ACES 2015
Proceedings Index

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Dear ACES / MDGs Colleagues,

Welcome to our second collaboration on Education for Sustainability and the Millennium Development Goals sponsored by the PRESDA Foundation.

We gather here today united by our determination and shared vision of a better world in which education and sustainable development take center stage. And it is through this intersection of interests that meaningful discourse and change arise. Your commitment to these objectives and gathering at the KKR Hotel Hiroshima bring renewed hope and ideas to a continent.

In the past, we have included education for sustainability and the MDGs as subthemes within other conferences; however, in preparation for the 2015 deadline, we wanted to bring as much attention as possible to these two, very important topics. We were encouraged early on by the high number of quality and diverse submissions we received, as well as the inquiries for audience. Naturally, though, the high cost of travel to Japan and the difficulty of securing hotel accommodation in Hiroshima, especially during this week when most schools in Japan have their graduation ceremony. It has unfortunately had an adverse impact on the number of participants that can physically attend. Nonetheless, we are delighted that nearly sixty-five participants representing more than twenty-five countries will be taking part in this event over the next three days.

We sincerely thank you for your participation in ACES / MDGs and for broadening the intellectual scope and understanding of the education and sustainable development in Asia and elsewhere. We hope you enjoy your stay in Hiroshima as well as the city’s rich cultural heritage while advancing our shared goals.

Sincerely,

Takayuki Yamada
Chairman, Board of Governors, The PRESDA Foundation (Japan)

John Latzo
Chairperson, Editorial Committee
Professor, Division of Humanities, POSTECH (Rep. of Korea)

Michael Sasaoka
ACES / MDGs Program Director
Academic Director TIER A Research Center (Japan)
Educating as sustainability: developing a pedagogy of hope and promise

Dr. Alan Brady, Kwansei Gakuin University, Osaka, Japan

Dr. Alan Brady is a full-time professor at Kwansei Gakuin University in Kansai, Japan and has worked there in the Sociology Faculty since 1991. He has lived and worked in Japan for over 40 years. His main research interests are the sociology of education and integrated social-natural worlds sustainability, language education policy, planning, and practices at universities in Japan, and the development of a civic responsibility and global and glocal citizenship thru integrated language and content higher learning. His most recent publications have centered on that development.

He received his B.S. at State University of New York (New Paltz), his M.A. from New York University (Linguistics), and his Ph.D (Linguistics and Modern English Language) from Lancaster University (England, UK). Has served as publicity chair for JALT 1991 conference, Japanese representative for IALIC (International Association of Languages and Intercultural Communication) 2001-present, Japanese representative of Sociology of Education Research Committee of ISA (International Sociological Association) from 2002.

ACES / MDGS 2015 Acknowledgements

We extend our deepest appreciation to the following institutions and people:

ACES / MDGS 2015 Sponsor
The PRESDA Foundation (Japan)

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Hiroshima Peace Institute, Hiroshima City University (Japan)
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Sonoma State University (USA)
Bar-Ilan University (Israel)
University of Guadalajara (Mexico)

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William P. Kittredge, Ph.D., President of Cervelet Management and Strategy Consultants

ACES / MDGS 2015 Featured Speaker
Dr. Alan Brady, Kwansei Gakuin University, Osaka, Japan

ACES / MDGS Audience and Special Guests
Siong Ying Tang, Dow Jones & Co., Beijing, China
Supotch Chaiyasang, International College, Rajabhat Suan Sunandha University, Thailand
Gary Piller, Kyoto University, Japan
Van Anh Vo, University of Tsukuba, Japan
John Fresly, Tarumanegara University, Indonesia
Dara Sim, Osaka University, Japan
Sang Bui, Nishi Nippon Junior College, Fukuoka, Japan
Ingvild Bode, The United Nations University, Japan
Tomoko Arakawa, The Asian Rural Institute, Japan
Mutsuhisa Ban, Tokyo Institute of Technology, Japan
Teilee Kuong, Nagoya University, Japan
Yi Zhang, Lingnan University, Hong Kong
Hisako Matsuo, St. Louis University, USA
Mike Duffy, University of San Francisco, USA
Edy Wong, University of Alberta, Canada

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About the Event

ACES / MDGS Organizer

The Pacific Rim Education for Sustainable Development Alliance (PRESDA) was established in 2010. We are an alliance of grassroots non-profit organizations, teachers, business people, and concerned citizens from around Asia and beyond who wish to make a difference. Incorporated under the laws of Japan, the PRESDA Foundation is an independent, not-for-profit foundation helping to fulfill the Millennium Development Goals.

For more information about the PRESDA Foundation and our projects, please visit our homepage at www.presdafoundation.org

Finally, on behalf of the ACES / MDGS 2015 team, we would like to extend our deepest thanks to the people of Hiroshima City for their support and gracious hospitality.

The Second Asia Conference on Education for Sustainability

Today’s sustainability challenges require a holistic perspective that embraces the critical relationship between the classroom and community service. This is evident as human communities as well as their diverse biological and cultural heritage are increasingly threatened by mounting environmental and societal problems from climate change and exploitation of finite resources to the inequities and human costs of unsustainable practices and technologies.

Progress on these issues is often further complicated by the contemporary hegemonic mind-set of the status quo, resulting in complacency, inactivity and the general perception of individual futility. This is particularly pronounced in many developing countries in Asia in which the focus on economic growth at the expense of the environment and the failure to recognize the inextricable link between these sustainable domains are commonplace. That is why educators play a pivotal role in understanding, challenging and altering such destructive and unsustainable courses. By examining and interpreting humans’ beliefs about their relationship to nature and intertwining this knowledge and policies across the disciplines, educators can broaden our understanding of sustainability and forge new sustainable paths.

Our shared biosphere and rapid globalization ensure no country is immune from another country’s problems and risks, which means a collective and multidisciplinary approach is essential for integrating environmental and cultural sustainability

The Second Asian Conference on the Millennium Development Goals

It has been fifteen years since the leaders of 189 countries established the Millennium Declaration which outlined eight target areas of concern to be achieved by the year 2015. The MDGs emphasize shared accountability and reciprocal obligations among developed and developing countries for key development outcomes. In addition, the global MDG effort rests on the premise that participation of every member of society is essential to the attainment of these goals. Not only is cooperation needed between countries, but campaigns need to mobilize society and bring together different actors of society – governments, private sector, civil society, the general public and the media – to be successful.
Proceedings

The conference organizer is a non-profit corporation that has been registered in Japan. As such, the proceedings for this conference have been approved and assigned an International Standard Serial Number (ISSN) through the Japanese National Centre for ISSN under the auspices of the National Diet Library.

The National Diet Library, which acquires national serial publications exhaustively as the only national and deposit library in Japan, plays a role as the Japanese National Centre for ISSN.

The Proceedings will be made available through the ESDFocus Library page. A link will be sent to all registered participants. Please note that the proceedings are published in electronic format only as we strive to be a carbon neutral event.

- ACES ISSN 2188-6997
- AMDG ISSN 2188-398X
Designated Hotel – KKR Hotel Hiroshima

All ACES / MDGS sessions will be held in the KKR Hotel Hiroshima, which is located a short distance from Hiroshima Castle and the government offices of Hiroshima Prefecture.

Three public transportation rail systems pass within a short distance of the KKR Hotel Hiroshima:

1. JOHOKU Station on the ASTRAM Rail Line is only 3 minutes west on foot.
2. HAKUSHIMA Station on the Dentetsu Streetcar Line (also known as the ‘Hiroden’) is also 3 minutes west on foot. Please transfer at “Hacchobori” to Hakushima-line and get off at the termination.
3. JR HIROSHIMA Station or JR YOKOGAWA Station is only 5 minutes by taxi

Venue

As one of the largest cities in western Japan, Hiroshima has been a bustling, affluent and prosperous city with a rich history dating back to 1589, when it was established as the capital city of a powerful samurai warlord. Today, of course, Hiroshima is most well-known as the first city in the world to have suffered an atomic bombing, which occurred towards the end of World War II on August 6, 1945. Around the city of Hiroshima, you will find many well-used green spaces, none of which are more important than the poignant Peace Memorial Park, where various statues and monuments reside, as well as the A-Dome building, which has become a symbol of peace and has been registered as a UNESCO World Heritage Site.

In addition, Hiroshima boasts some of the best traditional Japanese landscaping, including the beautiful Shukkeien Garden complete with tea-houses, ponds and bridges – located just a short distance on foot from the KKR Hotel. Finally, there is the iconic Miyajima Shrine Island, which is revered as one of the “three views of Japan” with its towering red torii gate standing in the midst of the Inland Sea.

Dress

During ACES / MDGS sessions and receptions, the expected dress code is business casual.

Weather

March temperatures in Hiroshima can reach an average low of 14.2 C (57.6F) to an average high of 23.4 C (74.1F). We advise that you dress warm, wear long sleeve shirts, and bring a light jacket. The temperature at night will be chilly. Also, if you will join the Miyajima Tour, we suggest bringing a pair of comfortable walking shoes, a hat and a light jacket.

Equipment

Presentation rooms are equipped with PC notebook computers, screens, projectors, speakers, laser pointers and microphones.

Please note that the computers are not connected to the sound system in the room. If you intend to have an audio track during your presentation, please let us know.

We also provide onsite technical support, if needed.
Session Moderators

Presentations during regular sessions have been allotted 25 to 30 minutes. We advise that presenters limit their presentation to 25 minutes and then use the remaining 5 minutes for questions and answers. We also ask that you allow time for the next presenter to prepare.

As it is difficult for presenters to be mindful of the time, we have selected (2) people from each panel to alert the presenters when the presentation has reached the 25-minute mark.

The primary task of the moderator is simply to remind presenters when the presentation time has expired so as to allow for a smooth transition for the next presenter.

The moderators are not required to introduce the speakers because details are included in the schedule program regarding the name and affiliation of the speaker.

If a presenter is absent or arrives late, the moderators should start the next presentation and inform the audience accordingly. If a moderator arrives late or is absent the panel should nominate an alternate moderator.

*Any presenters arriving late must wait until the final presenter has finished, and then may use any remaining time to present.*

Internet Access

WIFI access is available in the KKR lobby area. Please see the front desk for login and password details.

If you are staying in the KKR, then you can access the Internet free-of-charge in your room using the LAN cable provided.

*Having difficulty connecting to the WIFI inside the KKR? Please note that the ACES / MDGS organizers have no control over the WIFI access, so please inquire at the hotel front desk.*

Printing

Photocopies can be made at the Lawson convenience store near the KKR.

Alternatively, for larger printing needs, there is a Kinko’s located on Hon-Dori Avenue. See the KKR front desk for directions.

Stores near the KKR

There are two convenience stores within easy walk of the KKR: the nearest is a Lawson across from the KKR. Also, there is a 7-11 approximately 5 minutes on foot. Ask the front desk for a map and directions.

Banks / ATM / Currency Exchange

There is a bank that offers currency exchange within 5 minutes walk from the KKR. Please ask the hotel front desk for a map and directions.

All banks in Hiroshima are open until 3:00 p.m. Monday to Friday and closed on Saturday and Sunday. Please remember to bring your passport when exchanging money.

International ATMs with English menus are also available at 7-Eleven convenience stores, which are open 24 hours with locations throughout the city.
Conference Schedule Overview
Day 1:  Sunday, March 22, 2015

Opening Remarks and the Featured Presentation will be in the Suehiro Ballroom on the 1st floor.

14:00 to 15:30  Participant Check-in  
(Name Badge, Conference Program, Receipt, etc.)  
Location: KKR Hotel, Main floor lobby

16:00 to 17:00  Commencement (attendance is open to registrants only)  
Held in the Suehiro Ballroom on the 1st floor

16:15 to 17:00  Featured Presentation in the Suehiro Ballroom on the 1st floor  
Dr. Alan Brady, Kwansei Gakuin University, Osaka, Japan  
Title: Educating as sustainability: developing a pedagogy of hope and promise

17:15 to 19:00  Welcome Dinner Reception  
The restaurant is a short walk from the KKR Hotel. We will depart from the lobby at 17:10. Please wear your conference name badge to dinner.

Due to limited seating, the reception is open to registered participants only
DAY 2: Monday, March 23, 2015

All sessions will be held in the Chidori and Suehiro Ballrooms on the 1st floor.

08:00 to 09:00 Virtual Panel V-1 (Chidori Ballroom)
The Millennium Development Goals: 0230, 0250, 0251, 0252, 0275, 0280

09:00 to 10:30 Oral Session A-1 (Chidori Ballroom)
Thai Perspectives on Math Education I: 0303, 0327, 0331

09:00 to 10:30 Oral Session A-2 (Suehiro Ballroom)
ESD, Administration and Policy: 0305, 0320, 0337

10:45 to 12:45 Oral Session B-1 (Chidori Ballroom)
Secondary Education and Sustainability: 0326, 0328, 0329, 0330

10:45 to 12:45 Oral Session B-2 (Suehiro Ballroom)
Trending Perspectives in Education for Sustainability I: 0318, 0333, 0349, 0347

12:45 to 13:45 Lunch Recess

14:00 to 15:30 Oral Session C-1 (Chidori Ballroom)
Thai Perspectives on Math Education II: 0323, 0324, 0325

14:00 to 15:30 Oral Session C-2 (Suehiro Ballroom)
Special Topics in Education for Sustainability II: 0304, 0338, 0348

16:00 to 17:00 Poster Session and Networking Reception* (Suehiro Ballroom)
Food and drinks will be served.
Posters: 0311, 0312, 0317, 0318, 0350, 0390
DAY 3: Tuesday, March 24, 2015

The morning session and closing remarks will be held in the Suehiro Ballroom on the 1st floor.

08:00 to 09:00  Virtual Panel V-2 (Suehiro Ballroom)
Education for Sustainability: 0309, 0310, 0351, 301

08:00 to 09:00  Virtual Panel V-3* (Suehiro Ballroom)
Non-presenting Panel (Abstracts available in the Proceedings)
Education for Sustainability: 0319, 0342, 0344, 0345, 0346, 0356

09:00 to 09:30  Coffee and Closing Remarks

10:00 to 15:00  (Optional) Tour to Miyajima ‘The Shrine Island’

The tour includes roundtrip transportation, entrance fee, tea and cake and guidance in English by a professional tour guide.

About Miyajima ‘The Shrine Island’

Miyajima Island is the popular name of Itsuku-shima Island, situated in Hatsukaichi City in southwestern Hiroshima. It is a scenic site in which the mountains, sea, and red shrine buildings blend together in harmony. The entire island is designated as a UNESCO World Heritage Site. It is said to be one of the three most beautiful sights in Japan, along with Matsushima in Miyagi Prefecture and Amano-hashidate in Kyoto. The origin of Miyajima is said to date back to when the Itsuku-shima-jinja Shrine was built in 593 during the reign of Empress Suiko; however, the island of Miyajima itself has had a long history of being an object of worship, especially its Mt. Mi-sen that rises up at the center of the island.
Overview of Presenter Sessions
Maternal Child Health
0230 HTA of PPIUCD: To understand cost and clinical effectiveness of postpartum intrauterine device
Radhika Adholeya, Population services International, India

Population and Aging Health
0250 The hydration among elderly people
Anna Dittfeld, Medical University of Silesia, Poland
Katarzyna Gwizdek, Medical University of Silesia, Poland
Aneta Koszowska, Medical University of Silesia, Poland
Justyna Nowak, Medical University of Silesia, Poland
Anna Bronczyk-Puzoń, Medical University of Silesia, Poland
Karolina Kulik-Kupka, Medical University of Silesia, Poland

Mental Health
0251 Body satisfaction and human value among active people.
Anna Dittfeld, Medical University of Silesia, Poland
Katarzyna Gwizdek, Medical University of Silesia, Poland
Aneta Koszowska, Medical University of Silesia, Poland
Anna Brzęk, Medical University of Silesia, Poland
Anna Bronczyk-Puzoń, Medical University of Silesia, Poland
Karolina Kulik-Kupka, Medical University of Silesia, Poland

Nutrition and Malnutrition
0252 Orthorexia nervosa among dietetics students compared to physiotherapy students.
Anna Dittfeld, Medical University of Silesia, Poland
Katarzyna Gwizdek, Medical University of Silesia, Poland
Aneta Koszowska, Medical University of Silesia, Poland
Justyna Nowak, Medical University of Silesia, Poland
Katarzyna Ziora, Medical University of Silesia, Poland
Karolina Kulik-Kupka, Medical University of Silesia, Poland

Innovations in Water Supply and Waste Water
0275 Rural Community Based-Drinking Water Production
Kat Bun Heng, Community Translation Organization (CTO), Cambodia
Mr. Sean Prum, OXFAM Cambodia

Equity Issues for WASH
0280 Exploring the Link Between a Lack of Access to Water and Sanitation Facilities and Sexual Violence Against Women in Delhi, India.
Shirley Lennon, The London School of Hygiene and Tropical Medicine, United Kingdom
Monday, March 23, 2015

Session A-1: Thai Perspectives on Math Education I

Chidori Ballroom
09:00 to 10:30

Presenters: 0303, 0327, 0331

Session Moderators: Sukanya Dasri and Ekapong Benjakul

09:00 to 09:30
Math Education

0303 The Effect of Using Know – Want – Learn Strategy on Students’ Achievement and Attitude in Learning Mathematic of grade 12th Students.
Sukanya Dasri, International College, Suan Sunandha Rajabhat University, Surin, Thailand

09:30 to 10:00
Math Education

0327 The Effect of Using Discovery Learning Method on Students’ Achievement and Attitude
Ekapong Benjakul, International College, Suan Sunandha Rajabhat University, Thailand

10:00 to 10:30
Math Education

0331 The Influence of Van Hiele’s Phase-Based Instruction on The Performance in Analytic Geometry of Grade 10th Horwang Students’ achievement
Pornsuda Pengmuchaya, International College, Suan Sunandha Rajabhat University, Thailand

Presenters should finish by 10:30 so that the next session has enough time to prepare.
Monday, March 23, 2015

Session A-2: ESD, Administration and Policy

Suehiro Ballroom
09:00 to 10:30

Presenters: 0305, 0320, 337

Session Moderators: Caroline Kamau and Jung Tsun Liu

09:00 to 09:30
Education for Sustainable Development

0305 *Education for a sustainable urban mobility: transformation of a social representation by a communication process*
Jimmy Bordarie, University of Angers, France
Sandrine Gaymard, University of Angers, France

09:30 to 10:00
Administration and Policy

0320 *Government procurement decision-making and management of the development of BOT – the Taipei City “Zone T-9 – Q Square” Case*
Jung Tsun Liu, Chang Jung Christian University, Taiwan

10:00 to 10:30
Science Education Policy

0337 *Medical doctor preparedness and learning curve analysis: international perspectives*
Caroline Kamau, Birkbeck, University of London, United Kingdom

*Presenters should finish by 10:30 so that the next session has enough time to prepare.*
Monday, March 23, 2015

Session B-1: Secondary Education and Sustainability

Chidori Ballroom
10:45 to 12:45

Presenters: 0326, 0328, 0329, 0330

Session Moderators: Oraphan Boonruang and Jenjira Kampor

10:45 to 11:15
Secondary Education

0326 Using constructism paradigm to enhance students’ understanding and achievement in mathematics.
Oraphan Boonruang, International College, Suan Sunandha Rajabhat University, Thailand

11:15 to 11:45
Secondary Education

0328 The impact of using the Geometer’s Sketchpad as learning tool and 5Es Instructional Model on Students’ Higher Order Thinking Skills and Attitudes toward Mathematics.
Jenjira Kampor, International College, Suan Sunandha Rajabhat University, Thailand

11:45 to 12:15
Secondary Education

0329 Using the Cooperative Learning Strategy to Correct Misconceptions in Mathematics for Grade 10 Students
Pirawan Pothilert, International College, Suan Sunandha Rajabhat University, Thailand

12:15 to 12:45
Secondary Education

0330 Using open-ended problems to promote mathematical communication skills and creative thinking ability of gifted and talented education program 9 grade students.
Jiratcharya Kasaen, International College, Suan Sunandha Rajabhat University, Thailand

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Session B-2: Trending Perspectives in Education for Sustainability I

Suehiro Ballroom
10:45 to 12:45

Presenters: 0318, 0333, 0349, 0347

Session Moderators: Winnie Goh and Amnart Pohthong

10:45 to 11:15
Early Childhood Education

0318 The Association of Poverty on Early Childhood learning as reflected on Developmental Profile of Young Children
Winnie Goh, KK Women's & Children's Hospital, Singapore
Sita Padmini Yeleswarapu, Dept. of Child Development, KK Women's & Children's Hospital, Singapore
Wen-Si Yang, Dept. of Paediatric Medicine, KK Women's & Children's Hospital, Singapore
Rajni D/O Parasurum, Dept. of Paediatric Medicine, KK Women's & Children's Hospital, Singapore

11:15 to 11:45
Higher Education and Further Education

0333 The Study of Programming Problems in the First Programming Course for Students Enrolled in Computing Curricular Programs at Higher Education Levels
Amnart Pohthong, Prince of Songkla University, Thailand

11:45 to 12:15
Distance Education / E-learning

0349 Curriculum Development Electronic, Student Teachers Training in Inclusive Classrooms Use Model Co-Teaching
Orawan Nimtalung, Sakon Nakhon Rajabhat University, Thailand

12:15 to 12:45
Language Education

0347 Understanding the Nature of Auditory Recognition of Phonological/Grammatical/ Semantic Errors at the Sentence Level
Hirokatsu Kawashima, Nagasaki University of Foreign Studies, Japan
Lunch Recess
12:45 to 13:45

Included with the registration fee is one lunch voucher, which can be used at either of the KKR Hiroshima restaurants: Café Assittee (1F) or the Restaurant Hakushima (B1).

The Restaurant Hakushima serves a daily ‘A’ and ‘B’ special menu, which normally includes a meat entrée, such as fish or beef or chicken, as well as rice, miso soup and tea. The restaurant will have a sample display of the special menus near the entrance, so that you may easily make your choice.

The Café Assittee serves a toast set with jam, a boiled egg, salad and yogurt with coffee or tea. In addition, the café offers a popular beef curry and rice with salad and a drink of your choice. Alternatively, there is a cake set with coffee or tea.

We regret that the restaurants may not offer substitutions.

The ticket voucher is valid for the day that is stamped on it. Lost or misplaced tickets cannot be replaced. The voucher is only given to registered participants. The voucher cannot be exchanged for cash or redeemed if unused.
Monday, March 23, 2015

Session C-1: Thai Perspectives on Math Education II

Chidori Ballroom
14:00 to 15:30

Presenters: 0323, 0324, 0325

Session Moderators: Wassana Boontao and Bancha Morachat

14:00 to 14:30
Math Education

0323 Applying the Know-Want-Learn strategy to improve students’ mathematical problem solving
Wassana Boontao, International College, Suan Sunandha Rajabhat University, Thailand

14:30 to 15:00
Math Education

0324 The Improvement of Teaching by Creating an Instructional Model Implementing Polya’s Approach in Mathematical Problem Solving for Tenth Grade Students
Bancha Morachat, International College, Suan Sunandha Rajabhat University, Thailand

15:00 to 15:30
Math Education

0325 Using Cooperative Learning to Develop Learning Outcome in Mathematics of Grade 11 Students
Nawee Sakdadech, International College, Suan Sunandha Rajabhat University, Thailand
Monday, March 23, 2015

Session C-2: Special Topics in Education for Sustainability

Suehiro Ballroom
14:00 to 15:30

Presenters: 0304, 0338, 0348

Session Moderator: Tamara Savelyeva and Lance Neckar

14:00 to 14:30
Special Topic: Higher Education Sustainability

**0304** Anciently rooted and fully globalized: How Asian ecological discourses shape innovative sustainability practices in higher education
Tamara Savelyeva, The Hong Kong Institute of Education, Hong Kong

14:30 to 15:00
Special Topic: Higher Education Sustainability

**0338** What’s the Plan? Creative Interdisciplinary Sustainability Education in the Liberal Arts
Lance Neckar, Pitzer College, United States

15:00 to 15:30
Special Topic: Education for Sustainable Development

**0348** Climate Change Education and Youth Participation for Sustainable Development: A Reivew of Policy and Practice in Thailand
Joanne Narksompong, Chulalongkorn University, Thailand
Sangchan Limjirakan, Enviornment, Development and Sustainability, Chulalongkorn University, Thailand

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Poster Session and Networking Reception*

*Food and drinks will be served.

Suehiro Ballroom
16:00 to 17:00

Poster Presenters: 0311, 0312, 0317, 0318, 0350, 0390

Language Education

0311 Reflection of Education for Sustainable Development in English Textbook
Bulgantsetseg Munkhbat, Mongolian State University of Education, Mongolia
Enkhbayar Lkhagva, Mongolian State University of Education, Mongolia

Special Topic: Education for Sustainable Development

0312 Reflection of Education for Sustainable Development in English Textbook
Enkhbayar Lkhagva, Mongolian National University of Education, Mongolia
Enkhbayar Lkhagva, Mongolian National University of Education, Mongolia

Distance Education / E-learning

0317 A Comparative Study on Japanese and Korean Students’ Self-efficacy and Anxiety in Online Cooperative Learning
Hiroki Yoshida, Tokoha University, Japan
Seiji Tani, Tokoha University, Japan
Tomoko Uchida, Jeju National University, Republic of Korea
Minori Fukushima, Tokoha University, Japan
Akira Nakayama, Ehime University, Japan

Teacher Education

0318 Structural Analysis of Pre-service Teachers’ Belief in Teachers’ Qualities and Education
Hiroki Yoshida, Tokoha University, Japan

Language Education

0350 The Comparison of Two Free Classroom Response Systems: Socrative and InfuseLearning and Their Application to English Grammar Teaching
Leo Wen Hua Liang, Mackay Junior College of Medicine, Nursing and Management, Taiwan

Educational Technology / ICT

0390 Enhancing Learning Comprehension in Indonesia using Animation Videos in a Flipped Classroom
Muhammad Hamzah, Institut Teknologi Bandung, Indonesia; Yonemoto Laboratory, Chemical Engineering Department, Tohoku University, Japan

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Virtual Panel V-2
Suehiro Ballroom

08:00 to 09:00

Education for Sustainability

Virtual Presenter Panel: 0309, 0310, 0351, 0301

Secondary Education

0309 A Perfect World: Cultural Exploration in a Japanese Senior High School
Harry Carley, Matsuyama University, Japan

Elementary Education

0310 Sustainability in Japanese English Language Education at the Elementary and Junior High School Level: A Survey of the Texts
Harry Carley, Matsuyama University, Japan

Special Topic: Education for Sustainable Development

0351 Teaching Sustainability in the English for Academic Purposes Classroom
Alexander Nanni, Mahidol University International College, Thailand
Joseph Serrani, Mahidol University International College, Thailand

Special Topic: Education for Sustainable Development

0301 Can education for sustainability in secondary schools embrace a deep ecology philosophy?
William Smith, RMIT University, Australia
Virtual Panel V-3
Suehiro Ballroom

08:00 to 09:00

Education for Sustainability

Non-Presenting Panel*: 0319, 0342, 0344, 0345, 0346, 0356

*Abstracts available in the Proceedings.

Special Topic: Higher Education Sustainability

0319 Soft Skills for teaching Excellence to Employability within the High Education
Ruey-Fa Lin, FengChia University, Taiwan

Special Topic: Equity and Social Justice

0342 'Open-education': A Means to Social Justice and Equity
Dipannita Datta, Jadavpur University, India

Special Topic: Equity and Social Justice

0344 Disability Inclusive Communities for The Better Life
Ok Tiwi, Yogyakarta State University, Yogyakarta

Special Education

0345 'School Business Disability' as An Alternative Program to Provide Job Vocation for Disable People
Anis Syarifah, Yogyakarta State University, Indonesia

Special Education

0346 Special Spectacles for Persons with Low Vision
Leni Cahyani, Yogyakarta State University, Indonesia
Lina Ambar Melani, Gadjah Mada University, Indonesia

Special Topic: Education for Sustainable Development

0356 An Ecosystemic Approach to Public Policies, Research and Teaching Programmes
André Francisco Pilon, University of São Paulo, Brazil

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Closing Remarks in the Suehiro Ballroom

09:00 to 9:30

Coffee, tea, ice water and light snacks will be served.

09:30 to 10:00

Miyajima Tour Preparation

10:00 to 15:00

(Optional) Tour

Miyajima ‘The Shrine Island’

Miyajima is considered one of the top three views of Japan and a must-see for visitors to Hiroshima. The tour includes roundtrip participation, entrance fee and guidance in English by a professional, bilingual tour guide. In addition, participants will visit a Japanese teahouse on the island for a cup of hot green tea and a traditional Japanese cake.

Please come to the Suehiro Ballroom by 09:30 to receive your ticket, badge and information. The tour will depart from the KKR Hotel promptly at 10:00.

We suggest that you wear comfortable walking shoes, a long sleeve jacket or shirt and a hat, if possible.

*Please note that the tour does not include lunch. We suggest purchasing food and drinks at the 7-11 convenience store next to Miyajima Port or you can eat at one of the many restaurants on the island.*

About Miyajima ‘The Shrine Island’

Miyajima Island is the popular name of Itsukushima Island, situated in Hatsukaichi City in southwestern Hiroshima. It is a scenic site in which the mountains, sea, and red shrine buildings blend together in harmony. The entire island is designated as a UNESCO World Heritage Site. It is said to be one of the three most beautiful sights in Japan, along with Matsushima in Miyagi Prefecture and Amanohashidate in Kyoto. The origin of Miyajima is said to date back to when the Itsukushima-jinja Shrine was built in 593 during the reign of Empress Suiko; however, the island of Miyajima itself has had a long history of being an object of worship, especially its Mt. Misen at the center of the island.
0301 Special Topic: Education for Sustainable Development

Can education for sustainability in secondary schools embrace a deep ecology philosophy?
William Smith, RMIT University, Australia

Case studies, questionnaires and open-ended interviews with environment club students addressed the elements of the eight-point deep ecology platform, and some aspects of pre- and post-settlement land management by indigenous Australians. Student views on their position as a global environmental citizen were explored. The data was segmented and reassembled into codes using social theory and then sorted into themes using an inductive process borrowed from grounded theory. This was then used to build models for analysis. There is strong evidence from the data that students are ecocentric in their beliefs and reject anthropocentrism. The respondents were primarily influenced by the sustainability coordinators, their parents and club peers. Their social context is complex and has a critical role in the agency that students have over their role as an environmental advocate. Electronic media helps students find global environmental catastrophes relevant. Students in environment see themselves as the torchbearers of the future and they are not afraid to tackle the problems of overconsumption. We believe it is time to allow students to show their ecological wisdom by making ecophilosophy a part of their EfS. We believe that EfS is ready to embrace ecocentrism. Although this study is based on a small sample we believe it opens up ecoliteracy to include deep ecology at all levels of debate.

0303 Math Education

The Effect of Using Know – Want – Learn Strategy on Students’ Achievement and Attitude in Learning Mathematics of grade 12th Students.
Sukanya Dasri, International College, Suan Sunandha Rajabhat University, Surin

The purposes of this research were to investigate of using Know – Want – Learn Strategy (KWL strategy) on students’ achievement and to assess students’ attitudes towards learning mathematics. The samples consisted of 32 Grade 12 students in the second semester of the academic Year 2014 at Satree Wat Mahapurutaram Girls’ School, Bangkok, Thailand. The research instruments were lesson plans, test, observation forms and questionnaire. The researcher employed lesson plans and test to investigate of using Know – Want – Learn strategy, observation and questionnaire to assess students’ attitudes in learning mathematics. The researcher analyzed the data by using percentage, mean and standard deviation. Based on students writing in their K-W-L work sheets, the researcher found that students wrote what were given from the questions, shown their understandings and what they had to figure out. After the KWL strategy was used, students had high achievements and positive attitude in learning mathematics.

0304 Special Topic: Higher Education Sustainability

Anciently rooted and fully globalized: How Asian ecological discourses shape innovative sustainability practices in higher education
Tamara Savelyeva, The Hong Kong Institute of Education, Hong Kong

Responding to the demands of globalization, the Hong Kong higher education (HE) system adapts new directions and incorporates Western ideas of sustainability into its policies and practices. Following this global trend, the HE system mimics Western sustainability implementation approaches in all its areas and levels. This makes the system highly ranked, yet, creates a problem: Western sustainability does not fully resonate with the ecological frameworks that for centuries guide local educational traditions. What are these authentic ecological discourses and how they might aid implementation of Western sustainability in Asian HE? The author addresses this issue in her comparative case-study by revisiting Asian ecological discourses which ground sustainability implementation within the local cultural tradition. The research findings explain how ignorance to the culturally-specific ecological frameworks might minimize a widespread entry of the western sustainability into non-western HE systems. The author uses an example of the Global Seminar HE project to uncover the tenets of these localized traditions, explain innovative specifics of their curricular implementation, and propose possible organic contributions to the global sustainability discourse.

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0305 Administration / Policy

*Education for a sustainable urban mobility: transformation of a social representation by a communication process*

Jimmy Bordarie, University of Angers, France
Sandrine Gaymard, University of Angers, France

Framework: The Social Representations Theory (SRT) highlights the importance of communication in the creation of common-sense knowledge (Moscovici, 1961). Structural approach describes the existence of a central core and a peripheral system in the Social Representation (SR) (Abric, 1976; Flament, 1987). SR are influenced by social practices (Flament, 1994) but their elaboration is related to communication. Few studies are interested in the impact of communication on the structure of SR (Roussiau & Soubiale, 1996) and even less which use a longitudinal approach. In this research, we associate the fundamental aspect of the impact of communication on SR with the imminent social issue of sustainable urban mobility through the 30kph zones as social object (Bordarie, en cours; Bordarie & Gaymard, 2013; Gaymard & Bordarie, 2014).

Method: 123 French psychology students at Angers’ University answered to a questionnaire. 84.1% are women and 15.9% men. The average age is 18.52 years old ($\sigma = 1.05$). Individuals filled out a questionnaire once a week during one month. Before the second time, they were sensitized with an awareness campaign giving them information about the 30kph zones. Results: a Kruskal-Wallis test confirms that the most significant impact of the awareness campaign on the social representation structure concern the elements presented in the campaign, except for the safety. Our results also show the complex transformation of a central element with an only information campaign. But they also refute theoretical data concerning a potential return to “normal” of the representation’s structure after 15 days (Aissani, 1991a, 1991b).

0309 Secondary Education (Junior, Senior)

*A Perfect World: Cultural Exploration in a Japanese Senior High School*

Harry Carley, Matsuyama University, Japan

This presentation will offer details into the English language lessons given to senior high school students at a private school in Matsuyama, Japan. These students who will almost all go on to university, are part of a special International Program offered by this particular senior high school. Although the main emphasis is on English language education, Chinese language lessons along with guest lecturers from JICA (Japan International Cooperation Agency) and other associations allow students a broader education and window on the world. Students in the second year of this program spend 3 weeks in Australia along with a brief stay at an English camp in South Korea brushing up on their English language skills and experiencing other cultures. In Australia they attend English language classes at a language school that enrols students from all over the world. For many of these students it is their first trip overseas and their initial encounter with people from other nations and cultures. In their 3rd and final year while they are studying and preparing for Japanese university entrance exams their English language lessons continue. This presenter and author who is currently the primary native English instructor at the SHS will explain and specify the topics discussed during their final year. Class lesson topics covered on a global scale include Identity, Values, Gender and Culture, Social Change, and Global Community, along with many others; the final lessons resulting in a presentation of small groups explaining their ideas of a perfect world.

0310 Elementary Education

*Sustainability in Japanese English Language Education at the Elementary and Junior High School Level: A Survey of the Texts*

Harry Carley, Matsuyama University, Japan

This presentation and subsequent paper will explore Japanese English texts currently in use at the elementary and junior high school levels. Presently, Japanese students at the 5th and 6th grade levels are initially introduced to the English language through lessons which attempt to develop their English language skills while at the same time broadening their awareness of the world around them. Additionally Japanese junior high school students are also given more detailed English lessons throughout their 3 years of schooling before going on to another 3 years at the senior high school level. The Japanese English language texts in use in primary and junior high schools must be approved by the
Ministry of Education which is part of MEXT (Ministry of Education, Culture, Science and Technology). How concerned are these administrators with implementing world awareness at the adolescent level? By exploring and analyzing the subject matter contemporarily being introduced to learners through English language classes we are able to get a better understanding of how or how not sustainability on a global scale is being presented to Japanese students on a local level. By the conclusion of this presentation viewers should have a fundamental understanding of Japanese English language lessons and their association with sustainability in our world today. This presentation would be of concern not only to Japanese participants but also those conference participants from other countries with educational systems that are considering initiating the topic of sustainability toward younger learners into their educational systems.

0311 Language Education
Reflection of Education for Sustainable Development in English Textbook
Bulgantsetseg Munkhbat, Mongolian State University of Education, Mongolia
Enkhbayar Lkhagva, Mongolian State University of Education, Mongolia

This paper shares the experience of writing a national English textbook which has been designed as one of a series of new English textbooks for secondary education in Mongolia. The book is dedicated to 7th grade students who are studying the English language at the beginner-level. The authors wrote the textbook designed to help create sustainable development and prepare learners to be citizens with high competencies including critical thinking, problem solving, and working in a team. In this paper, the authors also share findings of three surveys conducted among the teenagers and secondary school teachers of Mongolia. The surveys aimed to reveal the appropriate content and methodology regarding education for sustainable development and integrate this concept throughout the textbook. The first survey demonstrated to what extent the needs and interests of young teenagers. The second described teachers’ opinions on how the education for sustainable development would be reflected in the content and methodology of the English textbook. The third survey showed how the new textbook is being used in English class and how the content and activities of this textbook supports learners in acquiring an education for sustainable development. Finally, the paper includes an evaluation of the textbook by the Asia-Pacific ESD - Network team member, expert educator Z. Bayarchimeg (Ph.D) on how the authors of the textbook impart an understanding of education for sustainable development through the textbook and give opportunities for teachers and students to become involved in incorporating sustainable development into daily life.

0312 Special Topic: Education for Sustainable Development
Reflection of Education for Sustainable Development in English Textbook
Enkhbayar Lkhagva, Mongolian National University of Education, Mongolia

This paper shares the experience of writing a national English textbook which has been designed as one of a series of new English textbooks for secondary education in Mongolia. The book is dedicated to 7th grade students who are studying the English language at the beginner-level. The authors wrote the textbook designed to help create sustainable development and prepare learners to be citizens with high competencies including critical thinking, problem solving, and working in a team. In this paper, the authors also share findings of three surveys conducted among the teenagers and secondary school teachers of Mongolia. The surveys aimed to reveal the appropriate content and methodology regarding education for sustainable development and integrate this concept throughout the textbook. The first survey demonstrated to what extent the needs and interests of young teenagers. The second described teachers’ opinions on how the education for sustainable development would be reflected in the content and methodology of the English textbook. The third survey showed how the new textbook is being used in English class and how the content and activities of this textbook supports learners in acquiring an education for sustainable development. Finally, the paper includes an evaluation of the textbook by the Asia-Pacific ESD - Network team member, expert educator Z. Bayarchimeg (Ph.D) on how the authors of the textbook impart an understanding of education for sustainable development through the textbook and give opportunities for teachers and students to become involved in incorporating sustainable development into daily life.
0313 Special Topic: Education for Sustainable Development

The Comparative Study of the Urban and Rural Development Plans of Identified City and Municipalties of Palawan Philippines: A Basis for Future Development Plans Towards a Resilient Urban and Rural Environment
Maricel Elorde, Palawan State University, Philippines

A comparative study of the present urban and rural development plans of the identified city and municipalities of Palawan, Philippines. The objective of the study is to understand and identify the different components of urban and rural development plans, as well as to understand the impacts to the sustainability and resiliency initiatives and practices of the rural and urban environment. The study reveals the efficiency of the plans that were implemented and its significant effect to the environment and economical productivity of the identified localities. One of the recommendations is to improve and rationalize the future development plans of the identified localities based on the assessment of the programs implemented of each locality in drafting the sustainability and resiliency initiatives applicable to the identified rural and urban environment of Palawan, Philippines.

0315 Teacher Education

Structural Analysis of Pre-service Teachers' Belief in Teachers' Qualities and Education
Hiroki Yoshida, Tokoha University, Japan

Japanese School teachers are undergoing drastic reformation of the system of teacher education and teacher training. The Basic Act on Education which sets national aims and goals of education in Japan has been revised for the first time since its enactment in 1947 according to the great changes of the present day society. It was followed by a teaching certificate renewal system was introduced in 2009 in order to improve the quality of teaching and a valid period for ten years was set for regular and special education personnel certificates. It is anticipated that the change of the Japanese society along with the change of the circumstances of teachers in school must affect pre-service teachers' views of teachers and education. Therefore, this study purposed to identify present Japanese pre-service teachers' cognition and beliefs about teachers and education. A questionnaire survey targeting 45 pre-service teachers was conducted. Affinity diagramming was used to categorize participants' responses with similar contents or characteristics together, and quantification method type III was used to classify the statements. As a result, 16 statements were identified as beliefs about teachers including four sub-scales: teaching ability, fairness and consistent behavior, motivation for self-development, and kindliness and consideration for the students. On the other hand, 17 statements were identified as beliefs about education with four sub-scales: diligence and commitment, cooperation and mutual support, saying what must be said, and consideration and appreciation.

0317 Distance Education / E-learning

A Comparative Study on Japanese and Korean Students' Self-efficacy and Anxiety in Online Cooperative Learning
Hiroki Yoshida, Tokoha University, Japan
Seiji Tani, Tokoha University, Japan
Tomoko Uchida, Jeju National University, Republic of Korea
Minori Fukushima, Tokoha University, Japan
Akira Nakayama, Ehime University, Japan

Development of computer-mediated communication technology enabled cooperative learning in virtual pedagogical settings. Online cooperative learning facilitates learners in a distance collaborate and achieve a common goal. However, previous studies note that learners' personal traits such as self-efficacy and anxiety have influence on their behavior and achievements in cooperative learning. Therefore, this study purposes to identify Japanese and Korean university students' self-efficacy and anxiety for online cooperative learning in advance of the implementation of online cooperative learning activities. Results of the study show that Korean students had significantly higher self-efficacy in utilizing computers (t (27) = 3.89, p < .01) and communicating with Japanese (t (27) = 2.42, p < .05) compared with Japanese students, while there was not a significant difference in participants' online learning self-efficacy (t (27) = 0.13, .05n.s.). Moreover, Japanese students had higher computer anxiety.
(t (27) = 2.96, p < .01) and online learning anxiety (t (27) = 3.65, p < .01), while there was not a significant difference in communication anxiety (t (27) = 0.13, .05n.s.). Results suggest that Korean students are quite confident and are not so much anxious in using computers for learning, their achievements in online learning, and communicating with Japanese students. On the other hand, Japanese students are anxious in using computers, and are ambivalent in their achievements. Given the findings of the study, it is necessary to develop online facilitation skills that reduce specific learners’ anxiety and promote their self-efficacy in order to enhance the quality of online cooperative learning.

0318 Early Childhood Education
The Association of Poverty on Early Childhood learning as reflected on Developmental Profile of Young Children
Winnie Goh, KK Women's & Children's Hospital, Singapore
Sita Padmini Yeleswarapu, Department Of Child Development. KK Women's & Children's Hospital, Singapore
Wen-Si Yang, Department Of Paediatric Medicine, Kk Women's & Children's Hospital, Singapore
Rajni D/O Parasurum, Department Of Paediatric Medicine. Kk Women's & Children's Hospital, Singapore

The relationships between socio economic status (SES) and early childhood learning, and its long-term impact on health and cognitive development is well established. Studies have shown a wide discrepancy in known vocabulary of 3 year-olds between those in lower and those in higher SES. We conducted a small sample study to review the developmental profile of young children from lower SES, as defined by household income of below 450 (Singapore Dollars SGD) per capital income(PCI) per month (National median PCI is SGD2200 per month). 33 children below 6 years old (19 boys and 14 girls) was recruited to be assessed by developmental paediatricians using the Ages & Stages Questionnaires® (ASQ). ASQ is a high quality tool for developmental screening of young children in areas of communication, gross motor, fine motor, problem solving and personal social skills. The data was analyzed by descriptive statistics. Across all ages, 51% of children showed significant delay (>2SD) in at least two domains, especially in the area of communication and problem solving skills. Of the children below 3 years’ old, significant delay in problem solving skill was observed in 53% and communication skills in 29%. In children above 3 years’ old, significant delay in commutation skill was observed in 44% and problem solving skills in 29 %. The significant delays we noted in communication and problem solving skills amongst these young children who come from impoverished backgrounds may likely impact their future learning. Therefore, planned community-based integrated early childhood education programmes are vital to optimise early learning foundation in these children.

0319 Special Topic: Higher Education Sustainability
Soft Skills for teaching Excellence to Employability within the High Education
Ruey-Fa Lin, Feng Chia University, Taiwan

Higher education has become a highly competitive market with the low fertility and aged civil society. For years, only those professional skills are stressed upon the effective employability. Nonetheless, the soft skills are being emphasized upon the labour force as man power policy amongst the globalised workplaces. The compatible occupational competency set is composed of knowledge, skills, and attitudes as well as professional qualifications such as certificates and diplomas and individual personalized characteristics. Therefore, those so-called soft skills such as teamwork, communication, leadership, and civility as well as language, literacy, and numeracy (LLN) are regarded as the requisite competencies needed by different disciplines and occupations. To somewhat extent the best practice proved as problem-based and evidence-based training takes place of competency-based training and renamed as modulated division/programme rather than traditional department. The individuality of personal characteristics plays the moderated and mediated roles to intervene the professionalized courses by way of seamless courses systematized to the workplace fields. This study aimed to explore the main effects resulted from soft skills and services learning yield in employability through the moderate and mediative effects intertwined with each other. Thus, the hierarchical multiple regression have been employed to reveal the plausible intrigue models to improve and assure the quality of learning from an AACSB accredited and teaching excellence awarded university in the
Middle Taiwan area. For its fundamental competitiveness, sustainability, and accountability to the organization functioning for society as a whole, these required credits would be kept, maintained, and innovated through a process improvement plan.

0320 Administration / Policy

Government procurement decision-making and management of the development of BOT – the Taipei City "Zone T-9 – Q Square" Case
Jung Tsun Liu, Chang Jung Christian University, Taiwan

This paper analyzes the policy decisions adopted by the government for the BOT development project and selects the Zone T-9 development project in Taipei City as a case study. Based on a literature review and interviews of scholars and specialists of related fields, we summarize the main factors and problems as follows: the feasibility of the replication at a different location, the attribution of responsibility of BOT development projects, the best applicant qualifications, the government responsibility for household use rights, the selection of development project investors. Owing to the controversial BOT-related decision-making process, this paper suggests that the government should develop some clear legal provisions to protect consumers’ rights, and should carefully assess the risk to select a high-quality professional team.

0323 Math Education

Applying the Know-Want-Learn strategy to improve students’ mathematical problem solving
Wassana Boontao, International College, Suan Sunandha Rajabhat University, Thailand

This classroom action research aimed to improve students’ ability in solving mathematical problem. The topic used in this study is “Conic Sections”. Participants were 44 grade 10 students from a classroom in the second semester of 2014. To help students better understanding the contents, I integrated GSP (The Geometer’s Sketchpad Program) in the lessons whenever it is appropriate. The researcher developed 18 lesson plans allied with Know-Want-Learn strategy. They lasted 18 periods. Data were collected from homework, test, classroom observation, student’s journal and student’s satisfaction questionnaire. The finding of this research demonstrated that Know-Want-Learn strategy was effective in improving the abilities to solve mathematical problems and promoting student’s satisfaction in learning with Know-Want-Learn strategy.

0324 Math Education

The Improvement of Teaching by Creating an Instructional Model Implementing Polya’s Approach in Mathematical Problem Solving for Tenth Grade Students
Bancha Morachat, International College, Suan Sunandha Rajabhat University, Thailand

The purposes of this action research were to create an instructional model based on the approach of Polya in solving mathematical word problems, and to study the attitude of the students towards mathematical problem solving. The sample consisted of 28 grade 10 mathematics students from Demonstration School of Suan Sunandha Rajabhat University. The research instruments used were two academic achievement tests, a student attitude survey, teacher observation forms, student journals, and students’ homework. This study consisted of two cycles. After the first one had been implemented, the collected data were analyzed and improvement was made to the instructional model before beginning the second cycle. The problem was identified from a test given to the students on the topic of solving mathematics word problems on the subject of “Sets.” The test scores were averagely low, which called for a solution. By using Polya’s approach, the expected results address students’ ability to solve mathematics word problems in a systematic way, which can be applied to other mathematics topics and other problems, and positive attitude towards mathematics problem solving.
0325 Math Education

*Using Cooperative Learning to Develop Learning Outcome in Mathematics of Grade 11 Students*

Nawee Sakdadech, International College, Suan Sunandha Rajabhat University, Thailand

The purposes of this action research were to study mathematics learning achievement of Grade 11 students before and after being provided Student Teams-Achievement Divisions (STAD) technique, to compare mathematics learning achievement of Grade 11 students after being provided STAD technique at the expected 70 percent criteria, and to study opinion of Grade 11 students towards STAD technique in mathematics. The participants in this study were 43 Grade 11 students in the second semester of the 2014 academic year at Debsirin School, Bangkok, Thailand. The experiment was conducted for 16 periods. The research instruments employed in this study consisted of 8 lesson plans based on the STAD technique, achievement test (IOC = 0.98, K.R.20 = 0.92) and questionnaire (IOC = 0.94). Achievement test and questionnaire were used to examine mathematics learning achievement and to study opinion of students toward STAD technique, respectively. The data were statistically analyzed by using t-test for dependent samples and t-test one sample. The findings showed that mathematics learning achievement after being provided STAD technique was statistically higher than before learning at the .01 level of significance. The mathematics learning achievement after being provided STAD technique was statistically higher than the expected criteria at the .01 level of significance. Students’ opinion towards STAD technique was at high level with the mean scores of 4.12.

0326 Secondary Education (Junior, Senior)

*Using constructism paradigm to enhance students’ understanding and achievement in mathematics.*

Oraphan Boonruang, International College, Suan Sunandha Rajabhat University, Thailand

This classroom action research aims to develop students’ understanding and help them to construct mathematical knowledge themselves by using constructivism paradigm. The participants were 31 grade 10 students in a classroom that the researcher was teaching in the second semester of 2014. The topic used in this study is “Complex number”. To enhance students’ understanding and to help them construct the knowledge themselves, the researcher developed 12 lesson plans on complex numbers which emphasized constructivist paradigm. To access students’ understanding and achievement, the researcher gathered information from homework, tests, exam, observation, and students’ journals. After 2 weeks, the same exam is also applied to measure students’ retention. The results of this study demonstrated that the constructivist lesson plan developed student’s understanding in learning Mathematics, encouraged students to construct new knowledge in Mathematics, and enhanced their achievement and retention.

0327 Math Education

*The Effect of Using Discovery Learning Method on Students’ Achievement and Attitude*

Ekapong Benjakul, International College, Suan Sunandha Rajabhat University, Thailand

The purposes of this research were to investigate the effect of using discovery learning method on students’ achievement and attitude in mathematics. The participants were 35 Grade 11 students in the second semester of Academic Year 2014 from Mahaprutaram Girls' School under the Royal Patronage of Her Majesty the Queen in Bangkok, Thailand. To enhance students’ understanding and to help them explore new knowledge by themselves, the researcher developed lesson plans on probability with experimenting mathematics activities. Based on research findings, students understood concepts of probability, applied their learning for solving problems in daily life, shared their thinking with others, and enjoyed to learn mathematics in classroom.
0328 Secondary Education (Junior, Senior)

*The impact of using the Geometer’s Sketchpad as learning tool and 5Es Instructional Model on Students’ Higher Order Thinking Skills and Attitudes toward Mathematics.*

Jenjira Kampor, International College, Suan Sunandha Rajabhat University, Thailand

The purposes of this action research were to investigate the impact of using the Geometer’s Sketchpad (GSP) and 5Es Instructional Model on students’ higher order thinking skills and students’ attitudes toward mathematics. The participants in this study were 30 Grade 10 students at Suankularb Wittayalai school in Bangkok, Thailand. The contents in this study were trigonometric functions. The 5Es Instructional Model composed of 5 steps in teaching: engagement, exploration, explanation, elaboration, and evaluation. The instruction lasted 10 periods. The research tools were 8 trigonometric lesson plans using GSP as learning tool and 5Es Instructional Model, exercises, formative test, observations, students’ journals, and attitude questionnaire toward mathematics. The findings of this study revealed that majority of participants had shown higher order thinking skills (understanding, applying, and analyzing) and positive attitude towards mathematics.

0329 Secondary Education (Junior, Senior)

*Using the Cooperative Learning Strategy to Correct Misconceptions in Mathematics for Grade 10 Students*

Pirawan Pothilert, International College, Suan Sunandha Rajabhat University, Thailand

The purposes of this action research were to correct student misconceptions in mathematics using the cooperative learning strategy (one-to-one tutoring) and to evaluate student satisfaction towards the proposed tutoring method. The topic used in this study was the “Matrices” which are a part of the high-school mathematics. The participants in this study were consisted of 43 grade-10 students at Debsirin School, Bangkok, Thailand. During the instruction of the specified topic, the researcher had employed formative assessments and identified students’ misconceptions through thinking steps in formative test. According to the class time limitation, the one-to-one tutoring was applied as an out-of-class activity where each student who had misconceptions was paired with the other student who had good mathematical concepts. The stronger student in each group attempted to assist his/her friend and evaluate if he/she had corrected the misconceptions. After the tutoring, students were assessed again and the results showed that most misconceptions were corrected. The participants were also asked to complete the questionnaire in which the results show that they had high level of satisfaction towards the proposed activity.

0330 Secondary Education (Junior, Senior)

*Using open-ended problems to promote mathematical communication skills and creative thinking ability of gifted and talented education program 9 grade students.*

Jiratcharya Kasaen, International College, Suan Sunandha Rajabhat University, Thailand

The purposes of this action research were to investigate mathematical communication skills and to examine creative thinking ability in Mathematics of students by using open-ended problems. Participants included 36 Grade 9 students in Gifted and Talented Education Program in the second semester of the 2014 academic year at Suankularb Wittayalai School in Bangkok, Thailand. Research instruments were lesson plans, mathematical creativity test, classroom observations and activity sheets. The experimental group was taught by using open-ended problems on Analytic Geometry and Relations. The researcher assessed individual observation and activity sheet with rubric evaluation form to measure mathematical communication skills. Besides, the researcher used mathematical creativity test to examine creative thinking ability in Mathematics. The results revealed that majority of participants were good mathematical communication skills and creative thinking abilities on Analytic Geometry and Relations.
0331 Math Education
The Influence of Van Hiele’s Phase-Based Instruction on The Performance in Analytic Geometry of Grade 10th Horwang Students’ achievement
Pornsuda Pengmuchaya, International College, Suan Sunandha Rajabhat University, Thailand

The purposes of this action research were to investigate learning efficiency by using van Hiele’s phase and to evaluate students’ attitudes toward mathematics learning by using van Hiele's phase. The participants were 42 Grade 10 students who enrolled in the second semester, academic year 2014 at Horwang School, Bangkok, Thailand. The research instruments comprised 10 lesson plans on the topics of Analytic Geometry, two unit tests, mathematics achievement test and questionnaire. The researcher carried out the lesson plans based on van Hiele's phase which have five steps consisting of inquiry/information, directed orientation, explication, free orientation and integration. The lesson plans, unit test and mathematics achievement test were used to investigate learning efficiency by using van Hiele’s phase and the questionnaire was used to evaluate students’ attitude towards Mathematics learning by using van Hiele's phase. The data were analysed in terms of percentage and descriptive analysis. The results of this study demonstrated that students’ achievement in performing his/her mathematical learning met the criteria 83.26/81.23. Besides, they had high level attitude towards van Hiele’s phase based on the performance in analytic geometry.

0333 Higher Education / Further Education
The Study of Programming Problems in the First Programming Course for Students Enrolled in Computing Curricular Programs at Higher Education Levels
Amnart Pohthong, Prince of Songkla University, Thailand

Computer programming skills are very important for students who study in computing disciplines at higher education levels and necessary for their profession. Many courses related to computer programming are added into undergraduate computing curricula. Teaching the first programming course is challenging to lecturers because expected programming skills gained by students will be needed for later courses. If students have problems in the first programming course, this will affect learning outcomes in the later courses as well as their careers. The 308-231 course, structured programming and applications, is the first programming course for students in the Information and Communication Technology (ICT) program at Faculty of Science, Prince of Songkla University. The observation from the previous experience in teaching this course found that students’ learning outcomes were unsatisfied. However, there is still lack of empirical data to be evidence for the course and curriculum improvement. Therefore, this research was aimed to study these problems as classroom action research by using thirty students who enrolled the 308-231 course in the first semester of academic year 2013. Questionnaires and depth interviews were used as data collection tools. The results from this study suggest thirteen topics from thirty topics or 43.33 % that the students claim as difficult and low understanding topics, and eight important factors for learning outcomes’ improvement.

0337 Science Education
Medical doctor preparedness and learning curve analysis: international perspectives
Caroline Kamau, Birkbeck, University of London, United Kingdom

There is high demand for medical doctors globally, giving them excellent occupational mobility, but posing some challenges when it comes to organizational adaption and adjustment to differences in healthcare systems. This presentation will introduce literature on the effects of medical education on workplace preparedness. Previous studies showed the need for more workplace-transferrable learning of clinical skills by medical students. This study asks: What is the psychology of learning clinical skills in medicine, and what is the association between learning curves and the learning objectives of medical education curricula in different countries? This empirical review compared learning curve analyses and curricula (connected with clinical skills acquisition by health students) from different countries. The results supported previous evidence of variation in the clinical skills competence according to the national medical education systems. The results also highlighted the need to push forward internationally harmonious approaches to medical education, extending previous evidence that some
Workplace learning activities for medical doctors are health system-specific and could be more globalized. The conclusion is that we should encourage a globalized outlook to linking health education with employability and workplace skills.

0338 Special Topic: Higher Education Sustainability

*What’s the Plan? Creative Interdisciplinary Sustainability Education in the Liberal Arts*

Lance Neckar, Pitzer College, United States

In this decade, we have arrived at teachable moment with respect to sustainability. Many liberal arts students see the impacts of cascading uncertainties in their everyday lives, and they come to college with strong passions for social and environmental change. Several leading U. S. scholars have spoken to the inherent values of liberal arts education in framing broad-spectrum, interdisciplinary solutions to complex sustainability problems. Some students see these problems in the context of environmental justice, others in terms of ecosystems services and biodiversity conservation. Some are focused on policy, some on research, and many others more broadly on social action. At the Claremont Colleges in California, Environmental Analysis as a field of study spans not only the disciplines but the colleges. A new degree track, Sustainability and the Built Environment focuses paired courses on analysis combined with projective thinking and creative making. The first, Case Studies in the Sustainable Built Environment, lays a systems-thinking foundation. Case studies of built projects are created by students as analyses of creative and collaborative manifestations of planning and design integration across systems and scales. Sustainable Place Studio provides the projective setting for engaged creativity. The collaborative studio setting aligns different modes of learning and problem-solving via design and planning pedagogies. Student-centered and peer learning are structured via problem identification, analysis, representation, and proposed solutions. Peer review evaluation builds confidence as students create proposals for resilient and livable places to meet uncertainties ahead.

0339 Special Topic: Higher Education Sustainability

*Educating as sustainability: developing a pedagogy of hope and promise*

Alan Brady, Kwansei Gakuin University, Japan

Flyvbjerg (2001) argues the social sciences need be practiced as phronesis which has four value-rational concerns: (1) where are we going, (2) who gains and who loses and by which mechanisms of power, (3) is this development desirable, and (4) what should we do about it. Morrison (2008) maintains that what and how children are taught results in their developing ideals and values that are then perpetuated in the wider society once students "go out into" society. Education is an essential tool for achieving sustainability. There is increasing concern that educators have not moved quickly enough to develop educating for sustainability learning programs. Educators have an obligation to dialogue with students so that they can together, individually and collectively, begin to think, feel, and act in ways to directly confront the continued acceptance and perpetuation of a capitalistic neoliberal agenda for profit and material wealth, not sustainable living. It is the duty of an educator to engage with students in imagining and living connected and intersubjective socio-natural lives celebrating and practicing cooperation and shared communal learning. The focus of pedagogy and learning is education as sustainability. Teachers and students interrogate values, opportunities, choices, decisions that enable them to live within the carrying capacity of the natural world. They can then begin to develop heightened awareness and care and concern for selves, others - including non-humans - and the vibrant health of an intersubjective socio-natural world. This paper will give social science and education support for education as sustainability.
0342 Special Topic: Equity and Social Justice

*Open-education*: A Means to Social Justice and Equity

Dipannita Datta, Jadavpur University, India

The world today, in the era of globalism is divided into Global-North and Global-South and further fragmented into several invisible layers as it were in the days of colonialism/imperialism upsetting the necessities for social justice. Arguing for the changing global mechanisms Martha Nussbaum in her book Not for Profit observes – ‘No system of education is doing a good job if its benefits reach only wealthy elites’. The distribution of access to quality education is an urgent issue in all modern approaches. While analysing within the harsh binaries of power structure operational in society, the proposition of ‘open education’ problematizes the conflicts of universalising homogeneity and monolithic constructs about social justice and the complexities of equity differences and distribution of education opportunities. With that said, this study argues that ‘distribution’ itself is the question, which needs to be answered first along the lines of discrimination of class, race, gender, nation etc. Moreover, how to access ‘quality education’ minus control? While global education policy cuts across the world-of-education, western archetypes of education continue to increasingly define and establish ways in which social justice is understood and practised. To build up a transnational solidarity negotiation of ‘open education’ policy or ‘personalizing world education’ while linking local-global perspectives is perhaps a healthy and reasonable alternative to humanity amidst war and conflicts. The current concern attempts to address: respectful accommodation of differences in education-cultures can help to move towards building future spaces for sustainable innovation beyond boundaries and facilitate social justice and equity without homogenising an education system.

0344 Special Topic: Equity and Social Justice

*Disability Inclusive Communities for The Better Life*

Ok Tiwi, Yogyakarta State University, Yogyakarta

Lately many discrepancy between a country's policies for the people with disabilities as well as the views of the public on the role of disability. In fact, many countries have formulated special policies for the disabled to get eligibility of life. But most people always have negative views about the condition of disability. Disabilities are people who have physical limitations, mental, intellectual or sensory impairments, so the environment interact and participate with obstacles. They often assume that the condition is lacking in the disability is considered beneficial to them and only complicate them. Seeing the problems that we all need a solution, in order to eliminate these eligibility. An inclusive communities as a solution to be built by all the people of a country in a state of life. Inclusive communities is defined as a condition of the people who appreciating the difference in togetherness among the persons with disabilities and non-disabled people. Recognizing that each person or group in communities has the potential above all their lacks. Thus the inclusive communities is the one that can help restore a sense of unity of the disability with other children and they also avoid negative labels. Another benefit, the disability will feel the rights, freedoms, the development of their potential, they are supposed to earn without any fear of being marginalized by a community. Keywords: communities, inclusive, disability, life.

0347 Language Education

*Understanding the Nature of Auditory Recognition of Phonological/Grammatical/ Semantic Errors at the Sentence Level*

Hirokatsu Kawashima, Nagasaki University of Foreign Studies, Japan

One important element of teaching/learning listening is intensive listening, such as listening for precise sounds, words, grammatical and semantic units. In order to explore the nature of auditory recognition of phonological, grammatical and semantic errors, which is based upon extensive listening, the presenter has conducted several classroom-based investigations. The current study reports the results of one such investigation, which targeted auditory recognition of phonological, grammatical and semantic errors at the sentence level. 56 Japanese EFL learners participated in this investigation, in which their recognition performance of phonological, grammatical and semantic errors was measured from the perspective of 1) two types of similar English sound (vowel and consonant minimal pair words), 2) two
types of sentence word order (verb phrase-based and noun phrase-based word orders) and 3) two types of semantic consistency (verb-purpose and verb-place agreements), respectively, and their general listening proficiency was examined using standardized tests. A close examination was carried out in order to understand the relationships between/among the six types of auditory error recognition and general listening proficiency. Analyses based upon the OPLS (Orthogonal Projections to Latent Structure) regression model have disclosed, for example, 1) that the performance of the six types of auditory error recognition, which requires intensive listening, can account for 46.4% of the variance of general listening proficiency (p < .000), and 2) that when non-linear elements of the six types of auditory error recognition (e.g., interactions) are embraced and processed as well, the explanatory power is increased up to 72.3% (p<.005).

0348 Special Topic: Education for Sustainable Development

Climate Change Education and Youth Participation for Sustainable Development: A Reivew of Policy and Practice in Thailand
Joanne Narksompong, Chulalongkorn University, Thailand
Sangchan Limjirakan, Enviornment, Development and Sustainability, Chulalongkorn University, Thailand

From Agenda 21 to The Future We Want, the importance of public participation, education and youth in sustainable development has been established and reaffirmed. Education is an acknowledged strategy for changing society's practice, behaviour and action towards more sustainable pathways. Growing awareness of climate change as a global environmental problem has increased interest in Education for Sustainable Development (ESD) as a means of preparing young people for unpredictable futures.

Within this framework, climate change education is vital for developing the awareness, motivation and skills necessary for authentic youth participation in climate change in the context of sustainable development. In developing countries, climate change issues are projected to exacerbate existing sustainable development challenges. Empowering today’s youth to be informed and active agents for change is an important goal of climate change education since youth are the future citizens and decision makers that must live with the impacts of climate change and take action on implementing solutions.

This study examines national policy and practice in Thailand regarding environment, climate change, education and youth that supports or hinders youth participation in climate change. The methodology is qualitative and descriptive analyses with the aim to determine the existing conditions and opportunities for youth participation in climate change issues in the context of sustainable development. This study reveals large disparities between the international policy that calls for education and youth participation in climate change and implementation of these policies and programs at national and local levels in Thailand.

0349 Distance Education / E-learning

Curriculum Development Electronic, Student Teachers Training in Inclusive Classrooms Use Model Co-Teaching
Orawan Nimtalung, Sakon Nakhon Radjabhat University, Thailand

This research aims to: 1) develop course training for student-teachers to teaching with Co-teaching by using E-Learning in English and Thai language With PDCA 2) to compare knowledge and Satisfaction. The samples used electronic were E-Learning, that develop by researcher during semester1, in year 2014. The course were design for efficiency by used Deming Cycle is PDCA : P=Plan : procurement and preparation method or activities of co-teaching in English and Thai language. ; D=Do , student-teachers as learning and working of activity that consists of learners build knowledge by themselves through a variety of learning and monitor learning. ; C=Check, evaluate the event that there is a problem or a fix. ; A=Act , researcher consequences were developed E-Learning in next unit. This course have 9 unit, that prepare to training student-teachers in semester2, in year 2014. After that, I setup the training program for a period of one semester. The E-Learning is http://e-learning.snru.ac.th/course/view.php?id=913. For Student-teachers Year1 and 3, majoring in special education, mathematics and science. The experimental group were 30 people and control group were
30 people. The results showed that knowledge and satisfaction of experimental group have upper control group.

0351 Special Topic: Education for Sustainable Development
Teaching Sustainability in the English for Academic Purposes Classroom
Alexander Nanni, Mahidol University International College, Thailand
Joseph Serrani, Mahidol University International College, Thailand

In Roadmap for an ASEAN Community, the ASEAN Secretariat spells out the need for employment, education, and development to be sustainable; however, many citizens of ASEAN countries would struggle to meaningfully define sustainability. In this presentation, two teachers from an intensive English for academic purposes program at a major Thai university will explain one approach to developing students’ understanding of sustainability: a term-long investigation into the sustainability of a multinational company. At the beginning of the term, teachers develop students’ understanding of the triple bottom line framework, which was coined by Elkington in 1994. This framework assesses the sustainability of a company by examining the company’s performance in three interrelated areas: people, planet, and profit. Following the principles of project-based learning (PBL), this assignment allows students significant autonomy; however, teachers advise the students as they move through the research process. All of the students’ source materials are authentic, creating a link between the classroom and the global community, a link that is strengthened by students’ recommendations for sustainable corporate practices. The project culminates in a 1,400-word paper and 5-7 minute presentation in which the students share their findings. This project, which can be adapted to suit the language proficiency of the students, will be of interest to educators in a variety of contexts.

0352 Language Education
The Comparison of Two Free Classroom Response System: Socrative and InfuseLearning and Their Application to English Grammar Teaching
Leo Wen Hua Liang, Mackay Junior College of Medicine, Nursing and Management, Taiwan

With the pervasiveness of Internet and mobile devices, Classroom response system (CRS) is becoming easy to access and free to use. By comparing two of the free CRS systems, Socrative (by MasteryConnect) and InfuseLearning, this research aims to investigate the advantages and disadvantages of both systems and how students respond to both systems. An English grammar class was conducted with the application of two systems. Questionnaires would be distributed to students and individual interviews were conducted after the grammar teaching. The results suggest that while Socrative has the advantages of easiness and convenience to use, iOS and Android mobile applications, quick and clear reports on students’ test results, InfuseLearning has flexibility of question types and user-friendly web interface. The students seem to favor InfuseLearning more in the overall survey.

0353 Language Education
An Error Analysis of Thai EFL Learners in Controlled Writing
Laphatrada O’Donnell, Burapha University Language Institute, Thailand

This research is an investigation to find out the linguistic errors of freshmen enrolled in English 1 as a foundation course at Burapha University, Thailand. There were 192 subjects in this study and they were assigned to do a controlled writing dialogue as pair work. The data consisted of 96 first draft dialogues of approximately 150 words per dialogue. The errors were recorded and classified. The findings of this research reported that the most frequent errors in order of number were capitalization, full stop, subject-verb agreement, adjective, verb tense and prepositional verb phrase. The results may be used for pedagogical purposes to improve student writing.
Problems of difficult solution in the world cannot be solved by segmented academic formats, market-place interests or mass-media headlines; instead of dealing with taken for granted issues (the apparent “bubbles” in the surface), public policies, research and teaching programmes should detect and deal with the problems deep inside the “boiling pot”. Problem solving implies dynamic and complex configurations intertwining four dimensions of being-in-the-world, as they combine, as donors and recipients, to induce the events (deficits and assets), cope with consequences (desired or undesired) and contribute to change (diagnosis and prognosis): intimate (subject’s cognitive and affective processes), interactive (groups’ mutual support and values), social (political, economical and cultural systems) and biophysical (biological endowment, natural and man-made environments). Planning and evaluation emphasise the need to strengthen the connections and seal the ruptures between the different dimensions of being-in-the-world, in view of their mutual support and dynamic equilibrium, as new structures and critical capacities to operate changes emerge in the socio-cultural learning niches. Policy making requires new paradigms of growth, power, wealth, work and freedom embedded into the cultural, social, political and economical institutions (more critical than individual motives and morals). A previous definition of desirable goals and the exploration of new paths to reach them encompasses education, culture, environment, health, politics, economics, ethics as concurrent and complimentary aspects; a concerted action by public and private sectors, social organisations, scientific and technical institutions, requires that the various parties cease to defend their vested interests in benefit of an ecosystemic model of culture.

This study is an attempt at constructing a linguistic classification of student errors from a second year paragraph writing class at Burapha University, Thailand. Errors were extracted from students’ writing and tabulated according to frequency of error category. Nine students participated in this study. From these nine students, 27 first drafts from a variety of paragraph types were examined. The findings of this study showed that the top three most frequent errors were verb related, noun related and lexical errors.

Singapore is a powerhouse in global education rankings, consistently placed among the top in league tables such as Program for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS). Its best students also frequently triumph in international competitions such as in maths and the sciences, and in diverse and creative skills ranging from debating, winning cases in moot courts to business plan writing. However, Singapore’s stellar performance belies what is at core a problematic conception of education. Critics have pointed out the cost to students and families of an intensely, even gruellingly, competitive system. But a greater concern is a narrow view of education as largely and fundamentally economic and instrumental in purpose. Despite assurances to the contrary, society at large (and hence the school system) devalues or has come to devalue other aspects of life (and hence of education) such as arts and culture, history, sports and citizenship in a democracy. This presentation discusses the above, and paints a portrait of the students and the adults they become who are good in certain things but often fall short of being fully realised and flourishing human beings. It also issues a warning to countries that seek to climb up the rankings, but risk losing sight of the more important aspects of education and life. The result will be people cut adrift from their essential humanity in this increasingly globalised, economy-centric, competition-driven, entertainment-oriented, consumerist and individualistic world.
0380 Special Topic: Education for Sustainable Development

Environmental Learning Out-of-the-Classroom - Perspectives from Programme for Environmental Experiential Learning (PEEL) in Singapore

Wen Hwee Liew, Singapore Environment Institute, National Environment Agency, Singapore
Annie Tan Peck See, Singapore Environment Institute of the National Environment Agency, Singapore
Lynda Lim Lai Ling, Singapore Environment Institute of the National Environment Agency, Singapore

The common format of environmental education, especially for professional development, typically takes the form of e-learning, classroom based learning or blended learning. Although these forms of education are effective modes for delivering knowledge, the challenge is how to present an engaging and fun learning format to make lessons come alive, help participants “experience” the knowledge and construct meaning from it. Since 2007, the Singapore Environment Institute (SEI) has been adapting experiential learning concept to help adult learners acquire knowledge through its Programme for Environmental Experiential Learning (PEEL). PEEL is the first experiential environmental learning programme developed in Singapore. It allows the adult learners to experience and gain insights from the behind-the-scenes look at how Singapore manages and maintains a clean and green environment through 6 different PEEL trails: namely, Clean Land, Clean Air, Clean Water, Recycling, Climate Change and Public Health Trails. The learning process will be facilitated by a specially trained PEEL guided and all learners will be provided with a set of PEEL information kit that serves as supplementary reading materials. This presentation will share perspectives and experiences from the Institute’s implementation of PEEL. SEI is the knowledge and training division of the National Environment Agency, a Statutory Board in the Government of Singapore.

0386 Performing Arts

A Continuous Effort to Revive the Local Performing Arts of Palembang

Nurhayati Bizzy, Sriwijaya University, Indonesia
Subadiyono, Sriwijaya University, Indonesia
Didi Suhendi, Sriwijaya University, Indonesia

Dulmuluk is one of the traditional performing arts of Palembang, Indonesia. Dulmuluk is like Ludruk of East Java and Lenong of Betawi but of course it has its own characteristics. Unlike the other two arts which are popular in the Indonesian society, Dulmuluk of Palembang is endangered. Researchers doing the groundwork for the revitalization mainly produce models of the Dulmuluk performing arts by incorporating elements of modern drama, invite the younger generation in particular prospective teachers to stage Dulmuluk. They involve traditional Dulmuluk groups, publish Dulmuluk scripts, have a talk show on either local TV, or newspapers. They present Dulmuluk revitalization at national and international levels, and establish a link with various parties. However, these efforts need to be maintained and kept continuously. Therefore, the purposes of this study are to (1) to establish a group that become the arena for Dulmuluk Campus student teachers to develop this performing arts with the collaboration of various universities; (2) to stage Dulmuluk by the Campus Dulmuluk Group by following the concept of the modern drama. This study used the method of research and development with various techniques of data collection and data analysis techniques. The study resulted in the formation of the Campus Dulmuluk Group that followed revitalization concept. Revitalization involved organization managerial and staging managerial aspects. In addition, the Campus Dulmuluk Group had performed well at local, regional, and international level.

0390 Educational Technology / ICT

Enhancing Learning Comprehension in Indonesia using Animation Videos in a Flipped Classroom

Muhammad Hamzah, Institut Teknologi Bandung, Indonesia

The usage of technology such as PowerPoint and videos in class tends to make the learning process focused on the technology itself, not the students. The flipped classroom approach is a learning model in which students gain first-exposure of knowledge prior to class, making classroom activities a time for interactive discussions and problem-solving. Reading assignments and lecture videos are usually given to students for self-study before the class, but because of its monotonic traits, students tend to get
bored easily and give up when the materials exceeds their cognitive load. A method of integrating open
source educational animation videos to enhance students comprehension before class is proposed in
this paper. Educational videos with an animation format are currently being used to catalyze curiosity
in learning outside the classroom. It has more adaptability in simplifying complicated concepts that
needs dynamic visualizations. Animation videos explaining concepts related to various subjects within
the curriculum of elementary, junior and senior high school in Indonesia will be uploaded to a
YouTube channel every week and can be accessed as material resource for teachers and students.
Various optimization such as narration, duration and speed are considered in making the animation
videos. Consistently built animation videos integrated in a flipped classroom can be utilized in study
and teaching purposes to enhance learning comprehension.

0391 Educational Psychology
A Study to Detect and Reform Aberrant Responses that Affect Results in Mastery Testing
Che-Ming Chang, Fu Jen Catholic University, Taiwan
Hung-Yi Lu, Fu Jen Catholic University, Taiwan

Purpose: Ministry of Health and Welfare of Executive Yuan in Taiwan will implement fire prevention
and emergency response in the 2012-2013 agenda as part of annual objectives to promote patient safety.
The fire occurred at dawn, 23 October, 2012 in Beimen Branch of Tainan SinYing Hospital, Taiwan
cau used the most disastrous casualty in the hospital in recent years. Therefore, the consequence could be
worse if there was no effective prevention plan in place. Method: This was an intervention study. The
study sample was comprised of a medical intensive unit, 2 neurology medical and surgical wards in
one of medical centers in Southern Taiwan. Discussions was carried out among the multi-disciplinary
team of the Department of Nursing, the Health and Safety Office, the General Affairs Office and the
Department of Respiratory Therapy to establish fire safety plans, which include (1)periodical auditing
on equipment and management lists, (2)guidelines for fire safety plans in each department and actual
nighttime drills when less staff is on duty, (3)carrying out 2-hour in-class fire safety education session
and drills on operating fire hose, extinguisher and emergency elevator to enhance emergency response
training relating to fire alarms. Result: The result of the study reveals that fire safety knowledge and
skills as well as satisfaction among health care team members has increased to 100% from 60% and
80% respectively after intervention unit received tabletop simulation and nighttime drills. Conclusion:
Inpatient safety can be improved by conducting tabletop simulation and actual nighttime drills in
response to fire occurring in the hospital; additionally, issues that arose through simulation can be
investigated to improve inpatient safety.

0393 Higher Education / Further Education
Building Academic Staff Portfolio to Increase Employee Retention: A Case Study of a Thai University
Pannarat Kadish, Rangsit University, Thailand

The competition to retain the best employees, specifically learned and research-active faculty members,
is now a challenge for universities in Thailand. Retaining these kind of employees is crucial in the
growth of universities and in maintaining its QA rating. The Office of the Higher Education
Commission (OHEC) requires all universities, both public and private, to comply with the standards of
Quality Assurance for continuous quality improvement. Key areas of QA requirements as mentioned
by Thaima (2012) which is directed at building academic staff portfolio includes: Teaching &
Learning, Research and Provision of Academic Services to the Community. This research paper aims
to examine employee retention through employee job satisfaction and its relationship with university
support in building academic staff portfolio. Moreover, this study aims to present a clear understanding
of the key areas in academic staff portfolio which complies with the requirements of OHEC and how it
is perceived by employees as contributing factors to employee job satisfaction thus employee retention.
The results of this study will aid the university in identifying key areas in building academic staff
portfolio that they should focus on or build upon to retain outstanding employees. It will also assist the
university in recognizing the importance of building academic staff portfolio in understanding the
needs and expectations of their faculty members.
0398 Special Education
'School Business Disability' as An Alternative Program to Provide Job Vocation for Disable People
Anis Syarifah, Yogyakarta State University, Indonesia

Many countries are increasingly concerned in providing services and education for people with disabilities and get better than past centuries. This is proved by increasing the number of education institution for people with disabilities/special people. In the other side, the graduation of special school only gets a little percent job vocation from companies, although the children got vocational services from school and are capable to work. This shows that job vocation providing for people with disabilities haven’t gotten optimal yet. Then, this aim of paper is developing the ‘School Business Disabilities’ program as an alternative program in providing job vocation for special student who graduated from school. ‘School Business Disabilities’ is a program that is held by the special school to give opportunity for the student in working after graduation. This program is held by school and implemented by making some job vocation. The disable people’s job is managed according to their own ability. The method of research is use the descriptive approach, which focus on design of the program and the implementation. Subject is school for people with disabilities. The process of data is done through observation, interviews, and documentation. The result of this paper is describing the design ‘School Business Disabilities’ as an alternative program to provide job vocation for disable people. Keyword: School Business Disabilities, Job Vocation, Disable Student

0399 Special Education
'Special Spectacles for Persons with Low Vision'
Leni Cahyani, Yogyakarta State University, Indonesia
Lina Ambar Melani, Gadjah Mada University, Indonesia

Low vision is different from totally blind. Persons with low vision still have ability to see something. They can still do what mostly people do with seeing tools which will help them to see something clearer. There are some seeing aids provide to help them. But, the seeing aids do not give attention to the important aspect for persons with low vision which are flexibility and illumination. Persons with low vision need a seeing aid which can be brought everywhere and anytime. They can not also use the seeing aid to read if there is not enough light for them. This research talks about the special seeing aid that can help persons with low vision. The seeing aid for them must be simple and equipped with light. This research uses research and development method which will develop a self-adjustable spectacles equipped with a light for persons with low vision. The lens thickness of this spectacles can be change by the user of the spectacles by setting the amount of water to fill the glass of the spectacles. They can also set the light intensity of the spectacles. The result of this research is to give alternative seeing aid for persons with low vision.
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Can environment students in secondary schools embrace a deep ecology philosophy?

William Smith
School of Education
RMIT University

Annette Gough
School of Education
RMIT University

ABSTRACT

This study investigates ecocentrism in secondary schools and challenges the anthropocentric view of conserving natural resources for future humans. It aims to reveal whether sustainability education in schools is driven by a narrow science focus or whether there are deep ecology perspectives also operating to solve environmental problems. This study also seeks to determine the collective thought of the school communities studied regarding the more philosophical aspects of sustainability, as seen through the lens of deep ecology. The study drew upon aspects of grounded theory to organize the data into themes. Strategic coding of the themes led to a coherent model for the socio-cultural responses to the research questions. A deep ecology scale (DES) was devised and used to measure ecocentric inclinations of the respondents. The data showed that students were more aligned to an ecocentric philosophy than the anthropocentric lifestyle.

Keywords: Deep ecology, anthropocentrism, ecocentrism

1 INTRODUCTION

Deep ecology is regarded (by some) as one of the most important approaches to environmental philosophy in the last 50 years [1]. The deep ecology movement first rose to prominence around 40 years ago when a relatively unknown publication by Naess [2] came to the attention of American academics, Bill Devall and George Sessions, a publication in which Naess assigned equal value to human and non-human life. The original form of the paper was first presented at the 3rd World Future Research Conference in Bucharest in September 1972, but only survived in the archives in Romania until it was later translated into English [3]. Naess described shallow ecology as the ‘Fight against pollution and resource depletion’ [2, p. 95] as a contrast to his notion of deep ecology. His original paper defined deep ecology as having seven key characteristics:

1. Rejection of the man-in-environment. “(Hu)man is seen as being in a “..relational, total-field image.” [2, p. 95-96], which essentially places (hu)mans in a relationship with the environment.
2. Biospherical egalitarianism, which expands the concept to all living things and mentions respect for non-human animals by placing them on an equal footing to humans.
3. The idea of diversity and symbiosis and protection for endangered species and specifically from the hunting and killing of whales and seals.
4. Adoption of an anti-class posture where the idea of the exploiter and the exploited is no longer viable; a premise that is proposed to underpin ecological stability.
5. Naess’s ideas about pollution and resource depletion are here linked to the choices we make in life say, for example, what type of job we do, and that we can make a choice to benefit the planet at the expense of our individual amenity.
6. The complexity-not-complication principle refers to looking at the biosphere not as an immensely incomprehensible (complicated) set of ecosystems, but as a generally complex set of relationships that warrant surveillance and monitoring for aberrations of function.

7. Local autonomy and decentralization. This is a rudimentary notion that hierarchies can drain the impetus of any group to do what in contemporary terms we say is to minimize your ecological footprint, or at the very least (avoid) becoming parasitic on the resources and funding to remedy some ecological crisis.

Within these principles Naess shifted the emphasis from humans as of prime importance above all other elements of the biosphere, to one where the living and non-living components of the earth itself have intrinsic value. Another way of viewing this is to say that ecosystems need to be sustained and nourished for the sake of the earth without reference to humans, and that sustainable development of resources to accommodate as many humans as possible is beyond the limits of the planet.

Respondents were asked questions to elicit opinions on the above elements of the deep ecology philosophy. Since deep ecology shares many features of the indigenous worldview [4], we also included questions about the land management practices of First Nations Peoples. This was in large part due to the notion that traditional landholders were better at caring for the earth and in essence were the ‘first ecologists’ [5].

2 THE STUDY COHORT AND METHOD

Three schools, 29 students, ten teachers, one principal, three parents and two siblings formed the study cohort. The schools were all middle-class, metropolitan high schools in Melbourne, Australia. The students were selected from the school environment club and each school had a sustainability co-ordinator that initiated projects and implemented school environment policy. Some teachers from geography, music, information technology, mathematics and outdoor education were also interviewed. The scope of this paper is based on the data from one school, ‘Bunjil’. Interviewees were audio-recorded and field notes were taken to supplement these mp3 files. Transcripts were produced for the coding and segmenting of data, and the field notes were scanned for broad themes to facilitate the subsequent analysis. These raw data formed the basis for a modified grounded-theory based on the inductive method of Boeije [6]. This then led to an ontological model based largely on social psychology [7, 8]. From this ontological view it then became possible to build a theory of what social dynamics was going on in schools in relation to the ecological self [9] of the students.
Part of the formative view of the students’ responses was gauged using an instrument we designed called the ‘Deep Ecology Spectrum’ (DES) (see Figure 1 below).

![Figure 1: The Deep Ecology Spectrum](image)

3 THE FINDINGS AND ANALYSIS

The summary of the ontological view was predictable in the sense that the sustainability coordinator was a pivotal figure in the analysis, with the parents, siblings and senior curriculum (years 11 and 12) as strong secondary factors. In the case of the family, the flow of influence varied from family to family, and it wasn’t always from student to home. Sometimes the parents or a sibling took the lead in forging a sustainability focus for the family. Almost universally though, senior curriculum commitments outweighed all other factors and typically prevented students continuing in the environment club. The corollary wasn’t that senior students’ interest in the environment waned; more that they were put on hold, and the responses showed that their early commitment to the environment club tended to become a long-term attribute. Other competing entities included extracurricular clubs such as the SRC (student representative council), instrumental music lessons, and sporting clubs. Childhood experiences (e.g. beach holidays) and other experiences with animals had a distinct and positive influence on becoming a member of the club, as did prior sustainability practices at the students’ primary school. This empathy for nature through animals was associated with ecocentric utterances.

Club students’ opinion of other students outside the club had a distinctive and possible predictable feature; the club students expressed almost special knowledge of the environment (that wasn’t necessarily elitist) and an awareness of environmental problems both locally and globally that set them apart from other students. The club students were somewhat forgiving of this situation, saying that the regular students were ignorant, lazy, immature or apathetic because they couldn’t see the big picture. This was particularly the case with younger students, with the gap narrowing in senior years. The latter feature was possibly due to Year 12 students having their own common room and therefore not being caught up in the schoolyard dynamics of littering and disregard for the environment.

Teachers other than the sustainability coordinator (regular teachers) provided another dimension to the analysis, but these need to be subdivided into two groups: mathematics/science teachers and humanities/arts teachers. In most cases the club students said that other teachers always...
placed their own curriculum ahead of any sustainability initiative at the school. Practices like turning off lights, reducing paper use, recycling paper and batteries, and a general interest in sustainability initiatives were only undertaken if they didn’t impose on the core business of teaching a subject. The exceptions to this were if a teacher taught biology or some aspect of sustainability within their curriculum, hence the finding that mathematics/science/geography teachers came out ahead of the arts/humanities teachers. Students were also well aware of the location of teachers’ desks and an unexpected social process was revealed as a result of this fact. If a teacher shared the same office as the sustainability coordinator, club students reported that these teachers had a sustainability focus that was not the norm for other teachers.

The principal of the school played little or no role in the responses of the club students, other than that the principal was part of the school as an institution that is held to be a sustainability model. The responses of the students support the idea that the sustainability coordinator operates within a school ethos that enables the sustainability policy to be promulgated throughout the school. However, it seemed to be the case that students perceive the coordinator as having to often push for that message to be implemented.

The remaining entity in our ontological model was The world (i.e. the internet), which we included because social influence also came from the internet, social media, television, YouTube, podcasts and advertising. These sub-entities may have had little influence in the case of one student, Lalande (who had no television or radio at home), but other respondents demonstrated an understanding of certain social pressure coming from advertising, in the sense that having the latest gadgets was seen as being cool. The club students were aware that this neophilia was bad for the planet because it consumed resources at a faster rate than what was adequate for human needs. The question of environmental disasters on the other side of the world (e.g. BP oil spill in Gulf of Mexico in April 2010) did impact on club students, even though it was a long way from Australia. It is unknown if this was because of the empathy that club students had for the coastal birds, or if it was the world-wide coverage that followed the disaster.

With regard to the notion that First Nations Peoples were in effect the first ecologists, there was general consensus that traditional landholders took good care of their tribal lands, probably because of the strong spiritual attachment to their place of birth. This caring for country [10] is a crucial part of the cultural anthropology of Australian indigenous people, and students recognized this through specific cultural projects initiated by the sustainability coordinator. Integrating indigenous cultural views is also part of the new Australian Curriculum [11].

A final observation relates to the more metaphysical aspects of deep ecology relating to transpersonal ecology [12]. Some of the students adopted existential frameworks by reflecting upon the nature of their own existence in the context of nature. This is often referred to as the self-realization in the deep ecology philosophy [13] where the person unfolds out into nature, in effect adopting a stance of monism. This was made clear in some responses where there was a belief that ‘If the earth suffered, then we would all suffer’. These responses are notable because they demonstrate a high-level cognitive response to the kind of world our young people are inheriting.
The results of the DES survey are shown in Figure 2 below. These data show that students have beliefs that are aligned more towards the ecocentric end of the shallow/deep binary.

![Average number of students at each DES scale](image)

Figure 2. The Deep Ecology Spectrum results

Their reasons varied but in general they thought that humans should start reducing their use of natural resources and should have less impact on the earth. This was tempered by the view that a radical shift to a ‘ten’ on the DES scale would be unrealistic given the current high use of resources by the affluent nations. Most students believed that the world’s resources were finite and that the adage of ‘there is no other earth’ was an accurate reflection on the projected state of the environment.

4 CONCLUSION

Our study shows that the social milieu of the sustainability culture in schools is complex, but that the social trajectories of sustainability club students can be explained by our data using our theoretical models. Students demonstrate an alignment to the deep ecology philosophy, and see themselves as part of nature in the sense that equates to discovering their ecological self. This is proof that students have that capacity to embrace the more metaphysical aspects of education for sustainability. Their world is driven largely by inherent values that they acquire from the sustainability coordinator, and as they proceed through their secondary years their environmental philosophy becomes more robust and coherent in their beliefs about the environment.

REFERENCES


THE EFFECT OF USING KNOW – WANT – LEARN STRATEGY ON STUDENTS’ MATHEMATICS ACHIEVEMENTS AND ATTITUDES IN GRADE 12.

Sukanya Dasri
Mathematics Education Program,
International College, Suan Sunandha Rajabhat University

ABSTRACT

The purposes of this research were to investigate of using Know – Want – Learn Strategy (K-W-L strategy) on students’ achievement and to assess students’ attitudes towards learning mathematics. The samples consisted of 32 Grade 12 students in the second semester of the academic Year 2014 at Satree Wat Mahaprutaram Girls’ School, Bangkok, Thailand. The research instruments were lesson plans, mathematics achievement test, and questionnaire. The researcher employed lesson plans and test to investigate of using K-W-L strategy and questionnaire to assess students’ attitudes in learning mathematics. The researcher analysed the data by using percentage, mean and standard deviation. Based on students writing in their K-W-L work sheets, the researcher found that students wrote what were given from the questions, shown their understandings and what they had to figure out. After the K-W-L strategy was used, students had high achievements and positive attitude in learning mathematics.

Keywords: Know-Want-Learn Strategy, students’ achievement, attitude

1 INTRODUCTION

Mathematics is an important subject with many aspects. Many people understand that mathematics is an intellectual discipline dealing with abstractions, logical arguments, deduction and calculation. In Thailand, The Basic Education Core Curriculum (Ministry of Education Thailand, 2008) stated that mathematics is highly important to develop human mind. It enables a person to think logically and systematically, to analyses various problems, to plan, to make decisions, to solve problems and to apply it in to daily life [1].

The problems connected with learning mathematics are common in many societies. In 2009, Thai students from schools attached to the General Education Commission, the Primary Education Commission, the Private Education Commission, the Ministry of Defense, the Vocational Education as well as from the university demonstration schools participated in the PISA assessment [2]. The results indicated that Thai students, except for those from university demonstration schools, ranked much lower than the OECD's average.

The K-W-L strategy suggested by Ogle (1986) is designed to help students learn from expository text in any content area [3]. Fogelberg (2008), Helm (2014) and Sukran Tok (2013) applied it effectively in students’ problem solving and achievement.

From the above reasons the researcher was interested in using K-W-L strategy to help students in learning mathematics. In Addition, the researchers also believed in that students’ writing K-W-L chart can be develop and reflect their understanding of mathematical concepts, abilities to solve mathematical problems and positive attitudes for the students.

2 RESEARCH OBJECTIVES

It is the intent of this study:
To study the effects of using K–W–L strategy on students’ mathematics learning achievements
2 To assess students’ attitudes towards using K–W–L strategy in mathematics learning

3 RESEARCH METHODOLOGY

The purposes of this research were to investigate of using Know – Want – Learn Strategy (K-W-L strategy) on students’ achievements and to assess students’ attitudes towards learning mathematics.

3.1 Participants

The participants of this study consisted of 32 Grade 12 students in the second semester of the academic Year 2014 at Satree Wat Mahaprutaram Girls’ School, Bangkok, Thailand.

3.2 Research Instruments

The research instruments in this study consisted of lesson plans, mathematics achievement test, and questionnaire.

3.2.1 Lesson Plan

3.2.1.1 Content

The contents on each lesson plan were designed following to mathematics curriculum; course M33102 in Grade 12 indicated the Basic Education Core Curriculum (2008). The topics in the contents included Frequency Distributions of data, Graph of Frequency Distributions of data, measures of central value and measures of dispersion.

3.2.1.2 K – W –L activity

The K-W-L strategy was designed for teachers to find out students' knowledge when they read problem. It also encouraged students to become involved in active thinking with their content in learning. The main purpose of the K-W-L strategy is to help students to correct misconceptions in learning mathematics [3]. The individuals completed this activity after reading the mathematics problem. The table below showed the sample of K-W-L worksheet.

<table>
<thead>
<tr>
<th>K</th>
<th>W</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>What we know</td>
<td>What we want to find out</td>
<td>What we learned and still need to learn</td>
</tr>
</tbody>
</table>

3.2.1.3 Worksheet

Every lesson plans includes worksheets to enhance learning process and to prepare students' learning on overtime, and K-W-L chart to analysed and solve mathematics problems. The worksheets were composed of about contents and questions.
3.2.2 A Questionnaire

A questionnaire is measured by 5-point Likert scale. It consisted of 15 questions divided into 3 elements which are cognitive component, affective component and behavioural component.

3.2.3 Mathematics achievement test

Mathematics achievement test which is measured students’ understanding of mathematical concepts and their ability to solve mathematical problems. It consisted of 16 items divided into two parts which are 14 questions with four multiple choice and two written items by using K-W-L Strategy.

3.3 Data analysis

The analysis of collected data was done statistically as follows:
1) The learning effectiveness was analysed from achievement test scores using one sample t-test with the significance level as 0.05
2) Assessment of the students’ attitudes through the questionnaire with 5-point Likert scale was calculated by using descriptive statistics and percentage.

4 RESULTS

Table 2 Student Mathematics Achievement Test Results

<table>
<thead>
<tr>
<th>Mathematics Achievement tests</th>
<th>Number of Students</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>32</td>
<td>18.22</td>
<td>1.54</td>
<td>8.03</td>
<td>31</td>
<td>.000</td>
</tr>
</tbody>
</table>

Students’ learning effectiveness was analysed by mathematics achievement test scores with one sample t-test as shown in Table 2. One sample t-test revealed a significant difference in testing score as t (31) =18.22, p < 0.05.

Table 3 Students’ Attitude towards leaning mathematics with K-W-L strategy

<table>
<thead>
<tr>
<th>Items</th>
<th>Level of Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>1. Students can effectively develop activities in writing conclusion.</td>
<td>15.62%</td>
</tr>
<tr>
<td>2. Students cannot cooperatively think and write with K-W-L strategy.</td>
<td>0%</td>
</tr>
<tr>
<td>3. Students think that K-W-L strategy is difficult to solve mathematical problems.</td>
<td>0%</td>
</tr>
<tr>
<td>4. Students think that K-W-L strategy makes them read deliberately. This activity promotes reading.</td>
<td>28.13%</td>
</tr>
<tr>
<td>5. Students can find the guidelines to solve mathematical problems themselves.</td>
<td>40.63%</td>
</tr>
<tr>
<td>6. Students cannot study with technique K-W-L strategy.</td>
<td>0%</td>
</tr>
</tbody>
</table>
The results from the students attitude survey in Table 3 indicated that students mostly strongly agreed (50%) with the items number 11 and 15, students have an opportunity to help their friends solve mathematical problems and students share their opinions and make a discussion to solve mathematical problems. The number indicated that 50% of the students strongly agree and 84%,37 of the students strongly disagree that students think that K-W-L strategy is difficult to solve mathematical problems.

The findings illustrate a manageable way of integrating the K-W-L strategy and writing strategies in learning in mathematics. Active learning, as shown in this study, can be well implemented in K-W-L instruction.

5 CONCLUSION

In this study, K-W-L strategy was used as tool in mathematics learning on the topic of statistics. The results of the study using K-W-L strategy as learning help tool students to improve their mathematics learning achievements. After the K-W-L strategy was used, students gave the average score at 18.22 out of 20 which is at the high achievements and positive attitudes in learning mathematics.

REFERENCES


A Perfect World: Cultural Exploration  
In a Japanese Senior High School  
Harry Carley, Matsuyama University  

Key words: Asia, Culture, Japan, Senior High School, Society

Abstract: This paper goes into further particulars from the presentation which was extended to participants at the Second Asia Conference on Education Sustainability in March 2015. It offers details into English language lessons which are given to senior high school students at a private school in Matsuyama, Japan. These students who will almost all go on to university, are part of a special International Program. Although the main emphasis is on English language education, Chinese language lessons along with guest lecturers from JICA (Japan International Cooperation Agency) and other associations allow students a broad education and window on the world. Students in the second year of this program spend 3 weeks in Australia along with a brief stay at an English camp in South Korea brushing up on their English language skills and experiencing other cultures. In Australia they attend English language classes at a language school that enrolls students from all over the world. For many of these students it is their first trip overseas and their initial encounter with people from other nations and cultures. In their 3rd and final year while they are studying and preparing for Japanese university entrance exams their English language lessons continue. This presenter and author who is currently the primary native English instructor at this particular SHS (Senior High School) will explain and specify the topics discussed during their final year. Class lesson topics covered on a global scale include Identity, Values, Gender and Culture, Social Change, and Global Community, along with many others; the final lessons resulting in a presentation of small groups explaining their ideas of a perfect world.

Text Explained

The specific text utilized for the third year students is entitled Identity by Shaules, Tsujioka, and Iida (2004) although any text that meshes communication and culture would be suitable. Comments from the authors state that:

Learning English will help you communicate with people from other countries. If you are simply travelling, the basic ability to have a basic conversation in English is enough. However, if you need to do business or live abroad, you will also need to have a deeper knowledge of the culture you are visiting (Shaules, Tsujioka, and Iida, 2004).

The units in this particular text offer a blend of comparing and contrasting their own culture (Japan) with those cultures of the world. Students are encouraged throughout each lesson to discuss and analyze different topics concerning their own culture and identity with those offered in the text. This text and overall course is not designed to be a sit and stare mode of instruction and learning. Instead it is try, talk, and transfer knowledge style of education. This paper then will go into detail each of the chapters of the Identity text and how they fulfill this particular instructional style. Although one individual text is mentioned throughout this paper it should be in no way considered an endorsement. Any textbook or instructional style that implements a similar mode is recommended. The needs of the learners matched with the aims of the instructor(s), is always a preferred method.

Lessons
The initial chapter discusses the word ‘identity’ itself. What it means and in this instance what it means to be Japanese. This particular senior high school and the strong emphasis in the international program pulls in students who are not only capable in their English skills but also enjoy learning it. They are mostly academic standouts from their junior schools. They come from small towns and villages as well as the larger cities in the surrounding area. Before their first class they most often do not know each other and are most likely strangers to each other. Therefore it is important for them to express their own identity. This may be conveyed through the festivals or cultural items or events that the area in which they grew up is famous for.

Additionally, the first chapter asks what is important to the students. Is it fashion, being popular, or just being a kind person? All these traits distinguish us from others and it is important for the students to say “hey, this is me.” Japan, being essentially a homogenous society does not encourage individualism sometimes; to a member of the global community we need to identify and accept ourselves before we can learn to identity with others.

Intercultural Communication

From their own cultural identity students then progress to learning about intercultural communication which can include the verbal and importantly nonverbal aspects of communication. Students in this course can relate back to their second year when they all spent three weeks in Australia as part of their English language education. For many it was their first time to travel overseas, interact with large numbers of non Japanese and live in a home stay environment for an extended period of time.

Students are then queried to recall their initial feelings of entering such a situation. How did they feel and react? They are required to take language lessons at a formal language school that has students enrolled from many countries. This includes many Chinese. On a political front Japan the country and China the country tend to be in confrontation from time to time. By way of these classes though many of the students have a chance to converse with Chinese students similar in age; many recite that they were very nice and friendly. This of course controverts what is sometimes portrayed on national news. In this small way they are able to discover of their own accord the differing views that take place. To communicate competently across cultures, individuals must understand some of the ways in which cultures diverge in their world views (CommGAP)

Culture Shock

Many of the students when they travel to Australia naturally go through a period of culture shock.

Culture shock is precipitated by the anxiety that results from losing all familiar signs and symbols of social intercourse. These signs are the thousand and one ways in which we orient ourselves to the situations of daily life: when to shake hands and what to say when we meet people, when and how to give tips, how to give orders to servants, how to make purchases, when to accept and when to refuse invitations, when to take statements seriously and when not. (Oberg)

For a majority of the travellers it is there first time away from their families. Although there are teachers and guidance leaders accompanying the group, solitary students are put into situations where they have to act on their own. There are times throughout the three
weeks that they will have to order lunch on their own and may even be required to travel from their host families’ residence to other destinations. It can be stressful and later once back in Japan many students have confessed that they missed Japan and couldn’t wait to get home. For others the trauma is not so austere. The two preeminent words for dealing with culture shock are adaptation and flexibility.

Culture in Language

For many individuals it doesn’t seem like culture is consequential in language learning. Teaching from only a text does nothing but reinforce this idea. Again this is another area that students on an overseas stay soon discover. To know a language may not be the successor to understanding that language’s culture. The same language can also have distinct cultures associated with it. The English or Arabic languages are good examples of this diversity and variety.

Language is not a thing to be studied but a way of seeing, understanding and communicating about the world and each language user uses his or her language(s) differently to do this. People use language for purposeful communication and learning a new language involves learning how to use words, rules and knowledge about language and its use in order to communicate with speakers of the language. (Language, Culture, and Learning, p.16).

This integration of the two, language and culture has been considered by some as a fifth language skill (Kramsch, 1993). He comments by stating that;

Culture in language learning is not and expendable fifth skill tacked on, so to speak, to the teaching of speaking, listening, reading, and writing. It is always in the background right from day one, ready to unsettle the good language learners when they expect it least, making evident the limitations of their hard won communicative competence, challenging the ability to make sense of the world around them.” (1993, p.1)

For the students at the particular SHS where this author instructs this means that by the time they graduate they will have been able to associate culture and languages together. Not only realizing the importance in the Japanese language and its culture but the many other languages of the world.

Individualism

This is a very interesting concept to most Japanese, with Japan being a group oriented society. Each individual does have their own likes and dislikes but in general major decisions are made with the group coconscious in mind. I as an instructor from the United States feel that I represent the complete opposite of that ideal. Class sessions are therefore a blend of the two perceptions. This is where the idea of cooperative learning can be instructed. Cooperative learning can lead to coefficient living in the world around us. If more children were taught
this vital concept at an earlier age maybe some of the conflicting issues and strife that encompasses us would be eliminated. Cooperative Learning refers to a systematic instructional method in which students work together in small groups to accomplish shared learning goals. (Zhang, 2010). The data in a large amount of research shows, compared with competitive and individualistic efforts, cooperation has positive effects on a wider range of outcomes (Johnson & Johnson, 1991; Slavin, 1995; Kagan, 1999). People operating in a cooperative learning activity attain higher achievement level than those who function under competitive and individualistic learning structures (Zhang, 2010).

**Gender and Culture**

Similar to most countries and cultures, the Japanese have particular stereotypes when it comes to men and women in society. The relationship of the two, gender and culture are intertwined and form the basis of society.

Gender (like race or ethnicity) functions as an organizing principle for society because of the cultural meanings given to being male or female. This is evident in the division of labour according to gender. In most societies there are clear patterns of “women’s work” and “men’s work,” both in the household and in the wider community – and cultural explanations of why this should be so. The patterns and the explanations differ among societies and change over time (Schalkwyk, 2000).

Many societies are very rigid in their roles that females and males play. Religion has a lot to do with how men and women are treated in society. The struggle for gender equality in religion is still an issue despite the progress that has been made in bridging the divide (Bakombo, 2013). More recently the consideration of Gay rights has made it to the forefront of debate. Students in a SHS setting are encouraged to continue the discussion of such issues.

**Global Community**

Unit 12 of the *Identity* textbook deals with Global Community. As Japan plays a significant role in the global community SHS students in coming years will be in a position to be in leadership roles. As the Japanese Ministry of Foreign Affairs states;

Japan has come to occupy an important position in the international community where interdependence among countries is growing. Overseas interest in Japan is being heightened. It is in Japan's national interest in the medium- and long-term to strengthen efforts to further deepen understanding of foreign countries toward Japan through broad cultural exchanges. Yet, much remains to be achieved in promoting overseas understanding of Japan and the Japanese people. Also as the Japanese people are increasingly exposed to other countries and their people, it is necessary for each and every Japanese to learn to appreciate and to deepen his or her understanding of different cultures to make Japanese society
more open to the world. In that sense, the international cultural exchange plays an increasingly significant role in promoting mutual understanding and trust (Diplomatic Bluebook, 1992).

Thusly, Japan in principle is attempting to be part of the global community in a cultural and harmonious manner with its neighbours. The news does not always project this ideal and some politicians seem to go counter to this but the overall will of the people should prevail.

Perfect World

The final lesson for the 3rd year students of this particular SHS allows them to present in groups what a perfect world would be like. After learning and discussing topics such as Values, Individualism, Politeness, Social Change, and others, then can now express their opinions as to what an ideal world would be like. Some comments and presentations were what one might naturally expect, one common language, everyone getting along, etc.; while other remarks were not. All in all though, there was a firm believe amongst the students that there could possibly be a perfect world.

In their version of a perfect world some students expressed “everyone you loved would love you back.” Basically, as one student put it “we are family”. This is actually very true since we have most likely all had common ancestors if we reach back far enough. The division of boarders across country lines is only a recent event in the overall history of the world. The concept of love and friendship for all seems a far off concept if one only watches the evening news.

One group described their perfect world as being one big Disneyland, a bit naïve but a nice thought. Their thought was taken from Disney’s slogan “the happiest place on earth.” They commented that should not just be in one place but all over the world for everyone to share. They also commented that “in the ideal world, no child would suffer.” Most importantly, “there would be global acceptance of all different types of people.”

“Open-mindedness needs to be a way of life” said another group. People who think small are small they commented. They also point out that close mindedness and non-acceptance of others starts at the individual level and then works its way to countries fighting against each other. There should be no war, they thought.

Almost all the groups came to the same conclusions; everyone would be equal, there would be fair and non-discriminatory justice. The perfect may not be easily achievable but a more sustainable world is. Thorough this course the learners were exposed to new ideas and thoughts of what the world could be like in the years to come; a world that they will be a part of through cultural acceptance and continued learning.

Conclusion

Students at this particular senior high school in Japan as one of their classes in a special international studies program learn and discuss various topics associated with the world
around them. Over the course of their 3rd and final year with around 35 lessons themes are introduced beginning with the identity of the students themselves. Who they are and how they fit into society. Ensuing the introductory sessions the students then divulge into more meaningful points. Many of these topics which they had mostly likely never had the chance to give serious consideration to but now are able to discuss with their classmates. By the conclusion of the course they are tasked with describing a perfect world in a five – ten minute review.

Although this presentation and paper described lessons particular to the textbook *Identity* this in no way should be seen as an endorsement for any one text or instructional mode. A text or lessons that fulfil the aims of a course while at the same time encouraging and motivating learners should be favoured.

The students described here are in a unique program at a private school. It is but one of their classes that they are part of. Although it takes place over an entire year those who wish to duplicate such lessons can unquestionably do so over a shorter span of time. It is important to note though the emphasis for these groups of 17-18 year olds is to begin to seriously consider the world that they are soon to graduate into. Although most will go on to another 2-4 years of college or university studies it is time for them to ponder their role in society. This is one of the focuses of this course.

**References**


Sustainability in Japanese English Language Education

At the Elementary and Junior High School Level: A Survey of the Texts

Harry Carley, Matsuyama University

Key words: Elementary School, English, Japan, Junior High School, Primary School

Abstract: This paper which is concurrent with a presentation that was given at the Asia conference on Education Sustainability in March 2015, will explore Japanese English texts presently in use at the elementary and junior high school levels. Most recently, Japanese students at the 5th and 6th grade levels are originally introduced to English vernacular through lessons which attempt to develop their English language skills. These lessons are also conducted with the aim of broadening learner’s awareness of some of the cultural aspects of the world around them. Additionally Japanese junior high school students are given more detailed English lessons throughout their 3 years of schooling before going on to another 3 years of English classes at the senior high school level. The Japanese English language texts in use in primary and junior high schools must be approved by the Ministry of Education which is part of MEXT (Ministry of Education, Culture, Science and Technology). How concerned are these administrators with implementing world awareness at the adolescent level? By exploring and analyzing the subject matter contemporarily being introduced to learners through English language classes we are able to get a better understanding of how or how not sustainability on a global scale is being presented to Japanese students on a local level. By the conclusion of the presentation and this subsequent paper interested parties should have a fundamental understanding of Japanese English language lessons and their association with sustainability in our world today. This topic would be of benefit not only to Japanese participants but also those parties from other countries with educational systems that are considering initiating the topic of sustainability toward younger learners into their educational system.

Recent History

Up until about 30 years ago English language education at the elementary school level was almost nonexistent. Coinciding with the bubble economy of Japan and the expansion of their international trade, the Japanese government realized the need to educate young people in the English language. There had been complaints that Japanese business men and women were not able to hold their own in the international business arena. Coupled with this was the increasing numbers of foreigners coming to Japan. The brought about the outset of a government program entitled JET or Japanese Exchange and Teaching program. There had actually been earlier policies of a similar nature as early as 1978, such as The English Teaching Recruitment Programme, British English Teachers Scheme and Mombusho English Fellows Program. In 1987, many other countries were added along with the original British and American participants. Partly due in fact to a large number of the young teachers from abroad weighing in to the stereotypical Anglo Saxon blued eyed blonde type. Observers felt that a more balanced cultural and world representation needed to be comprised. The current aim of the JET program which now has around 5000 individuals from 42 countries for the academic year 2014-2015 ([www.jetprogramme.org](http://www.jetprogramme.org), 2014) is:

The Japan Exchange and Teaching (JET) Programme aims to promote grass roots internationalisation at the local level by
inviting young overseas graduates to assist in international exchange and foreign language education in local governments, boards of education and elementary, junior and senior high schools throughout Japan. It seeks to foster ties between Japanese citizens (mainly youth) and JET participants at the person-to-person level. (www.jetprogramme.org, 2010).

While the results and overall achievements have been and continue to be in constant debate the general objectives do seem to have been accomplished. English education and internationalisation have been at the forefront. This is especially true for areas outside of the large cities, such as Tokyo, Osaka, or Kyoto. These places always have had and will continue to have foreigners residing, sightseeing and passing through or doing business there. It is the rural areas, cities and towns, such as where this author has resided for the past 25 years that can and do experience the greatest benefits of having mostly young foreigners come visit their schools and interact with the local inhabitants. The downside to this team teaching approach that couples JTE’s (Japanese Teacher’s of English) with ALT’s (Assistant Language Teacher’s) whom are predominately JET’s is that “…There are considerable amounts of JTEs who have no English language abilities. Japanese teachers need to improve their basic English communication skills (Ohtani, 2010, p. 44)

**Elementary School**

Until recently, most students began learning English in Japan in junior high school (i.e., middle school) at approximately 12 years old (Grade 7) (McKenzie, 2008, p. 271). Currently, there are only regularly scheduled classes for the 5th and 6th grade students. Many schools still try to find time in their schedules to have some form of English lessons for the younger grades at least once or twice a semester or even more frequently. Subsequently, from 2020, weekly English lessons will commence at the 3rd and 4th grade levels. The plan prescribed by MEXT for the upcoming addition is:

1. **New English Education corresponding to globalization**

   - Elementary school (Third and Fourth grade): English Language Activities classes 1-2 times a week
   - Supervision by class teacher
   - English Language (Subject): classes 3 times a week (also utilize module classes)
   - Nurture basic English language skills
   - In addition, class teachers with good English teaching skills, actively utilize specialized courses teachers
   - To ensure nurturing English communication skills by establishing current learning achievement targets throughout elementary and lower/upper secondary school.
   - Enrich educational content in relation to nurturing individual's sense of Japanese identity on traditional culture and history among other things.

   (http://www.mext.go.jp/english/topics)

   Until that time in 2020 when most certainly the texts used for classroom instruction will be reviewed and adjusted to accommodate all levels 3-6th, the current books for the 5th and 6th graders have come with mixed results. These negative comments have been voiced due to their lack of overall English language instruction and their deficiency toward a balanced cultural consciousness. The initial text which was entitled *Eigo Note* took numerous years to develop and finally was put into print in April of 2011 (Carley, 2011). It was distributed throughout all Japan to every elementary school. There were of course two levels,
Due to displeasure by Japanese instructors and a significant number of JET’s the books lasted only one school year and were hastily re-done to be once again issued under the title of Hi Friends in 2012.

Due to the fact that this paper’s main theme is not to solely discuss the calibre of the Japanese texts themselves, no further comments will be made on this subject. It should be noted in closing remarks on this subject that there was already a revision after the first year. There have been many complaints from instructors foreign and native Japanese alike. The second version depending on who is queried may actually be worse than the first. As one instructor has commented,

The textbook content is very sparse. If you were to do a chapter a lesson, you would be done with the 5th grade book (Hi Friends 1) in 9 lessons, the 6th grade book (Hi Friends 2) in 8 lessons. MEXT requires 35 English lessons for the school year. You do the math. (www.hifriendsblog.com)

Lessons

At the 5th grade and current introductory level topics such as greetings around the world, and school lunches of other countries usher in Japanese children to the English language along with a view of the world outside their own country. These small but meaningful examples allow the students to encounter subjects and themes that they normally would not find in their other course work.

As previously mentioned, there have been many individuals who have been critical of the entire English language scheme in place by MEXT. As with many matters of concern it all depends on how one looks at it. Although there are not enough lessons to cover an entire semester this allows instructors the leeway to expand on any particular lesson. As this author has had the opportunity to teach for numerous years in Japanese elementary schools he has partaken and shared in such experiences with students.

The advent of more technological teaching tools such as the Internet allows for learners to instantly access further details on any given topic. Yahoo Kids offers safe secure opportunities that permit more detailed investigation into items such as foods around the world and as earlier noted school lunches for children in other countries. Class reports that are presented by small groups of students are just one example where one lesson can be expanded into 3 or 4 lessons. In this fashion learners are not only exposed to one particular school lunch but also many more and the other groups share their findings. This may seem like a minor item to some but in actuality it opens the door into many other topics. Items such as housing, living standards along with sanitation practices are but some subjects available for more lengthy discussion at the fifth grade level. Either attempting to encompass some easy English or departing to Japanese as need be.

Upon reaching the 6th grade level, these learners are able to delve deeper into certain topics and cultural areas. Lesson 5 of Hi Friends, is entitled ‘Let’s go to Italy’. While the
course matter is no overly specific it again allows for instructional ingenuity to share
countries of the world with Japanese 6th graders. Students in the 6th grade are already 10 or
11 years and through modern media devices are probably already aware of many worldly
issues. Again through class reports or other teaching designs adolescent children can begin to
learn and discuss items that will be part of the world that they are in the process of inheriting.

Book 2 also introduces familiar Japanese stories to be explained in simple English.
The lives and stories of other countries are an excellent way to expand the student’s
knowledge. Stories say a lot about a country’s culture and habits, comparing these with
Japanese stories can offer contrast and constructive comparison. Again Internet sites such as
*Culture Crossing*;

…is a unique resource for information about different countries. It provides some basic demographics, but it also details about communication style, dress, gestures, etc. It’s unlike any other source of information about countries that’s on the web. (Ferlazzo, 2010)

Ultimately, texts are only tools regardless of the subject it is the teacher that welds these tools who can give the instructional matter substance and meaning. For adolescent learners the world around them is only beginning to come into true focus. This is a critical time for them to understand the differences and similarities of those around them whether they be near or far.

**Junior High School**

Readers of this paper not familiar with the Japanese education system should be aware that the ultimate goal of junior high school is to get ready for the entrance examinations for senior high. Likewise the overall aim of most senior high schools is to get students ready for the college and university exams. All texts in almost all classes at the junior and senior high regardless of subject are intended for this preeminent objective. Thusly, the English texts are no different. English classes at the junior high level are usually held twice a week for 50 minutes. Sadly though, a teach-to-test culture pervades most junior high schools (Hardy, 2007).

Despite this, there has been much analysis into the cultural awareness of JHS (junior high school) as well as SHS (senior high school) texts. As Takeda, Choi, Mochizuki, and Watanabe (2006) state;

The junior high school textbook tries to raise cultural awareness explicitly by contrasting different cultures or different perspectives on one culture. The junior high school textbook not only provides information through reading texts but also makes students think about it through various activities.

A little more choice is given for selection of the JHS texts over that of the single text prescribed by MEXT in elementary school. For JHS numerous types with slightly differing
English level abilities are available. Depending on various factors, various editions may be selected at the city or school district level. As pointed out, regardless of selection, the texts cover common themes such as world heritage places, or famous people from history in Japan or on the broader world stage.

Additionally, in summation of Japanese JHS texts, again the authors (Takeda, et al, 2010) report that;

As for the content, the Japanese textbooks provide a variety of topics with culturally neutral content and pictures that help broaden students’ perspectives. The goal is to raise learners’ consciousness about the multi-culture and multi-perspective nature of the world. However, since the main focus is providing grammar knowledge, the content provided through the textbooks is not expanded to invoke students’ critical thinking.

The emphasis then is on consciousness of culture over actual crucial thought of cultures. In some instances this could be compared to individuals who read a magazine and those that only skim though it, reading the headlines and a few sentences. In some sense Japanese JHS English classes have taken on a similar conformation. They are able to see about a culture but fail to fully understand it.

Additionally the cultures and individuals portrayed tend to be more westernized. As pointed out by Yamanaka (2006);

Hence, in the past, cultural issues related to native speakers of English were the main focus because English was regarded as a language for communicating with people from Western countries. At present, however, as English has become a global language which is used for interacting with people all over the world, it would be beneficial for young Japanese people to learn about a variety of cultures…

To add a counter balance to Japan’s bonds with Western culture it needs to constantly be aware and in tune with its closest neighbours, those being, China, South Korea, the Philippines, and others. Yamada indicates that;

…Because of Japan’s increased international responsibility, the nation may be urged its citizens to learn about “Western” cultures and people and further acquire “Western” ways of communication skills through English.

However, international education does not mean to teach and learn only about Western and English speaking nations. Because Japan plays a significant role with its neighbours in Asia, it also has to pay attention to Asia in order to maintain peaceful relations. However, a tension is often
apparent between Japan and other Asian countries, particularly with South Korea and China.

Consequently, then it is not only satisfactory to teach about cultures of the world but to provide an adequate and equal balance in doing so. In some aspects Japan has done a suitable effort. In other ways, at all levels, Japan needs to estrange itself away from the predominantly “Western” ways to has come to feel comfortable with. Japan’s closer neighbours share an intertwined history that has gone on for centuries.

Conclusion

Although this paper for the sake of simplicity and space limitations has commented on the JET programme and its advantages and disadvantages there are also many other smaller independent programs and individuals who assist in English language education in Japanese schools. All seem to work equally to various degrees. The overall aim is the introduction and acceptance of cultures other than Japan. Exposing them to young children at an impressionable age is most important so they can not only learn another language but also the diverseness that goes with it.

Obviously in a classroom situation various texts and learning tools are required to expose these ideas and values to a large number of children. The current books in use at the elementary school level have only been recently been published in the last 4 or 5 years and have not quite met everyone’s anticipations.

At the JHS level there is a broader range of topics concerning other cultures but their study seems to shallow to be of much benefit. The subjects covered seemed to be extremely westernized to be of exclusion of its close neighbours such as China and South Korea. Admittedly, to strike an equal balance amongst all nations and cultures would be undoable but an extended effort needs to be made.

Overall Japan is trying to achieve competency with culture for their younger generation. These goals can be more easily obtained these days through the advent of the Internet. The Internet when provided in a respectable learning environment can provide extra material and valuable information on an exponential range of topics. For cultural competency to foster and grow all teaching implements need to be availed and exposed.

Ultimate control and acceptance of any text in a Japanese school regardless of level is at the Ministry of Education, known as MEXT. In the past, they have been criticised for omitting certain gray areas of Japanese history and culture. These omissions have caused indignation and distrust amongst Japan’s Asian neighbours. To live in a sustainable world governments have to realize that the decision they make at the highest of levels can affect the simplest acts. This can include something as discreet as the selection of classroom texts for young children.

References


Government procurement decision-making and management of the development of BOT – the Taipei City "Zone T-9 – Q Square" Case

PhD program at the Graduate School of Business and Operations Management, Chang Jung Christian University

PhD candidate LIU, JUNG -TSUN

Abstract

This paper analyzes the policy decisions adopted by the government for the BOT development project and selects the Zone T-9 development project in Taipei City as a case study. Based on a literature review and interviews of scholars and specialists of related fields, we summarize the main factors and problems as follows: the feasibility of the replication at a different location, the attribution of responsibility of BOT development projects, the best applicant qualifications, the government responsibility for household use rights, the selection of development project investors. Owing to the controversial BOT-related decision-making process, this paper suggests that the government should develop some clear legal provisions to protect consumers' rights, and should carefully assess the risk to select a high-quality professional team.

Key words: BOT Development Projects, Decision Management, Trust, Residential

1. Foreword

The Zone T-9 development project in Taipei for which Radium Life Tech Co., Ltd. was awarded the tender in 2004 probably represents the most prominent and successful BOT development project in recent years. The completed building is located in the vicinity of Taipei Main Station and enjoys a favored status as a transportation hub for HSR and TaiRail, Taipei and Taoyuan airport MRT connections, and freeway bus services. The building interior is suitable for office, residential, or hotel uses or commercial purposes. Taipei City Government retains the land ownership rights, while Jing-Jan Retail Business Co., Ltd., a subsidiary of Radium Life Tech, Fenisia Hotel under the banner of Chinatrust Hotels Ltd., and Vie Show Cinemas Co., Ltd. jointly own the management rights.

Due to the complicated and complex relationship between government units, developers, and consumers in this “Zone T-9- Q Square” BOT land development and construction project, the problem of how to define the common interests of these three parties to enable the government to achieve the principle of social equity and interest during the decision-making process for this BOT land development and construction project represents the research motivation for this study. The application qualifications and the main considerations for selection, the future attribution of responsibility, and the feasibility of replication of the project at a different location during the decision-making process by the government in the face of this complex relationship constitute the research focus of this study. The research objectives can therefore be summed up as follows:

1. Exploration of the attribution of responsibility for this BOT project

2. Analysis of the qualifications of optimal applicants
3. Government accountability for usage rights of occupants

4. Selection of investors for the development project

5. Exploration of the feasibility of replication of the project at a different location in the future

2. Literature review

2.1 Solution of the problem of BOT asset attribution through land trusts

Financial problems are a key factor affecting BOT programs. Xiu-Ju Liang (2006) points out that phenomena such as a stagnation of BOT projects due to mismanagement or financial difficulties on the part of concessionaires can be avoided through the adoption of trust methods for the execution of the project. Her research clearly shows that the adoption of trust methods allows a smooth execution of BOT projects.

An optimal use of the land trust system therefore gives BOT projects a sound basis through compulsory takeover and protects these projects from compulsory execution by creditors of concessionaires. This also leads to a separation of working assets and management rights of concessionaires which in turn is conducive to sustained management of public infrastructure (see Fig.1).
3. Research methods

The author started by collecting profound problems related to the Zone T-9 land development project in Taipei City. After previously designed interview questions had been revised by scholars and specialists of respective fields, another three scholars of related fields and industry specialists who have participated in this project were interviewed.

4. Analysis of empirical results

4.1 Exploration of attribution of responsibility for the BOT project

1. By virtue of the nature of these partnership operations, the relationships between the two parties is based on the principle of equality and mutual benefit and clearly defined rights and obligations during the course of interactions between public and private departments with regard to required updates. The maximization of mutual benefits is pursued through the
sharing and integration of superior resources and the sharing of risks and responsibilities (Ying-Ming Wu, 2004).

2. BOT contract contents mainly focus on contracting and commissioning

The government must guarantee the profits of contractors and implementation of public authority measures. Contractors, on the other hand, must fulfill their contract obligations, complete construction projects, and carry out operations and transfers. The established cooperation model can therefore be characterized as a partnership which differs from the traditional concept of independent operations after contract conclusion.

3. The legal basis for the adoption of a BOT development model for construction projects on public land is as follows:

   (1) Article 42, Paragraph 1 of the Act for Promotion of Private Participation: Private participation in infrastructure projects planned by the government

   (2) Article 3 (traffic infrastructure) and Article 8, Paragraph 1, Clause 1 (BOT) of the Act for Promotion of Private Participation

   (3) Article 44, Paragraph 3 of the Act for Promotion of Private Participation

   (4) Article 7, Paragraph 1 of the Mass Rapid Transit Law

Based on life community relationships, the financing institutions may exercise their right of intervention. The continued execution of the whole BOT project not only minimizes the losses incurred by the government, financing institutions, and concessionaires but also helps achieve social benefits. Public departments should therefore embrace the spirit of partnership relations.

4.2 Analysis of the qualifications of optimal applicants

1. Judging from the example of the “Zone T-9 – Q Square” development project, the main problem currently lies in the fact that organizers lack the capability to effectively grasp and accurately forecast the future development of the basic structure of the BOT project, which in turn caused investment applicants to charge consumers an advance down payment of 30,000 NTD.

2. Only after both sides have reached a consensus and the contract has been signed may the qualification of optimal applicants be made public.”

3. “The Zone T-9 – Q Square” development project adopts a BOT model in which the successful bidder is awarded the surface rights for the site for a period of 50 years.

4.3 Analysis of government accountability

1. The law clearly states that construction businesses and trustee banks are required to provide compulsory warranty to fulfill their responsibility to safeguard rental rights and public facilities and housing structure and provide relevant collateral and joint guarantees in order to provide post-purchase assurance for consumers. For the sake of the public interest, government departments should give priority to the consideration of problems arising out of “Zone T-9– Q Square”. For instance, the government may construct ordinary residential housing on state-owned land and subsidize rents to prevent speculative behavior and stabilize
housing prices.

2. For this Zone T-9 project, the government awarded concessions to the private sector and a BOT model was adopted for the construction and development project on public land.

3. Consumers purchase housing usage right certificates in the context of this “Zone T-9 – Q-Square” project. A BOT model was adopted for this development project and a trust model was employed for the assets. Compulsory execution by the creditors of the proprietor with regard to entrusted assets is not possible, which in turn directly safeguards the rights of construction businesses and other proprietors during the development period.

4.4 Selection of investors for the “Zone T-9– Q Square” development project

The following four factors must be considered for the selection of investors for the “Zone T-9 – Q Square” development project:

(1) Investors inflate their own financial capabilities

The three major development project of the Taipei MRT system, namely the Xindian Depot project, the Taipei Main Station Zone T-9 BOT project, and the Nangang Depot project were all awarded to the same bidder. The Xindian Depot project and Zone T-9 BOT project are expected to require a total investment of 5.5 billion and 10.5 billion NTD, respectively. It is suspected that the successful bidder for these two projects made a single deposit at a certain bank to apply for a certificate of deposit and then transferred the deposit to another bank to apply for another certificate of deposit.

(2) Reasonable ratio between assets and value of contracted projects

The assets of the investor have a value of only 2.4 billion but the value of the major public engineering and development project that the investor was awarded amounts to 21.9 billion. In addition, the company which was awarded the Xindian Depot project, the Taipei Main Station Zone T-9 BOT project, and the Nangang Depot project has a total capital of less than 30% of the amount required for participation in the bidding process.

(3) Preferential negotiating rights

The invitations to tender in December 2001 and November 2002 for the Zone T-9 BOT development project both failed. The third invitation to tender was announced on July 10, 2003 after modification of specifications, and an information meeting for bidders was organized on July 23, 2003. Only one bidder completed the bidding procedures before the closing date. Upon overall assessment it was decided to grant this bidder preferential negotiating rights and first priority in the application process. A contract was signed on December 27 of the following year.

(4) Concessions and advance payments

After the investor was awarded the Xindian Depot development project in 2001, the Taipei City Council questioned the successful acquisition of the project despite the suspected lack of capital, which in turn led to a lack of obvious progress in the construction project. As for the Zone T-9 BOT project and the Nangang Depot project, the Taipei City Government approved the sale of housing usage certificates in the context of the Zone T-9 – Q Square development project. Based on the development-related financing and advance payments,
consumers were charged an advance down payment of 30,000 NTD each which is suspected to serve the purpose of capital increase. Although this study explores these related issues, the analysis is confined to discussions with scholars and specialists.

4.5 Exploration of the feasibility of replication of a successful project at a different location

1. Transformation of market financing affects the marketing mechanism

Incomplete real estate information in addition to transformation of financing methods of construction businesses has caused supply to greatly outweigh demand on the real estate market, while prices failed to adjust rapidly. The only effective solution to this problem lies in a reasonable adjustment of prices and quantities. Any form of intervention that counteracts market mechanisms is bound to lead to a tradeoff between a reduced price adjustment range in the short run and longer adjustment times. This will have a negative effect on the long-term development of the real estate market (Jin-E Zhang, Jian-Wen Peng, 1999).

2. Government assistance serves as a powerful backup

To strengthen land use and make full use of the available land, the Taipei City Government implemented modifications of urban planning through zoning for the transit station site and increased the floor area ratio from 400% to 560%. Land use items are based on the items of Commercial Zone – Type 3. Upon completion of development, investors attract shopping mall and hotel operators through a unified operation and management model. Operating revenue is shared among land owners, investors, and competent authorities based on the weighted value ratio of the distributed square footage. Large-scale and comprehensive commercial activities create an agglomeration economy and trigger a commercial transformation of the western district, the project may also serve as a model for the activation of private land property rights in the western district (Liang-Hui He et al., 2007).

3. Taipei City is the only area in Taiwan with a hub for five transportation networks

Restrains in the promotion of new building projects by construction businesses resulted in an equilibrium between supply and demand. Between 2006 and 2007, the number of issued building permits decreased significantly. 7,583 and 7175 applications for building permits were submitted in 2006 and 2007, respectively, which represents a decline by 55.21% and 57.62% compared to the 16,931 applications submitted in 2005. Furthermore, no similar development projects currently exist in Kaohsiung. It is therefore difficult to successfully replicate this project.

5. Conclusion and recommendations

This study found that the government must consider the following main factors for the decision-making process in relation to BOT projects: attribution of responsibility for the BOT project, qualifications of optimal applicants, government accountability for usage rights of occupants, selection of investors for the development project, and feasibility of replication of the project at a different location in the future.

This study recommends that the government should carefully assess risks and select outstanding professional entities when carrying out BOT projects as described below:
(1) The weighing of the qualifications of optimal applicants may generate controversies even if no illegal circumstances exist. Since the government encourages the private sector to participate in infrastructure projects through BOT schemes, it should assist the private sector in the integration of resources and enhancement of operational performance by relying on its public authority and the administrative resources of public departments. The dual relationship between private investors and the government should be based on partnership and collaboration.

(2) The concept of the government as the supervising agency should be abandoned and the numerous restrictions and interventions by the government should be simplified. There is a general misconception that BOT is equivalent to privatization and that private operators should assume full responsibility for success or failure of the project. This is a purely cognitive problem. In view of the fact that the government grants private businesses concessions or special privileges in the development of major infrastructure projects on public land, such projects are closely linked to the public interest and should therefore not be viewed as simple development projects.

(3) Risks should be carefully assessed in the selection of outstanding professional entities. Reviews and the award of concessions to contractors should not be solely based on formalized written qualifications to avoid concerns regarding the smoothness of project execution.

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Applying the Know-Want-Learn Strategy to Improve Students’ Mathematical Problem Solving

Wassana Boontao
Mathematics Education Program
International College, Suan Sunandha Rajabhat University, Bangkok, Thailand

ABSTRACT

This classroom action research aimed to improve students’ ability in solving mathematical problem by using Know-Want-Learn strategy. The topic used in this study is “conic sections”. Participants were 44 grade 10 students from a classroom in Bangkok, Thailand where researcher taught in the second semester of academic year 2014. To help students gain better understanding the contents, researcher applied Know-Want-Learn strategy and integrated GSP (The Geometer’s Sketchpad Program) in the lessons wherever it is appropriate. The researcher developed 13 lesson plans allied with Know-Want-Learn strategy. They lasted 13 periods. Data were collected from tests, final examination, and student’s satisfaction questionnaire. The finding of this research demonstrated that Know-Want-Learn strategy was effective in improving the students’ abilities to solve mathematical problems and in promoting students’ satisfaction in learning with Know-Want-Learn strategy.

Keywords: GSP (The Geometer’s Sketchpad Program), Know-Want-Learn strategy, Students’ satisfaction, Problem solving

1 INTRODUCTION

Mathematics plays an important role in the development of the human mind. It develops human thinking, creativity, reasonable thought, and systematic planning. It proves useful in everyday life not only in improving the quality of life but also in living harmony with others. It is also important in daily living. Mathematics is a primary key that leads to economic growth and any progression such as science, engineering, and technology [4]. For Thailand, students’ learning mathematics both at primary and secondary levels is not at a satisfactory condition. Results from international study, PISA (Programme for International Student Assessment) in Thailand, 2012 revealed that average score of Thai grade 8 students is 427 while the overall PISA average score is 494. Thai students’ average score is ranked 50th from 64 countries in this international study [9].

My teaching at Satriwittaya School in Bangkok, researcher found that many students did not gain the scores expected by teachers and school. Homework and the examination revealed many causes of these problems. One of them is problem solving ability. Moreover, problem solving is an essential key that can improve student’s competency and their further studying. The contents of conic sections are consisted of circles, ellipses, parabolas, and hyperbolas, which are important parts in studying higher mathematics such as calculus and economics. The details of conic sections emphasize on problem solving which student need to use their problem solving skill and techniques. However, the past result showed that they could not solve the problems effectively. Problem solving is a must in mathematical learning. I want to enhance my students to be keen in problem solving by using techniques and strategies.

The researcher tried to find out techniques and some suggestions from experts and researchers to improve students’ mathematical problem solving. Finally, researcher found a strategy, Know-Want-Learn strategy, which can help the student in problem solving. So, the researcher applied classroom action research to solving this problem.

Know-Want-Learn (What we know, What we want, and What we learned) strategy suggested by Ogle (1986) is designed to help students learn from expository text in any content area [5]. Fogelberg (2008) applied KWL strategy to the mathematics classroom [1]. The KWL strategy can be used to help problem solving ability in the early phases of problem solving. It requires the students to consider what they know about a problem placed in front of them, what they know, and
what they learned [7]. Helm found that many students could successfully transfer the math problem solving to their thinking about the stories they were reading [2]. Şükran Tok (2013) also found that KWL strategy in mathematics classroom is effective in increasing students’ math achievement [8].

Know-Want-Learn (KWL) strategy has three steps. Each step will be recorded on the related column of KWL chart. The first step (What we know) is for the students to explain or write what they have already known about the topics and recorded in the first column, the K column. The second step (What we want) is to generate a list that reflects what the students want about the topics and list all possible strategies to solve the problems and students write or explain on the second column, the W column. The last step (What we learned) is to list the information learned about the topics and recorded on the last column, the L column. This procedure is intended to assist teachers become more responsive to help students to access appropriate knowledge.

1.1 Research Objectives

1.1.1 To develop students’ ability in solving mathematics problems by applying know-want-learn strategy.

1.1.2 To study students’ satisfaction in learning by applying know-want-learn strategy.

For research objective 1, the researcher aimed 75% of all students in my class to pass the problem solving tests and exam. The criterion for each student to pass the tests and exam is to gain at least 75% of each test and exam.

For research objective 2, the researcher investigated students’ satisfaction from a satisfaction questionnaire developed by researcher.

2 METHOD

2.1 Participants

The participants in this study were 44 grade 10 students in a classroom that researcher taught in second semester of academic year 2014.

2.2 Contents

The contents used in this study are conic sections. They are translation of axis (1 period), circles (3 periods), parabolas (3 periods), ellipses (3 periods), and hyperbolas (3 periods).

2.3 Instruments

The following instruments were used in this research:

2.3.1 The researcher developed 13 lesson plans on conic sections allied with KWL strategy. Details are shown in table 1.

<table>
<thead>
<tr>
<th>Lesson plans Number</th>
<th>contents</th>
<th>Periods (50 minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Translation of axis</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Circles with center (0,0)</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Circles with centers (h,k)</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Circles with centers (h,k) (cont.) and test 1 on circles</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Parabolas with vertex (0,0)</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Parabolas with vertecis (h,k)</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Parabolas with vertices (h,k) (cont.) and test 2 on parabolas</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Ellipses with center (0,0)</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Ellipses with centers (h,k)</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 1 Details of lesson plans (continued)

<table>
<thead>
<tr>
<th>Lesson plans Number</th>
<th>contents</th>
<th>Periods (50 minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Ellipses with centers (h,k) (cont.) and test 3 on ellipses</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Hyperbolas with vertex (0,0)</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Hyperbolas with vertices (h,k)</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>Hyperbolas with vertices (h,k) (cont.) and test 4 on hyperbolas</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Final examination (Summative test)</td>
<td>1</td>
</tr>
</tbody>
</table>

In each lesson plan, the researcher integrated KWL chart to stimulate students to think about the contents they learned and they were asked to apply it in solving problems. At the end of each period, the researcher reflected students’ problem solving and results for improvement in the next period.

2.3.2 Mathematics problem solving tests taken 20 minutes each consisted of 2 written items and KWL chart was also used to remind the students about their thinking.

2.3.3 Final examination comprised 14 multiple choice items and 2 written items.

2.3.4 Questionnaire on learning satisfaction comprised five categories on learning satisfaction. They are as follow: content presentation, teaching, learning activity, instructional media, and assessment. The levels of satisfaction are evaluated by students at five-point likert-type scale ( 5 - very satisfied, 4 - satisfied, 3 - neither satisfied nor dissatisfied, 2 - dissatisfied ,and 1 - very dissatisfied) [3].

2.4 Procedure

Procedure is as follows:

2.4.1 The researcher taught lessons on conic section allied with KWL strategy. The researcher created 13 lesson plans. Each lesson plan lasted 50 minutes.

2.4.2 The researcher used mathematic problem solving tests of circles, parabolas, ellipses, and hyperbolas to test the students after learning each topic in conic sections, 20 minutes each.

2.4.3 The researcher constructed final examination on conic sections to test the students after learning conics sections by using KWL strategy. It took 50 minutes.

2.4.4 The researcher applied questionnaire on learning satisfaction to investigate students’ satisfaction in learning with KWL strategy.

3 DATA ANALYSIS AND RESULTS

3.1 Results of students’ problem solving tests are shown in table 2.

Table 2 Results of mathematic problem solving tests

<table>
<thead>
<tr>
<th>Topic</th>
<th>Test 1 (circles)</th>
<th>Test 2 (parabolas)</th>
<th>Test 3 (ellipses)</th>
<th>Test 4 (hyperbolas)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of students</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td>Number of students</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passed</td>
<td>36</td>
<td>37</td>
<td>37</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>Not passed</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Percentage</td>
<td>81.82</td>
<td>84.09</td>
<td>15.19</td>
<td>84.09</td>
<td>15.91</td>
</tr>
</tbody>
</table>

Table 2 showed that more than 81% of all students passed each test. In total, 75% of all students passed the tests as required by the researcher.

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3.2 Results of final examination are shown in table 3.

Table 3 Results of final examination

<table>
<thead>
<tr>
<th>Final examination</th>
<th>Part 1 (multiple choice items)</th>
<th>Part 2 (written items)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Passed 44</td>
<td>Passed 44</td>
<td>44</td>
</tr>
<tr>
<td>Number of students</td>
<td>33</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Percentage</td>
<td>75</td>
<td>79.55</td>
<td>75</td>
</tr>
</tbody>
</table>

Table 3 showed that 75% of all students passed part 1 of final examination and 79.55% of all students passed part 2. So, the percentage of students who passed the part 2 of final examination was higher than that of students who passed the part 1. In total, 75% of all students after learning conics sections by using KWL strategy passed the final examination as required.

3.3 Results of satisfaction are shown in table 4.

Table 4 Results of students’ satisfaction

<table>
<thead>
<tr>
<th>Categories</th>
<th>Content presentation</th>
<th>Learning activity</th>
<th>Instructional media</th>
<th>Assessment</th>
<th>Teaching</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>3.99</td>
<td>4.28</td>
<td>4.09</td>
<td>4.23</td>
<td>4.61</td>
<td>4.24</td>
</tr>
<tr>
<td>Meaning</td>
<td>Satisfied</td>
<td>Satisfied</td>
<td>Satisfied</td>
<td>Satisfied</td>
<td>Very satisfied</td>
<td>Satisfied</td>
</tr>
</tbody>
</table>

Table 4 showed that students are satisfied with content presentation, learning activity, instructional media, assessment, and they are very satisfied with teaching.

4 CONCLUSION AND DISCUSSION

The result of this study showed the success of applying KWL strategy in solving mathematics problems. This finding was consistent with some studies [6, 7]. The reasons why KWL strategy promoted problem solving are the following: 1) KWL chat reminds the students about their thinking. 2) In the K column, students wrote what they know about the subject to combine all knowledge for solving problems. This step corresponds with Schoenfeld’s first category in solving mathematics problem, resource [6]. 3) In the W column, students wrote what they want to get and listed all possible strategies. This step encourages students’ thinking and doing. This step corresponds with Schoenfeld’s second and third categories, heuristics and control [6]. 4) In the L column, after students solved problem completely, they wrote what they have learned in problem for applying to other problems.

Some errors were found from students’ tests. They are 1) Circles – Some students were unable to change general equations into standard equations correctly. 2) Parabolas – Some students were unable to distinguish the characteristics of the specified parabolas, for example; open up ward, open down ward, open left ward, or open right ward. 3) Ellipses – Some students were unable to distinguish if the specified ellipses were on a vertical or horizontal plane. 4) Hyperbolas – Some students incorrectly created standard equations of hyperbola. Moreover, the researcher found that students had wrong computing processes, for example; addition, subtraction, multiplication, and division.

These errors will be useful for other teachers to know in advance to prevent students from doing the errors.

REFERENCES


The Improvement of Teaching by Creating an Instructional Model Implementing Polya’s Approach in Mathematical Problem Solving for Tenth Grade Students

Bancha Morachat
Mathematics Education Program
International College
Suan Sunandha Rajabhat University

ABSTRACT

This action research aims to create an instructional model based on Polya’s approach for solving word problems in mathematics, and to study the attitude of the students towards mathematics word problem solving after the instructional model is taken into account. The sample consists of 28 students in Grade 10 at the Demonstration School of Suan Sunandha Rajabhat University. The study period covers the second term of Academic Year 2014. The research instruments used are an instructional model, two academic achievement tests (IOC1 = 0.96, IOC2 = 0.93), a student attitude survey, teacher observation forms, student journals, and students’ homework. This study contains two cycles. After the first cycle had been implemented, the collected data were analyzed and some adjustment was made to the instructional model for improvement before beginning the second cycle. The problem identified from a test given to the students is on the topic of “Sets.” The test results are averagely low, which are called for a solution. The findings of the study is that the average points students get on the first and second achievement tests are 4.89 with the standard deviations of 2.2 and 7.66 with the standard deviations of 1.23 respectively, maximum of 10 points. The students showed positive attitudes towards mathematics problem solving.

Keywords: Instructional Model, Polya’s approach, Mathematical Problem Solving, Mathematics Word Problem

1 INTRODUCTION

Mathematics is one of the most important fields because it is a foundation in studying other subjects such as science, physics, chemistry which still rely on mathematical calculations and thinking process. As stated in the Basic Education Core Curriculum [4] that mathematics is highly significant for the development of the human mind. It enables a person to think logically and systematically, to analyse various problems or situations, to anticipate, to plan, to make decisions, to solve problems and to apply mathematics to daily life. Indeed, mathematics is not only a tool that helps with the accuracy of obtained results in any kind of problem solving but also an imperative instrument in workplaces, regardless of which line of work that requires careful thinking and reliable problem solving process.

When it comes to the teaching of how to solve mathematics word problems on the topic of “Sets” to a classroom of Grade 10 students, learning problems were identified including the students’ lacking skills in solving mathematics word problems procedurally and systematically, and poor test results were derived. This was due to the students not having a problem solving strategy to follow as a guideline. According to La-or Ngernmak [5], in order for the students to be able to solve mathematical problems, they need to know and understand the process of mathematical problem solving, and effective cognitive processes are also essential to allow students to solve mathematics problems more effectively.

In addition, during the joint analysis of the students’ learning problems with several in-service teachers from the mathematics department in the school, one suggestion received is that the teacher should also be largely responsible for the students’ learning problems. These sorts of problems often occur with an intern pre-service teacher in particular. The information from the teacher’s observation notes at the end of the lesson plans were used by the host supervisor to
provide suggestions for improving the teaching instructions and the lesson plans also emphasized the problems.

After studying several methods of mathematics word-problem solving, there are various studies that confirm positive results. According to Cruce [1], the students found Polya’s problem-solving strategy useful and it increased the students’ problem-solving ability. Similarly, the study of Shin-Yi Lee [2] states that the use of “look back” step in Polya’s strategy was positively related to success in mathematical problem solving. Therefore, Polya’s problem-solving approach [6] fits for this problematic context. Indeed, an instructional model based on the problem-solving technique of Polya and created by the researcher the students were expected to learn mathematics problem solving more effectively and to have more fun in learning mathematics.

1.1 Research Objectives

1.1.1 To create an instructional model using Poly’s problem-solving strategy to help with the improvement of 10th grade students’ mathematics word problem solving skills.

1.1.2 To study student’s attitude towards mathematics word problem solving after learning through the created instructional model.

2 METHODOLOGY

2.1 Participants

The sampling group consisted of 28 students in Grade 10 (Class 4/2) from the Demonstration School of Suan Sunandha Rajabhat University, Bangkok, Thailand.

2.2 Duration of the Study

This action research was conducted from 9th January, 2015 to 27th February, 2015 which is the second semester of Academic Year 2014.

2.3 Research Instruments

2.3.1 An instructional model, based on Polya’s problem-solving model, consisting of six lesson plans on the topics of Linear Function, Quadratic Function, and Mathematical Reasoning

2.3.2 Two subjective achievement tests (IOC 1 = 0.96, IOC 2 = 0.93); Test 1 consisting of six questions, and Test 2 consisting of eight questions

2.3.3 A student survey using Likert scale [3] comprising of 10 items to evaluate the student attitude towards mathematics after learning by using the instructional model

2.3.4 Teacher’s observation notes

2.3.5 Student’s weekly journals

2.3.6 Student’s homework

2.4 Data Collection

This action research contains 2 cycles using an instructional model based on the four-step problem-solving model of Polya as follows:
Cycle 1

Step 1: Identify the problems
Learning problems were identified and analyzed.

Step 2: Plan
An instructional model was created using Polya’s problem-solving approach.

Step 3: Act
After the instructional model was implemented, Test 1 was administered.

Step 4: Observe
Observation information deriving from the teacher’s notes, students’ weekly journals, students’ homework, and Test 1 results were employed.

Step 5: Reflect
With some advice from experienced in-service teachers working at the math department in the school, the teacher’s notes, students’ weekly journals, students’ homework, and Test 1 results were analyzed for adjustment to improve the researcher’s teaching.

Cycle 2

Step 6: Plan
Changes taken into account for some adjustment were incorporated into the instructional model.

Step 7: Act
After an instructional model had been implemented, Test 2 was administered. After that a student attitude survey was distributed.

Step 8: Observe
Observation information obtained from the teacher’s notes, students’ weekly journals, students’ homework, Test 2 results, and student attitude survey were utilized.

Step 9: Reflect
The information from the teacher’s notes, students’ weekly journals, students’ homework, Test 2 results, and student attitude survey was analyzed.

3 RESULTS

Cycle 1
During the first cycle, the teacher observations suggest that arranging students into small groups did not work as effectively as expected due to the lack of communication among the group members, therefore, the level of peer-assist-peer was low. However, some benefits of students working in small groups, explaining how one would solve a problem were noticed. Subsequently, a better way to get the students to share more of their ideas with the group is needed.

Additionally, some students were found to be uncomfortable with presenting their work solutions in front of the class because they were not used to doing so. This may take time for the students to adjust and finally consider it as a regular routine. By presenting their solutions in front of the class it will not only help their friends to understand how to solve specific mathematics problems, but will also help the presenters to practice communication skills and gain confidence in public presentation.

The students’ homework shows that the students were able to apply Polya’s problem-solving approach on their linear and quadratic function word problems. However, the student journals indicate that some of the quadratic function word problems seemed to be too difficult for students to solve. This issue may be fixed by rearranging the order of the word problems’ level of difficulty from the easy level to the more challenging ones, and also by allowing the students more time to work on problem solutions. More practice on new kinds of problems will also make more progression on tests.
Practically, only short time was allowed to the students to practice solving linear and quadratic word problems with a few sets of problems. As a result, merely half of the class passed Test 1 as displayed in Table 1. It did not come as a surprise to the researcher that those who passed the test were those rated with high mathematics skills. One problem that stands out besides the students not being able to solve some problems on Test 1 is that some students failed follow the test instructions given. For example, the students were asked to find algebraic expressions of the situations given, but instead, some students ended up solving for the variables. When asked why they did that, their answer that it was against their nature to see an equation and not to solve for the variables.

**Cycle 2**

After changes had been made to the instructional model, the second cycle commenced. The groups were arranged slightly differently with the help from all the group leaders. The groups finally clicked and took off. As the researcher walked around the class observing the students during their group activities, I saw my students eagerly sharing their thoughts on how to solve the word problems that everyone in the group was involved. With more time to work on the group worksheet problems, the students were able to understand how to solve all of them from the group and class discussions. As they understood how to work the problems, they were more confident and willing to present their solutions in front of the class. This resulted well also on the group worksheets and the individual homework as they applied Polya’s problem solving technique in details to solve the word problems correctly. The student journals were on a positive note as many students expressed their enjoyment in applying Polya’s approach to solving mathematics word problems. The results of Test 2 in Table 1 also confirmed that not only all of the students passed the test with an average score of 7.66 out of maximum 10 points, but the standard deviation of 1.23 indicates that the majority of the students did really well on the test.

<table>
<thead>
<tr>
<th>Table 1 Student Achievement Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mathematics Achievement Tests</strong></td>
</tr>
<tr>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Test 1 (Max. 10 points)</td>
</tr>
<tr>
<td>Test 2 (Max. 10 points)</td>
</tr>
</tbody>
</table>

The results from the student attitude survey in Table 2 indicates that the majority of the students agree that Polya’s problem-solving technique is useful and helps increase confidence in solving mathematics problems. The number indicates that 46.43% of the students agree that they had a difficult time with math in the past, but 42.86% also display that learning Polya’s approach to problem solving helps them like mathematics more, and of the 50% agree that learning Polya’s approach helps them realize the essence of mathematics in life.

<table>
<thead>
<tr>
<th>Table 2 Student Attitude Survey Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Question Items</strong></td>
</tr>
<tr>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>1. Polya's problem-solving approach was useful in solving mathematics problems.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2. Polya’s problem-solving approach helped increase confidence in solving mathematics problems.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3. Worksheets helped the students better understand the topic lessons.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>4. Learning in small groups allowed students to help each other.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>5. The teacher better motivated the students’ mathematics learning.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>6. The teacher allowed the students the opportunities to be involved in the classroom</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
The teacher was well-prepared before the lessons.

8. In the past, the students found it difficult in solving mathematics problems.

9. After learning how to solve mathematics problems using Polya’s problem-solving approach, the students like mathematics more.

10. After learning how to solve mathematics problems using Polya’s problem-solving approach, the students realize that mathematics is essential in life.

### 4 CONCLUSION

Polya’s problem-solving model not only helps students to solve mathematics word problems more effectively but also help them gain confidence, enjoy the subject, and see the importance of learning mathematics. Moreover, learning mathematics in small groups allows more interaction between students which will generate knowledge and skills received during that interaction as part of their thinking system eventually, as similar to Vygotsky [7]. He believed that through interactions with other children and adults, children ultimately experience knowledge and skills, which will be internalized and used to guide and direct students’ own behaviour. Additionally, allowing ample time and appropriate amount of problem exercise will help increase students’ problem-solving skills. Polya’s problem-solving technique should therefore be taken with more emphasis on school mathematics curriculum and applied as early as in elementary level because it can foster more effectiveness in students’ learning mathematics.

### REFERENCES

[1] Cruce, M., (2010), The Effects of the Four-Step Problem-Solving Model on Algebra I Students’ Mathematical Achievement and Opinions, Master Dissertation, Curriculum and Teaching, University of Kansas, USA.


Using Cooperative Learning to Develop Learning Outcome in Mathematics of Grade 11 Students

Nawee Sakdadech
Mathematics Education Program
International College, Suan Sunandha Rajabhat University

ABSTRACT

The purposes of this action research were to study mathematics learning achievement of Grade 11 students before and after being provided Student Teams-Achievement Divisions (STAD) technique, to compare mathematics learning achievement of Grade 11 students after being provided STAD technique at the expected 70 per cent criteria, and to study opinion of Grade 11 students towards STAD technique in mathematics. The participants in this study were 43 Grade 11 students in the second semester of the 2014 academic year at Debsirin School, Bangkok, Thailand. The experiment was conducted for 16 periods. The research instruments employed in this study consisted of 8 lesson plans based on the STAD technique, achievement test (IOC = 0.98, K.R.20 = 0.92) and questionnaire (IOC = 0.94). Achievement test and questionnaire were used to examine mathematics learning achievement and to study opinion of students towards STAD technique, respectively. The data were statistically analysed by using t-test for dependent samples and t-test one sample. The findings showed that mathematics learning achievement after being provided STAD technique was statistically higher than before learning at the .01 level of significance. The mathematics learning achievement after being provided STAD technique was statistically higher than the expected criteria at the .01 level of significance. Students' opinion towards STAD technique was at high level with the mean scores of 4.12.

Keywords: Cooperative learning, student teams-achievement divisions (STAD), learning outcome, learning achievement, opinion

1 INTRODUCTION

Mathematics is a subject found in all school curriculums around the world. The Ministry of Education mentioned that mathematics is one of the most important to develop human thinking skills. It enables a person to acquire skills in daily life. It is, therefore, useful to one’s life, enhances quality of life and enables a person to live in harmony with others [9]. There are some problems in teaching and learning mathematics. Two main causes of these problems were a variety of students’ abilities and quality of teaching technique. As a result, students had still poor learning achievement and had negative attitude towards mathematics.

Davison stated that cooperative learning, small–group learning, offers opportunities for students to be successful in mathematics. The group interaction is designed to help all members learn the concepts and problem–solving strategies. Dividing students into small group with different levels, high, medium and low level, encourages students to help and learn each other [2]. Cooperative learning is small group learning that allows students to work together to accomplish shared goals. Students seek outcomes that are beneficial to all. Students discuss the content and concept with each other, help each other understand it, and encourage each other to work hard [4]. In 2006, Shininger [7] embarked on a study to determine the benefits of using STAD in a middle school mathematics classroom. He found that Students Teams Achievement Divisions (STAD) increases academic achievement and improves students' self-esteem as learners and their social interactions with their peers. Weaver [11] investigated the benefits of cooperative learning in the secondary math classroom. He found that cooperative learning is useful for learning mathematics in high school. The students who were exposed to cooperative learning seemed to have higher score on the tests and have positive attitude towards mathematics. In [12], Zakaria et al. studied the effects of cooperative learning on students’ mathematics achievement and attitude towards mathematics. Student Teams-Achievement Divisions (STAD) technique was used in their research. They found that cooperative learning methods improve students’ achievement in mathematics and
attitude towards mathematics. The findings above were also similar to the studies of Hossain and Tarmizi, Tran, and Zakaria et al. [3, 10, 13].

Therefore, the researcher was interested in studying on using cooperative learning (STAD technique) to develop learning outcome in mathematics of Grade 11 students, in order to encourage students to have more communication, interaction and teamwork competency so that they can be successful in their work and their personal lives in the future.

1.1 Research Objectives

1.1.1 To study mathematics learning achievement of Grade 11 students before and after being provided Student Teams-Achievement Divisions (STAD) technique

1.1.2 To compare mathematics learning achievement of Grade 11 students after being provided Student Teams-Achievement Divisions (STAD) technique at the expected 70 per cent criteria

1.1.3 To study opinion of Grade 11 students towards Student Teams-Achievement Divisions (STAD) technique in mathematics

2 METHODOLOGY

2.1 Participants

The participants in this study were 43 Grade 11 students in the second semester of the 2014 academic year at Debsirin School, Bangkok, Thailand. This experiment was conducted for 16 periods.

2.2 Research Instruments

2.2.1 Eight lesson plans under the STAD technique on the topic of Complex Numbers

2.2.2 An achievement test (IOC = 0.98, K.R.20 = 0.92) consisting of 20 questions with four multiple choices

2.2.3 A questionnaire (IOC = 0.94) comprising 12 questions to evaluate students’ opinion towards cooperative learning (STAD technique) in mathematics

2.3 Data Collection

This study compared mathematics learning achievement of Grade 11 students before and after being provided STAD technique and compared mathematics learning achievement of Grade 11 students after being provided STAD technique at the expected 70 per cent criteria. Table 1 shows a graphic form of experimental design of this study. $A$ represents the target group. $O_1$ represents the pre-test while $O_2$ represents the post-test. The STAD technique is represented as $X$.

Table 1 Pre-test and Post-test target group design

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Treatment</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A$ ($n = 43$)</td>
<td>$O_1$</td>
<td>$X$</td>
<td>$O_2$</td>
</tr>
</tbody>
</table>
The researcher conducted the study as follows:

1) The researcher taught Grade 11 students in the topic of Complex Numbers by using STAD technique developed by Slavin [8] according to the following approaches and steps:

**Step 1: Introduction**
Teacher divided students into group of four to five students with different levels; high (one student), medium (two students) and low (one student). Teacher identifies learning objectives and conditions for Students Teams Achievement Divisions.

**Step 2: Class presentation**
Teacher taught students the content following to the provided schedule with suitable techniques, activities, and learning experiences.

**Step 3: Team and Quizzes**
Students worked on handout in their own group. Then students took individual quizzes or other assessments such as essays or performances.

**Step 4: Individual Improvement Scoring**
In addition to the quiz score, the scores from tests each week were included. The scores of tests indicated the students’ progress of their performance. The improving scores of each student were calculated from the difference of the test scores and the base score of each student by using criteria.

**Step 5: Team recognition**
Team scores were calculated from the score of each group member by using criteria.

2) Opinion of Grade 11 students towards STAD technique in mathematics were collected by using questionnaire.

2.4 Data Analysis

2.4.1 Mathematics learning achievement of grade 11 students before and after being provided STAD technique was analysed by paired-samples t – test [1]

2.4.2 Mathematics learning achievement of Grade 11 students after being provided STAD technique at the expected 70 per cent criteria was analysed by one-sample t – test [1].

2.4.3 Opinion of Grade 11 students towards STAD technique in mathematics was analysed by mean (\(\bar{X}\)).

The levels for opinion evaluation of 5-point Likert scale [5]:

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>4</td>
<td>Agree</td>
</tr>
<tr>
<td>3</td>
<td>Undecided</td>
</tr>
<tr>
<td>2</td>
<td>Disagree</td>
</tr>
<tr>
<td>1</td>
<td>Strongly Disagree</td>
</tr>
</tbody>
</table>
3 RESULTS

The results of this study were reported following to the objectives stated earlier as follows:

1) Mathematics learning achievement of Grade 11 students before and after being provided STAD technique

Paired-samples t-test was conducted to compare the mathematics learning achievement of Grade 11 students between before and after being provided cooperative learning model. The total score of achievement test was 20. The pre-test mean scores of students’ mathematics learning achievement was 4.77 (SD = 1.69), and post-test mean scores of students’ mathematics learning achievement by using STAD technique was 15.33 (SD = 1.48). Table 2 showed that the mean of the post-test (X̄ = 15.33) was greater than that of the pre-test (X̄ = 4.77). The difference between pre-test and post-test mean scores was significant \( t(42) = 44.29, p < 0.01 \), which revealed that mathematics learning achievement after being provided STAD technique was significantly higher than before learning.

Table 2 Paired-samples t-test comparing means of the mathematics learning achievement between before and after being provided STAD technique

<table>
<thead>
<tr>
<th>Mathematics learning achievement</th>
<th>n</th>
<th>Total Score</th>
<th>Mean (X̄)</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>43</td>
<td>20</td>
<td>4.77</td>
<td>1.69</td>
<td>44.29</td>
<td>42</td>
<td>0.00</td>
</tr>
<tr>
<td>Post-test</td>
<td>43</td>
<td>20</td>
<td>15.33</td>
<td>1.48</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Mathematics learning achievement of Grade 11 students after being provided STAD technique at the expected 70 per cent criteria

One-sample t-test was conducted to compare the mathematics learning achievement of Grade 11 students after being provided STAD technique at the expected 70 per cent criteria. The 70 per cent of total score was 14 score. The results showed that the mean of post-test, X̄ = 15.33 (SD = 1.48) was greater than 14 score. As stated in Table 3, a significant difference was found \( t(42) = 5.89, p < 0.01 \), which revealed that the mathematics learning achievement after being provided STAD technique was significantly higher than the expected 70 per cent criteria.

Table 3 One-sample t-test comparing means of the mathematics learning achievement of Grade 11 students after being provided STAD technique at the expected 70 per cent criteria.

<table>
<thead>
<tr>
<th>Mathematics learning achievement</th>
<th>n</th>
<th>Total Score</th>
<th>70 per cent of total score</th>
<th>Mean (X̄)</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test</td>
<td>43</td>
<td>20</td>
<td>14</td>
<td>15.33</td>
<td>1.48</td>
<td>5.89</td>
<td>42</td>
<td>0.00</td>
</tr>
</tbody>
</table>

3) Opinion of Grade 11 students towards STAD technique in mathematics

The mean was conducted to evaluate the opinion of Grade 11 students towards cooperative learning (STAD technique) in mathematics. Table 4 showed that mean of students’ opinion towards cooperative learning (STAD technique) in mathematics (X̄ = 4.12) was at high level. The first three highest mean scores were statement no. 11, 4, and 1 and 3, respectively: 1) \textit{Group success was the most important to the students} (X̄ = 4.40); 2) \textit{When learning complex numbers students liked working together} (X̄ = 4.23); and 3) \textit{Cooperative learning helped students gain knowledge in complex numbers} and \textit{The use of cooperative learning helped students to enjoy complex numbers} (X̄ = 4.16).
Table 4 Opinion of Grade 11 students towards cooperative learning in mathematics

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean ((\bar{x}))</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cooperative learning helped students gain knowledge in complex numbers.</td>
<td>4.16</td>
<td>High</td>
</tr>
<tr>
<td>2. Cooperative learning helped students express idea more fully.</td>
<td>4.02</td>
<td>High</td>
</tr>
<tr>
<td>3. The use of cooperative learning helped students to enjoy complex numbers.</td>
<td>4.16</td>
<td>High</td>
</tr>
<tr>
<td>4. When learning complex numbers students liked working together.</td>
<td>4.23</td>
<td>High</td>
</tr>
<tr>
<td>5. Working together was useful to students.</td>
<td>4.12</td>
<td>High</td>
</tr>
<tr>
<td>6. Students were able to help my friends during the study of complex numbers.</td>
<td>4.09</td>
<td>High</td>
</tr>
<tr>
<td>7. During the study of complex numbers students enjoyed working with others with different abilities.</td>
<td>4.02</td>
<td>High</td>
</tr>
<tr>
<td>8. Cooperative learning helped students study better.</td>
<td>4.09</td>
<td>High</td>
</tr>
<tr>
<td>9. Students liked exchanging ideas with other group members.</td>
<td>4.14</td>
<td>High</td>
</tr>
<tr>
<td>10. Students preferred receiving a reward for work to receiving good grades.</td>
<td>4.00</td>
<td>High</td>
</tr>
<tr>
<td>11. Group success was the most important to the students.</td>
<td>4.40</td>
<td>High</td>
</tr>
<tr>
<td>12. Students would like to apply cooperative learning in other subjects.</td>
<td>4.00</td>
<td>High</td>
</tr>
<tr>
<td><strong>Total mean</strong></td>
<td><strong>4.12</strong></td>
<td><strong>High</strong></td>
</tr>
</tbody>
</table>

4 CONCLUSION AND DISCUSSION

The findings of this study show that cooperative learning, STAD, has significant influence on students’ achievement in mathematics and opinion towards STAD technique. Students’ mathematics learning achievement after being provided STAD technique was significantly higher than before learning and higher than the expected criteria. The findings of this study are consistent with the studies by [3, 10, 12, 13]. These studies indicate that STAD technique assists students to have higher mathematics learning achievement.

According to the second objective, students’ opinion towards STAD in mathematics was at high level. Students mostly agreed with the statement, *Group success was the most important to the students*. The results above are consistent with the studies of Johnson & Johnson and Macpherson [4, 6]. They addressed that team members need to help each other to be successful in the goals of each group.

The findings of this study showed that cooperative learning helps students to improve their mathematics learning achievement. Therefore, teachers who teach mathematics should consider the benefits and importance of cooperative learning, particularly STAD which is one of the effective techniques of cooperative learning that encourages students to help each other in their groups. Therefore, school principal should encourage educators and teachers to implement this technique, STAD, including other cooperative learning methods.

REFERENCES


Using Constructivism Paradigm to Enhance Students’ Achievement and to Maintain Retention in Mathematics

Orphan Boonruang
Mathematics Education Program,
International College, Suan Sunandha Rajabhat University, Bangkok, Thailand

ABSTRACT

This classroom action research aims to enhance students’ achievement and help them to construct mathematical knowledge themselves by using constructivism paradigm. The participants were 31 grade 10 students in a classroom that the researcher was teaching in the second semester of academic year 2014. The topic used in this study is “complex numbers”. To enhance students’ achievement and to help them construct mathematics knowledge themselves, the researcher developed 9 lesson plans on complex numbers which emphasized constructivist paradigm. To access students’ achievement, the researcher gathered information from tests, and exam. After 2 weeks, the same exam is also applied to measure students’ retention. The results of this study demonstrated that the constructivist lesson plans enhance students’ achievement in mathematics and maintained their knowledge retention.

Keywords: constructivism paradigm, mathematics achievement, knowledge retention, complex numbers

1 INTRODUCTION

Mathematics is an important tool in developing human thinking skills; creativity, logical and systematic thinking. It is required for analyse of complex situations and problems, accurate predictions, appropriate planning, and decision-making in everyday life. Mathematics is also important for learning of science, technology and other related subjects [6]. However, learning mathematics in traditional ways, remembering and applying formulas, did not successfully develop higher level of thinking. Results from international study such as PISA (Programme for International Student Assessment) revealed that average score of Thai students was in the 50th rank out of 64 countries in 2012 [9].

Traditional teaching methods focussed on classroom instruction where the teacher used a whiteboard and textbooks as critical tools. Students needed to remember course contents including a large number of mathematical formulas, and use them to solve specific math problems given by the teacher. Using such this teacher-centered method, students could only be recipient since it was one-way communication. And without proper following up and feedback process, students would have forgotten the contents they had learnt. Successful learners should be able to construct knowledge from their real-life experiences. Such that knowledge will last long as they realize the relationship between what they have learnt and real world situations.

In the constructivist view, a child constructs knowledge based on his or her own experiences, existing cognitive structure, and internal motivation [5]. Cognitive conflict which occurs when a child encounters the problematic situation or interacts with other people will motivate reflective thinking in order to get rid of the conflict. This process leads to cognitive reconstructuring which will be a tool for constructing knowledge [1, 2]. In the process of reflection, it will be very helpful if students have an opportunity to discuss and share their ideas with others [4]. They will help one another investigate solving methods or ideas by using supportive reasons. Students will gradually get rid of conflict they initially have, and finally gain understanding. This approach seems to support the promotion of learning mathematics by construction their known knowledge.

Teaching at a secondary school, the researcher found that student achievement in mathematics and students’ knowledge retention were not satisfactory. So, the researcher was interested in solving this problem using a constructivism paradigm. The main activity in a constructivist classroom is solving problems. Students used inquiry methods to ask questions, investigate a topic, and used a variety of resources to find solutions and answers. As students
explored the topic, they made conclusions. And as exploration continues, they revisit those conclusions, explored for unclear solutions which lead to more questions.

2 RESEARCH OBJECTIVES

2.1 To enhance students’ learning achievement in mathematic by applying the constructivist paradigm

2.2 To investigate retention of students who applied constructivist paradigm in learning mathematics

For research objective 1, the author aims 75% of students to pass mathematics achievement test and final examination. The criterion for each student to pass the test and exam is to gain at least 75% of achievement test and final examination. While research objective 2, the accepted criteria to maintain retention of each student is to gain at least 75% of the second examination.

3 METHODOLOGY

3.1 Participants

The participants in this study were consisted of 31 students in grade 11 in the second semester of the academic year 2014 at Satriwittaya School, Bangkok, Thailand. Based on the constructivist paradigm, the participants were selected by using the purposive selection method.

3.2 Instruments

Research instruments are consisted of 9 lesson plans on complex numbers topic emphasized the constructivism paradigm as shown in Table 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Contents</th>
<th>Period (50 minutes each)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Imaginary numbers</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Operations on complex numbers</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Conjugate complex numbers</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Absolute of value of complex numbers</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Graphs and the absolute values of complex numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Achievement Test</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Polar forms of Complex numbers</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Multiply and divide complex numbers in polar form</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>De Moivre’s theorem</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>$n^{th}$ root of a complex number in polar form.</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Polynomial equations</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Final exam</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>14</td>
</tr>
</tbody>
</table>

The researcher constructed lesson plans for 14 periods of instruction of grade-11 students. These lesson plans were developed based on the constructivist teaching based model which was
evolved from the constructivist theory. The principle of this theory is that children are to be encouraged to construct their own knowledge from their experience. The emphases of lesson plans were students’ existing knowledge, collaborative working, use of manipulative, conflict and reflective teaching approach, and real world situations. It is assumed that knowledge construction processes involve learning achievement and retention. Each lesson plan was composed of lesson purposes, key concepts, basic knowledge, teaching materials, and exercise.

The constructivist paradigm [7] includes the following approaches and steps:

Step 1: Engage
Capture students’ attention, stimulate their thinking and help them access prior knowledge.

Step 2: Explore
Give students time to think, plan, investigate, organize, and collected information.

Step 3: Explain
Involve students in an analysis of their explorations. Use reflective activities to clarify and verify their understanding.

Step 4: Elaborate
Give students the opportunity to expand and confirm their understanding of the concepts, and possibly apply it to a real-world situation.

Step 5: Evaluate
Evaluate students throughout the lesson. Present students a scoring criteria at the beginning target on what students must know and do. Sometimes this criteria is under the agreement of both teacher and students.

The achievement test which is composed of 11 written items for 15 points was used during the process and the final exam which comprises 20 multiple-choice items for 30 points was used to collect summative results. The final exam was used again after 14 days to determine student knowledge retention.

3.3 Procedure

The data collection of this study was performed during 14 periods of instruction, as described in the previous section. During the intervention period, the participants received learning instruction based on a constructivist paradigm for 4 lesson periods in the classroom. Then, all participants were asked to take the mathematics achievement test. After the test section the teacher continued the instruction as specified in the lesson plans. The participants took final exam at the final period. The same final exam was conducted again 14 days after the final exam to evaluate student knowledge retention.

3.4 Data analysis

The Data from the test and final examination were analyzed to find arithmetic mean ( $\bar{x}$ ), standard deviation ( $SD$ ), percentage of overall scores of the participants, and number and percentage of students passing the test.

4 RESULTS

Results collected from achievement test, final exam, and retention exam are displayed in the Table 2 with the analysis of data.

Table 2 Achievement Test Results

<table>
<thead>
<tr>
<th>Items</th>
<th>Scores</th>
<th>Student passing above 75%</th>
</tr>
</thead>
</table>

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<table>
<thead>
<tr>
<th></th>
<th>$\bar{x}$</th>
<th>Total</th>
<th>$SD$</th>
<th>N</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement Test</td>
<td>13.45</td>
<td>15</td>
<td>1.48</td>
<td>29</td>
<td>93.54</td>
</tr>
<tr>
<td>Final exam</td>
<td>24.65</td>
<td>30</td>
<td>2.71</td>
<td>25</td>
<td>80.65</td>
</tr>
<tr>
<td>Retention final Exam</td>
<td>23.68</td>
<td>30</td>
<td>3.16</td>
<td>24</td>
<td>77.42</td>
</tr>
</tbody>
</table>

Total number of students = 31

5 DISCUSSION AND CONCLUSION

The results revealed that the constructivist lesson plans is effective in developing student achievement in mathematics since more than 75% of the participants have the average scores attaining above the desired level at 75% of the total scores in both tests. Student knowledge retention also remained after the instruction ended as more than 75% of the participants still have the scores above the desired level. These results would imply that using the constructivist paradigm in the mathematics classroom would enhance the learning of mathematics in secondary schools.

Implementation of the constructivist paradigm should be reviewed in terms of knowledge and skills of each student. In this case, training and continuous development is needed for student, to maintain retention. Students can learn from each other and can construct knowledge of the instruction that has been implemented, and their experience can be shared with each other to understanding and maintains retention of learning activity.

REFERENCES

The Effect of Using Discovery Learning Method on Students’ Achievements and Attitudes

Ekapong Benjakul
Mathematics Education
International College, Suan Sunandha Rajabhat University

ABSTRACT

The purposes of this research were to investigate the effect of using discovery learning method on students’ achievements and attitudes in mathematics. The participants were 35 Grade 11 students in the second semester of Academic Year 2014 from Mahaprutaram Girls’ School under the Royal Patronage of Her Majesty the Queen in Bangkok, Thailand. To enhance students’ understanding and to help them explore new knowledge by themselves, the researcher developed lesson plans on probability with experimenting mathematics activities. Based on research findings, students understood concepts of probability, applied their learning for solving problems in daily life, shared their thinking with others, and enjoyed to learn mathematics in classroom.

Keywords: discovery learning method, achievements, attitudes

1 INTRODUCTION

As part of The Basic Education Core Curriculum, Ministry of Education Thailand [1], mathematics learning aims to have all students continuously learning mathematics in accordance with their full potential, solving problems using various methods, reasoning, communication and presentation in mathematics, connecting mathematical ideas to other concepts in mathematics and to other disciplines [1]. One of the critical components of a mathematics program is Data Analysis and Probability taught in Grade 11 and 12. Probability is the content that many students do not understand about its important and concept because of using only describe without demonstrations or activities. Students should learn probability with understanding, actively building new knowledge from experience and prior knowledge by experimenting mathematics activities together with direct lecture. One of instructional methods of learning that can help students learn probability with understanding is discovery learning. Discovery learning is an active learning process in which learners improve their higher-level skills to build understanding of main ideas and concepts deeply. From these reasons, the researcher was interested in discovery learning method to create instructional model and how to discovery learning can improve students’ achievements and attitudes in mathematics.

2 DISCOVERY LEARNING METHOD

Discovery learning is an instructional model of learning that can help students explore and learn new knowledge by doing activities. Bicknell-Homes and Hoffman [3] explain the three main of necessary attributes of discovery learning as 1) exploration and problem solving to create, integrate, and generalize knowledge, 2) student driven, interest-based activities in which the student determines the sequence and frequency, and 3) activities to support integration of new knowledge into the learner’s existing knowledge base. These three attributes are combined to make discovery learning for students to create a lesson or an activity for developing their understanding and abilities in mathematics. Discovery learning is active and process-based learning and focuses on new knowledge, feedback and understanding.
3 RESEARCH OBJECTIVES

The research objectives in this research:
3.1 To investigate students’ achievements by using discovery learning method in probability; and
3.2 To investigate students attitudes by using discovery learning method in probability.

4 RESEARCH QUESTIONS

4.1 Does discovery learning method has an effect on the students’ achievements of probability?
4.2 Does discovery learning method has an effect on the students’ attitudes toward learning mathematics?

5 METHOD AND PROCEDURE

5.1 Participants

The participants were 35 Grade 10 students from Mahaprutaram Girls' School under the Royal Patronage of Her Majesty the Queen submitted subject M 32201 Fundamental Mathematics in the second semester of Academic Year 2014.

5.2 Instruments

The research instruments in this study consist of lesson plans, worksheets, achievement test, and questionnaire.

5.2.1 Lesson Plans

The researcher created 10 lesson plans under using discovery learning method in probability focused on activities to improve students’ understanding about probability and to motivate students. Moreover, students were assigned to explore their interesting topics in daily life related probability and discussed with their friend in class.

5.2.2 Worksheets

Some lesson plans includes worksheets to enhance learning activity and to guide students’ learning to explore new knowledge.

5.2.3 Achievement Test

An achievement test consisting of 15 questions with 4-choice items was created to assess their knowledge based on research objectives and The Basic Education Core Curriculum, Ministry of Education Thailand [1].

5.2.4 Questionnaire

The researcher created a questionnaire consisting 10 questions to evaluate attitudes of students toward using discovery learning method.
5.3 Data Collection

In this study, the researcher prepared discovery learning approaches based on course description and research objectives in the selected topic (Probability). The researcher prepared lesson plan using the discovery learning method as learning activities for probability topic and other research instruments including measurement tools and a questionnaire. The researcher used worksheets to collect the data from students and received their assignments including power point presentation and conclusion report. Moreover, the researcher collected students’ feedbacks and attitudes from questionnaire.

5.4 Data Analysis

The analysis of collected data was done statistically as the following:
5.4.1 The learning achievement was analysed from achievement test scores using one sample t-test with the significance level 0.05;
5.4.2 Assessment of the students’ attitudes through the questionnaire was calculated by using descriptive statistics, percentage.

6 RESULTS

6.1 Achievement Results

The achievement test scores were analysed and displayed in Table 1. The total score test is 15 and the total number of students is 35.

Table 1 Students’ Achievement Results toward using Discovery Learning Method

<table>
<thead>
<tr>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>11.82</td>
<td>2.35</td>
<td>2.04</td>
<td>34</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Students learning effectiveness was analysed by achievement test scores with one sample t-test as shown in Table 1. One sample t-test revealed a significant difference in testing score as $t(34) = 2.04, p<0.05$.

6.2 Attitude Results

A questionnaire with attitude test scores is shown in Table 2 displaying percentage score on each statement.

Table 2 Students’ Attitude Results toward using Discovery Learning Method

<table>
<thead>
<tr>
<th>Items</th>
<th>Level of Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>1. The discovery learning approach helped students interested in probability.</td>
<td>37.14%</td>
</tr>
<tr>
<td>2. The discovery learning approach appropriated to probability.</td>
<td>57.14%</td>
</tr>
<tr>
<td>3. The discovery learning approach helped students enjoy learning probability.</td>
<td>68.57%</td>
</tr>
<tr>
<td>4. The discovery learning approach helped students learn probability easily.</td>
<td>14.29%</td>
</tr>
<tr>
<td>5. The discovery learning approach helped students explore new knowledge in probability.</td>
<td>34.29%</td>
</tr>
<tr>
<td>6. The discovery learning approach helped students learn probability more understanding.</td>
<td>40.00%</td>
</tr>
</tbody>
</table>
7. The discovery learning approach helped students think reasonably. 

| Percentage | 37.14% | 45.71% | 11.43% | 2.86% | 0.00% |

8. The discovery learning approach helped students think creatively. 

| Percentage | 25.71% | 57.14% | 14.29% | 0.00% | 0.00% |

9. The discovery learning approach help students discover new knowledge. 

| Percentage | 31.43% | 34.29% | 28.57% | 2.86% | 0.00% |

10. The discovery learning approach helped students use probability in their daily life. 

| Percentage | 31.43% | 31.43% | 25.71% | 8.57% | 0.00% |

In this questionnaire, there are 10 questions that required the students’ evaluation on using discovery learning method as learning activities. In Table 2 showed that the first three highest percent of statements that most students strongly agree were statement 3, 2, and 6 respectively: 1) The discovery learning approach help students enjoy learning probability (68.57%); 2) The discovery learning approach appropriated to probability (57.14%).

7 CONCLUSION

The research findings show that discovery learning method was used in probability helps students to improve their mathematics learning achievement. Students understand probability concepts and contents. They are able to apply probability in their daily life. Moreover, students are interested in probability activities and they have positive attitudes to discovery learning in probability.

REFERENCES


APPENDIX:

Figure 1: Students’ Worksheets

Figure 2: Students’ Assignment after Discovery Learning Activity
The Impact of Using 5Es Instructional Model and the Geometer’s Sketchpad as Learning Tool on Students’ Higher Order Thinking Skills and Attitudes toward Mathematics

Jenjira Kampor
Department of Mathematics Education
International College, Suan Sunandha Rajabhat University, Bangkok, Thailand

ABSTRACT

The purposes of this action classroom research were to investigate the impact of using 5Es Instructional Model and the Geometer’s Sketchpad (GSP) as learning tool on students’ higher order thinking skills and students’ attitudes toward mathematics. The participants in this study were 30 Grade 10 students at Suankularb Wittayalai school in Bangkok, Thailand. The contents in this study were trigonometric functions. The 5Es Instructional Model composed of 5 steps in teaching: engagement, exploration, explanation, elaboration and evaluation. The instruction lasted 10 periods. The research tools were 8 trigonometric lesson plans using 5Es Instructional Model and GSP as learning tool, higher order thinking skills test and attitudes questionnaire toward mathematics. The findings of this study revealed that majority of participants had shown higher order thinking skills (understanding, applying, and analyzing) and high level attitude towards mathematics.

Keywords: 5Es Instructional Model, Geometer’s Sketchpad as learning tool, Higher Order Thinking Skills, Attitudes toward Mathematics

1 INTRODUCTION

Mathematics is important to develop human mind. It enables a person to acquire skills in logical, systematic and reasonable ways of thinking, and allows one to carefully and thoroughly analyses various problems or situations. Mathematics serves as a tool for learning science, technology and other disciplines. It enables a person to live in harmony with others [4]. For Thailand, students’ learning mathematics is not a satisfactory condition. From PISA (2003) (Programme for International Student Assessment), which assesses mathematical competencies that composed of 6 levels, revealed that the average score of Thai students’ mathematical competencies was level 2, students can use basically thinking abilities on easy contexts in simple test [3].

From the class I taught as a mathematics teacher in the first semester of 2014 academic year at Suankularb Wittayalai School, Bangkok, Thailand, it was found that many students faced the problems of understanding which lead to other problems such as applying and analyzing, in some difficult topics. As the results, the researcher intended to solve this problem and to increase students’ understanding and thinking abilities.

This classroom action research has adopted both the 5Es Instructional Model and the Geometer’s Sketchpad as learning tool to construct understanding, applying and analyzing in trigonometric functions.

The 5Es Instructional Model, one of the constructivist approaches developed by Rodger W. Bybee in the 1980s, provides students with opportunities to learn and construct their knowledge deeply and meaningfully. The concept behind the model is to begin with students’ current knowledge, make connections between current knowledge and new knowledge, provide direct instruction of ideas the students would not be able to discover on their own, and provide opportunities to demonstrate understanding [2]. Selma Pulat (2009) found that the students’ mathematics achievement improved after the instruction of 5E learning cycle [7].

Every element of the five “Es” is carefully crafted to promote student construction of knowledge: Engagement—Access prior knowledge and engage the new concept through short activities that promote curiosity; Exploration—Provide a common base of activities in which current concepts are identified and conceptual change is facilitated; Explanation—Focus on a
particular aspect of engagement to provide opportunities to demonstrate conceptual understanding, process skills, or behaviors. This phase also provides an opportunity for teachers to directly introduce a concept, process, or skill to guide students toward a deeper understanding; Elaboration—Challenge conceptual understanding and skills through new experiences to develop deeper and broader understanding and application; Evaluation—Students assess their understanding and teacher evaluates student progress toward educational objectives [2].

Technology gives students the prospect of owning the mathematics that is being taught by providing more time for modeling and conceptualizing the mathematical ideas [6]. The Geometer’s Sketchpad, dynamic geometry software, makes students understand and clear in difficult topics by visualization, comparison and observation the change that occur and opportunities for thinking and solving problems [6]. Ron York Myers (2009) found the use of technology (particularly GSP) is likely to boost students’ Florida Comprehensive Assessment mathematics test scores [5].

2 RESEARCH OBJECTIVE

1. To study the impact of using the 5Es Instructional Model and the Geometer’s Sketchpad as learning tool on students’ higher order thinking skills.
2. To study the impact of using the 5Es Instructional Model and the Geometer’s Sketchpad as learning tool on students’ attitudes toward mathematics.

For research objective 1, the researcher aimed 70% of all students in my class to pass the higher order thinking skills test. The criterion for each student to pass the higher order thinking skill test is to gain at least 70% of total scores.

For research objective 2, the researcher investigated students’ attitudes from the attitudes questionnaire.

3 METHODOLOGY

3.1 Participants

The participants in this classroom action research were 30 Grade 10 students in the second semester of the 2014 academic year at Suankularb Wittayalai School, Bangkok, Thailand.

3.2 Instruments

Instruments used in this research are including of 3 types as follow:

3.2.1 The 8 lesson plan based on 5Es Instructional Model by using Geometer’s Sketchpad as learning tool consisting of 8 subtopics in trigonometric functions.

<table>
<thead>
<tr>
<th>Lesson plan No.</th>
<th>Contents</th>
<th>Period (Hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unit Circle and Arcs of Unit Circle</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Sine and Cosine Functions</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Other Trigonometric Functions</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>The Angles of Trigonometric Functions</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>The Values of Sine and Cosine Functions of Real Numbers</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>The Values of Other Trigonometric Functions</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>The Tables of Trigonometric Function Values</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Graph of Trigonometric Functions</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Higher Order Thinking Skill Test</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>11</strong></td>
</tr>
</tbody>
</table>

At the end of each period, the researcher reflected students’ higher order thinking skills and results for improvement in the next period.
3.2.2 Higher order thinking skills Test is used to measure students’ higher order thinking skills — those thinking skills generally considered selected from the top three levels of thinking skills in Bloom’s Taxonomy of Thinking Skills. They are analyzing, evaluating, and synthesizing or creating. In this classroom action research, those thinking skills refer to three levels: Understanding—constructs meaning from instructional messages, including oral, written, and graphic communication; Applying—carries out or uses a procedure in a familiar or unfamiliar task; Analyzing—to break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose [1]. This test consisted of 10 written items.

3.2.3 Attitude questionnaire toward mathematics consisted of 15 items. The five-point Likert-type rating scale were used. The rates are Strongly Agree (5), Agree (5), Undecided (3), Disagree (2), and Strongly Disagree (1).

3.3 Procedure

3.3.1 The researcher taught as the prepared lesson plans, observed and recorded interaction among students and between teacher and students, students’ behaviors and classrooms’ atmospheres during to learning activities.

3.3.2 The researcher used higher order thinking skill test to evaluate students’ higher order thinking skills and questionnaire to investigate students’ attitudes toward mathematics that they learnt by the 5Es Instructional Model and the Geometer’s Sketchpad as learning tool at the end of the instruction.

4 DATA ANALYSIS AND RESULTS

4.1 The results of students’ higher order thinking skill test

<table>
<thead>
<tr>
<th>Student Number</th>
<th>Higher Order Thinking Skills</th>
<th>Percentage</th>
<th>Passed/Not</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Understanding (12) Applying (15) Analyzing (8) Total (35)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>12 9 8 29</td>
<td>82.86</td>
<td>Passed</td>
</tr>
<tr>
<td>2</td>
<td>9 12 7 28</td>
<td>80.00</td>
<td>Passed</td>
</tr>
<tr>
<td>3</td>
<td>12 15 8 35</td>
<td>100.00</td>
<td>Passed</td>
</tr>
<tr>
<td>4</td>
<td>7 13 5 25</td>
<td>71.43</td>
<td>Passed</td>
</tr>
<tr>
<td>5</td>
<td>0 3 1 4</td>
<td>11.43</td>
<td>Not Passed</td>
</tr>
<tr>
<td>6</td>
<td>0 5 1 6</td>
<td>17.14</td>
<td>Not Passed</td>
</tr>
<tr>
<td>7</td>
<td>12 8 5 25</td>
<td>71.43</td>
<td>Passed</td>
</tr>
<tr>
<td>8</td>
<td>12 15 7 34</td>
<td>97.14</td>
<td>Passed</td>
</tr>
<tr>
<td>9</td>
<td>4 6 1 11</td>
<td>31.43</td>
<td>Not Passed</td>
</tr>
<tr>
<td>10</td>
<td>12 5 1 18</td>
<td>51.43</td>
<td>Not Passed</td>
</tr>
<tr>
<td>11</td>
<td>12 13 6 31</td>
<td>88.57</td>
<td>Passed</td>
</tr>
<tr>
<td>12</td>
<td>9 12 8 29</td>
<td>82.86</td>
<td>Passed</td>
</tr>
<tr>
<td>13</td>
<td>12 13 8 33</td>
<td>94.29</td>
<td>Passed</td>
</tr>
<tr>
<td>14</td>
<td>0 0 6 6</td>
<td>17.14</td>
<td>Not Passed</td>
</tr>
<tr>
<td>15</td>
<td>7 10 8 25</td>
<td>71.43</td>
<td>Passed</td>
</tr>
<tr>
<td>16</td>
<td>12 12 7 31</td>
<td>88.57</td>
<td>Passed</td>
</tr>
<tr>
<td>17</td>
<td>7 10 3 20</td>
<td>57.14</td>
<td>Not Passed</td>
</tr>
<tr>
<td>18</td>
<td>3 9 5 17</td>
<td>48.57</td>
<td>Not Passed</td>
</tr>
<tr>
<td>19</td>
<td>12 12 8 32</td>
<td>91.43</td>
<td>Passed</td>
</tr>
<tr>
<td>20</td>
<td>12 13 7 32</td>
<td>91.43</td>
<td>Passed</td>
</tr>
<tr>
<td>21</td>
<td>8 12 5 25</td>
<td>71.43</td>
<td>Passed</td>
</tr>
<tr>
<td>22</td>
<td>8 13 8 29</td>
<td>82.86</td>
<td>Passed</td>
</tr>
<tr>
<td>23</td>
<td>8 11 6 25</td>
<td>71.43</td>
<td>Passed</td>
</tr>
<tr>
<td>24</td>
<td>12 11 7 30</td>
<td>85.71</td>
<td>Passed</td>
</tr>
<tr>
<td>25</td>
<td>12 13 8 33</td>
<td>94.29</td>
<td>Passed</td>
</tr>
<tr>
<td>26</td>
<td>7 13 8 28</td>
<td>80.00</td>
<td>Passed</td>
</tr>
</tbody>
</table>
Table 2 showed the following result.
1. 16 students from 30 students passed the understanding part (53.33%). The average score is 8.68 (72.31%) from the total score 12;
2. 20 students from 30 students passed the applying part (66.67%). The average score is 10.77 (71.83%) from the total score 15;
3. 21 students from 30 students passed the analyzing part (70%). The average score is 6.00 (75.00%) from the total score 8 and
4. 23 students from 30 students passed the higher order thinking skill test (76.67%). The average score is 25.45(72.72%) from the total score 35.

4.2 The results of students’ attitudes toward mathematics

<table>
<thead>
<tr>
<th>Statement</th>
<th>Average</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The 5Es and GSP allow students to monitor previous knowledge.</td>
<td>4.50</td>
<td>Agree</td>
</tr>
<tr>
<td>2. The 5Es and GSP motivate students to want to learn more.</td>
<td>4.40</td>
<td>Agree</td>
</tr>
<tr>
<td>3. The 5Es and GSP give opportunities to plan for the solution.</td>
<td>3.90</td>
<td>Agree</td>
</tr>
<tr>
<td>4. The 5Es and GSP give students greater opportunities to discuss their opinions in classroom.</td>
<td>3.60</td>
<td>Agree</td>
</tr>
<tr>
<td>5. The 5Es and GSP allow students exchange knowledge with classmate.</td>
<td>4.10</td>
<td>Agree</td>
</tr>
<tr>
<td>6. The 5Es and GSP help students to think more logically and to solve mathematics problems.</td>
<td>4.50</td>
<td>Agree</td>
</tr>
<tr>
<td>7. The 5Es and GSP help students understand mathematics more concretely.</td>
<td>4.80</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>8. The 5Es and GSP help develop students’ visual skill.</td>
<td>4.40</td>
<td>Agree</td>
</tr>
<tr>
<td>9. The 5Es and GSP help students want to solve problems by themselves.</td>
<td>3.90</td>
<td>Agree</td>
</tr>
<tr>
<td>10. The 5Es and GSP allow more students’ involvement in the learning activities.</td>
<td>3.70</td>
<td>Agree</td>
</tr>
<tr>
<td>11. The 5Es and GSP increase students’ confidence and expressiveness.</td>
<td>3.60</td>
<td>Agree</td>
</tr>
<tr>
<td>12. The 5Es and GSP help students’ comfortable learning.</td>
<td>4.20</td>
<td>Agree</td>
</tr>
<tr>
<td>13. The 5Es and GSP increase students’ role in mathematical thinking.</td>
<td>4.20</td>
<td>Agree</td>
</tr>
<tr>
<td>14. The 5Es and GSP help students realize the important of the use of technology in mathematics learning.</td>
<td>4.10</td>
<td>Agree</td>
</tr>
<tr>
<td>15. I would like to learn mathematics using the 5Es and GSP.</td>
<td>4.40</td>
<td>Agree</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>4.15</td>
<td>Agree</td>
</tr>
</tbody>
</table>

Table 3 showed that the most students after learning trigonometric functions by using 5Es instructional model and the Geometer’s sketchpad as learning tool agree with this instruction that the average score is 4.15 which is at the “High” level.

5 CONCLUSION

In this classroom action research, mathematical teaching using the 5Es Instructional Model and the Geometer’s Sketchpad as learning tool was performed under the trigonometric functions. The finding revealed that the majority of participants had shown higher order thinking skills (understanding, applying, and analyzing) and high level attitude towards mathematics.

REFERENCES


Using the Cooperative Learning Strategy to Correct Misconceptions in Mathematics

Pirawan Pothilert
Department of Mathematics Education
International College, Suan Sunandha Rajabhat University

ABSTRACT

The purposes of this action research were to correct student misconceptions in mathematics using the cooperative learning strategy (one-to-one tutoring) and to evaluate student satisfaction towards the proposed tutoring method. The topic used in this study was the “Matrices” which are a part of the high-school mathematics. The participants in this study were consisted of 43 grade-10 students at Debsirin School, Bangkok, Thailand. During the instruction of the specified topic, the researcher had employed formative assessments and identified students’ misconceptions through thinking steps in formative test. According to the class time limitation, the one-to-one tutoring was applied as an out-of-class activity where each student who had misconceptions was paired with the other student who had good mathematical concepts. The stronger student in each group attempted to assist his/her friend and evaluate if he/she had corrected the misconceptions. After the tutoring, students were assessed again and the results showed that most misconceptions were corrected. The participants were also asked to complete the questionnaire in which the results show that they had high level of satisfaction towards the proposed activity.

Keywords: Misconceptions in Mathematics, One-to-One Tutoring, Cooperative Learning, Student Satisfaction

1 INTRODUCTION

Misconception in mathematics results from student incorrect process of thinking or misunderstanding in definitions, axioms, theorems, or formulas. It may result from previous inadequate learning and teaching process or poor remembrance. Many studies suggested that repeating a lesson or making it clearer will not help students who base their reasoning on strongly held misconceptions. It is very important to recognize student misconceptions and to re-educate students to correct mathematical thinking [1].

Panitz encouraged teachers to implement cooperative learning at least a part of the time to identify student misconceptions and enable the teachers to focus on specific concepts or algorithms. The researcher concluded that cooperative learning techniques, when used extensively in mathematics classes, generate many advantages for students and teachers [5]. Daro suggested that students who are behind need different learning styles at different times to catch up with their peers. Students who have misconceptions might disrupt other participants in regular class. They need to be taught beyond regular classes for weeks at a time supported by materials that help teaching conceptual understanding of basics [3]. According to Daro, matching the student to the tutor one-to-one or one-to-two could address specific mathematical skills that are critical to the student’s understanding of the current assignment and provide immediate feedback. Tutors can be college students, older students, volunteers, or peers.

One-to-one tutoring or peer-assisted learning is one of cooperative learning strategies that matches one low-achieving student and one higher-achieving student who is confident in his/her activity. Tutors were asked to provide clear instructions, use positive reinforcement, provide effective feedback, and systematic error correction. Tutees should respond to questions, apply feedback appropriately, seek clarification when needed, and request for helps that will promote independent problem solving. Frequent monitoring and supervision by the teacher is required to keep students on track with their tutoring activities and goals, and improves the increasing academic achievement [2].
The researcher taught mathematics at the practicum school. During the instruction of the “Matrices” topic, which is a part of the grade-10 mathematics, the researcher had employed a formative test based on the learning objectives in each subtopic and found that a significant number of students had misconceptions in mathematics through the analysis of student’s written test. Trying to correct these misconceptions during the class time seemed to be difficult under the circumstances that there were limited of time, students had to participate in the school activity, and learning abilities among students were different. Misconceptions would have obstructed their future studies in related topics and subjects if the correction was not successfully and promptly performed.

Therefore the researcher applied the one-to-one tutoring strategy as an out-of-class activity where students worked in pairs. Grouping of students was subjected to their test results in each subtopic. Each student who had misconceptions in mathematics would have one strong student with good mathematics as a tutor. The stronger student in each group attempted to teach his/her friend and evaluate if the weaker student had corrected the misconceptions. This process had been repeated until the last subtopic was reached, which took around one month of instruction according to the lesson plans and the academic calendar. Students were to be assessed again using a post-test which based on the same learning objectives as the formative tests. The analysis of this summative test results could reveal if students had corrected misconceptions through the tutoring strategy.

**RESEARCH OBJECTIVES**

This research aimed to correct student misconceptions in mathematics by using a one-to-one tutoring strategy and to determine student satisfaction towards using the proposed strategy as a part of the learning process.

**2 RESEARCH METHODOLOGY**

**2.1 Participants**

Participants of this study were 43 students studying in grade 10, semester 2, academic year 2014 at Debsirin School, Bangkok, Thailand.

**2.2 Procedure**

The researcher identified student misconceptions in mathematic by analyzing the formative test results. The one-to-one tutoring strategy was used for correcting student misconceptions. In each subtopic, any student with misconceptions was to be paired with the other student who had correct conceptions. The higher-achieving student (the tutor) was asked to help the other one to correct misconceptions by sharing his/her strategy for solving a particular math problem. The tutor was also responsible for overseeing his/her friend in completing the assigned homework and exercise. The tutor needed to confirm that his/her peer had corrected the misconceptions.

A post-test was employed on schedule after the tutoring session in order to find if misconceptions were corrected. This summative test was consisted of 20 multiple-choice questions which were related to the learning objectives (as used during the classroom instruction). Students were also asked to complete a questionnaire as completion of this research to evaluate their satisfaction in using the proposed one-to-one tutoring strategy to correct misconceptions in mathematics. A questionnaire included 10 questions based on a 5-point scale covering the students’ conception, self-confidence and student-student interaction both in and out of the classroom [4, 6]. The planned tutoring process is described in Figure 1.
3 RESULTS

The analysis of formative test result in each session revealed the number of students with misconceptions and correct conceptions, as specified in Table 1. The tutoring was employed as specified above and students were assessed again after the tutoring. The results showed that most misconceptions were corrected, as shown in Table 1 and Figure 2. This implied that students had corrected their misconceptions through the tutoring process.

Table 1 Student Misconceptions Before and After the Tutoring

<table>
<thead>
<tr>
<th>Behavior Descriptions</th>
<th>Before the Tutoring</th>
<th>After the Tutoring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Misconceptions</td>
<td>Correct Conceptions</td>
</tr>
<tr>
<td>1. Find the value of variables in matrices when two matrices are equal.</td>
<td>6 13.95%</td>
<td>37 86.05%</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>13.95%</td>
<td>86.05%</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>n</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>41</td>
<td>95.35%</td>
</tr>
</tbody>
</table>
2. Addition and subtraction of two matrices, and multiplication by a scalar number.  

3. Solve the problem which was mingled with addition, subtraction and multiplication by scalar number of matrices.  


5. Find the determinant of $2 \times 2$ matrices.  

6. Find the inverse of $2 \times 2$ matrices.  

7. Find the determinant of $n \times n$ matrices; $n > 2$.  

8. Apply the determinant, minor, cofactor and adjoint of matrices.  

9. Find the inverse of $n \times n$ matrices; $n > 2$ using determinant.  

10. Apply the properties of determinant for solving matrix problems.  

11. Convert equation systems into the matrices.  

12. Solve the equation systems by using the Cramer’s rule.  

Percentages of students who had correct conceptions before and after the tutoring process  

<table>
<thead>
<tr>
<th>Behavior Description</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>86.05%</td>
<td>95.35%</td>
</tr>
<tr>
<td>2</td>
<td>97.67%</td>
<td>90.07%</td>
</tr>
<tr>
<td>3</td>
<td>95.35%</td>
<td>97.67%</td>
</tr>
<tr>
<td>4</td>
<td>76.74%</td>
<td>97.67%</td>
</tr>
<tr>
<td>5</td>
<td>74.42%</td>
<td>97.67%</td>
</tr>
<tr>
<td>6</td>
<td>88.37%</td>
<td>97.67%</td>
</tr>
<tr>
<td>7</td>
<td>90.7%</td>
<td>97.67%</td>
</tr>
<tr>
<td>8</td>
<td>74.42%</td>
<td>97.67%</td>
</tr>
<tr>
<td>9</td>
<td>76.34%</td>
<td>97.67%</td>
</tr>
<tr>
<td>10</td>
<td>65.12%</td>
<td>97.67%</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 2 Comparison of Students Achievement Before and After the Tutoring  

From Table 1 and Figure 2, students more than 90% had correct conceptions after the tutoring. However there was the significant number of students who still unable to apply the determinant, minor, cofactor and adjoint of matrices (item 8) correctly. In this case the tutoring should be planned again.
Questionnaire results, as in Table 2, showed that students satisfied in using the proposed cooperative learning strategy (one-to-one tutoring) to correct misconceptions in mathematics with the average score at 4.18 out of 5.00 which is in the “high” level.
Table 2 Student Satisfaction

<table>
<thead>
<tr>
<th>Statements</th>
<th>Strongly Agree (5)</th>
<th>Agree (4)</th>
<th>Neither Agree nor Disagree (3)</th>
<th>Disagree (2)</th>
<th>Very Disagree (1)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I like when the one-to-one tutoring was used in learning mathematics.</td>
<td>14</td>
<td>17</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>4.00</td>
</tr>
<tr>
<td>2. I think that helping each other gives me deeper understanding of the math concept.</td>
<td>18</td>
<td>19</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>4.26</td>
</tr>
<tr>
<td>3. I think that the one-to-one tutoring helps me to learn the concept easier.</td>
<td>17</td>
<td>14</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>4.09</td>
</tr>
<tr>
<td>4. I learnt better from the one-to-one tutoring than I did from the direct instruction by the teacher.</td>
<td>21</td>
<td>15</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>4.30</td>
</tr>
<tr>
<td>5. I feel proud to be a tutor or tutee in this activity.</td>
<td>20</td>
<td>16</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>4.30</td>
</tr>
<tr>
<td>6. The one-to-one tutoring increases self-confidence.</td>
<td>18</td>
<td>18</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>4.26</td>
</tr>
<tr>
<td>7. I was able to work with my partner without any serious trouble.</td>
<td>14</td>
<td>17</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>4.05</td>
</tr>
<tr>
<td>8. Together with my partner we were able to solve problems than I could not do by myself alone.</td>
<td>19</td>
<td>16</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>4.26</td>
</tr>
<tr>
<td>9. The one-to-one tutoring leads to a positive classroom community.</td>
<td>15</td>
<td>19</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>4.09</td>
</tr>
<tr>
<td>10. I think that close relationship is important for the one-to-one tutoring activity.</td>
<td>17</td>
<td>17</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>4.19</td>
</tr>
</tbody>
</table>

Total number of students (N = 43)

Average 4.18

4 CONCLUSION AND DISCUSSION

The findings of this study indicated that the one-to-one tutoring strategy was able to correct student misconceptions in mathematics as the percentage of higher-achieving students after the tutoring session increased from prior measurement. Moreover the analysis of student satisfaction in using the proposed one-to-one tutoring method gave the average score at 4.18 out of 5.00 which is at the “high” level.

REFERENCES


Using Open-Ended Problems to Promote Mathematical Communication Skills and Creative Thinking Ability of Gifted and Talented Ninth-Grade Students

Jiratcharya Kasaen
Mathematics Education Program
International College Suan Sunandha Rajabhat University, Bangkok, Thailand

ABSTRACT

The purposes of this action research were to investigate the effects of using open-ended problems on the development of mathematical communication skills and creative thinking ability. Participants in this research included 36 grade-9 students in the gifted and talented education program, the second semester of the academic year 2014 at Suankularb Wittayalai School, Bangkok, Thailand. The selected mathematics topic is the “Relations”. An activity sheet with open-ended problems was given to the participants in the designated session. The researcher observed and assessed participants individually using a prepared rubric evaluation form to measure their mathematical communication skill and creative thinking abilities. The results revealed that students had mean of scores for mathematical communication skill at 77% and had mean of test scores for creative thinking at 83% which implied that students had good mathematical communication skill and creative thinking abilities in solving open-ended problems.

Keywords: Open-ended problem, mathematical communication skill, creative thinking ability, gifted and talented students

1 INTRODUCTION

The practical experience in teaching ninth-grade gifted and talented students revealed that complex problems were likely to challenge and stimulate these students more than general problems. They tried to solve these problems and had interaction not only between students and the teacher but also students and students. Students were challenged to communicate with friends to share their thinking or strategies for solving the specified problems, either orally or in writing. They learn to clarify their ideas, convince their methodologies, and precise use of their mathematical language [4].

Many studies revealed techniques to persuade the mathematical communication. Becker and Shimada [1] suggested that teachers need to provide rich mathematical situations for students which will encourage them to learn new things by communicating with teachers and peers. One possible method to provide students with such opportunities is to apply the open-ended problems. Any open-ended problem will have multiple solutions or methods to solve. Also the open-ended problems can contribute to encourage the ability of mathematical communication in discussing for possible solutions and conclusions. It is easy to evaluate student thinking abilities and determine how well students understand what they have learned, using open-ended problems. Using this strategy, students will participate more actively in the class and show their ideas more frequently. They also have more opportunities to make understanding with the use of their knowledge and skills.

Since open-ended problems allow multiple correct solutions, each student has opportunities to obtain his/her own solutions within their own scope and range of abilities [1]. Classroom activities and lessons should be understandable for every student. With many different solutions, students have their right to choose their favoured strategies in obtaining the answers. Teachers are able to conduct more discussions with students about the methods used to solve problems. Through comparing and discussing with others, students are motivated to share their solutions and strategies. This provides opportunities for students to develop their mathematical thinking [5].
Sheffield [6] had suggested that open-ended or complex problems encourage students to respond creatively in ways that are original, fluent, flexible, and elegant. The perspective on mathematics creative thinking refers to a combination of logical and divergent thinking which is based on perception. Because most questions in mathematics have only one answer, students are highly likely to discourage them from exploring diverse ideas. So, open-ended problems can make up for this disadvantage because they allow various answers or various strategies. This is why the researcher was interested in using open-ended problems to investigate mathematical communication skill and creative thinking ability.

2 METHODOLOGY

2.1 Research objective

This research aims to investigate mathematical communication skill in writing and creative thinking ability of talented students by assigning open-ended problems.

2.2 Participants

The participants in this research were 36 ninth-grade students in the gifted and talented education program who were studying mathematics at Suankularb Wittayalai School, Bangkok, Thailand.

2.3 Instruments

Research instruments are consisted of 10 lesson plans covering subtopics in the “Relations” topic as shown in Table 1.

<table>
<thead>
<tr>
<th>Topics</th>
<th>Subtopics</th>
<th>Lesson Plans Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relations</td>
<td>1 Cartesian products</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2 Relations</td>
<td>2, 3</td>
</tr>
<tr>
<td></td>
<td>2 Domain and Range of Relations</td>
<td>4, 5</td>
</tr>
<tr>
<td></td>
<td>2 Graphing of relations</td>
<td>6, 7</td>
</tr>
<tr>
<td></td>
<td>2 Inverse of Relations</td>
<td>8, 9</td>
</tr>
<tr>
<td></td>
<td>1 Graphing of Inverse Relations</td>
<td>10</td>
</tr>
</tbody>
</table>

The researcher designed an activity sheet for each subtopic which included open-ended questions in writing format. Classroom observation sheets with evaluation criteria were used to determine communication and creative thinking skills of individual student. A criteria for determine mathematical writing skills of students was developed from [3], as shown in Table 2. Each student was to be assigned in one of four levels according to his/her visible performance. A criteria for determine creative thinking abilities is shown in Table 3 where points are accumulated for each student if specified conditions were satisfied.

<table>
<thead>
<tr>
<th>Scores</th>
<th>Levels</th>
<th>Mathematical communication shown</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Excellent</td>
<td>- Students completely explained the idea of finding solutions correctly, clearly, and in good ordering.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Students used mathematical language and symbols correctly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Students completely showed the valid solutions of their own to others.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Students completely summarized the given situations clearly and accurately.</td>
</tr>
</tbody>
</table>
Good
- Students explained the idea of finding solutions mostly correct and in good ordering.
- Students used mathematical language and symbols mostly correct.
- Students showed mostly valid solutions of their own to others.
- Students summarized the given situations mostly clear and accurate.

Average
- Students could explain the idea of finding solutions partially correct.
- Students used mathematical language and symbols partially correct.
- Students partially showed valid solutions of their own to others.
- Students summarized the given situations partially clear and accurate.

Poor
- Students could not explain the idea of finding solutions.
- Students could not use mathematical language and symbols correctly.
- Students could not show the valid solutions of their own to others.
- Students could not summarize the given situations.

Table 3 Criteria for Determining Creative Thinking Abilities

<table>
<thead>
<tr>
<th>Levels</th>
<th>Creative Thinking abilities shown</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluency</td>
<td>Student provided correct solution(s) in solving the specified problem.</td>
<td>1</td>
</tr>
<tr>
<td>Flexibility</td>
<td>Student presented several strategies for solving the specified problem.</td>
<td>1</td>
</tr>
<tr>
<td>Originality</td>
<td>Student has his/her own idea for solving the specified problem.</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

2.4 Procedure

This study was conducted in the second semester of the academic year 2014 spending 10 periods of instruction. The designated instruction time for each period is two classes a week with 50 minutes each. Each period includes individual learning and small-group cooperative learning. Therefore each activity was designed to fit within a 50-minute class. All course contents, activity sheets, and observation sheets were prepared prior to the instruction.

The researcher first introduced students about this instruction method and clarified the assessment criteria. In each activity session the teacher specified the problem and encouraged students to produce as many answers as they could while observing their participation. Students were allowed to speak with each other and share their findings, solutions, and strategies in which each performance were to be recorded and scored according to the prepared observation sheets. In the classroom, teacher need to maintain a free discussion atmosphere by making an effort to guide students but not to give fixed solutions of the problems. After finishing all lessons, the participants were test by using mathematics creativity test and then the researcher analyzed the collected data and made conclusion.

3 RESULTS

This study was focused on mathematical writing skill and creative thinking ability of students in solving open-ended problems in mathematics.

3.1 Mathematical Writing Skill Results

The researcher collected scores from observation sheets used in 10 periods (6 subtopics) of instruction. The analysis of data yielded the average results as shown in Table 4. The overall score is at 77%.
Table 4 mathematical writing scores

<table>
<thead>
<tr>
<th>Subtopics</th>
<th>Average Scores</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scores (out of 3.00)</td>
<td>Scores as Percentages</td>
</tr>
<tr>
<td>Cartesian product</td>
<td>2.32</td>
<td>77</td>
</tr>
<tr>
<td>Relation</td>
<td>2.58</td>
<td>86</td>
</tr>
<tr>
<td>Domain and Range</td>
<td>2.18</td>
<td>73</td>
</tr>
<tr>
<td>Graphing of relation</td>
<td>2.25</td>
<td>75</td>
</tr>
<tr>
<td>Relation inverse</td>
<td>2.27</td>
<td>76</td>
</tr>
<tr>
<td>Graphing of relation inverse</td>
<td>2.32</td>
<td>75</td>
</tr>
<tr>
<td>Overall mean</td>
<td>2.32</td>
<td>77</td>
</tr>
</tbody>
</table>

3.2 Creative Thinking Ability Results

In the final period of instruction, students sat for mathematics creativity test that comprised 5 different descriptive open-ended questions to examine their creative thinking abilities. The researcher assessed students’ scores of each item using criteria in Table 3. The results showed that the mean score of this test was at 12.5 out of 15.0, or 83.15% in percentages with S.D. = 1.9. Students’ creative thinking scores of each question were shown in Table 5.

Table 5 Creative Thinking Ability Scores

<table>
<thead>
<tr>
<th>Test Items</th>
<th>Average Scores</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scores (out of 3.00)</td>
<td>Scores as Percentages</td>
</tr>
<tr>
<td>Question 1</td>
<td>2.42</td>
<td>80.56</td>
</tr>
<tr>
<td>Question 2</td>
<td>2.53</td>
<td>84.26</td>
</tr>
<tr>
<td>Question 3</td>
<td>2.42</td>
<td>80.56</td>
</tr>
<tr>
<td>Question 4</td>
<td>2.56</td>
<td>85.19</td>
</tr>
<tr>
<td>Question 5</td>
<td>2.56</td>
<td>85.19</td>
</tr>
</tbody>
</table>

4 CONCLUSION

The experimental results showed the mean score of students’ mathematical communication at 77% which means students had good mathematical communication skills. The results also showed the average score of the creativity test at 83.15% which means students had high level of creative thinking abilities. These results implied that the mathematics classroom based on open-ended problems with diverse answers and methods results in positive effects on promoting mathematical communication skills and creative thinking abilities.

REFERENCES


A Studying of Applying van Hiele’s Phases of Learning in Analytic Geometry on Students’ Achievement

Pornsuda Pengmuchaya
Mathematics Education Program, International College
Suan Sunantha Rajabhat University, Bangkok, Thailand

ABSTRACT

The purposes of this research were to investigate learning efficiency by using van Hiele’s phase of learning and to evaluate students’ attitudes toward mathematics learning by using van Hiele's phase of learning. The participants were 42 Grade 10 students studying in the second semester, academic year 2014 at Horwang School, Bangkok, Thailand. The research instruments comprised 10 lesson plans on the “Analytic Geometry” topic, two quizzes, mathematics achievement test and questionnaire. The researcher carried out the lesson plans based on van Hiele's phase of learning which have five steps consisting of inquiry/information, directed orientation, explication, free orientation and integration. The lesson plans, quizzes and mathematics achievement test were used to investigate learning efficiency by using van Hiele’s phase and the questionnaire was used to evaluate students’ attitude towards Mathematics learning by using van Hiele's phase of learning. The data were analyzed in terms of percentage and descriptive analysis. The results of this study demonstrated that student learning efficiency using the proposed model were at 83.26/81.23 attaining above the 70/70 criteria. Besides, they had high level of attitude towards learning mathematics using the applying van Hiele’s phase of learning in analytic geometry.

Key word: van Hiele’s Phase of learning, Students’ achievement, Students’ attitude

1 INTRODUCTION

“Analytic geometry is one of the most important and exciting ideas of mathematics. In particular it is central to the mathematics students meet at school. It provides a connection between algebra and geometry through graphs of lines and curves. This enables geometric problems to be solved algebraically and provides geometric insights into algebra [2]”. Traditional teaching methods on this topic involved with remembering a large number of math formulas and graph drawing, either by hands or using specific software.

Teaching at Horwang School in Bangkok, the researcher found that many students had struggled with understanding mathematical concepts. Remember formula in many topics seemed to be difficult for students and brought down the atmosphere in mathematics class. This resulted in many students had low achievement scores. The researcher observed students inability to solve math problems and it becomes obvious that instruction methods should be manipulated. It was not easy to provide effective learning in this topic using traditional learning methods.

1.1 The van Hiele’s Phases of Learning

Van Hiele proposed five sequential phases of learning geometry as follows [5, 6]:

1) Information: At the beginning, the teacher and students engage in conversation and establish an activity about the objectives of the study.

2) Directed Orientation: Students explore the topic they are currently studying through materials provide by the teacher.
3) Explication: Students build knowledge based on their previous experiences, express and exchange their findings with the others.

4) Free Orientation: Students encounter more complex tasks with many steps, or tasks that can be completed in several ways (open-ended tasks).

5) Integration: Students were required to summarize the knowledge of that topic. They originated an overview of what they have learned about analytic geometry.

1.2 Related Works

There are previous studies that tested the effectiveness of the activities based on the van Hiele’s phases of learning. The results demonstrated that it helps student to motivate geometric thinking. It is revealed that activities prepared based on the van Hiele’s phases of learning had given positive effects to students in various aspects including the student understanding and their imagination of geometric thinking [3, 4].

Choi-Koh (2000) developed activities based on the van Hiele’s phases of learning geometry using the Geometer’s Sketchpad Program (GSP) to assist in the instruction in the “Triangle” topic. Abdullah and Zakaria (2011) also conducted to study the learning of students’ perceptions towards the van Hiele’s phases of learning geometry using geometry’s sketchpad software. They found that used of Van Hiele’s phases of learning geometry integrated with GSP software is very encouraged as an alternative strategy in learning geometry to increase the students’ understanding and their level of geometric thinking. This approach does not only help to increase the students’ level of thinking, but can invigorate their understanding of geometry concepts.

According to previous studies, the researcher believed that implementation of the applying van Hiele’s phases of learning can help students to understand mathematical concepts clearer, improve the learning efficiencies, and yield positive attitudes in mathematics. Methodologies are explained further in this paper.

1.3 Purposes of Study

This research has two purposes described as follows:

1) to investigate learning efficiency by using van Hiele’s phase of learning according to criteria 70/70
2) to evaluate students’ attitudes toward mathematics learning

For purposes 1) the researcher used criteria 70/70 to determine the efficiency by using van Hiele’s phase of learning. The first, the exercises and quizzes were used to assess efficiency of the learning process (\(E_1\)). The second, the mathematics achievement test was used to assess efficiency of the learning process (\(E_2\)).

For purposes 2) the researcher use questionnaire to determine students’ attitudes.

2 METHODOLOGIES

2.1 Participants
The participants were 42 Grade 10 students with mix abilities. They enrolled in the second semester, academic year 2014 at Horwang School, Bangkok.

2.2 Research Instrument and Data Collection

The Research Instruments in this research comprised as follows:

1) Ten lesson plans on the topics of Analytic Geometry topic, as shown in Table 1, which is a part of the grade-10 mathematics. Lesson plans are divided into three sessions including period 1-4, period 5-8, and period 9-11.

2) Two quizzes, in which each test was to be done by students after they had finished session 1 and session 2.

3) Mathematics achievement test which was to be taken by students after they had completed all sessions in the lesson plans.

4) Attitude questionnaire used to evaluate students’ attitude. It contains statements covering three aspects which are learning activity, course contents, and materials. The participants were asked to complete this questionnaire at the end of the instruction.

Table 1 Details of lesson plans

<table>
<thead>
<tr>
<th>Lesson plan No.</th>
<th>Contents</th>
<th>Period (50 minute each)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Distance between two points</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Midpoint between two points</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Area of polygon</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Slope of line and quiz I</td>
<td>1</td>
</tr>
<tr>
<td>Session 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Parallel lines</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Perpendicular lines</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Equations of lines and quiz II</td>
<td>2</td>
</tr>
<tr>
<td>Session 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Distance between point and line</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Distance between two lines</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>The angle between two lines</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Mathematics achievement test</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

The researcher carried out the lesson plans based on applying van Hiele’s phase of learning. Integration of the applying van Hiele’s phase of learning with the proposed Analytic Geometry class was explained in Figure 1. The instruction took place for 12 periods in December
including exercises, quizzes and test. Data was collected throughout the instruction, as mentioned above.

![Figure 1: Applying van Hiele’s phases of learning in analytic geometry](image)

### 2.3 Data Analysis

The researcher used descriptive statistics for the analysis of data in this research. Student learning efficiencies were analyzed using \((\frac{E_1}{E_2})\) with expected criterion at 70/70. The \(E_1\) and \(E_2\) formulas are review as following:

\[
E_1 = \frac{\sum X}{N} \times 100
\]

where \(E_1\) is the efficiency of the applying van Hiele’s phases of learning

\(\sum X\) is the total scores from the exercises’ sheets and quizzes,

\(N\) is the total number of students,

\(A\) is the total scores of every exercises’ sheets and quizzes,

\[
E_1 = \frac{\sum F}{N} \times 100
\]

where \(E_2\) is the outcome efficiency of applying van Hiele’s phases of learning

\(\sum F\) is the total scores from the mathematic achievement test,

\(N\) is the total number of students,

\(B\) is the total scores of the mathematic achievement test,

Students’ level of attitude was evaluated from questionnaire results which were scored according to the 5-point Likert scale. Students determined their level of agreement in each statement which were scored as follows: 1=Strongly Disagree, 2=Disagree, 3=Unsure, 4=Agree and 5=Strongly Agree [1].
3. RESULTS

Evaluation of student learning efficiencies gave the results as shown in Table 2. The learning process efficiency \((E_1)\) was at 83.26 and the outcome efficiency \((E_2)\) was at 81.23. The overall efficiency of the proposed learning method emphasizing the applying van Hiele’s phases of learning was at 83.26 / 81.23 attaining above the 70 / 70 criterion.

<table>
<thead>
<tr>
<th>Learning efficiency</th>
<th>Total Score</th>
<th>(N)</th>
<th>(\bar{X})</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedure efficiency ((E_1))</td>
<td>173</td>
<td>42</td>
<td>144.05</td>
<td>83.26</td>
</tr>
<tr>
<td>Outcome efficiency ((E_2))</td>
<td>17</td>
<td>42</td>
<td>13.81</td>
<td>81.23</td>
</tr>
</tbody>
</table>

Questionnaire results are shown in Table 3 showing that the average score is 4.10 out of 5.00 which means students have positive attitudes towards the proposed instruction method.

<table>
<thead>
<tr>
<th>Categories</th>
<th>Teaching Activities ((5))</th>
<th>Instructional media ((5))</th>
<th>Contents Presentation ((5))</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>4.03</td>
<td>4.10</td>
<td>4.26</td>
<td>4.10</td>
</tr>
<tr>
<td>Meaning</td>
<td>High level</td>
<td>High level</td>
<td>High level</td>
<td>High level</td>
</tr>
</tbody>
</table>

4. CONCLUSION AND DISCUSSION

Based on the results, it can be concluded that applying the applying van Hiele’s phases of learning in teaching the Analytic Geometry resulted in good learning efficiencies and yielded positive effect on student attitudes towards mathematics.

In this research shown that implementation of the applying van Hiele’s phases of learning can help students to understand mathematical concepts clearer, improve the learning efficiencies, and yield positive attitudes in mathematics. This is parallel to the finding of Halat (2008) and Choi-Koh (2000) who stressed that learning activities done by students will be more structured based on the phases of learning geometry suggested in Van Hiele’s model. Moreover, 86.67% of the students agreed that the prepared activities encouraged the active participation of students in learning geometry [3, 6]. This finding is in line with studies by Penelope (2008), and Chew (2009) who proved the necessities of systematic geometry instructions to increase the knowledge and understanding of students [4, 8]. Meanwhile, according to Stipek (1998), the study environment and tasks given give a deep impact to the students’ attitude [9].
REFERENCES


The Study of Programming Problems in the First Programming Course for Students Enrolled in Computing Curricular Programs at Higher Education Levels

Amnart Pohthong
Department of Computer Science, Faculty of Science, Prince of Songkla University

ABSTRACT

Computer programming skills are very important for students who study in computing disciplines at higher education levels and necessary for their profession. Many courses related to computer programming are added into undergraduate computing curricula. Teaching the first programming course is challenging to lecturers because expected programming skills gained by students will be needed for later courses. If students have problems in the first programming course, this will affect learning outcomes in the later courses as well as their careers. The 308-231 course, structured programming and applications, is the first programming course for students in the Information and Communication Technology (ICT) program at Faculty of Science, Prince of Songkla University. The observation from the previous experience in teaching this course found that students’ learning outcomes were unsatisfied. However, there is still lack of empirical data to be evidence for the course and curriculum improvement. Therefore, this research was aimed to study these problems as classroom action research by using thirty students who enrolled the 308-231 course in the first semester of academic year 2013. Questionnaires and depth interviews were used as data collection tools. The results from this study suggest thirteen topics from thirty topics or 43.33% that the students claim as difficult and low understanding topics, and eight important factors for learning outcomes’ improvement. Moreover, the levels of understanding and fulfillment of learning outcomes corresponding to the course’s expectation in five categories based on the Thailand Qualification Framework (TQF) for computing curricula: 1. ethics and moral, 2. knowledge, 3. cognitive skills, 4. interpersonal skills and responsibility, 5. numerical analysis, communication and information technology skills, were also evaluated and averaged with a 5 Likert scale (from 1 = low to 5 = very good) as 3.92, 3.58, 3.37, 3.87 and 3.53 respectively.

Keywords: classroom action research, computing curricula, first programming course, programming problem

1 INTRODUCTION

Nowadays, computers and information technology are very important for human activities. Most organizations use computers to support their businesses in order to improve service quality and opportunity for competition. A computer system consists of three components: hardware, software, and people. In order to adopt computers as information systems or computing systems for any application, software plays the key role for those systems. Without software or a computer program, a computer cannot work [1]. In addition to basic computer literacy, to build software needs specific knowledge and skills such as computer languages and programming skills as well as knowledge for application domains. Moreover, requirements engineering, software design, software testing, software maintenance, software engineering infrastructure, software quality and project management, are knowledge and skills needed for building complex software [2-6]. Thus, many universities and colleges around the world offer several academic programs related to computers and information technology such as Computer Science, Computer Engineering, Information Technology, and Software Engineering.

In Thailand, knowledge for teaching and learning in schools is classified into 8 groups: Mathematics, Science, Social studies Religion and Culture, Physical Education, Arts, Career and Technology, and Foreign Languages [7]. Knowledge about computers and programming is included in the group of Career and Technology. Some academic people have argued that this knowledge should be included in the group of Science and the country should pay more attention to this...
knowledge for schools’ curricula. The study of computer programming in most schools in Thailand varies from school to school depending on their curricula and teachers’ capabilities in computer programming. These problems also affect student recruitment to universities. The general aptitude test (GAT) and the professional and academic aptitude test (PAT) for university entrance have not included computer and programming knowledge. These two tests are organized by the National Institute of Educational Testing Service (NIETS) [8]. Therefore, these problems also affect when students learn their first programming in universities. These become serious problems for students who enrol in undergraduate computing programs since programming skills will be desired skills for their further studies and their careers. Many teachers and instructors face difficulties in teaching programming courses and students also face difficulties in their learning process [9], especially for the first programming courses.

However, in Thailand, researchers in computing areas pay less attention to classroom research. Most researchers focus on their research interests in computing rather than in education because their research outcomes can be used for their career promotion. Therefore, teaching and learning process of programming and other computing issues should be paid more attention and requires more action research [10-13]. This would lead to curricular improvement, better teaching and learning outcomes, and fulfils better educational quality standards. Consequently, this would also lead to better graduates and better human resources in computing for the country.

2 PROGRAMMING COURSE IN COMPUTING CURRICULA

When a computer was introduced, a set of instructions for controlling it was simple. Later, the computer technology has been advancing in both hardware and software. Several computer languages have been invented and introduced. Computer languages have dramatically evolved from a machine language and symbolic languages to high-level languages such as BASIC, FORTRAN, Pascal, COBOL, and C. Many styles of programming techniques have also been introduced such as structured programming, logic programming, visual programming, and object-oriented programming. At the beginning era of computers, most programming courses were included in the curricula of Mathematics, Physics, and Electrical and Electronics Engineering. The Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE) have dedicated to computing over the past decades. They have also created some guidelines for undergraduate computing curricula [14-15]. Many universities around the world have adopted these guidelines for their computing curricula.

In Thailand, the Ministry of Education declared the Thai Qualifications Framework (TQF) for higher education in 2009. Undergraduate computing programs in this TQF are Computer Science (CS), Computer Engineering (CE), Software Engineering (SE), Information Technology (IT) / Information and Communication Technology (ICT), and Business Computer (BC). The body of knowledge for these five programs is distinguished by the ratio of courses in these following five areas: hardware and architecture (HA), system infrastructure (SI), technologies and software methods (TSM), technologies for applications (TA), organizational and information system issues (OIS). Most programming courses for computing curricula are provided in TSM. In general, the IT&ICT curricula for example, should have at least 0% of HA, 13% of SI, 27% of TSM, 40% of TA, and 20% of OIS. The ICT curriculum at Prince of Songkla University (PSU) conforms to the regulation of this TQF guidelines and is based on the ACM guidelines for the following subject areas: (1) information technology fundamentals, (2) human-computer interaction, (3) information assurance and security, (4) information management, (5) integrative programming and technologies, (6) Mathematics and Statistics for Information Technology, (7) networking, (8) programming fundamentals, (9) platform technologies, (10) systems administration and maintenance, (11) systems integration and architecture, (12) social and professional issues, and (13) web systems and technologies.

Moreover, since the ICT program at PSU is in the Faculty of Science, most courses during the foundation year or first year are Basic Sciences, Mathematics, and General Education. Although students are recruited to the ICT program in the second semester of the first year, they study only two courses from the ICT curriculum in this semester: 308-101 Fundamentals of ICT and 308-121 Visual Arts and Computer Graphics. These two courses do not include any computer programming.
concepts and practice. Therefore, the 308-231 course firstly introduces programming concepts and practice using C language.

3 METHODOLOGY

3.1 Research Questions

In order to investigate the programming problems in the first programming course, the following research questions were investigated.

Q1: Which topics are difficult to understand and students get low understandings?
Q2: What are key factors for students’ learning outcome improvement?
Q3: How much do students understand the course expectation of learning outcomes based on the course TQF?

In addition to the main research questions: Q1-Q3, other interesting questions were also investigated. For example, how does the teaching and learning plan affect the learning outcomes? How does the course evaluation and grading system affect the learning outcomes? How do students favor computer programming or software development? How do students tend to enter their careers in software development?

The study was designed and conducted to answer the research questions for the 308-231 course as a case study.

3.2 Scope of the Study

In investigating the research questions, the course contents were broken into 30 topics as shown in Table 1. The populations of the study were 30 students who enrolled the 308-231 course in the first semester of academic year 2013. The samples of the study were 20 students who took part in the depth interview. Purposive sampling was used. The duration of the study was one year from June 2013 to May 2014. This covered the teaching, marking, and grading periods, the course evaluation, and teaching assessment. Data collection using the questionnaires and the interviews was performed after the course was finished.

### Table 1 The topics for the 308-231 course

<table>
<thead>
<tr>
<th>Topic No.</th>
<th>Topic Name</th>
<th>Topic No.</th>
<th>Topic Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C Program Structure</td>
<td>16</td>
<td>Recursive Function</td>
</tr>
<tr>
<td>2</td>
<td>Program Compiling and Executing</td>
<td>17</td>
<td>Parameter Passing</td>
</tr>
<tr>
<td>3</td>
<td>Variable Declaration</td>
<td>18</td>
<td>Scope Rules</td>
</tr>
<tr>
<td>4</td>
<td>Constant Declaration</td>
<td>19</td>
<td>C Standard Library Functions</td>
</tr>
<tr>
<td>5</td>
<td>Expression</td>
<td>20</td>
<td>Type Definition</td>
</tr>
<tr>
<td>6</td>
<td>Basic Input Mechanisms</td>
<td>21</td>
<td>Enumeration Type</td>
</tr>
<tr>
<td>7</td>
<td>Basic Output Mechanisms</td>
<td>22</td>
<td>Array</td>
</tr>
<tr>
<td>8</td>
<td>If Statements</td>
<td>23</td>
<td>String</td>
</tr>
<tr>
<td>9</td>
<td>While/Do While Statements</td>
<td>24</td>
<td>Pointer</td>
</tr>
<tr>
<td>10</td>
<td>For Statement</td>
<td>25</td>
<td>Struct</td>
</tr>
<tr>
<td>11</td>
<td>Switch Statement</td>
<td>26</td>
<td>Union</td>
</tr>
<tr>
<td>12</td>
<td>Break Statement</td>
<td>27</td>
<td>File Processing and Operations</td>
</tr>
<tr>
<td>13</td>
<td>Continue Statement</td>
<td>28</td>
<td>Algorithms Development</td>
</tr>
<tr>
<td>14</td>
<td>Functions in C</td>
<td>29</td>
<td>Program Testing</td>
</tr>
<tr>
<td>15</td>
<td>Function Prototype</td>
<td>30</td>
<td>Documentation</td>
</tr>
</tbody>
</table>

3.3 Research Methods

At the beginning of the 308-231 course, the course syllabus together with the teaching and learning schedule and plan were explained to the students. The learning expectation corresponding to the course TQF and the grading systems were also explained. Then, the pretest was performed by the students before the first topic was taught. The course ran 15 weeks with 2 hours of lecture and 2 hours of practice in the laboratory each week. Moreover, the students were given some assignment for their homework. All teaching materials and learning media were provided on the university.
learning management system, LMS@PSU [16]. The post-test was performed by the students in order to investigate the students’ knowledge improvement. When the course was finished, the students were asked to complete the questionnaires for investigating the research questions. The returned questionnaires were completed by 27 students (7 males and 20 females). After grading for the course, the samples were selected from the populations using purposive sampling for the depth interview, based on their performances from the course. The selected students (5 males and 15 females) were explained about the interview and asked to sign for their consent. Finally, the data collected from the questionnaires and the depth interviews were analyzed.

4 RESULTS

From the results of the pretest and post-test with the total score 20 marks as shown in Table 2, most students have better knowledge of C programming than before taking the course. Based on the topics in Table 1, the students were asked to rate the ten most difficult topics. The same 8 topics from the questionnaires and the interviews that students agree they are difficult and get low understandings, are 17, 24, 16, 22, 23, 11, 25, and 26. More details are shown in Table 3.

<table>
<thead>
<tr>
<th>Test</th>
<th>N of Students</th>
<th>Mean</th>
<th>Range</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>28</td>
<td>2.09</td>
<td>14</td>
<td>2.47</td>
</tr>
<tr>
<td>Post-test</td>
<td>28</td>
<td>14.90</td>
<td>19</td>
<td>4.62</td>
</tr>
</tbody>
</table>

Table 3 The difficult topics that the students get low understandings

<table>
<thead>
<tr>
<th>Topic No. from the Questionnaires</th>
<th>% of Students from the Questionnaires</th>
<th>Topic No. from the Interviews</th>
<th>% of Students from the Interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>74.07</td>
<td>17</td>
<td>90.00</td>
</tr>
<tr>
<td>24</td>
<td>74.07</td>
<td>24</td>
<td>85.00</td>
</tr>
<tr>
<td>16</td>
<td>66.67</td>
<td>16</td>
<td>80.00</td>
</tr>
<tr>
<td>22</td>
<td>62.96</td>
<td>22</td>
<td>70.00</td>
</tr>
<tr>
<td>23</td>
<td>59.26</td>
<td>23</td>
<td>60.00</td>
</tr>
<tr>
<td>28</td>
<td>59.26</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>55.56</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>48.15</td>
<td>11</td>
<td>55.00</td>
</tr>
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<td>25</td>
<td>48.15</td>
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<td>26</td>
<td>48.15</td>
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<td>-</td>
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<tr>
<td>-</td>
<td>-</td>
<td>15</td>
<td>45.00</td>
</tr>
<tr>
<td>-</td>
<td>-</td>
<td>21</td>
<td>45.00</td>
</tr>
</tbody>
</table>

Twelve factors that might affect the students’ learning outcomes were identified. They are (1) F1: classroom attention, (2) F2: teaching materials and media, (3) F3: practice in the laboratory, (4) F4: the instructor’s ability of knowledge transfer, (5) F5: reviewing after the class by a student, (6) F6: reading and preparing before the class, (7) F7: knowledge sharing among the students, (8) F8: self learning and practice, (9) F9: project-based learning, (10) F10: inquiry in the classroom, (11) F11: good cares and friendships from the instructor, and (12) F12: the classroom atmosphere. When asking the students to rate 12 factors, the results from the questionnaires and the interviews are as shown in Table 4.

Table 5 shows the students’ understandings of the course expectation and the fulfilment of learning outcomes in terms of teaching and evaluation methods, based on the course TQF. The course expectation of learning outcomes were evaluated in five categories: ethics and moral (E), knowledge (K), cognitive skills (C), interpersonal skills and responsibility (I), and numerical analysis, communication and information technology skills (N).
Table 4 The average rating of the factors affecting the students’ learning outcomes

<table>
<thead>
<tr>
<th>Factors</th>
<th>Average Rating from the Questionnaires</th>
<th>Average Rating from the Interviews</th>
<th>Overall Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>4.41</td>
<td>4.55</td>
<td>4.48</td>
</tr>
<tr>
<td>F2</td>
<td>4.26</td>
<td>4.25</td>
<td>4.26</td>
</tr>
<tr>
<td>F3</td>
<td>4.44</td>
<td>4.45</td>
<td>4.44</td>
</tr>
<tr>
<td>F4</td>
<td>3.93</td>
<td>4.30</td>
<td>4.12</td>
</tr>
<tr>
<td>F5</td>
<td>4.22</td>
<td>3.90</td>
<td>4.06</td>
</tr>
<tr>
<td>F6</td>
<td>3.81</td>
<td>3.80</td>
<td>3.80</td>
</tr>
<tr>
<td>F7</td>
<td>3.81</td>
<td>4.10</td>
<td>3.96</td>
</tr>
<tr>
<td>F8</td>
<td>4.30</td>
<td>3.95</td>
<td>4.12</td>
</tr>
<tr>
<td>F9</td>
<td>3.67</td>
<td>3.50</td>
<td>3.58</td>
</tr>
<tr>
<td>F10</td>
<td>3.70</td>
<td>3.85</td>
<td>3.78</td>
</tr>
<tr>
<td>F11</td>
<td>3.92</td>
<td>4.40</td>
<td>4.16</td>
</tr>
<tr>
<td>F12</td>
<td>4.04</td>
<td>4.20</td>
<td>4.12</td>
</tr>
</tbody>
</table>

Table 5 The students’ understandings and fulfillment of learning outcomes

<table>
<thead>
<tr>
<th>TQF Expectation</th>
<th>Understandings</th>
<th>Fulfillment of Teaching</th>
<th>Fulfillment of Evaluation Methods</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>3.85</td>
<td>3.85</td>
<td>4.05</td>
<td>3.92</td>
</tr>
<tr>
<td>K</td>
<td>3.30</td>
<td>3.60</td>
<td>3.85</td>
<td>3.58</td>
</tr>
<tr>
<td>C</td>
<td>3.10</td>
<td>3.45</td>
<td>3.55</td>
<td>3.37</td>
</tr>
<tr>
<td>I</td>
<td>4.20</td>
<td>3.75</td>
<td>3.65</td>
<td>3.87</td>
</tr>
<tr>
<td>N</td>
<td>3.45</td>
<td>3.65</td>
<td>3.50</td>
<td>3.53</td>
</tr>
</tbody>
</table>

From the interviews, the students agree that the course teaching-learning plan and the grading systems affect the learning outcomes with 85% and 90% respectively in terms of their efforts and learning engagement. Only nineteen percentages of students favour computer programming or software development and thirty-seven percentages of students tend to enter their careers in software development.

5 DISCUSSION

To answer the main research questions, some following points can be discussed. Responding to Q1, the topic of “Parameter Passing” seems to be the most difficult topics. There are also other 12 topics that instructors should be aware such as 24, 16, 22, 23, 28, 9, 11, 25, 26, 27, 15, and 21. However, when considering the students’ performances in their examination, their understandings of algorithmic design is low with corrective proportion (CP) 0.17 but this topic was not rated in the most difficult topics from the depth interviews. Responding to Q2, the most important factor is “Class Attention” while the least important factor is “Project-Based Learning”. In addition to the factor of “Class Attention”, “Practice in the laboratory” and “Teaching Materials and Media” are also the quite important factors. The students were also concerned with the factor of “Good Cares and Friendships from the Instructor”. However, eight factors were rated by the students with overall average greater than 4.00 among twelve factors. These factors seem to affect the students’ learning outcomes and instructors should be aware of them. Responding to Q3 based on the course TQF, the course expectation of “Ethics and Moral” was rated as the highest understandings and fulfillment with overall average 3.92 while “Cognitive Skills” was rated as the lowest understandings and fulfillment with overall average 3.37. However, most items of the course expectation were rated lower than 4.00. This means the instructor should communicate with his or her students and explain about the course objectives and expectation carefully, and how teaching methods and evaluation methods would fulfill the course objectives and learning expectation. Some following interesting suggestions were also raised by the students during the interviews.
- The course should focus on the laboratory than the lecture.
- Laboratory should be done together with lecture.
- The instructor should take some examples of C programs from the industrial adoption.
- The instructor should demonstrate more examples of C programs.
The instructor should guide algorithms for given problems.

6 CONCLUSION

This research investigated and reported programming problems in the first programming course for students enrolled in computing curricula. The ICT program at Prince of Songkla University, Thailand, was selected as the case study. Questionnaires and depth interviews were used to collect data in this classroom action research. Thirty students were asked to complete the questionnaires and twenty students were selected by purposive sampling based on their learning performance for the depth interviews. The study suggests thirteen topics that the students rated as difficult topics and get low understandings. Eight important factors affecting the students’ learning outcomes were indentified. The study also suggests that the course objectives and learning expectation should be communicated and carefully explained to the students since this may affect the learning outcomes. In future, new teaching and learning techniques for the first programming course such as flipped classroom will be explored and the study will be replicated with other computing programs such as the Computer Science program at Prince of Songkla University.

REFERENCES

What's the Plan? Creative Interdisciplinary Sustainability Education in the Liberal Arts

Lance Neckar
Professor, Environmental Analysis
Pitzer College, USA

In this decade, we have arrived at teachable moment with respect to sustainability. Many liberal arts students see the impacts of cascading uncertainties in their everyday lives, and they come to college with strong passions for social and environmental change. Several leading U. S. scholars have spoken to the inherent values of liberal arts education in framing broad-spectrum, interdisciplinary solutions to complex sustainability problems. Some students see these problems in the context of environmental justice, others in terms of ecosystems services and biodiversity conservation. Some are focused on policy, some on research, and many others more broadly on social action. At the Claremont Colleges in California, Environmental Analysis as a field of study spans not only the disciplines but the colleges. A new degree track, Sustainability and the Built Environment focuses on climate change and broad issues of sustainability using the built environment as a medium of adaptive and mitigative change. Its approach is characterized by the two required courses in the degree track, Case Studies and Sustainable Place Studio. These paired courses combine analysis with projective design and planning thinking and creative making.

The urgency of now
In the age of the anthropocene, our growing urbanized populations have put pressures on everything from natural resources to commodities. David Orr, Oberlin College professor, the originator of American liberal arts education on sustainability has coined the phrase, the urgency of now, to characterize the imperative of addressing sustainability in the context of changes to American (and ideally global) higher education. We are cruising to 400 ppb in carbon emissions. Climate change, in its multiple manifestations, has been scientifically linked to the green house gas emissions, largely associated with the support of human life, especially in the so-called advanced world. While scientific unanimity on the causes of climate change exists, policy makers and their constituents in some countries, especially, the United States, remain unconvinced. The generations now in control have jeopardized the well-being of the young and those yet to be born. With so many pressing environmental conditions, overlaid by issues of environmental justice including access to resources, students are overwhelmed. Some are numbed by the data and their implications.

In California, living in this seductively sublime environment on the edge, the everyday paradoxes of climate change can be seen at the state and regional scales. The state’s Air Resources Board has been brought air quality under some control via fuel regulations on fuels and consequent emissions. Monitoring of performance, and more recently the mitigation of impacts operate in southern California through the auspices of the South Coast Air Quality Management District. The work of this agency, created as one of the state’s most important state’s regional policy case studies, captured by University of
Southern California Professor Daniel Mazmanian’s research, is taught in the Case Studies course as an example of sustainable policy creation and implementation.

**Challenges: Uncertainty Fraught with Complexity**

This all said, the topic, sustainability, and the students bring multiple challenges.

Sustainability combines academic disciplinarity with advocacy. Many liberal arts students come to the courses at Pitzer with strong interests in advocacy. For them, policy is seen as the grail of sustainability. This in spite of a recent history of gridlock and denial. They often have an idea that policy change will result in behavioral change. While some students remain committed to policies and regulation that would promote mitigation of impacts, even their reduction, others have accepted that the challenges of environmentally damaging legacy systems, indicates that adaptation – small- and large-scale - may be the order of the day.

Whether policy wonks or planners and designers, for many liberal arts students challenges lie in their understanding of technology.

For some, there is a tacit faith in technology to automatically incur technological change that will, in turn, spur behavioral change. Others are skeptical. Regardless few students understand how the physical world works technologically much less mechanisms of potential control through policy. And in spite of being immersed in a visual culture, their capacity to create their own visual analyses in diagram form, for instance, is an important aspect of the course assignments.

In an era of uncertainty, even a few analytical tools and experiences with design and planning thinking can be valuable for some students to understand how things work and how they might be changed.

**Systems Analysis: the Interdisciplinary Window on Collaboration**

Two courses are intended to provide students with examples of concrete approaches to more sustainable design, planning and policy with respect to the built environment:

Case Studies in the Sustainable Built Environment, lays a systems-thinking analytical foundation. Case studies of built projects are created by students as analyses of creative and collaborative manifestations of planning and design integration across systems and scales.

The Sustainable Place Studio provides the projective setting for engaged creativity. The collaborative studio setting aligns different modes of learning and problem-solving via design and planning pedagogies. Student-centered and peer learning are structured via problem identification, analysis, representation, and proposed solutions. Peer review evaluation builds confidence for students who create proposals for resilient and livable places to meet uncertainties ahead.

**Case Studies: Looking Across the Globe and the Disciplines**

The Case Studies course opens an analytical window onto multiple disciplines associated with the built environment In the case studies course, this broad bandwidth approach
looks at the complexity of systems – cultural, technological and natural –via investigation of their interdependency and the collaborative roles played in making more sustainable places. Lectures use cases to understand how sustainable development attempts to integrate systems – such as transportation and storm water management in the plan and design for Highland Gardens Village. Similarly, urban and regional planning, economic development policy, and landscape architecture were integrated in the design of the Landschaftspark Duisburg Nord, also underpinned by brownfield re-vegetation analysis, community process, and multifunctionality in programming.

Liberal arts students are accustomed to reading, writing and discussion assignments. And while many have made powerpoint presentations, they have not been particularly distinguished as representations of documentation and analysis processes. Assignments to document and analyze cases by mapping and diagramming as a mode of representation of the case reveals the different lenses and foci that students bring depending on their disciplinary preparation. Similarly analytical presentation varies not only by the emphases of the cases but as means of interdisciplinary discourse. For example, technologically adept students tend to understand the systems assignment differently than the humanistic and the social scientific approaches of most liberal arts students. For engineering students, technical systems performance is central - Kate Kryder, HMC engineering student diagrammed the BEDZED project by engineering and architectural systems related to the BREEAM framework. PZ student, Env Analysis, Dash Pinger mixed his emerging interest in GIS with a concern about social issues in his critique of post-Katrina housing. In contrast, CMC student Sydney Stephenson chose the David and Lucile Packard Foundation, a well-documented case with many drawings and diagrams already made. However, when she went into the studio course, she became more adventurous in the way she explored representational media.

Some students are not used to doing this kind of research, i.e., drawing from a breadth of disciplines, many unfamiliar. Because many sustainable projects are not as well known as those noted above, the web becomes a source. The reliability of data becomes an issue, and of course, even this simple data gathering approach can be confounded by issues of data privacy including intellectual property and other proprietary challenges. Finally for many liberal arts students, technological and other issues also challenge their capacity to understand the complexity of issues resolved in a plan or project.

**Teaching in Place: the Studio**

Teaching in southern California provides a sharpened context for sustainability education. Southern California, especially greater Los Angeles is a 18 million person region dependent on the urbanized systemic delivery of resources. Water scarcity and solutions and the idea of site-based and regional approaches provide a core thread of pedagogy in the studio. Water like air, ignores the usual jurisdictional resources. And in this case greater Los Angeles – indeed the whole state depends on other places such as the Colorado River basin complexly linked by infrastructure for potable water.

The recent studio problem has been to create a sustainable vision for a former gravel pit, now owned by the Claremont Colleges. The built fabric of Los Angeles can be
understood as a gravel quarry, concretized, above ground. It is the literally concrete product of the extraction of gravel from the alluvial fans of the San Gabriel Valley. Some nearby gravel pits are still active, but in this specific area near the colleges, many are now part of the regional drainage system. The colleges have adopted a plan for turning the pit into athletic fields, but in the studio, the students are free to come forward with a different vision. Their inquiry is grounded in understanding the regulatory framework of the two cities (and counties) in which the pit is situated. The challenge of reconciling their visions with sustainability imperatives and also needed changes to regulations requires both carefully researched analysis and creative leaps of inquiry and imagination.

Redesigning/planning for water conservation in Southern California

The water problem presents many challenges for students. Not the least is their lack of knowledge of and familiarity with research on the built environment. Students do not know how the built environment restructures the hydrological cycle, and, therefore, do not understand why the built environment creates a wasteful infrastructure for water. Infrastructure, much of it unseen, is not understood as an expression of values, much less technologically. So the redesign/replanning water in SoCal is very challenging.

This said, the passage by the California legislature of AB 32, the California Climate Action Act, and SB 375 Sustainable Communities Act frame multiple paths to sustainability. Because water conservation issues have been sharpened by the recent decade-long drought, water conservation can be potentially seen by students in the wider contexts that is framed by legislation and policy. In addition best practices examples of stormwater (and wastewater) treatment have been piloted in a number of communities and projects in the region and elsewhere. And various performance rubrics such as Sustainable Sites and the Living Building Challenge, have been used on some projects that have tried to pair zero emissions with zero runoff and waste. In this sense the case studies course is ideally a prerequisite for the studio.

The colleges’ disused gravel pit, which is the site we have used in studio recently, is diagonally bisected by the boundary between Los Angeles and San Bernardino County and the cities of Claremont and Upland. Originally San Antonio Creek, flowing off the southeast slope of Mount San Antonio (Baldy) County, spread into an alluvial fan across the boundary. The history of water use, water rights and flood control can be seen in the differences in the water regime either side of this boundary. Particularly vivid are the different ways in which land use and infrastructure were coordinated to manage storm and flood water. This difference is depicted in this aerial/GIS map. As land uses change again, the challenge for the students is to take the aims of the new policy framework, tailor local legislation and policy, and develop innovative ways in which to situate new land uses in the gravel pit such that stormwater is infiltrated back into the aquifer.

Ideas and Media of creativity:

Given the challenges to merge data and representation, the format requirements for student work was broad. Students variously flexed their representational and media capacities and interests. Some stuck to well-known software or media; others learned
new software or took the opportunity to draw and model. In their Art Park design—Maggie Smith and Sidney Stephenson combined drawing and the free software, Sketchup. Sandy Glickman, Catherine O’Hare, and Libby Reyff have also used Sketchup and a physical model to develop an environmental college with a large stormwater treatment area. Shannon Julius had learned GIS in another class and produced the first mapping of a water system.

Conclusions
Many questions, large and small, are raised in students’ minds in these courses, and for some, there are answers. Perverse economic aspects of recent California regulation and sustainability (SB 375) and climate legislation (AB 32) create possible near term answers using cap and trade revenues, but long term challenges. Are they models for a global solution?

And is a richer world, per se, a more sustainable one? What about other big issues such as biodiversity, ecosystems services, equality, justice? Who wins when we do what to change? In the Price of Civilization, required reading in the Case Studies course, economist Jeffrey Sachs, makes mindfulness about resource preservation a central message. While Sachs provides many econometric arguments for a mindful society, he also acknowledges the difficulty of breaking political gridlock in the context of global capitalism and the interlocking systems of public policy. Given the need for and success of local action, place-based action combined with design and planning thinking can tie innovation to broadly-based community and regional change. While students find themselves in different places with respect to their capacities for analysis, technology, planning and design, all have the mindful experience of visualizing and proposing systemic sustainable change. This is the core pedagogical hypothesis of the Sustainability and the Built Environment curriculum and the two courses outlined here.
Higher educating for and as sustainability: pedagogies of hope and promise

Alan Brady
Faculty of Sociology
Kwansei Gakuin University, Japan

ABSTRACT

As a higher educator working in a sociology faculty since 1991 I have for the past 15 years been developing, in consultation and negotiation with students, an integrated sociology content and additional English language higher learning. This pedagogical-learning mission is directed primarily in service to helping to develop students’ - and my own as well - local, regional, and international-global civic and citizenship responsibilities. It has also been an attempt to help integrate students’ sociology content and additional English higher learning needs and desires within the sociology faculty where there has been and continues to be a rigid divide between almost 100% L1 Japanese language general and specialized sociology content study, and English language study.

I now realize and wish to actively practice, this citizenship development higher learning in service to a higher ideal: an educating as and for sustainability (EaS and EfS). This approach adopts what Forbes (2005) calls a learning that encapsulates responsibility for and to society. The latter is a clear recognition of where society now stands and what is or may be difficult, perhaps even undesirable, to (attempt) to change in society. The former is an imagination of what society can and ought to be: ways in which individuals and collectivities and groups of caring concerned individuals can better (their) society by first conceptualizing and then practicing new ways of being social, and being in and part of society and the natural world.

Higher educators’ role and responsibility involving sustainability: from uncritical transmission to critical phroentic practice and transformation.

Cortese (2003) urges us to:

Imagine a society in which all present and future humans
are healthy and have their basic needs met….. Imagine a society where technology and economic activities sustain rather than degrade the natural environment and enhance human health and well-being. Imagine a future where the concept of waste is eliminated because every waste product is a raw material or nutrient for another species or activity or (is) returned into the cycle of nature. Imagine that we are managing human activities that restores and increases the biological diversity and complexity of the ecosystems on which we all depend. (2003: pp. 15-16)

Cortese (2003) argues that the mindset required to realize the above vision “must be a sustained long-term effort to transform education at all levels.” Although there are many individuals and groups of people working together towards this effort, Cortese recognizes that “an education and educating for a just and sustainable world is not a high priority.” To make matters worse, he maintains that those who successfully come out of the world’s best universities are in fact continuing to lead us down the present unhealthy, inequitable, and unsustainable path. Why he asks is this trajectory so? He conjectures that there are a number of structural aspects of education in general, and higher education in particular, contributing to the ongoing problem. He further maintains that a large part of this failure results from higher education stressing individual learning and competition which, he says, results in graduates who are ill-equipped and unprepared for the cooperative efforts that are necessary to change the present trajectory.

Learning in higher education remains fragmented between specialized disciplines such as law and politics, business administration, sociology, history, or economics, and also within the sub-fields of disciplines where faculty are not encouraged, in fact are often discouraged, from extending their academic efforts into (sub)disciplines and content areas other than their own. Much of higher education institutional (HEI) curricula does not, argues Cortese, ask students to challenge the following six assumptions:
1. humans are the dominant species on earth and are separate(d) from nature,
2. the earth’s resources are free and inexhaustible,
3. our world’s ecosystems can assimilate any and all human impacts,
4. technology can and will ultimately solve society’s many problems,
5. most if not all human needs and wants can be met through material means,
6. individual success and progress is independent of the health and well-being of communities, cultures, and life support systems.

Orr (1994: p. 5) cited in Cortese (2003) tells us what is at educational stake and states that;

The kind of education we need begins with the recognition that the crisis of global ecology is first and foremost a crisis of values, ideas, perspectives, and knowledge, which makes it a crisis of education, not one in education.

Cortese reminds us that formal education is seriously challenged to compete with the larger and more pervasive educational effects of, for example, highways, shopping malls, agribusiness, huge utilities and multinational global corporations, the media, and non-stop advertising all of which imbues in us the values and ideas and behavioral practices extolling dominance, speed, material accumulation, and self-indulgent individualism (Orr, 2002: p. 31). Aligning the higher educational experience – and I recognize that this alignment should educationally begin earlier – of students with the principles and practices of sustainability will ultimately require that the content of learning be interdisciplinary systems thinking, dynamics, and critical analysis for all majors, disciplines, and professional degrees.

N. Klein (2014:212) states, (added or slightly changed parts are in bold)

It isn’t that there is no role for the public. We are called
upon periodically to write letters, sign petitions, turn off our lights for an hour. But most of all we non-celebrity people are called upon to exercise our consumer power not by shopping less but by our discovering new and exciting ways to consume more. These various approaches serve to reinforce the very “extrinsic” values we should know are the greatest psychological barriers to climate action, from the worship of wealth and fame for their own sakes, to the idea that real meaningful change for climate change action can be and is handed down from above by the betters, rather than something we must demand for ourselves. These approaches may even play a role in weakening public belief in the reality of climate change.

There are clear parallels between what Klein says and how education is conducted. In both cases people’s individual and collective agency to effect change is something that is relied on to occur through the efforts of others, be they celebrities, politicians, people “in the know,” people who have material power to propose and effect “change,” or teachers who tell us what and how to study and then control both the goals and process of that study.

Flyvbjerg (2001) in *Making Social Science Matter* argues that the social sciences, and I would add education in general and as a whole, should be practiced as *phronesis*. Phronesis has at its core four value-rational concerns: (1) where are we going, (2) who gains and loses and by which mechanisms of power in that pursuit, (3) is this direction and development desirable and for whom, and (4) what should we do about it. An EaS study is grounded on how classrooms and classroom study can be differently conceived, reconfigured, re-organized and practiced to continue to support the status quo, or to create potential new directions for society unencumbered by socio-cultural, socio-political, and socio-economic hegemony.

*Both* the content of (higher) learning and its process will have to change in order for sustainability to become more than just another convenient and perhaps fragmented topic of study or discussion. Cortese sees this change involving educating to help make human
and environmental interdependence, values, and ethics “a seamless and central part of teaching of all the disciplines” (2003: p. 20). Furthermore, the process of educating will have to, according to Cortese, emphasize “active, experiential, inquiry-based learning and real-world problem solving both on campus and in the wider larger and more global community/communities. It is not the ability of higher education to take on this challenge (2003: p. 19), but the willingness of HEI and higher educators to do so within a very strict time frame. I myself have come late, not too late I hope, to this calling, and it is high time that higher education, higher educators, and HEI do likewise.

II. Setting the stage for a sustainability educating: a one-world, three-tiered social study based on values and a philosophy of thought.

A one-world ontology experiential citizenship in service to EaS can be the focus of social science-sociology interdisciplinary tertiary level course-class study. This study can be effected through a four-fold framework of what I label 3Cs cooperative shared learning that emphasizes the economic, the social, and the ecological: (1) caring for self and self sustainable development, (2) caring for others and societies’ sustainable development, and (3) most importantly connecting (1) and (2) to caring for the world’s ability to sustain life in all its forms on earth. Such study is founded on R. Steiner’s social three-folding approach (outlined in Lamb, 2008), B. Flyvbjerg’s (2001) phronetic value-laden approach, the Bollinger et al (2003) one-world ontology of integrated content and language-communication approach, and (4) Splitter’s (1995) Philosophy Of and For Thought approach. I will not go into details on any of these approaches here but instead refer readers to Brady (2006, 2010, 2013) for a more complete description of each approach. Within this four-fold 3 Cs framework is the primary concern of equal power relations and partner participants, teachers with students, in an interdependent individual and collective shared responsibility they together have both to and for society, and a shared developing communal concern for the inter-connectedness of the social and the natural worlds.

The first challenge for (higher) educators is to raise our own and our students’ awareness of what is involved in the issue of existential experiential sustainability, both on
a personal individual-group collectivity level, but also and perhaps more importantly on a systemic institutional structural level. We must begin immediately and comprehensively to seriously raise our knowledge base, our caring levels, and our awareness of how we have come to this crisis point. We must do so without creating, recreating, or perpetuating those habits of mind and behavior that have led us, and continue to lead us, to distance ourselves from active involvement in combating unsustainability and achieving sustainability.

This can not be accomplished if classroom educating continues to condone thought and practices in the wider society that serve as obstacles to our changed mindsets and behavior and our concerted action to avert climate and ecological disaster(s). In short, SE must, says Medrick (2013) mirror the patterns that exist in the natural as well as social environment(s), as well as human conditions society that can prepare us for uncertain and rapidly transforming world conditions that are both both social and natural.” SE needs to redesign and contrast the present and predominant managerial mechanistic learning paradigm with which we have been accustomed, with a more holistic economic, social and ecological model of learning that, in Medrick’s words, “will emphasize the realization of continued human potential and interdependence of the inter-related social, economic, and ecological well being of all life.”

An EaS is the actualizing means through which citizens can be transformatively educated to the ideals, values, opportunities, choices, and decisions which need be made by themselves, and other individuals, collectivities, social institutions, and governments to attack those forces that keep the world on its unsustainable trajectory. On one level people need to be aware of how they personally leave an imprint on nature every day and with every action they take or do not take. But, according to Klein (2014) we need to also be more aware of how our inaction and lack of concern to effect systemic change(s) has been controlled by institutional forces that continue to lead us to avoid thinking seriously and (not) acting seriously to combat the continued systemic and systematic degradation of the natural world.

In order to implement an EaS which gives hope of achieving an EfS, higher education social and natural scientists alike need to explore and differently practice their
educating so that they and their students come to be much more aware of problems they
hitherto did not (sufficiently) notice or simply, like myself, ignored. Some essential
dispositions in this conceptualization and practice of educating includes learning:

to be more inquisitive,
to work for consensus and collective action though respectful dissensus,

to be more observant of the world outside self and others,
to be more attentive to the needs of society and the world,
to be more reflective of what has or has not been accomplished,
to be more prone to inclusive shared decision-making,
to be more prepared for ambiguity and uncertainty,
to be more organized and responsible to not only self but others,
to be more prepared for learning that is not pre-determined
to guess and hypothesize when and where necessary

Our private-individual and more public-collective indifference to and acquiescence in the continued degradation and destruction of the natural world and the power of the capitalistic status quo serves to condones that continued degradation and destruction  This degradation is not solely or primarily by or through our actions or inactions as individuals, but more damagingly and dangerously by the mindsets and actions and inactions of corporations, governments which purport to serve people’s interests, and by other social institutions and structures which together conspire to keep us on an unsustainable trajectory worshipping economic growth and unfettered profit-prosperity for some at the expense of the many and the world in general.

An EaS can not be imposed on teachers and students but encourages them, on their own terms and their own speed, to develop heightened awareness of the world outside themselves and their associations, outside human technological progress, and to develop skills, thinking, and behavior to seek out practical solutions to combating personal-individual natural world and public-corporate degradation. As Klein (2014)
persuasively argues, social injustice, inequities, widening gaps of inequality, and the degradation of human rights in all its forms are intertwined with a philosophy that celebrates greed, profit, immediate satisfaction, and getting ahead at the expense of others and the world.

Higher education, indeed education has been and continues to be complicit in this lack of concern by not valuing the potentiality of young people to make a difference. HEI and educators can no longer afford to teach and research compartmentally and top-down. What is needed is a bottom-up educating revolution that empowers those who are “being educated” to reflexively and reflectively become aware and remain more aware of what is at stake concerning sustainability. This is a journey that I have just recently embarked on in my teaching and research as I close out my full-time higher educating career, and it is the direction in which I will proceed with renewed vigor and hope for a better world for all, especially, as I argued in a paper presented at the Social Sciences and Sustainability conference held here in Hiroshima in December 2014, those who will outlive us. Sustainability education EfS is the best and preferred overall thematic content framework for the what of a world that is in peril. An EaS is the how or process of that shared learning.

Special Acknowledgement

I want to acknowledge and thank one of my colleagues, Gabi Hadl, a media “specialist” for impressing upon me some time ago the urgency of higher education and its practitioners being first and foremost engaged in EfS across the entire curriculum.
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Teaching Sustainability in the English for Academic Purposes Classroom

Alexander Nanni
Mahidol University International College

Joseph Serrani
Mahidol University International College

ABSTRACT

In Roadmap for an ASEAN Community, the ASEAN Secretariat spells out the need for employment, education, and development to be sustainable; however, many citizens of ASEAN countries would struggle to meaningfully define sustainability. In this presentation, two teachers from an intensive English for academic purposes program at a major Thai university will explain one approach to developing students’ understanding of sustainability: a term-long investigation into the sustainability of a multinational company. At the beginning of the term, teachers develop students’ understanding of the triple bottom line framework, which was coined by Elkington in 1994. This framework assesses the sustainability of a company by examining the company’s performance in three interrelated areas: people, planet, and profit. Following the principles of project-based learning (PBL), this assignment allows students significant autonomy; however, teachers advise the students as they move through the research process. All of the students’ source materials are authentic, creating a link between the classroom and the global community that is strengthened by students’ recommendations for sustainable corporate practices. The project culminates in a 1,400-word paper and a 5-minute presentation in which the students share their findings. This project, which can be adapted to suit the language proficiency of the students, will be of interest to educators in a variety of contexts.

Keywords: Sustainability, English for academic purposes (EAP), project-based learning (PBL), triple bottom line (TBL)

1 CONTEXT

This paper will describe an approach to language instruction that utilizes project-based learning to engender meaningful learning. While the focus is on improving students’ English language skills, the project offers a method to encourage autonomy in learning and develop an awareness and knowledge of a vital issue the students face, that of sustainability in general and business sustainability in particular. The project approach to covering the topic of sustainability allows students the opportunity to engage with language in authentic, multifaceted, and personal ways, all of which enhanced learning. This project addresses the needs of the students at the Preparation Center for Language and Mathematics (PC), an intensive English for academic purposes program at Mahidol University International College in Thailand and can be suited to meet the needs of students in many contexts.

As Thailand is a member state of the Association of Southeast Asian Nations (ASEAN), its future lies in the formation of the ASEAN Economic Community (AEC) to be formally instituted this year. The AEC has established sustainable development as one of its central goals [2]. This is essential given the rapid development seen in the region in recent decades and the accompanying environmental devastation and social upheaval. Although Thailand has had some success in preserving the environment and strengthening society, extensive damage has been done, and the effects have been far reaching. Furthermore, the nations of ASEAN have chosen English as the language with which to integrate and develop their economies and communities [2]. The challenges of integration, sustainable development, and communication the AEC is confronting will need to be met by the education systems in the region. Meeting these challenges will be a difficult task.
The education system in Thailand can be seen as severely underprepared for the challenges ahead. The Thai education system remains largely fossilized and characterized by being overly concerned with discipline [7] and lacking in accountability on many levels [11] despite a clear awareness that the system is not producing the desired results. The case of English language education highlights the struggle. There has been a mandate for nation-wide English language classes from elementary school through high school for two decades, yet the English language ability of Thais remains well below expectations [6]. The challenges ahead, including that of business sustainability, require a paradigm shift in perception, critical thinking, and problem-solving ability.

Mahidol University International College is striving to “meet the challenges of living and working in the 21st century” [1]. A related objective is included in the upper-intermediate level syllabus at PC: students “demonstrate a capacity to evaluate crucial global issues connected to society, the economy and the environment”. This specific context makes project-based learning about business sustainability in an IEP for future university students a particularly apt undertaking. Using project-based learning, the triple bottom line (TBL), a term coined by John Elkington in 1994, is employed to develop students’ understanding of business sustainability while they improve their English language skills.

2 PROJECT-BASED LEARNING

Project-based learning (PBL) is an approach to teaching and learning that has a long history, extending back to educators such as Dewey [4] in the late 19th and early 20th Centuries who advocated learning through experience rather than by rote. There is no universally accepted definition of PBL, but the diverse definitions that are available seem to converge on key elements. The Buck Institute for Education, an organization dedicated to promoting PBL, offers a clear definition: “a systematic teaching method that engages students in learning knowledge and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks” [9]. Another definition describes PBL as “intent on bringing about deep learning by allowing learners to use an inquiry-based approach to engage in issues and questions that are real and relevant to their lives” [13]. Both of these definitions highlight the importance of questions and inquiry. These definitions are consistent with Dewey’s [5] observation that thinking only occurs in response to problems. In short, PBL is based on the idea that facilitating learners’ responses to challenging, meaningful questions is effective in fostering learning. Currently, many educational systems are shifting from teacher-centered to student-centered models. Learning has come to be seen more as a process than as a product, and this shift has opened the door for meaningful, autonomous student work.

Thomas [12] proposes five essential criteria of PBL. These five criteria, which were synthesized in a thorough and widely cited literature review, are as follows: “centrality, driving question, constructive investigations, autonomy, and realism” [12]. The first criterion, centrality, stipulates that PBL projects are essential elements of the curriculum, i.e., the projects are not simply for further enrichment of concepts taught through traditional methods. In contrast, many of the projects that teachers assign are “busywork” [8] and lack essential characteristics of PBL. The second criterion, driving question, stipulates that PBL is centered on a question that will lead students to engage with “the central concepts and principles of a discipline” [12]. This question unifies and focuses the project, giving students a clear purpose [8] and improving students’ engagement and motivation [3]. The third criterion, constructive investigations, stipulates that students must construct new knowledge and skills in order to complete the project [12]. Projects that merely require the application of previously learned material do not qualify as PBL. Adherence to this criterion also improves inherent motivation: “Students find project work more meaningful if they conduct real inquiry .... [which] leads to a search for resources and the discovery of answers, and
often ultimately leads to generating new questions, testing ideas, and drawing their own conclusions” [8]. The fourth criterion, autonomy, stipulates that students must have a certain amount of freedom in their work [12]. This entails elements of choice and personal responsibility. Based on the context, the level of autonomy granted to students can vary. In a low-autonomy PBL project, students might be assigned a guiding question and be given freedom to decide on an approach to finding an answer, whereas in a high-autonomy PBL project students might be given voice in determining the guiding question itself [8]. The fifth and final criterion, realism, stipulates that PBL projects must be authentic [12]. That is, the projects should focus on real-world problems and the students should have an opportunity to present to real-world audiences. Being exposed to authentic audiences gives students an additional incentive to produce high-quality work [8]. These five criteria define PBL projects, an example of which will be given in the following section of the paper.

3 TRIPLE BOTTOM LINE PROJECT

The project commences with an investigation into the history of the environmental movement. Various readings and videos are used to raise students’ awareness of the negative impacts businesses can have on the environment and society. The PBS documentary American Experience: Rachel Carson’s Silent Spring is used to vividly illustrate the destructive effects of some businesses. This historical perspective is then linked to the current treatment of the environment and society by business, such as modern farming practices and nuclear energy production. Students then read adapted texts from John Elkington’s book Cannibals with Forks and other sources to explore the methods and considerations that are central to businesses sustainability. Case studies of large and small corporations are included to provide examples of the TBL in action, the suitability of its application, and the challenges involved in defining and attaining sustainability. In-class discussions are regularly held to deal with the complexity of the topic, particularly the ways in which the three aspects of the TBL are interdependent.

Students then evaluate a large corporation in terms of the TBL framework, eventually coming to a conclusion as to the corporation’s long-term sustainability. A company’s reports, website and third-party sources are including in the analysis. The credibility of each source is carefully considered by scrutinizing the motivations, transparency, accountability, and professionalism of the reporting party. In consultation with an advisor who is one of their teachers, students engage with the writing process by producing multiple drafts of an outline and term paper. Recommendations for improvements in language and content are offered by the advisor in one-on-one advisory sessions. Students submit a final draft to Turnitin to ensure academic honesty. Finally, students formally present their paper to their peers and advisor, elaborating on areas of particular interest and discovery.

4 DISCUSSION

The TBL project is an example of project-based learning (PBL) as it meets Thomas’ five criteria: “centrality, driving question, constructive investigations, autonomy, and realism” [12]. Three of the criteria — centrality, driving question, and constructive investigations — are met fully whereas the criteria of autonomy and realism are only minimally satisfied. The project meets the criterion of centrality as the project is the major focus of the course. Students complete readings about topics relevant to the project, participate in discussions about topics relevant to the project, and compose APA-style referenced essays about topics relevant to the project. The project is not an afterthought; it is essential to the course. The project meets the criterion of driving question, as the question of whether or not a major multinational company is sustainable will lead to engagement with important issues in the field of sustainability. These issues include the meaning of sustainability,
which students must negotiate in order to even begin addressing the sustainability of the company that they will assess in their term paper. The students must also engage with the complex question of whether their large-scale business can be sustainable. The project meets the criterion of constructive investigations as students must create new knowledge in order to complete the project. At the beginning of the term, the teacher helps students reach an understanding of the TBL. Once that has been done, students begin their individual research. They engage with authentic texts about the company that they are investigating and interpret the information that they find through the lens of the TBL. This process is not mere paraphrasing; it requires high-order thought.

Two of the criteria, autonomy and realism, are less fully addressed. The project meets the criterion of autonomy; however, it is a low-autonomy PBL project. In this type of project, students are given freedom in finding the answers to the driving question, but they are not given any input in the selection of the question itself. In the case of this project, students are not given input into the selection of the driving questions mainly because of time constraints. The project is completed over a 10-week term, and students begin their independent research in the second week. Students would not be able to create a meaningful driving question related to sustainability without first having some understanding of sustainability, and developing this understanding takes time. In the context of this project, students further their understanding of sustainability during their investigation of a driving question set by the teacher. In contexts where students have longer to complete the project, e.g., a university semester, students could be allowed greater autonomy in choosing the driving questions after an initial period of instruction. The criterion of realism is also only minimally met. The project is highly realistic in terms of the driving question and the research process. Students investigate an important real-world issue. Many of the students at the Preparation Center for Languages and Mathematics plan to study business in the future, so this project is highly relevant to their future careers. That being said, the audience of the project could be more realistic. Students share their work with their teachers and with their peers, and the project culminates in a short presentation. Sharing students’ work with the wider community, even with companies themselves, would provide a much more realistic audience.

5 CONCLUSION

This paper has discussed an example of project-based learning in an English for academic purposes program that aims to enrich learning and address pressing issues in the process of language acquisition. The project meets all of Thomas’ criteria for PBL although not fully in all regards given the constraints of the program. The TBL project achieves several critical aims: it develops language skills through students’ reading, writing, and presenting; it develops students’ knowledge about meaningful, relevant topics; and it makes students better citizens of ASEAN and of the world by cultivating their awareness of sustainability.

REFERENCES


ABSTRACT

The usage of technology such as PowerPoint and videos in class tends to make the learning process focused on the technology itself, not the students. The flipped classroom approach is a learning model in which students gain first-exposure of knowledge prior to class, making classroom activities a time for interactive discussions and problem-solving. Reading assignments and lecture videos are usually given to students for self-study before the class, but because of its monotonic traits, students tend to get bored easily and give up when the materials exceed their cognitive load. A method of integrating open source educational animation videos to enhance students comprehension before class is proposed in this paper. Educational videos with an animation format are currently being used to catalyze curiosity in learning outside the classroom. It has more adaptability in simplifying complicated concepts that needs dynamic visualizations. Animation videos explaining concepts related to various subjects within the curriculum of elementary, junior and senior high school in Indonesia will be uploaded to a YouTube channel every week and can be accessed as material resource for teachers and students. Various optimization such as narration, duration and speed are considered in making the animations. Consistently built animation videos integrated in a flipped classroom can be utilized in study and teaching purposes to enhance learning comprehension.

Keywords: flipped classroom, education, animation, videos, learning comprehension

INTRODUCTION

The use of videos as a learning material for students are common to be found in education systems adopting the flipped classroom model. In a flipped classroom, prior knowledge in a certain topic is gained before engaging in classroom activities, which involves harder work such as problem solving and analyzing [1]. This illustrates an example of effectively using technology in educational systems, in contrast of using it in class which would take more time and divert the focus of students. Videos used in a flipped classroom are created by the teachers or provided from open source online videos such as Khan Academy.

In Indonesia, the amount of open source educational videos that are available online are limited, and the ones integrated with the national curriculum are even fewer. The videos that are available online are provided in a lecture format and tend to be monotonic with limited visualizations. Educational animation videos such as TED-Ed and Kurzgesagt can be found as free open source videos on YouTube. Animation videos has several advantages such as simplification; ability to highlight certain symbols within a complex background; control of motion, shape, or color changes; and the stepwise fading in and out of symbols which are useful in explaining scientific process [2]. The cognitive theory of multimedia is used as a principle to effectively promote learning comprehension in classrooms. Integrating educational animation videos in a flipped classroom can be a promising prospect in increasing knowledge diffusion and education quality in Indonesia based on the first priority in Education for Sustainable Development, which is improving basic education.

TECHNOLOGY IN A FLIPPED CLASSROOM

Flipped classroom is an educational technique that consists of two parts: interactive group learning activities inside the classroom, and direct computer-based individual instruction outside the classroom [3]. Flipped classroom is based on several theoretical frameworks on
education, which focuses on experimental learning through real life experiences. According to Brame [1], there are 4 key elements working on a flipped classroom, 1) provide an opportunity for students to gain first exposure prior to class 2) provide an incentive for students to prepare for the class 3) Provide a mechanism to assess students understanding 4) Provide in-class activities that focus on higher level cognitive activities.

![Flipped Classroom Model](image)

Figure 1: Flipped Classroom Model [2]

Videos are used as a tool for prior exposure before activities in the classroom. These videos can be created by the instructor or found online from YouTube and educational websites such as Khan Academy which has 3200 videos and 350 practice exercises in 2012 [2]. The availability of open source structured educational videos in Indonesia is limited and tend to be provided with lecture formats. Studies show that video lectures (slightly) outperform in-person lectures [4], but there are still inconsistencies in the result of the research that are caused by several factors.

**ANIMATION VIDEOS FOR BASIC EDUCATION**

Animation is a simulated motion picture depicting movement of drawn (or simulated) objects [5]. A question that should be considered regarding animation is that does it promote learning comprehension better compared to videos provided in a lecture format with minimal visualization. Based on the cognitive multimedia theory, humans have two separate channels for processing information (auditory and visual) [6]. Each channel has a limited capacity which will cause an overload in one channel if the audio and visual information given is not balanced. The brain does not process information from multimedia presentation of words, pictures and auditory in a mutually exclusive fashion, but these elements are selected and organized dynamically to produce logical mental constructs. This theory suggests that learners are able to build a better mental connection when picture and words are close to each other rather than separated, which would waste cognitive capacity.

![Cognitive Theory of Multimedia](image)

Figure 2: Cognitive Theory of Multimedia [5]
Educational videos presented in an animation format has been used as a catalyst for curiosity and are available as channels in YouTube, such as TED-Ed and Kurzgesagt. These videos cover topics in science, history and other fields but are not presented structurally and can not function wholly as a main source for materials in the classroom for elementary, junior and high school.

VIDEO DESIGN

The purpose of this paper is to propose a model of enhancing learning comprehension in Indonesia by producing effective animation videos and implementing it in a flipped classroom. Several strategies and considerations are made based on the principles of animation and micro-level instructional design for video clips.

Animation Principles

How should animation be used? There are 7 principles for the design of multimedia presentations involving animation based on rigid researches that should be considered in designing educational animation videos [5].

Table 1 Empirical Multimedia Results and Applications [7]

<table>
<thead>
<tr>
<th>Empirical Results</th>
<th>Practical Applications</th>
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</thead>
<tbody>
<tr>
<td><strong>Multimedia principle:</strong> is that students learn more deeply from animation and narration than from narration alone.</td>
<td>On screen animation, slide shows, and narratives should involve both written or oral text and still or moving pictures. Simple blocks of text or auditory only links are less effect than when this text or narration is coupled with visual images.</td>
</tr>
<tr>
<td><strong>Spatial Contiguity Principle:</strong> students learn more deeply when on-screen text is presented next to the portion of the animation that it describes than when on-screen text is presented far from the corresponding action in the animation.</td>
<td>When presenting coupled text and images, the text should be close to or embedded within the images. Placing text under an image (i.e., a caption) is sufficient, but placing the text within the image is more effective.</td>
</tr>
<tr>
<td><strong>Temporal contiguity:</strong> students learn more deeply when corresponding portions of the narration and animation are presented at the same time than when they are separated in time.</td>
<td>When presenting coupled text and images, the text and images should be presented simultaneously. When animation and narration are both used, the animation and narration should coincide meaningfully.</td>
</tr>
<tr>
<td><strong>Coherence principle:</strong> students learn more deeply from animation and narration when extraneous words, sounds (including music), and video are excluded rather than included.</td>
<td>Multimedia presentations should focus on clear and concise presentations. Presentations that add “bells and whistles” or extraneous information (e.g. to increase interest) impede student learning.</td>
</tr>
<tr>
<td><strong>Modality principle:</strong> that students learn more deeply from animation and narration than from animation and on-screen text.</td>
<td>Multimedia presentations involving both words and pictures should be created using auditory or spoken words, rather than written text to accompany the pictures.</td>
</tr>
<tr>
<td><strong>Redundancy principle:</strong> students learn more deeply from animation and narration than from animation, narration, and on-screen text.</td>
<td>Multimedia presentations involving both words and pictures should present text either in written form, or in auditory form, but not in both.</td>
</tr>
<tr>
<td><strong>Personalization principle:</strong> students learn more deeply from animation and narration when the narration is in conversational rather than formal style.</td>
<td>The aforementioned strategies are most effective for novices (e.g., low-knowledge learners) and visual learners (e.g., high-spatial learners). Well structured multimedia presentations should be created for they are</td>
</tr>
</tbody>
</table>
Instructional Design for Animation Videos

YouTube, the most visited online video destination, has 13 hours of video uploaded every minute which makes it a strategic place for sharing educational videos [8]. To increase effectiveness of animation videos for education, an instructional design is implemented in producing the videos. Micro-level instructional design is the development of small multimedia products such as short presentations, podcasts, or interactive simulations with a duration of approximately one to fifteen minutes [9]. Videos are made in segments, which increases with complexity of the subject. One of the first tasks, when applying micro-level design, is to identify one or more educational outcomes associated with the instructional message. The output of every segment is to fulfill one or more goals in basic competence of certain subjects in the national curriculum in Indonesia. In the studies of enzyme, students are urged to have basic comprehension regarding the components, function and work process of enzymes [10].

CONCLUSION

To gain effectiveness on integrating educational videos in a flipped classroom, videos are presented in an animation format, which according the cognitive theory of multimedia, reduces overload in cognitive capacity. Animation videos are also produced with the micro-level instructional design and principles of animation and distributed to YouTube to increase accessibility. Enhancing learning comprehension in a flipped classroom can be gained through balancing visual and auditory learning and optimization using various principles and techniques in video production.
REFERENCES


ABSTRACT

The theory of social representations (SR) highlights the importance of communication in the creation of common-sense knowledge (Moscovici, 1961). The structural approach describes the existence of a central core and a peripheral system (Abric, 1976; Flament, 1987). SRs are influenced by social practices (Flament, 1994a, Gaymard, 2014b) but their elaboration is related to communication. Few studies are concerned with the impact of communication on the social representation’s structure (Roussiau & Soubiale, 1996a, 1996b). Few of them use a longitudinal approach. In this research, we associate the fundamental aspect of the impact of communication on SR with the imminent social issue of sustainable urban mobility through 30kph zones as social object (Bordarie, in process; Bordarie & Gaymard, 2013; Gaymard & Bordarie, 2014a).

With regard to the methodology, 123 French psychology students at Angers University answered a questionnaire. 84.1% were women and 15.9% men. The average age was 18.52 years old (σ = 1.05). Individuals filled out a questionnaire once a week for one month. Before the second occasion, they were sensitised with an awareness campaign giving them information about 30kph zones.

A Kruskal-Wallis test confirms the most significant impact of the awareness campaign on the social representation’s structure concerning the elements presented in the campaign, except for safety. Our results also show the complex transformation of a central element with merely an information campaign. But they also refute theoretical data concerning a potential return to “normal” of the representation’s structure after 2 weeks (Aïssani, 1991a, 1991b).

Keywords: Social representation, transformation, communication, sustainable urban mobility

1. Framework

Social representations (Moscovici, 1961) are common-sense knowledge (Jodelet, 1991). They arise in communication processes such as diffusion, propagation or propaganda (Moscovici, 1961). Each type appears as an educational way of transmitting and teaching a vision of the object of representation. It enables the transmission of information required to read and act towards social objects. The information is added to an existing representation according to a specific organization.

The structural approach of social representations (Abric, 1976; Flament, 1987; Gaymard, 2003, 2014b) rests upon an organisation into two components. A central core gives its meaning and its coherence to the representation. It defines the object being formed by consensual and non-negotiable elements. A conditional and contextual periphery is related to individuals’ practices. During the transformation processes, the periphery plays a protective role of the central core. A social representation is considered to be transformed when the central core has changed.

These transformation processes must be studied to understand the dynamics of representation (Abric, 1994; Flament, 1994a, 1994b). Social practices and representations influence and rub off on each other (Abric, 1989). Studies are principally focused on the influence of social practices (Flament, 1994a, 1994b; Guimelli, 1989, 1994). Despite its importance in the representations’ elaboration, communication on the other hand does not appear to be studied widely in transformation processes (Roussiau & Bonardi, 2001). And yet, it seems to have an important role to play (Roussiau & Soubiale, 1996a, 1996b). From a structural point of view, some results question the impact of communication on the representation’s transformation and its duration, assuming a return to “normal” of the representation’s structure after two weeks (Aïssani, 1991a,
1991b). In order to analyse the structural transformation of a representation, the “calling into question” is widely used (Moliner, 1989). This method rests on a double negation. Questioning a central element (first negation) causes a refutation of the object (second negation). This technique is interesting in order to study the elements’ centrality after an awareness campaign for example, and to measure its impact on the structure of the representation.

In this study, we focus upon a public policy for sustainable urban mobility, especially 30kph zones. This measure appears as a way to promote sustainability in many ways (Bordarie, in process; Bordarie & Gaymard, 2013; Gaymard & Bordarie, 2014a). In this field, few studies are focused upon the impact of communication from a structural point of view. Studies reveal the central core is constituted of notions such as safety, slowness and schools; and the periphery refers to many ideas such as cohabitation, respect for others, tranquility and quality of life for example (Bordarie, in process; Bordarie & Gaymard, submitted). Research on communication principally refers to safety aspects and the importance of adapting awareness campaigns towards target groups (Do Duy Dinh & Kubota, 2013a, 2013b). We also highlighted the importance of emphasising quality of life aspects and user vulnerability (Gaymard & Bordarie, 2014a, 2014b).

We will analyse the impact of a communication campaign on the structure of the representation of 30kph. We assume that an awareness campaign should have an impact. The contradiction of a central element should cause the element to disappear in the central core. But we should observe its reintegration over time, confirming its complex evolution. The confirmation of a salient peripheral element should lead to its integration in the central core, thus modifying the structure of the representation.

2. METHOD

a) Population

123 French psychology students at Angers University answered a questionnaire. The average age was 18.52 years old (σ = 1.05). 84.1% were women and 15.9% men, which constitutes a limitation to our study.

b) Procedure

Individuals filled out a questionnaire four times within a month. The second time, one week after the first time, before filling out the questionnaire, they were sensitised with an awareness campaign giving them information about zones at 30kph. Then, they had to complete it the next week. Finally, the fourth time, they filled it out two weeks after, that is to say, three weeks after the communication, or in other words, four weeks after the first time.

c) Tool

The questionnaire used the “calling into question technique”. For example, we asked “driving at 30kph...is not for safety” (first negation). Items were randomised. Subjects had to choose between 7 modalities, from 1 (not agree at all = second negation) to 7 (totally agree).

d) Material

For the second time, an awareness campaign was given to individuals. Information was presented as the results of scientific research. The communication refuted the central element of slowness comparing travel time in 30kph zones and streets at 50kph. It confirmed aspects such as cohabitation, respect of others and calm which favors quality of life.

3. Results

A Kruskal-Wallis test reveals significant differences between the different phases for the items: calm, slowness, ecology, travel time increasing, cohabitation, respect for others, quality of life.
life and prudence (p < .001). Except for prudence and ecology, all the items were used in the awareness campaign. Some items such as schools, safety and pedestrians, do not reveal significant differences. Results show the impact of communication on the social representation.

A Bonferroni test confirms stable significant differences over time (p < .05) for items presented in the awareness campaign except for slowness between the first and the fourth phase. The analysis of the averages as a function of the first and fourth phases reveals interesting results, presented in the following graph (Figure 1). We emphasize significant differences with a purple star.

![Figure 1: Averages of some items participating in the structural transformation of the SR of 30kph](image)

Safety and schools are still central without score differences. During the fourth phase, peripheral items scores are on the whole lower than during the first one, except for travel time increasing (consequence of the campaign). Effects are higher for quality of life and respect of others. The latter obtains a very low score, closer to the central items. At the end, children and prudence get lower scores than safety and schools. On the other hand slowness reveals a higher score after the awareness campaign, higher than elements considered as peripheral during the first phase (pedestrians and children). Thus, we can question the centrality of slowness, even if we do not observe statistical differences.

### 4. Discussion

The results show us that differences at the statistical level can not really be taken as an indicator of the centrality’s evolution. Because of the absence of significant differences, we can not validate our second hypothesis. Three weeks after the awareness campaign, the re-integration of slowness in the central core must be rejected. Moreover, we can not deny the centrality of new elements (children and prudence). And yet, these two elements were not part of the awareness campaign. The evolution of theses elements may be explained as the consequence of the representation’s restructuration generated by the communication. The apparent centrality of the item respect of others seems to be the direct consequence of the awareness campaign. This confirms our third hypothesis with regard to the suitability of reinforcing peripheral elements. All these results confirm that communication can impact representation and provoke a structural transformation. Thus, we confirm our first and principal hypothesis: an awareness campaign can have an impact on social representation’s structure. We observed a modification of the central core by the integration of new items (children, prudence and respect of others) and the suppression of....
another (*slowness*). The calling into question technique (Moliner, 1989) confirms its relevance in highlighting this complex process. We also can confirm the periphery’s role during the transformation (Flament, 1994a), supplying new material to integrate into the central core. We also can refute theoretical data concerning a potential return to “normal” of the representation’s structure after two weeks (Aissani, 1991a, 1991b). Our experiment showed that after three weeks, the process of transformation is still strongly observable.

In conclusion, communication appears to be an important way to inform and educate people. Public policies, such as 30kph in the field of sustainable urban mobility, are worthy of attention. Social marketing is principally based upon communication and constitutes one of the rare ways to massively educate the population on the importance of a political measure. But special attention has to be given to its construction. Our results show that all the arguments are not always taken into account. For 30kph, we note the importance of reinforcing some elements initially located in the periphery of the representation. This confirms some of our previous results in which we recommended communicating on vulnerable users and quality of life (Bordarie & Gaya'mard, 2014; Gaya'mard & Bordarie, 2014b). But most of all, the contradiction of some negative aspects or received ideas can generate an important impact on the structure of a representation. Communicating counter to false popular beliefs seems to be a relevant method to transform social representations. This kind of communication by diffusion and propagation processes shows the importance of taking into account social representations (Moscovici, 1961) in order to inform and educate the population efficiently as regards public policies and sustainability issues.

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