Prof.Dr. Mehmet Ali Dikermen - Middlesex University, UK
Prof.Dr. Mehmet Çağlar - Near East University, TRNC
Prof.Dr. Mehmet Gürol - Fırat University, Turkey
Prof.Dr. Mehmet Kesim - Anadolu University, Turkey
Prof.Dr. Mei-Mei Chang - National pingtung university, Taiwan
Prof.Dr. Melissa Huı-Mei Fan - National central university, Taiwan
Prof.Dr. Min Jou - National Taiwan Normal University, Taiwan
Prof.Dr. Ming - Puu Chen - National Taiwan Normal University, Taiwan
Prof.Dr. Murat Barkan - Yaşar University, Turkey
Prof.Dr. Mustafa Murat Inceoğlu - Ege University, Turkey
Prof.Dr. Mustafa Şahin Dündar - Sakarya University, Turkey
Prof.Dr. Nabi Bux Jumani - International Islamic University, Pakistan
Prof.Dr. Nian - Shing Chen - National Sun Yat - Sen University, Taiwan
Prof.Dr. Paul Gibbs - Middlesex University, UK
Prof.Dr. Petek Aşkar - Hacettepe University, Turkey
Prof.Dr. Ramdane Younsi - Ecole polytechnique de Montreal, Canada
Prof.Dr. Rauf Yıldız - Çanakkale 19 Mart University, Turkey
Prof.Dr. Roger Hartley - University of Leeds, UK
Prof.Dr. Rozhan Hj. Mohammed Idrus - Universiti Sains Malaysia, Malaysia
Prof.Dr. Saedah Siraj - University of Malaya, Malaysia
Prof.Dr. Sello Mokoena - University of South Africa, South Africa
Prof.Dr. Servet Bayram - Marmara University, Turkey
Prof.Dr. Shan - Ju Lin - National Taiwan University, Taiwan
Prof.Dr. Sheng Quan Yu - Beijing Normal University, China
Prof.Dr. Shi-Jer Lou - National pingtung university, Taiwan
Prof.Dr. Shu - Sheng Liaw - China Medical University, Taiwan
Prof.Dr. Shu-Hsuan Chang - National Changhua University of Education, Taiwan
Prof.Dr. Stefan Aufenanger - University of Mainz, Germany
Prof.Dr. Stephen Harmon - Georgia State University, USA
Prof.Dr. Stephen J.H. Yang - National Central University, Taiwan
Prof.Dr. Sun Fuwan - China Open University, China
Prof.Dr. Sunny S.J. Lin - National Chiao Tung University, Taiwan
Prof.Dr. Teressa Franklin - Ohio University, USA
Prof.Dr. Toshio Okamoto - University of Electro - Communications, Japan
Prof.Dr. Toshiyuki Yamamoto - Japan
Prof.Dr. Tzu - Chien Liu - National Central University, Taiwan
Prof.Dr. Uğur Demiray - Anadolu University, Turkey
Prof.Dr. Ülkü Köymen - Lefke European University, TRNC
Prof.Dr. Vaseudev D.Kulkarni - Hutatma Rajjguru College, Rajguruunagar(Pune),(M.S.) INDIA
Prof.Dr. Xibin Han - Tsinghua University, China
Prof.Dr. Yau Hon Keung - City University of Hong Kong, Hong Kong
Prof.Dr. Yavuz Akpinar - Boğaziçi University, Turkey
Prof.Dr. Yen-Hsyang Chu - National central university, Taiwan
Prof.Dr. Yuan - Chen Liu - National Taipei University of Education, Taiwan
Prof.Dr. Yuan-Kuang Guu - National pingtung university, Taiwan
Prof.Dr. Young-Kyung Min - University of Washington, USA

Assoc.Prof.Dr. Abdullah Kuzu - Anadolu University, Turkey
Assoc.Prof.Dr. Adile Aşkım Kurt - Anadolu University, Turkey
Assoc.Prof.Dr. Ahmet Eskicumalı – Sakarya University
Assoc.Prof.Dr. Aijaz Ahmed Gujjar - Sindh Madressatul Islam University, Pakistan
Assoc.Prof.Dr. Chen - Chung Liu - National Central University, Taiwan
Assoc.Prof.Dr. Cheng - Huang Yen - National Open University, Taiwan
Assoc.Prof.Dr. Ching - fan Chen - Tamkang University, Taiwan
Assoc.Prof.Dr. Ching Hui Alice Chen - Ming Chuan University, Taiwan
Assoc.Prof.Dr. Chiung - sui Chang - Tamkang University, Taiwan
Assoc.Prof.Dr. Danguole Rutkauskiene - Kauno Technology University, Lietvenia
Assoc.Prof.Dr. David Tawei Ku - Tamkang University, Taiwan
Assoc.Prof.Dr. Eric Meng - National pingtung university, Taiwan

Copyright © The Turkish Online Journal of Educational Technology

Assoc.Prof.Dr. Eric Zhi Feng Liu - National central university, Taiwan
Assoc.Prof.Dr. Erkan Tekinarslan - Bolu Abant İzzet Baysal University, Turkey
Assoc.Prof.Dr. Ezendu Ariwa - London Metropolitan University, U.K.
Assoc.Prof.Dr. Fahad N. AlFahad - King Saud University
Assoc.Prof.Dr. Fahriye Altinay - Near East University, TRNC
Assoc.Prof.Dr. Gurnam Kaur Sidhu - Universiti Teknologi MARA, Malaysia
Assoc.Prof.Dr. Hao - Chiang Lin - National University of Tainan, Taiwan
Assoc.Prof.Dr. Hasan Çalışkan - Anadolu University, Turkey
Assoc.Prof.Dr. Hasan KARAL - Karadeniz Technical University, Turkey
Assoc.Prof.Dr. Hsin - Chih Lin - National University of Tainan, Taiwan
Assoc.Prof.Dr. Huey - Ching Jih - National Hsinchu University of Education, Taiwan
Assoc.Prof.Dr. Huichen Zhao - School of Education, Henan University, China
Assoc.Prof.Dr. Hüseyin Yaratan - Eastern Mediterranean University, TRNC
Assoc.Prof.Dr. I - Wen Huang - National University of Tainan, Taiwan
Assoc.Prof.Dr. I Tsun Chiang - National Changhua University of Education, Taiwan
Assoc.Prof.Dr. Ian Sanders - University of the Witwatersrand, Johannesburg
Assoc.Prof.Dr. Işıl Kabakcı - Anadolu University, Turkey
Assoc.Prof.Dr. Jie - Chi Yang - National Central University, Taiwan
Assoc.Prof.Dr. John I-Tsun Chiang - National Changhua University of Education, Taiwan
Assoc.Prof.Dr. Ju - Ling Shih - National University of Taiwan, Taiwan
Assoc.Prof.Dr. Koong Lin - National University of Tainan, Taiwan
Assoc.Prof.Dr. Kuo - Chang Ting - Ming - HSIN University of Science and Technology, Taiwan
Assoc.Prof.Dr. Kuo - Liang Ou - National Hsinchu University of Education, Taiwan
Assoc.Prof.Dr. Larysa M. Mytsyk - Gogol State University, Ukraine
Assoc.Prof.Dr. Li - An Ho - Tamkang University, Taiwan
Assoc.Prof.Dr. Li Yawan - China Open University, China
Assoc.Prof.Dr. Manoj Kumar Saxena - Central University of Himachal Pradesh, Dharamshala, Kangra, India
Assoc.Prof.Dr. Mike Joy - University of Warwick, UK
Assoc.Prof.Dr. Ming-Charng Jeng - National pingtung university, Taiwan
Assoc.Prof.Dr. Murat Ataizi - Anadolu University, Turkey
Assoc.Prof.Dr. Nergüz Serin - Cyprus International University, TRNC
Assoc.Prof.Dr. Norazah Mohd Suki - Universiti Malaysia Sabah, Malaysia
Assoc.Prof.Dr. Normaliza Abd Rahim - Universiti Putra Malaysia, Malaysia
Assoc.Prof.Dr. Oğuz Serin - Cyprus International University, TRNC
Assoc.Prof.Dr. Ping - Kuen Chen - National Defense University, Taiwan
Assoc.Prof.Dr. Popat S. Tambade - Prof. Ramkrishna More College, India
Assoc.Prof.Dr. Prakash Khanale - Dnyanopasak College, INDIA
Assoc.Prof.Dr. Pramela Krish - Universiti Kebangsaan Malaysia, Malaysia
Assoc.Prof.Dr. Tzu - Hua Wang - National Hsinchu University of Education, Taiwan
Assoc.Prof.Dr. Vincent Ru-Chu Shih - National Pingtung University of Science and Technology, Taiwan
Assoc.Prof.Dr. Wu - Yuin Hwang - National Central University, Taiwan
Assoc.Prof.Dr. Ya-Ling Wu - National pingtung university, Taiwan
Assoc.Prof Dr. Yahya O Mohamed Elhadj - AL Imam Muhammad Ibn Saud University, Saudi Arabia
Assoc.Prof Dr. Yavuz Akbulut - Anadolu University
Assoc.Prof.Dr. Zehra Altınay - Near East University, TRNC
Assoc.Prof.Dr. Zhi - Feng Liu - National Central University, Taiwan

Assist.Prof.Dr. Aaron L. Davenport - Grand View College, USA
Assist.Prof.Dr. Andreja Istenic Starcic - University of Primorska, Slovenija
Assist.Prof.Dr. Anita G. Welch - North Dakota State University, USA
Assist.Prof.Dr. Betül Özkan - University of Arizona, USA
Assist.Prof.Dr. Burçin Kısa Işık - Gaziantep University, Turkey
Assist.Prof.Dr. Chiu - Pin Lin - National Hsinchu University of Education, Taiwan
Assist.Prof.Dr. Chun - Ping Wu - Tamkang University, Taiwan
Assist.Prof.Dr. Chun - Yi Shen - Tamkang University, Taiwan
Assist.Prof.Dr. Chung-Yuan Hsu - National pingtung university, Taiwan
Assist.Prof.Dr. Dale Havill - Dhofar University, Sultanate of Oman
Assist.Prof.Dr. Ferman Konukman - College of Arts and Science, Sport Science Program, Qatar University
Assist.Prof.Dr. Filiz Varol - Fırat University, Turkey
Assist.Prof.Dr. Guan - Ze Liao - National Hsinchu University of Education, Taiwan
Assist.Prof.Dr. Hsiang chin - hsiao - Shih - Chien University, Taiwan

Copyright © The Turkish Online Journal of Educational Technology

Assist.Prof.Dr. Huei - Tse Hou - National Taiwan University of Science and Technology, Taiwan
Assist.Prof.Dr. Hüseyin Ünlü - Aksaray University, Turkey
Assist.Prof.Dr. Jagannath. K Dange - Kuvempu University, India
Assist.Prof.Dr. K. B. Praveena - University of Mysore, India
Assist.Prof.Dr. Kanvaria Vinod Kumar - University of Delhi, India
Assist.Prof.Dr. Marko Radovan - University of Ljubljana, Slovenia
Assist.Prof.Dr. Min-Hsien Lee - National central university, Taiwan
Assist.Prof.Dr. Mohammad Akram Mohammad Al-Zu'bi - Jordan Al Balqa Applied University, Jordan
Assist.Prof.Dr. Muhammet Demirbilek - Süleyman Demirel University, Turkey
Assist.Prof.Dr. Pamela Ewell - Central College of IOWA, USA
Assist.Prof.Dr. Pei-Hsuan Hsieh - National Cheng Kung University, Taiwan
Assist.Prof.Dr. Pey-Yan Liou - National central university, Taiwan
Assist.Prof.Dr. Phaik Kin, Cheah - Universiti Tunku Abdul Rahman, Kampar, Perak
Assist.Prof.Dr. Ping - Yeh Tsai - Tamkang University, Taiwan
Assist.Prof.Dr. S. Arulchelvan - Anna University, India
Assist.Prof.Dr. Seçil Kaya - Anadolu University, Turkey
Assist.Prof.Dr. Selma Koç Vonderwell - Cleveland State University, Cleveland
Assist.Prof.Dr. Sunil Kumar - National Institute of Technology, India
Assist.Prof.Dr. Tsung - Yen Chuang - National University of Taiwan, Taiwan
Assist.Prof.Dr. Vahid Motamedi - Tarbiat Moallem University, Iran
Assist.Prof.Dr. Yalın Kılıç Türel - Fırat University, Turkey
Assist.Prof.Dr. Yu - Ju Lan - National Taipei University of Education, Taiwan
Assist.Prof.Dr. Zehra Alakoç Burma - Mersin University, Turkey
Assist.Prof.Dr. Zerrin Ayvaz Reis - İstanbul University, Turkey
Assist.Prof.Dr. Zülfü Genç - Fırat University, Turkey

Dr. Arnaud P. Prevot - Forest Ridge School of the Sacred Heart, USA
Dr. Aytaç Göğüş - Sabancı University, Turkey
Dr. Balakrishnan Muniandy - Universiti Sains Malaysia, Malaysia
Dr. Brendan Tangney - Trinity College, Ireland
Dr. Chen Haishan - China Open University, China
Dr. Chin Hai Leng - University of Malaya, Malaysia
Dr. Chin Yeh Wang - National Central University, Taiwan
Dr. Chun Hsiang Chen - National Central University, Taiwan
Dr. Chun Hung Lin - National central university, Taiwan
Dr. Farrah Dina Yusop - University of Malaya, Malaysia
Dr. Hj. Issham Ismail - Universiti Sains Malaysia, Malaysia
Dr. Hj. Mohd Arif Hj. Ismail - National University of Malaysia, Malaysia
Dr. I-Hen Tsai - National University of Tainan, Taiwan
Dr. İsmail İpek - Bilkent University, Turkey
Dr. Jarkko Suhonen - University of Eastern Finland, Finland
Dr. Li Ying - China Open University, China
Dr. Norlidah Alias - University of Malaya, Malaysia
Dr. Rosnaini Mahmud - Universiti Putra Malaysia, Malaysia
Dr. Sachin Sharma - Faridabad Institute of Technology, Faridabad
Dr. Seetharam Chittoor Jhansi - Pushpa Navnit Shah Centre for Lifelong Learning, India
Dr. Tam Shu Sim - University of Malaya, Malaysia
Dr. Tiong Goh - Victoria University of Wellington, New Zealand
Dr. Vikrant Mishra - Shivalik College of Education, India
Dr. Zahra Naimie - University of Malaya, Malaysia

Copyright © The Turkish Online Journal of Educational Technology

Table of Contents

A Digital European Self-Assessment Tool for Student Teachers of Foreign Languages: The EPOSTL 1
Ismail Hakki MIRICI, Sinem HERGÜNER

A Replication Study on the Multi-Dimensionality of Online Social Presence 11
David B. MYKOTA

Adaptability and Replicability of Web-Facilitated, Hybrid, and Online Learning in an Undergraduate Exercise Psychology Course 19
Huaibo XIN

Adult Learners' Perceptions of Designed Hypermedia in a Blended Learning Course at a Public University in Malaysia 31
Maslawati MOHAMAD, Harieza HUSSIN, Shahizan SHAHARUDDIN

Design of Guidelines on the Learning Psychology in the Use of Facebook as a Medium for Teaching & Learning in Secondary School 39
Nurulrabihah Mat NOH, Saedah SIRAJ, Mohd Ridhuan Mohd, JAMIL, Zaharah Husin, Ahmad Arifin SAPAR

Effectiveness of E-Lab Use in Science Teaching at the Omani Schools 45
A. AL MUSAWI, A. AMBUSAIDI, S. AL-BALUSHI, K. AL-BALUSHI

Ipad Use and Student Engagement in the Classroom 53
Oraib MANGO

Personalization of Student in Course Management Systems on the Basis Using Method of Data Mining 58
Martin MAGDIN

Physical Education Teachers' Subjective Theories about Integrating Information and Communication Technology (ICT) into Physical Education 68
Rolf KRETSCHMANN

Technology Facilitated PBL Pedagogy and its Impact on Nursing Student's Academic Achievement and Critical Thinking Dispositions 97
Wei-Chieh Wayne YU, Chunfu Charlie LIN, Mei-Hsin HO, Jenny WANG

The Effects of "Live Virtual Classroom" On Students' Achievement and Students' Opinions about "Live Virtual Classroom" at Distance Education 108
Ozgur YILMAZ

The Effects of Multimedia and Learning Style on Student Achievement in Online Electronics Course 116
Herman Dwi SURJONO

The Effects of Online Peer Assessment and Family Entrepreneurial Experience on Students' Business Planning Performance 123
Chun-Yi LEE

The Influence of Learner Readiness on Student Satisfaction and Academic Achievement in an Online Program at Higher Education 133
Özkan KIRMIZI

The Pedagogy of Flipped Instruction in Oman 143
Mary Lane-KELSO

The Place of Technology Integration in Saudi Pre-Service Teacher Education: Matching Policy with Practice 151
Abdulrahman AL-ZAHRANI

Using an on-Line Assessment System to Diagnoze Student' Mental Models in Chemistry Education 163
Wen-Wei CHIANG, Mei-Hung CHIU

Copyright © The Turkish Online Journal of Educational Technology

THE EFFECTS OF MULTIMEDIA AND LEARNING STYLE ON STUDENT ACHIEVEMENT IN ONLINE ELECTRONICS COURSE

Herman Dwi Surjono
hermansurjono@uny.ac.id

ABSTRACT
This experimental study investigated the effects of multimedia preferences and learning styles on undergraduate student achievement in an adaptive e-learning system for electronics course at the Yogyakarta State University Indonesia. The findings showed that students in which their multimedia preferences and learning style matched with the way the material presented in online electronics course have higher scores significantly compared to those in which their learning mode were mismatched. The difference happened both in adaptive and non-adaptive online courses.

Keywords: multimedia, learning style, adaptive, electronics course, e-learning

INTRODUCTION

Empirical studies have shown that individual one-on-one tutoring is the most effective mode of teaching. Individual tutoring allows learning to be highly individualized and consistently yields better outcomes than other methods of teaching (Hock, 2001). Because individual tutoring logistically and financially is impossible for all students in a traditional classroom situation, numerous kinds of computer programs have been developed for teaching in the form of Computer Assisted Instruction (CAI) and Computer Based Training (CBT). Students can learn individually with these computer systems. Although both CAI and CBT may be somewhat effective in teaching students, they do not provide the same kind of individualized attention that a student would receive from a human tutor. In these systems the instruction is not individualized to the student needs. They do not take into account the student's knowledge, learning style, preferences and other characteristics. The same teaching material is presented to every student in the same way regardless of his or her prior knowledge and experience.

This limitation has prompted a new generation of educational systems known as Intelligent Tutoring Systems (ITS). An important feature of ITS is their ability to adapt the presentation of material to a student's needs. They can adapt instruction dynamically to the different levels of student's knowledge. These systems obtain their intelligence and adaptivity by adopting pedagogical rules about how to teach as well as using information about the students. ITS design is founded on fundamental assumptions on learning that individualized instruction is far superior to classroom style learning because the instruction can be adapted for each student (Jerinic, 2000).

ITS have not been so popular in schools, because of problems such as high development cost, hardware dependency, installation and delivery problems. Integration of the traditional ITS and web technology has supposedly resolved these problems. Along with the advances of computer technology, more ITS researchers found it practical to develop an ITS and a learning material in electronic form. This is known as adaptive hypermedia and it has become a new field of research.

Adaptive educational hypermedia, which is a particular application of AHS in education, is a recently established area of research integrating technologies of CAI, ITS and hypermedia systems. There are at least two reasons driving the advances of educational adaptive hypermedia. First, educational hypermedia applications are typically used by much more heterogeneous users than any standalone computer-based learning application. Any web-based learning system that is designed for a specific group of users may not suit other users. Second, generally the user of web based educational hypermedia is working without any assistance from teachers, as would be the case in a traditional classroom situation.

An adaptive e-learning system (AES) has been developed for electronics course for undergraduate students in Yogyakarta State University (Surjono, 2007a), (Surjono, 2007b). The adaptivity mechanism that is used in the system to decide whether a student will get a certain learning mode is very simple. As it was described in the system design, students have to fill out the questionnaires when the first time accessing the adaptive course. The questionnaire contains questions that ask the tendency of learning styles and multimedia preferences.

It is known that a mismatch between student learning styles and the way the material is presented (as reflected by teacher teaching styles) can lead to poor student performance. A mismatch between the teacher's and learner's styles may hinder the learning process.

Copyright © The Turkish Online Journal of Educational Technology

A number of researchers have investigated the improved performance of students whose learning styles matched the presentation mode. Ford and Chen (2001) have found significant differences in performance on conceptual knowledge for students learning in matched and mismatched conditions. Performance in matched conditions was significantly higher than that in mismatched conditions. Bajraktarevic et al. (2003) has suggested that significantly higher results were obtained for the matched session compared with the mismatched session.

This study investigated whether students in which their actual multimedia preferences and learning style (learning mode) matched with the way the material presented in online electronics course have higher achievement scores compared to those in which their learning mode were mismatched. The comparison was also made both in adaptive and non-adaptive online courses.

MULTIMEDIA PREFERENCES

There are many definitions of multimedia available. Typical examples define multimedia as "the use of multiple forms of media in a presentation" (Schwartz and Beichner, 2003), "a combination of text, graphics, animation, pictures, video, and sound to present information in a coherent manner" (Singh, 2003), and "the integration of media such as text, sound, graphics, animation, video, imaging into a computer system" (Jonasses, 2003). Vaughan (2011) defined multimedia as a class of computer-driven interactive communication systems which create, store, transmit, and receive textual, graphic and auditory networks of information. All of these definitions agree that multimedia is the integration of more than one medium in a computer system to present information.

A research study was conducted to investigate the effectiveness of multimedia instruction (Najjar, 1996). Students in the control group studied the learning materials in a classroom or lecture, combined with hands-on experiment. Students in the experimental group studied the material via multimedia-based instruction. The result indicated that student achievement was higher in the experimental group. Motion effect in animation creates illusion of movement which helps to explain abstract concepts. Computer graphics are effective for gaining attention and can encourage students to create mental images that in turn make it easier for them to learn certain types of information (Rieber, 1996).

Research conducted by Asoodeh (1993) showed that subjects who used animated visuals scored significantly higher on mental rotation tests than those who used static visuals. The use of graphics, charts and diagrams describes the relationship between pictures and words in a learning environment. Presenting learning materials in graphical form can encourage students to use mental skills in a more effective way. Arnheim (1994) suggested that visual learning can increase students understanding of abstract concepts because a student's perception of ideas can be enriched by visual example. Therefore, visuals can promote development of perceptual thinking.

The use of multimedia in a computer based learning system is expected to increase student understanding with particular materials. However, an excessive use of multimedia may or may not improve the learning effectiveness. In order for multimedia to be effective, it should only be used in certain situations. Applying multimedia in every situation uses a lot of resources but does not necessarily provide a desirable result. Singh (2003) suggests that multimedia should be used only:

- when students have low prior knowledge;
- when students have low motivation;
- when multimedia is effectively designed.

LEARNING STYLE

There are various definitions of learning style from the literature. According to James and Blank (1993) learning style can be defined as the complex manner in which learners most efficiently and most effectively perceive, process, store and recall what they are trying to learn. McLoughlin (1999) summarizes the term of learning style as referring to adopting a habitual and distinct mode of acquiring knowledge. In addition, Honey and Mumford (1992) have defined learning style as the attitudes and behaviours which determine an individual's preferred way of learning.

Riding and Cheema (1991) surveyed a number of learning style constructs and classified them into two broad categories: wholist-analytical and verbaliser-imager. The wholist-analytical category describes how individuals process information. Wholists prefer to learn material globally, while analysts are likely to process information in details. The verbaliser-imager describes how individuals represent information. Verbalisers prefer to present information in words, while imagers tend to present information in pictorial form. According to Felder et al. (1991), wholist and serialist are known as global and sequential; while verbalise and imager are known as verbal and visual.

Copyright © The Turkish Online Journal of Educational Technology

There are a wide variety of instruments available for the measurement of learning styles. These include:

- Honey and Mumford's Learning Styles Questionnaire
- Grasha-Riechmann Student Learning Style Scales
- Felder's Index of Learning Styles

Honey and Mumford's Learning Styles Questionnaire is a widely used inventory learning style developed by Honey and Mumford (1992). The inventory suggests that there are four types of learner falling into two categories:

- Activists and reflectors
- Theorists and pragmatists

The Grasha-Riechmann Student Learning Style Scales (GRSLSS) were developed in the early 70's to identify and categorize the following styles of learners (2002):

- Competitive and collaborative
- Avoidant and participant
- Dependent and independent

The Felder's Index of Learning Styles focuses on aspects of learning styles significant in engineering education and has four dimensions (1991):

- Visual-verbal
- Sequential-global
- Active-reflective
- Sensing-intuitive

LEARNING MODE

Learning mode is a combination of learning style and multimedia preference that is used in the adaptive e-learning system (AE) in this study [3]. Students have their own learning styles (ls) and multimedia (mm) preferences that can be obtained through online questionnaires. Depending upon the questionnaire scores, the AES will present the learning materials with one of four possible learning modes, i.e.: *Global-Multimedia*, *Global-nonMultimedia*, *Sequential-Multimedia* and *Sequential-nonMultimedia*.

Any possible questionnaire result related to the ls dimension is shown in Table 1 (Surjono, 2006).

Table 1. Possible questionnaire results for LS dimension

Answer "a" (sequential)	Answer "b" (global)	Result (b – a)	Preference interpretation
0	11	11	Very strong preference toward global mode
1	10	9	
2	9	7	Moderate preference toward global mode
3	8	5	
4	7	3	Little preference toward global mode
5	6	1	
6	5	-1	Little preference toward sequential mode
7	4	-3	
8	3	-5	Moderate preference toward sequential mode
9	2	-7	
10	1	-9	Very strong preference toward sequential mode
11	0	-11	

There are six possibilities of the ls preference interpretation ranging from "very strong preference for global mode" to "very strong preference for sequential mode". A student who has a positive result (1 to 11) indicating that his or her learning style tendency is global will be given a presentation in global mode. On the other hand, a student who has a negative result (-1 to -11), indicating that his or her learning style tendency is sequential, will be given a presentation in sequential mode.

Any possible questionnaire result related to the mm dimension is shown in Table 2 (Surjono, 2006).

Copyright © The Turkish Online Journal of Educational Technology

Table 1. Possible questionnaire results for MM dimension

Answer "a" (multimedia)	Answer "b" (non-multimedia)	Result (b – a)	Preference interpretation
0	11	11	Very strong preference toward non-multimedia mode
1	10	9	
2	9	7	Moderate preference toward non-multimedia mode
3	8	5	
4	7	3	Little preference toward non-multimedia mode
5	6	1	
6	5	-1	Little preference toward multimedia mode
7	4	-3	
8	3	-5	Moderate preference toward multimedia mode
9	2	-7	
10	1	-9	Very strong preference toward multimedia mode
11	0	-11	

There are six possibilities of the mm preference interpretation ranging from "very strong preference for non-multimedia mode" to "very strong preference for multimedia mode". A student who gets a positive result (1 to 11) indicating that s/he has verbal learning tendency will be given a presentation of the learning material without any additional multimedia resources. On the other hand, a student who gets a negative result (-1 to -11), indicating that s/he has a tendency towards visual learning, will be presented learning material with additional multimedia resources.

Presentation style used in the AES is a two-state variable that is defined as the way that the material is presented: this can be either sequential (where material is presented in a set unchangeable sequence) or global (where the various sections of the material are available for direct access, so that the user can pick and choose). Multimedia mode is also a two-state variable that allows material to be presented with optional multimedia artefacts in the form of film clips or animated schematics. Learning style will be referred to as ls and multimedia mode will be referred to as mm.

The additional multimedia resources are presented to the student who has a tendency of visual learning regardless of his or her ls values. The student can access navigation buttons of the multimedia features located at the bottom of the learning material page. The multimedia resources offered to the intended student include music, video clip and flash animation.

RESEARCH METHOD

The research was carried out using a randomized pretest-posttest control group experimental design. This design consisted of an experimental group and a control group. Employing this design minimized possible threats to internal validity such as history, maturation, instrumentation, regression, and selection. A total of 67 students agreed to participate voluntarily in the experimentation. The random assignment technique resulted in 34 students being in the experimental group and 33 students in the control group.

The experimental treatment used in this study was accessibility to the AES for students in the experimental group. As a comparison, students in the control group were provided accessibility to the NON-AES. The AES and NON-AES contained the same learning material, exercises and tests that are covered in an electronic course called Analogue Electronics for first-year second-semester undergraduate students at the Department of Electronics at Yogyakarta State University. The syllabus of Analogue Electronics implemented in the systems includes 7 chapters and had to be learned by the students for seven weeks with 2 hours access each week. An advanced multilevel statistical analysis was used to investigate the effects of the learning mode on student achievement.

RESULTS

In the NON-AES, students cannot change the learning mode by configuring different options of learning style and multimedia availability. The system provides a fixed default setting for the learning mode, which is a sequential and non-multimedia presentation. In order to do an analysis within the NON-AES group, additional data is required concerning actual student's preference towards the learning style and multimedia. Since the NON-AES was not designed to have questionnaires that can be accessed online, the data was collected manually

Copyright © The Turkish Online Journal of Educational Technology

through a printed version of questionnaires. The questionnaires are used to obtain the actual learning mode (ls and mm) preferences of students.

The printed questionnaires results consisting of ls and mm values were compared to the NON-AES ls and mm default values which are ls = 0 and mm = 0. Two variables were created to accommodate this comparison: suited_ls and suited_mm. The categories are as follow:

- suited_ls = 1, if their actual ls preference is equal to 0.
- suited_ls = 0, if their actual ls preference is equal to 1.
- suited_mm = 1, if their actual mm preference is equal to 0.
- suited_mm = 0, if their actual mm preference is equal to 1.

The analysis is to examine the effect of suited_ls and suited_mm variables (learning style and multimedia mode suitability) on the test scores over repeated measures within the NON-AES group only. This analysis will answer the following research question: "Do students who study using the NON-AES in which their actual learning mode preferences are suited to the system perform better than those who are not suited?"

A research hypothesis that will be tested following the analysis result can be defined as follow: "Students who study the learning material in the NON-AES in which their actual learning mode preferences are suited (suited_ls = 1 and suited_mm = 1) will achieve higher test scores than those who study the same material in the same system in which their preferences are not suited (suited_ls = 0 and suited_mm = 0)."

Using the multilevel statistical analysis, an optimum model can be plotted to illustrate the relations of each score mean corresponding to respective learning mode over the repeated measures. Figure 1 shows score mean of students among learning mode over repeated measures.

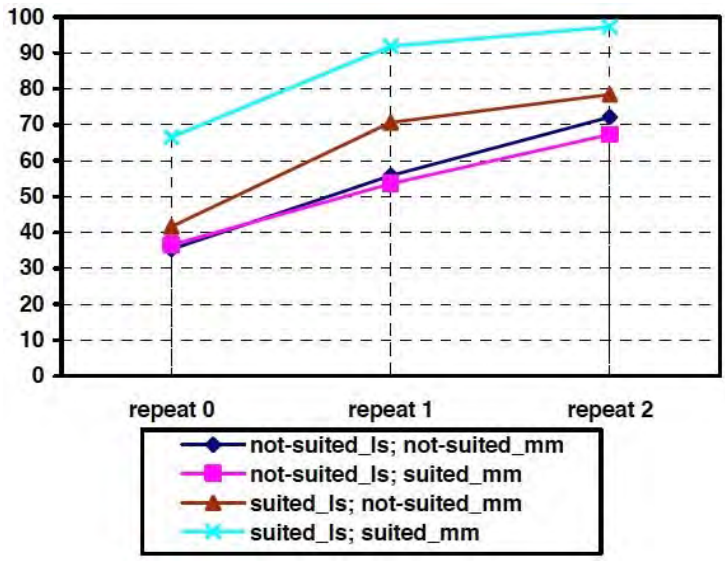

Figure 1. Comparison of score means for suited/unsuited learning mode in NON-AES

From the hypothesis testing, there is enough empirical data to reject the null hypothesis at the significance level of p = 0.05. It can be concluded that students who learn using the NON-AES in which their learning mode is suited have higher test score at repeat 0 and repeat 1 than students using the same system in which their learning mode is not suited.

Even though the AES allows students to change their learning mode, some students may not realize that either they need to do this or that the system can do this, because the students have only a limited on-line time during the experimentation. Consequently, the way the system presents the learning material may not match with their actual learning mode preferences. In order to reveal their actual learning mode preferences, they were asked to answer a printed version of questionnaires where the completion time was not limited.

Copyright © The Turkish Online Journal of Educational Technology

The printed questionnaires results consisting of ls and mm values were compared to their learning mode from profile when they use the AES. Two variables were created to accommodate this comparison: suited_ls and suited_mm. The categories are as follows:

- suited_ls = 1, if their actual ls preference is equal to their ls stored in the profile.
- suited_ls = 0, if their actual ls preference is not equal to their ls stored in the profile.
- suited_mm = 1, if their actual mm preference is equal to their mm stored in the profile.
- suited_mm = 0, if their actual mm preference is not equal to their mm stored in the profile.

The analysis is to examine the effect of suited_ls and suited_mm variables (learning style and multimedia mode suitability) on the test scores over repeated measures within the AES group only. This analysis will answer the following research question: "Do students who study using the AES in which their actual learning mode preferences are suited to their profiles perform better than those who are not suited?"

A research hypothesis that will be tested following the analysis result can be defined as follow: "Students who study the learning material in the AES in which their actual learning mode preferences are suited (suited_ls = 1 and suited_mm = 1) will achieve higher test scores than those who study the same material in the same system in which their preferences are not suited (suited_ls = 0 and suited_mm = 0)."

Using the multilevel statistical analysis, an optimum model can be plotted to illustrate the relations of each score mean corresponding to respective learning mode over the repeated measures. Figure 2 shows score means of students with learning mode over repeated measures.

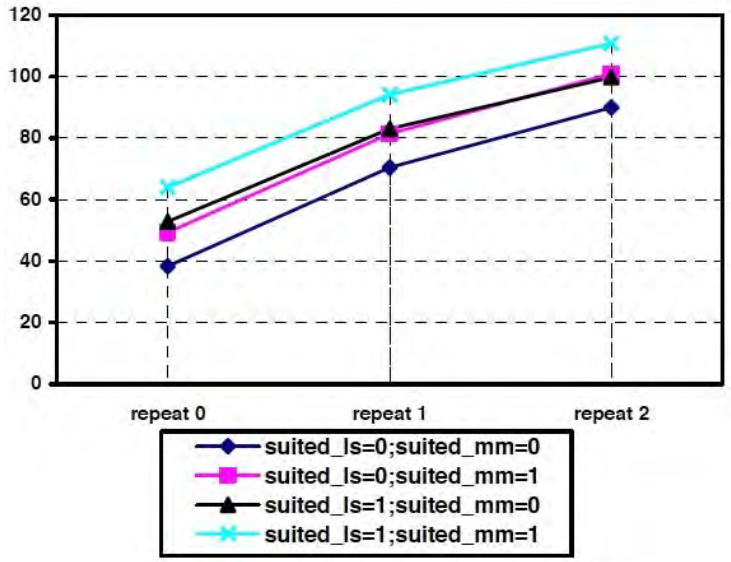

Figure 2. Comparison of score means for suited/unsuited learning mode in AES

From the hypothesis testing, there is enough empirical data to reject the null hypothesis at the significance level of p = 0.05. It can be concluded that students who study using the AES system in which their learning mode is suited have higher test score at repeat 0, repeat 1 and repeat 2 than students who study using the same system in which their learning mode is not suited.

CONCLUSIONS

In an non-adaptive e-learning system, students in which their actual multimedia preferences and learning style matched with the way the material presented in online electronics course have higher achievement scores compared to those in which their learning mode were mismatched.

In an adaptive e-learning system, students in which their actual multimedia preferences and learning style matched with the way the material presented in online electronics course have higher achievement scores compared to those in which their learning mode were mismatched.

Copyright © The Turkish Online Journal of Educational Technology

REFERENCES

Arnhein. (1994). *Computers in education* (6th ed.). CT: The Dushkin Publishing Group Inc.

Asoodeh, M., M. (1993). *Static visuals Vs. computer animation used in the development of spatial visualization.* Unpublished doctoral dissertation, Texas A&M University, TX.

Bajraktarevic, N., Hall, W., & Fullick, P. (2003). *Incorporating learning styles in hypermedia environment: Empirical evaluation.* Paper presented at the AH2003: Workshop on Adaptive Hypermedia and Adaptive Web-Based Systems, Budapest, Hungary.

Felder, R. M., & Solomon, B. (1991). *Index of learning styles questionnaire*. Retrieved 9 April, 2014, from http://www4.ncsu.edu/unity/lockers/users/f/felder/public/ILSdir/ILS-nondisclosure.html

Ford, N., & Chen, S. (2001). Matching/mismatching revisited: An empirical study of learning and teaching styles. *British Journal of Educational Technology, 32*(1), 5-22.

Grasha, A. F. (2002). *Teaching with styles: A practical guide to enhancing learning by understanding teaching and learning styles*. Pittsburgh, PA: Alliance Publishers.

Hock, M. F., Pulvers, K. A., Deshler, D. D., & Schumaker, J. B. (2001). The effects of an after-school tutoring program on the academic performance of at-risk students and students with LD. *Remedial and Special Education, 22*(3), 172-186.

Honey, P., & Mumford, A. (1992). *The Manual of Learning Styles* (3rd ed.). Maidenhead, UK: Peters Honey.

James, W. B., & Blank, W. E. (1993). Review and critique of available learning-style instruments for adults. In D. Flannery (Ed.), *Applying cognitive learning styles* (pp. 47-58). San Francisco: Jossey-Bass.

Jerinic, L., & Devedzic, V. (2000). The friendly intelligent tutoring environment teacher's approach. *SIGCHI Bulletin, 32*(1), 83-94.

Jonasses. (2000). *Computers as mindtools for schools*. Upper Saddle River, NJ: Merrill.

McLoughlin, C. (1999). The implications of research literature on learning styles for the design of instructional material. *Australian Journal of Educational Technology, 15*(3), 222-241.

Najjar. (1996). Multimedia information and learning. *Journal of Educational Multimedia and Hypermedia, 5*, 129-150.

Riding, R., & Cheema, I. (1991). Cognitive styles: An overview and integration. *Educational Psychology: An International Journal of Experimental Educational Psychology, 11*(3-4), 193-215.

Rieber, L., P. (1996). Animation as feedback in a computer based simulation: Representation matters. *Educational Technology Research & Development, 44*(1), 5-22.

Schwartz, & Beichner. (1999). *Essentials of educational technology*. Boston: Allyn and Bacon.

Singh, V. K. (2003). *Does Multimedia really improve learning effectiveness?* Paper presented at the Asia Pacific Conference on Education, Re-envisioning Education: Innovation and Diversity, Singapore.

Surjono, H. D. (2006). *Development and Evaluation of an Adaptive Hypermedia System Based on Multiple Student Characteristics*. Unpublished doctoral dissertation, School of Multimedia and Information Technology, Southern Cross University, Australia.

Surjono, H.D. (2007a). *The design and implementation of an adaptive e-learning system*. Paper presented at the International Symposium Open, Distance, and E-learning (ISODEL 2007), Denpasar, Indonesia.

Surjono, H.D. (2007b). *Empirical evaluation of an adaptive e-learning system and the effects of knowledge, learning styles and multimedia mode on student achievement*. Paper presented at the UiTM International Conference on ELearning 2007 (UICEL), Universiti Teknologi MARA, Shah Alam, Malaysia.

Vaughan, T. (2011). *Multimedia: Making It Works*. 8th Edition. New York: McGraw Hill, 2011.

Copyright © The Turkish Online Journal of Educational Technology