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WORLD ACADEMY OF SCIENCE, ENGINEERING AND TECHNOLOGY
WASET

INTERNATIONAL SCIENCE INDEX

SEPTEMBER 10-11, 2015 SINGAPORE

International Scholarly and Scientific Research & Innovation

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CERTIFICATE OF ATTENDANCE

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INTERNATIONAL SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT

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	The Effects of Applying Linguistic Principles and Teaching Techniques in Teaching English at Secondary School in Thailand	Wannakarn Likitrattanaporn Srinakharinwirot University Thailand
e-Poster	Tertiary Level Teachers' Beliefs about Codeswitching	Hoa Pham Curtin University Australia
	A Voice Retrieved from the Holocaust in New Journalism in Kazuo Ishiguro's the Remains of the Day	Masami Usui Doshisha University Japan

September 10, 2015

Session II: 10:30-12:30

Lunch: 12:30

Chair: Jaibir Sharma, Prasanna Murali Krishna P.

	Robust Adaptation to Background Noise in Multichannel C-OTDR Monitoring Systems	Andrey V. Timofeev, Viktor M. Denisov LLP "EqualiZoom" Kazakhstan
	Comparison of Microwave-Assisted and Conventional Leaching for Extraction of Copper from Chalcopyrite Concentrate	Ayfer Kilicarslan, Kubra Onol, Sercan Basit, Muhlis Nezihi Saridede Yildiz Technical University Turkey
	Investigation of Parameters Affecting Copper Recovery from Brass Melting Dross	Sercan Basit, Muhlis N. Sarıdede Yildiz Technical University Turkey
e-Poster	Grid Tied Photovoltaic Power on School Roof	Yeong-cheng Wang, Jin-Yinn Wang, Ming-Shan Lin, Jian-Li Dong Vanung University Taiwan
e-Poster	Microfabrication of Three-Dimensional SU-8 Structures Using Positive SPR Photoresist as a Sacrificial Layer for Integration of Microfluidic Components on Biosensors	Su Yin Chiam, Qing Xin Zhang, Jaehoon Chung The Institute of Microelectronics (IME) Singapore
	The Design, Development, and Optimization of a Capacitive Pressure Sensor Utilizing an Existing 9DOF Platform	Andrew Randles, Ilker Ocak, Cheam Daw Don, Navab Singh, Alex Gu Institute of Microelectronics Singapore
	Preparation of Porous Metal Membrane by Thermal Annealing for Thin Film Encapsulation	Jaibir Sharma, Lee JaeWung, Merugu Srinivas, Navab Singh Institute of Microelectronics Singapore

REMARKS: Presenters of particular session should be ready in the meeting room at least 10 minutes before the beginning of the session. Also, Presenters should introduce themselves to the session chair and upload their papers to the computer.

CONFERENCE VENUE

River View Hotel Singapore

382 Havelock Road

Singapore 169629

CONFERENCE REGISTRATION

September 10, 2015 from 08:15 to 11:00

September 11, 2015 from 09:15 to 11:00

September 10, 2015

Session I: 08:40-10:15

Coffee Break: 10:15-10:30

Chair: Philippe Gugler, Martha Karunakar

	Convergence or Divergence of Economic Growth within the ASEAN Community: Challenges for the AEC	Philippe Gugler University of Fribourg Switzerland Switzerland
e-Poster	Designing Social Media into Higher Education Courses	Thapanee Seechaliao Mahasarakham University Thailand
	Factors Underlying the Digital Divide for Disabled People: Focus on a Korean Case Study	Soungwan Kim Korea Disabled People's Development Institute Korea, Republic Of
	Design of Knowledge Management System with Geographic Information System	Angga Hidayah Ramadhan, Luciana Andrawina, M. Azani Hasibuan Telkom University Indonesia
	Teaching English to Rural Students: A Case Study of a Select Batch at SSN College of Engineering, Chennai	Martha Karunakar SSN College of Engineering India

e-Poster	Oleic Acid Enhances Hippocampal Synaptic Efficacy	Rema Vazhappilly, Tapas Das Abbott Laboratories Singapore
	Selected Ethnomedicinal Plants of Northern Surigao Del Sur: Their Antioxidant Activities in Terms of Total Phenolics, ABTS Radical Cation Decolorization Power, and Ferric Reducing Ability	Gemma A. Gruyal Surigao del Sur State University-Cantilan Philippines
	Physicochemical Properties of Palm Stearin (PS) and Palm Kernel Olein (PKOO) Blends as Potential Edible Coating Materials	I. Ruzaina, A. B. Rashid, M. S. Halimahton Zahrah, C. S. Cheow, M. S. Adi Management and Science University Malaysia
	Prevalence and Risk Factors Associated with Nutrition Related Non-Communicable Diseases in a Cohort of Males in the Central Province of Sri Lanka	N. W. I. A. Jayawardana, W. A. T. A. Jayalath, W. M. T. Madhujith, U. Ralapanawa, R. S. Jayasekera, S. A. S. B. Alagiyawanna, A. M. K. R. Bandara, N. S. Kalupahana Rajarata University of Sri Lanka Sri Lanka
	Effects of Food Habits on Road Accidents Due to Micro-Sleepiness and Analysis of Attitudes to Develop a Food Product as a Preventive Measure	Rumesh Liyanage, S. B. Nawaratne, K. K. D. S. Ranaweera, Indira Wickramasinghe, K. G. S. C. Katukurunda University of Sri Jayewardenepura Sri Lanka

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We kindly ask the presenters to prepare a short electronic presentation (NO PRINT OUT) for their e-POSTERs as scheduled with the oral presentations. The e-POSTER presentations will last in 5 min including discussions.

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As many delegates insert their USB devices into the laptop computer provided for presentation we can not avoid Cyber/Computer viruses. Therefore, you are kindly advised to bring a USB Flash Drive containing only your .ppt, .ptx or .pdf presentation file in it. Otherwise, your files may become corrupted or inaccessible permanently.

THE SESSION CHAIR'S ROLE The duties of the Session Chair include the following:

1. Show up to the session 5-10 minutes before the session begins. Identify the paper presenters and discussant(s) in advance, and introduce yourself. Remind each presenter of the time limits that apply, and describe the method you will use to alert them of time limits during the actual presentation.
2. At the start of the session, introduce yourself to the audience, announce the session/title, and offer a brief overview indicating how the papers are related.
3. Next, introduce the speakers with brief comments regarding the affiliation and/or background of each presenter.
4. Prior to each presentation, announce the paper's title, authors' names and their affiliations. Identify the individual who will be speaking if it is someone other than the first author.
5. During the presentations enforce time limits strictly so that no author (or audience member) monopolizes someone else's time. Oral paper presentations each have 20 minutes (15 minutes for full presentation papers, 5 minutes discussions), and 10 minutes for e-Poster (electronic poster) presentations (5 minutes for poster presentation and 5 minutes for discussions).
6. Once presentations are complete (oral paper presentations and e-Poster presentations) the remainder of the time can be used for informal discussion with the audience and session participants. It is your job to field questions from the audience.
7. Try to conduct the session as informally as possible (e.g., use first names when addressing participants and members of the audience) to encourage as much audience participation as possible.

Investigation of Chord Protocol in Peer to Peer Wireless Mesh Network with Mobility	P. Prasanna Murali Krishna, M. V. Subramanyam, K. Satya Prasad Dr. Samuel George Institute of Engineering & Technology/Jawaharlal Nehru Technological University, Kakinada India
Mechanical Properties and Chloride Diffusion of Ceramic Waste Aggregate Mortar Containing Ground Granulated Blast-Furnace Slag	H. Higashiyama, M. Sappakittipakorn, M. Mizukoshi, O. Takahashi Kinki University Japan
Human Walking Vertical Force and Vertical Vibration of Pedestrian Bridge Induced by Its Higher Components	Masahiro Yoneda Kinki University Japan

September 11, 2015

Welcome Coffee: 09:15-09:30

Session III: 09:30-12:30

Lunch: 12:30

Chair: Manjula Kola, Ruzaina Binti Ishak

Attenuative Effect of Vitamin E on Experimental Cataract in Rats	Seyedeh Zeinab Peighambarzadeh, Mehdi Tavana Shoushtar Branch, Islamic Azad University Iran, Islamic Republic Of
Pyelography by Intraosseous Injection of Iodixanol in Persian Squirrel	Mehdi Tavana, Seyedeh Zeinab Peighambarzadeh Shoushtar Branch, Islamic Azad University Iran, Islamic Republic Of
A Conceptual Framework of Scheduled Waste Management in Highway Industry	Nurul Nadhirah Anuar, Muhammad Fauzi Abdul Ghani Universiti Teknologi MARA Malaysia
Potential of γ-Polyglutamic Acid for Cadmium Toxicity Alleviation in Rice	N. Kotabin, Y. Tahara, K. Issakul, O. Chunhachart Kasetsart University Thailand
Diversity and Structure of Trichoptera Communities and Water Quality Variables in Streams, Northern Thailand	T. Prommi, P. Thamsenanupap Kasetsart University Thailand
Catalytic Wet Air Oxidation as a Pretreatment Option for Biodegradability Enhancement of Industrial Effluent	Sushma Yadav, Anil K. Saroha Indian Institute of Technology Delhi India
Social Marketing – An Integrated and Comprehensive Nutrition Communication Strategy to Improve the Iron Nutriture among Preschool Children	Manjula Kola, K. Chandralekha Sri Venkateswara University India

Article | TABLE OF CONTENTS | Page

TABLE OF CONTENTS

Convergence or Divergence of Economic Growth within the ASEAN Community: Challenges for the AEC

Philippe Gugler

Abstract— This contribution reflects some important questions regarding inter alia the economic development occurring in the light of the ASEAN's goal of creating the ASEAN Economic Community (AEC) by 2015. We observe a continuing economic growth of GDP per capita over recent years despite the negative effects of the world economic crisis. IMF forecasts indicate that this trend will continue. The paper focuses on the analysis and comparison of economic growth trends of ASEAN countries.

Research Issues:

Our study's aim is to identify the process of economic convergence or divergence of economic growth of ASEAN Countries. We address the following issues:

- Beta convergence process of ASEAN countries with some developed economies such as the United States.
- Beta convergence process within the ASEAN community;
- Conditional convergence process " within the ASEAN community;
- Speed of convergence from one country to another within the ASEAN community;
- Income disparities among the ASEAN countries, a phenomenon called "*sigma-convergence*".

Philippe Gugler is with the Center for Competitiveness of the University of Fribourg/Switzerland, Bd de Pérolles 90, 1700 Fribourg, Switzerland (phone +41 26 3008226; philippe.gugler@unifr.ch).

Main results:

- Regarding the absolute convergence of ASEAN countries with developed economies, we observe that some countries (Malaysia, Indonesia, Thailand and Vietnam) confirm the trend toward absolute convergence. However, two exceptions are notable in the figure. The rate of growth of Singapore is comparatively higher and the rate of growth of the Philippines is comparatively lower than the theoretical trends.

- We observe that the convergence process is at work among the ASEAN countries: the ASEAN economies with the lowest level of GDP per capita record higher economic growth than the richest countries.

- Regarding the "*conditional convergence*", the speed of convergence differs from one country to another. These differences are explained by "*spatial heterogeneity*", which creates several "*convergence clubs*" within the ASEAN community.

- Regarding the sigma convergence, we observe a decrease in this coefficient, reflecting a reduction of prosperity disparities among ASEAN countries as a general trend.

- Although we may observe a process of convergence as well as a reduction of disparities within the ASEAN community, an important GDP per capita gap persists among its members. This GDP per capita gap is primarily explained by the productivity gap.

Economic and policy relevance:

Although we may observe a process of convergence as well as a reduction of disparities within the ASEAN community, an important GDP per capita gap persists among its members. As noted by the ADB, "*Narrowing the development gap within and across ASEAN economies is a critical step for deepening economic integration*" (ADB, 2012, p.6). A regional integration process may be understood as a tool to speed up the catching-up process of the member states. However, the convergence process should be understood within the context of a global upward trend in development or, in other words, within a context of sustainable growth.

The results of this study may contribute to contemplate the best policy responses of the ASEAN community to address the disparities trends.

Keywords— ASEAN, Convergence, Divergence, Economic Growth, Globalization, Integration.

Designing Social Media into Higher Education Courses

Thapanee Seechaliao

***Abstract*—**This research paper presents guiding on how to design social media into higher education courses. The research methodology used a survey approach. The research instrument was a questionnaire about guiding on how to design social media into higher education courses. Thirty-one lecturers completed the questionnaire. The data were scored by frequency and percentage. The research results were the lecturers' opinions concerning the designing social media into higher education courses as follows: 1) Lecturers deem that the most suitable learning theory is Collaborative Learning. 2) Lecturers consider that the most important learning and innovation Skill in the 21st century is communication and collaboration skills. 3) Lecturers think that the most suitable evaluation technique is authentic assessment. 4) Lecturers consider that the most appropriate portion used as blended learning should be 70% in the classroom setting and 30% online.

***Keywords*—**Instructional design, social media, courses, higher education.

I. Introduction

THE Thai university launched the project "Microsoft Surface for Lecturers and Learners" to support online learning and encourage lecturers and learners using technology in education. The Faculty of Education, Mahasarakham University also specified in the Strategic Plan 2011- 2020 that aims to develop an e-learning system. It will provide students access to online courses easily [1]. Therefore, lecturers need to be familiar with technology and design their courses to support online learning effectively.

An overwhelming majority report that the potential's social media becomes a valuable tool to support communications and collaborative learning. Especially, social media in trend such as Facebook, Youtube, Blogs, Wikis, Tweeter, Myspace, LinkedIn, Flickr, Slideshare, and Podcasts can promote online learning. [8]. Lecturers believe that social media sites such as video, podcasts, and wikis are valuable tools for teaching and collaborative learning. Youtube and Facebook were also the most frequently cited to support professional careers [6]. Facebook was the most popular platform for online social networking among university students. Facebook could be utilized as an online environment to facilitate the learning of English [4]. Moreover, the potential of Facebook can support students to communicate and collaborate with lecturers effectively. Therefore, students have been adopted Facebook widely [8].

Thapanee Seechaliao is with the Educational Technology and Communications Department, Faculty of Education, Mahasarakham University, Thailand. 44000 (e-mail: thapanee.see@msu.ac.th).

Social media can facilitate learning activities at university. Facebook was developed for four university courses and provided information relevant to the courses and allow student to have more interaction [3]. Almost lecturers were using social media both in during class and outside class. They have posted content for students to view or read outside class, required students to read or view social media as part of a course assignment, and assigned students to comment on or post to social media sites [6].

Instructional Design (ID) is popular for depicting the systematic process of developing education and training. Various forms of models exist that can be best applied in different settings [2]. ID is a process that can help improve the design and development of courses and course content. Often associated with training in business and industry, ID has been widely used by educators in revising and modifying existing courses and to plan and implement new instruction [7]. The instructional planning process they actually describe the concept of course design, as well as what has been indicated as instructional design on the operational level. In fact, their guide helps teachers to plan instruction that gears toward intended learning outcomes on the operational level [5]. Additional, the systematic instructional design process can be used to create effective instruction which will be meaningful for instructors and students [7]. The term instructional design will be used to describe the complete process of: (a) analyzing *what* is to be taught and learned; (b) determining *how* it is to be taught and learned; (c) conducting *tryout* and *revision*; and (d) assessing *whether* learners do learn [2]. The systematic instructional design process can help instructors can become more efficient in developing their courses and approaches to different learning situations [7].

Although lecturers in faculty of education, Mahasarakham University deem that social media can benefit for online learning. Most lecturers still use traditional teaching methods and focus on knowledge as usual. Finally, they may reject and or hesitate to use such technology as part of their course [10]. Therefore, researcher would like to investigate these guiding on how to design social media into higher education courses. The crucial components of course design including; (1) what Learning and Innovation Skills should be emphasized on 21st Century skills, (2) what Learning Theory, and (3) Evaluation are appropriate designed in 21st Century learning. The results would guide lecturers design social media into their courses more appropriately and encourage lecturers using social media into their courses widely. The efficient course design will help students achieve their learning objectives as expected in 21st Century learning.

II. LITERATURE REVIEW

A. Social Media in Higher Education

The potential's social media becomes a valuable tool to support communications and collaborative learning. Especially, social media in trend such as Facebook, Youtube, Blogs, Wikis, Tweeter, Myspace, LinkedIn, Flickr, Slideshare, and Podcasts can promote online learning. [8].

Lecturers believe that social media sites such as video, podcasts, and wikis are valuable tools for teaching and collaborative learning. Youtube and Facebook were also the most frequently cited to support professional careers [6]. Facebook was the most popular platform for online social networking among university students. Facebook could be utilized as an online environment to facilitate the learning of English [4]. Moreover, the potential of Facebook can support students to communicate and collaborate with lecturers effectively. Therefore, students have been adopted Facebook widely [8].

Social media can facilitate learning activities at university. Facebook was developed for four university courses and provided information relevant to the courses and allow student to have more interaction [3]. Almost lecturers were using social media both in during class and outside class. They have posted content for students to view or read outside class, required students to read or view social media as part of a course assignment, and assigned students to comment on or post to social media sites [6].

Lecturers need to know and learn how to design social media in their courses to help learners learn more and achieve learning objectives as expected.

B. Instructional Design

Instructional Design models are popular for depicting the systematic process of developing education and training. Various forms of models exist that can be best applied in different settings [2]. The systematic instructional design process can be used to create effective instruction which will be meaningful for instructors and students. Following the basic processes and procedures that constitute instructional design, instructors can become more efficient in developing their courses and approaches to different learning situations [7].

However, the instructional planning process they actually describe the concept of course design, as well as what has been indicated as instructional design on the operational level. In fact, their guide helps teachers to plan instruction that gears toward intended learning outcomes on the operational level. These examples show the variety of terms used and how the various authors attribute different meanings to these terms. Differences in opinion about how the learning process takes place in the individual can be reflected in the approaches to curriculum development, course design, and instructional planning. As a course is an educational solution to a problem, or an educational answer to a question, it is of great interest how the designer perceives the learning process that makes part of that solution or answer. In the following sections a variety of these perceptions and their related approaches are discussed [5].

The term instructional design will be used to describe the complete process of: (a) analyzing what is to be taught and learned; (b) de*termining how it is to be taught and* learned; (c) conducting tryout and revision; and (d) assessing whether learners do learn. In some situations a fifth step is added involving implementing the resulting product or system in the intended setting or marketing it commercially depending on their distribution plan. [2].

Instructional Design (ID) is a process that can help improve the design and development of courses and course content. Often associated with training in business and industry, ID has been widely used by educators in revising and modifying existing courses and to plan and implement new instruction. The process is systematic and systemic; steps are taken in the design (planning) phase of the course that are dependent upon each other to generate a successful product (course). One of the more tried and true ID models is ADDIE (Analyze, Design, Develop, Implement, and Evaluate) although many others exist and are used in different learning situations [7].

Following the steps of a widely accepted Instructional Design (ID) model can assist instructors in preparing and delivering meaningful and effective instruction. The term instructional design refers to the systematic and reflective process of translating the principles of learning and instruction into plans for instructional materials, activities, information resources, and evaluation [9]. It is during this systematic process that you should consider the audience for whom the instruction is designed, what goals drive the instruction, and which objectives will students follow to ensure they do what you want them to do [7].

C. Course Design

Instructional Design (ID) is a process that can help improve the design and development of courses and course content [7]. In this entry, "course design" is the term used for the tactical planning process that is positioned between the large-scale strategic level of curriculum development and the small- scale operational level of instruction design. On this tactical level, the main goals from the overall curriculum development outcomes are organized in courses, that is, in comprehensive entities of objectives, assessment instruments, and instructional strategies and materials. This planning process involves analysis of the specific needs, the analysis of favorable and inhibiting conditions for implementation, and the selection and application of instructional theories. The aim of this entry is to review the concepts and approaches to course design as well as their application in formal and corporate education [5].

This research investigates how to design social media into higher education courses appropriately in 21st Century learning. The crucial components of course design including; (1) what Learning and Innovation Skills should be emphasized on 21st Century skills, (2) what Learning Theory, and (3) Evaluation are appropriate designed in 21st Century learning. The results would guide lecturers design social media into

their courses more appropriately and encourage lecturers using social media into their courses widely. The efficient instructional design will help students achieve their learning objectives as expected.

III. Research Methodology

The research methodology uses a survey approach as follow:

A. Objective

The objective is to investigate the guiding on how to design social media into higher education courses.

B. Samples

The samples consist of 31 lecturers in the Faculty of Education at Mahasarakham University.

C. Research Instrument

The research instrument is a questionnaire about guiding on how to design social media into higher education courses. It consists 12 statements rated on a five-point Likert scale (1= strongly disagree, 2= disagree, 3=undecided, 4= agree, and 5=strongly agree). This instrument was validated by 3 experts in diffusion of innovations, 5 experts in online learning, and 3 experts in educational research and evaluation using the index of item-objective congruence (IOC). The IOC values were ranging from 0.79 to 1.00. This instrument was applied to pilot participants of 125 lecturers from Chulalongkorn University, Srinakharinwirot University, Kasetsart University, Silpakorn University, and Khonkhean University. The reliability coefficient was calculated by using Cronbach's equation and it was 0.62 which is suitable for conducting the study.

D. Procedure

The data were collected through the questionnaire of guiding on how to design social media into higher education courses. Thirty one lecturers completed the study.

E. Data Analysis

The data were scored by using frequency and percent.

IV. Results

The research results as follows; a majority of the lecturers who completed the study were male. The largest age group was 30-35 years old. The most commonly held highest degree was a Master's. The most common academic position they held was "lecturer." The largest group was in the Department of Educational Technology and Communications. They had monthly incomes of 30,000 THB and over. They had experience of using social media, namely, Facebook, mostly through internet use on devices such as notebooks and desktops.

Fig. 1 presents the findings of this research were the Learning Theory that is suitable for guiding on how to design social media into higher education courses as follow; the first suitable Learning Theory is Collaborative Learning (frequency=25, percent=37.31) 2) The second proper theory is Problem-Based Learning (frequency=24, percent=35.29), followed by Project-Based Learning (frequency=18, percent=26.47).

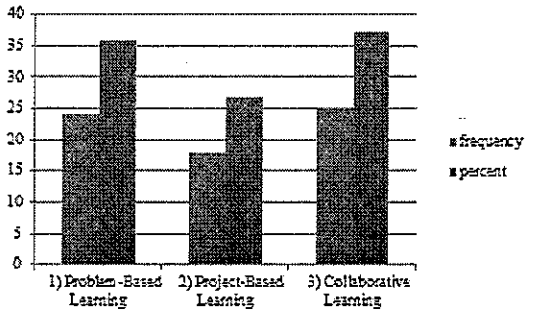

Fig. 1 Learning Theory that is suitable for guiding on how to design social media into higher education courses

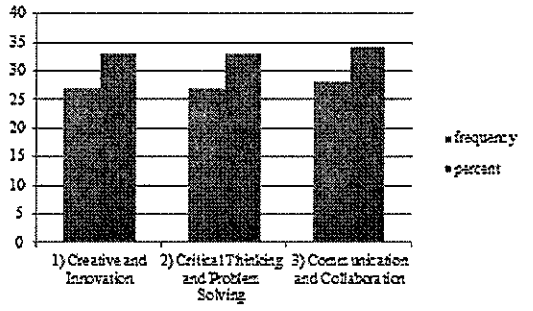

Fig. 2 Learning and Innovation Skills that is suitable for guiding on how to design social media into higher education courses

Fig. 2 presents the findings of this research were the Learning and Innovation Skills that is suitable for guiding on how to design social media into higher education courses as follow; Instructional techniques should help students develop the learning and innovation skills in the 21st century, in which the most important skill is communication and collaboration skills (frequency=28, percent=34.14), followed by creativity and innovation skills (frequency= 27, percent=32.93)and then critical thinking and problem solving (frequency=27, percent=32.93).

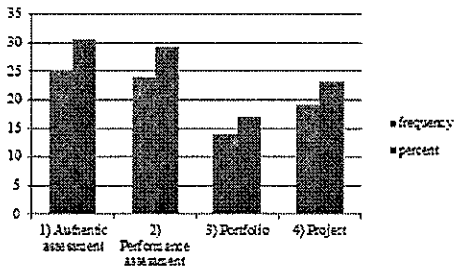

Fig. 3 Evaluation that is suitable for guiding on how to design social media into higher education courses

Fig. 3 presents the findings of this research were the Evaluation that is suitable for guiding on how to design social media into higher education courses as follow; Regarding evaluation techniques , authentic assessment should be firstly taken into account (frequency= 25, percent=30.12), followed

by performance assessment (frequency= 24, percent=28.92) and then project (frequency=19, percent=22.89).

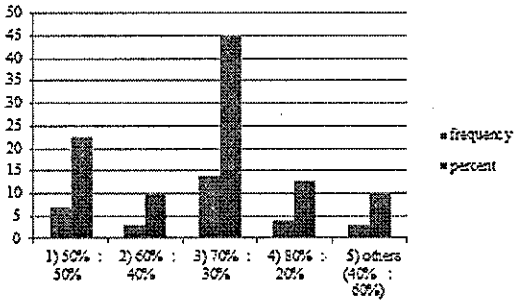

Fig. 4 Appropriate portion used as blended learning that is suitable for guideline on designing social media into higher education courses

Fig. 4 presents the findings of this research were the appropriate portion used as blended learning that is suitable for guideline on designing social media into higher education courses as follow; The most appropriate portion of integrated social media in higher education used as blended learning should be 70% in the classroom setting and 30% online (frequency=14, percent=45.16), followed by 50% in the classroom and 50% online (frequency=7, percent=22.58) and then 80% in the classroom and 20% online (frequency=4, percent=12.90).

V. Conclusion

The results of this research revealed the guiding on how to design social media into higher education courses. It found that lecturers gave their opinions concerning the guiding on how to design social media into higher education courses. It can be guideline to design instruction that is more suitable for 21st Century Learning.

The first suitable learning theory is Collaborative Learning. The second proper theory is Problem-Based Learning, followed by Project-Based Learning. Therefore, it should be good to directly guide instructional designers and lecturers to design Collaborative Learning into their courses.

Instructional techniques should help students develop the learning and innovation skills in the 21st century, in which the most important skill is communication and collaboration skills, followed by creativity and innovation skills and then critical thinking and problem solving. Therefore, it should guide instructional designers and lecturers to emphasize enhancing communication and collaboration skills into their courses.

Regarding evaluation techniques, authentic assessment should be firstly taken into account, followed by performance assessment and then project. Therefore, it should guide instructional designers and lecturers to design authentic assessment into their courses. Moreover, according to the results, the most appropriate portion of designing social media into higher education courses used as blended learning should be 70% in the classroom setting and 30% online, followed by 50% in the classroom and 50% online and then 80% in the classroom and 20% online. Therefore, it should guide instructional designers and lecturers to design appropriate portion used as blended learning into their courses. However, the most appropriate portion used as blended is up to course description and characteristic.

At last, this course design could help learners achieve learning outcomes as the 21st Century learners.

Acknowledgment

This work has been supported by the Mahasarakham University Development Fund, Mahasarakham University, Thailand under the international conference grant.

References

[1] Executive Board of Education. (2010) *the Strategic Plan 2011-2020.* Mahasarakham: Faculty of Education, Mahasarakham University.

[2] Gustafson, K.L. (1996). Instructional Design Models. In Plomp, Tj., and Donald P. Ely. (Eds.), *The International Encyclopedia of Educational Technology*, 2nd edition (pp. 27-32). Oxford: Pergamon Press/Elsevier Science Ltd.

[3] Irwin, C., Ball, L., Desbrow, B., & Leveritt, M. (2012). Students' perceptions of using Facebook as an interactive learning resource at university. Australasian Journal of Educational Technology, 28(7), 1221-1232.

[4] Kabilan, M.K., Ahmad, N, & Abidin, M. J. Z. (2010). Facebook: An online environment for learning of English in institutions of higher education? *Internet and Higher Education*, 13 (4), 179–187.

[5] Kessels, J.W.M. & Plomp, Tj. (1996). Course Design. In Plomp, Tj., and Donald P. Ely. (Eds.), *The International Encyclopedia of Educational Technology*, 2nd edition (pp. 143-148). Oxford: Pergamon Press/Elsevier Science Ltd.

[6] Moran, M., Seaman, J., & Tinti-Kane, H. (2011) *Teaching, Learning, and Sharing: How Today's Higher Education Faculty Use Social Media.* Boston, MA: Pearson Learning Solutions.

[7] Northern Illinois University, Faculty Development and Instructional Design Center. (2015, January 12). *Course Design: A Systematic Approach.* Retrieved from http://www.facdev.niu.edu/facdev/resources/guide/prepare/course_design_a_systematic_approach.pdf

[8] Roblyer, M.D., McDaniel, M., Webb, M., Herman, J., & Witty, J. V. (2010). Findings on Facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites. *The Internet and Higher Education*, 13(3), 134-140.

[9] Smith, P. L., & Ragan, T. J. (1999). *Instructional design* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

[10] Whattananarong, K. (2011). *Innovation and Technical Education Technology.* Bangkok, Thailand: King Mongkut's University of Technology North Bangkok.

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Factors Underlying the Digital Divide for Disabled People: Focus on a Korean Case Study

Soungwan Kim

Abstract—This study identifies factors underlying the digital divide that is faced by the disabled. The results of its analysis showed that the digital divide in PC use is affected by age, number of years of education, employment status, and household income of more than KRW 3 million. The digital divide in smart device use is affected by sex, age, number of years of education, time when disability struck, and household income of more than KRW 3 million. Based on these results, this study proposes methods for bridging the digital divide faced by the disabled.

Keywords—Digital divide, digital divide for the disabled, information accessibility for pcs and smart devices.

I. Introduction

KOREA'S transformation into an information-oriented society has been unmatched in speed and paralleled by very few countries. Korea has quickly become a society in which information drives economic and social change. In such an information-oriented society, the use of information and communication technologies (ICTs) is highly important, as it allows people to obtain the skills that they require in their daily lives and economic activities, and to enjoy their social and cultural lives. However, there are individual differences in how people utilize ICTs to approach the information that they require, and how they obtain that information to use for their purposes. More specifically, the disabled are relatively less able to use ICTs to gain the information that they require than the non-disabled, which leads to the problem known as the digital divide. In the case of smartphones and other similar devices, such difficulties can be particularly immense. When disabled individuals lack the ability to utilize smart devices, it results in an inequality of information that may lead to unequal opportunities and difficulties forming social networks. This can potentially limit the lives of the disabled.

With the above in mind, this study has observed factors that affect the digital divide for the disabled. It identifies which factors impact the approachability of PCs and smart devices, and considers these factors from a policy perspective.

II. Theoretical Discussion

A. Definition of the Digital Divide

OECD defines the digital divide as "the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities" [1]. Moreover, NTIA in the United States defines the digital divide as the divide between people who are able to approach new technologies and those who are unable to do so [2]. Therefore, the digital divide separates people, who have access to ICTs and those who do not, as well as users and non-users of information. Recently, terms such as "digital opportunity" and "digital inclusion" have also come into use, as the United States and Europe expand their definitions of the digital divide.

B. Existing Research on the Digital Divide

Monlar has identified the types of digital divide by focusing on the mechanism that causes the digital divide to move through the phases of early adaptation, take-off, and saturation [3]. First, the stage of early adaptation is defined by differences in access, between people who are able to access ICTs and those who are unable to. This stage, in which the access divide first appears, is caused by factors such as income, living arrangements, education, and age. Second is the take-off stage, when information services become more accessible and widely-used, due to the supply and spread of information communication devices, the build-out of information communications networks, and the spread of PCs and the Internet. In this stage, the access divide, which has been present since the early adaptation stage, is partially resolved through efforts to boost information accessibility. However, a division called the usage divide then emerges, caused by the simple usage differences between information users and non-users. The third is the saturation stage, which does not signal differences in the approachability or usage of information services, but is a stage in which a divide exists between users with regard to what information is acquired for which purposes, how much information is acquired, and how the information is utilized to drive results, in terms of impact. Unlike in the early adaption and take-off stages, a divide does not exist between users and non-users of information, but within the group of users, and is thought to arise from differences in individual levels of recognition and accommodation.

Selwyn has broken down the digital divide through a multi-layered relational approach, beginning with access to information and moving through information use, engagement with information devices or content, resulting outcomes, and consequences [4]. He argues that the digital divide occurs and intensifies through various forms, ranging from access to consequences, in a staged or complex fashion. Meanwhile, Haywood (1998) has criticized the concept of the trickle-down

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effect, which views ICTs as being used by a few people in the early stages of their distribution, but over time spreading to the entire society. Haywood points out that inequality in access to information tends to persist, and can even intensify the separation between rich and poor that is caused by the digital divide [5]. Moreover, Mun-Jo Kim and Jong-Kil Kim assert that the digital divide occurs because of decisions concerning whether or not to accommodate information, the extent to which to do so, and the value gained by utilizing information [6].

C. The Digital Divide of the Disabled

Since 1983, the United Nations has pressed to guarantee information access to the disabled in many countries. As a result, from the policy and engineering perspectives, attention has turned to problems that ensue when users with physical or mental disabilities use information-communication products and services. Within this context, Korea has consistently researched policies for improving and maintaining information access for the disabled, through government agencies [7], [8].

A number of studies have focused on the digital divide facing the disabled. Ju-Eun Jo has compared and analyzed the reasons behind different levels of information access among the disabled and the non-disabled in Korea and the United States [9]. Jo's study concludes that the disabled in both Korea and the United States have very low information access levels compared to the non-disabled, and that socioeconomic factors have heavily influenced this divide. Katz and Aspden have focused on low levels of economic power as the primary reason for the digital divide experienced by the disabled [10]. To approach information, special equipment such as additional hardware, software, and other supporting devices are required, beyond the purchase of a PC, and the ability to make regular payments for internet access is also required. Moreover, valuable information tends to be commercialized, and therefore additional expenditures are required, in addition to the purchase of a PC. Therefore, as the disabled have fewer opportunities for economic activity and thus tend to have lower income levels than the non-disabled; further limitations are created with regard to information access. Moss asserts that the digital divide occur based on differences between individual abilities to utilize information [11]. As the majority of information found on the Internet is presented in English, as are the methodologies for utilizing a PC or the Internet, a certain level of foreign language skill is required. Since the education levels of the disabled are often low and digital education is institutionalized, this could also be a limiting factor for disabled individuals who are limited in their physical movement abilities.

The digital divide faced by the disabled is caused by differences in the individual characteristics and backgrounds of users, including features such as sex [12], [13], social status or job title, level of education received, age, geographic/ environmental condition [14], [15], and type of disability.

Seung-Ho Baek has determined that statistically meaningful influences on information inequality exist, as measured by divides in digital access and information utilization, according to sex, age, region of residence, income, and job factors [16]. Moreover, Jun-Woo Lee and Yun-Shin Kim have analyzed the impact of jobs and income levels, as socioeconomic characteristics, for those with hearing disabilities, and how they affect levels of information access. They have found that the higher a person's income level is, the higher their level of information access [17].

Physical and mental disabilities are some of the main factors that limit the access to and usability of information by the disabled. In order to utilize a keyboard and mouse, users must be able to see and move their hands nimbly, and users require sight in order to understand the outputs on a screen. Alternative input and output devices and methods have been developed for approaching information with devices other than a keyboard or a mouse, and for receiving information with skills other than sight (voice recognition and output, Braille printers). However, many of these alternatives have been made for the non-disabled, and therefore inherently limit access by disabled individuals who have difficulty using their hands and eyesight [18].

III. METHODOLOGY

A. Subjects

This study utilizes data from the "Current State Investigation of the Digital Divide of the Disabled – 2013" by the National Information Society Agency (NISA). The purpose of this investigation is to provide underlying information for determining policy direction and evaluating how to resolve the digital divide affecting the disabled, by determining the levels of information orientation among the disabled and the current state of the digital divide. This target of this investigation was registered disabled persons across the 17 provinces and diverse metropolitan areas of Korea, aged between 7 and 69, and the study employs an effective sample size of 2,700. It analyzes 1,862 respondents with regard to the information accessibility of PCs and 981 respondents concerning the information accessibility of smart devices.

B. Dependent Variable

The dependent variable of this study was defined through questions that measured levels of information accessibility, with 14 questions relating to PCs and 14 questions relating to smart devices. The questions are structured similarly to the following example: "To what extent are you able to carry out, without help, the following activities with your computer (desktop and laptop) and smart device (smartphone and tablet)?" Each question could be answered on a 4-point Likert scale, with 1 indicating "no activity" and 4 indicating "engage in the said activity often." The reliability of the questions relating to PCs, based on the use of Cronbach's Alpha, were 0.937. The smartphone questions had a Cronbach's Alpha of 0.941, indicating similarly high reliability.

C. Independent Variables

1) Socio-Demographic Factors

The sociodemographic factors in this study include sex, age, and number of years of education. Sex was coded first, with males having a value of 0 and females having a value of 1. Secondly, the respondents' ages were coded and changed to natural log values through normality tests. Thirdly, numbers of years of education were changed to root values, through normality tests of the number of years of the education variable, which is a continuous variable derived from the final education institution variable.

2) Disability Factors

The disability factors considered in this study include the type of disability and the period in which the disability occurred. Firstly, external bodily disability was coded as 0, while sensory disability, mental disability, and internal bodily disability were coded as 1. Secondly, for the period of disability occurrence, if the disability occurred before or at birth, this was coded as 0, while if it occurred after birth, it was coded as 1.

3) Economic Factors

The economic factors addressed in this study include employment status and household income. First, unemployment was coded as 0, while employment was coded as 1. Secondly, household income was split into four dummy variables: "below KRW 1 million," "from KRW 1 million to 2 million," "from KRW 2 million to 3 million," and "more than KRW 3 million." If the dummy variables did not apply, that was coded as 0, while if they did apply, it was coded as 1.

4) Control Variables

The control variables include the disabled person's status in the household and region of residence. If the respondent was not the head of the household that was coded as 0 while if he or she was the head of the household, it was coded as 1. Secondly, rural areas were coded as 0 and urban areas were coded as 1.

D. Data Analysis

To identify the influential factors affecting information accessibility for the disabled in using PCs and smart devices (i.e., the occurrence of the digital divide), a multiple regression analysis was performed. First, to test the normality of the dependent and independent variables, some variables were modified, with skewness and kurtosis considered. Secondly, in order to determine the presence of multicollinearity between independent variables, the variance inflation factor (VIF) was checked, and it was determined that it was not problematic. Secondly, an analysis of the relationships between independent variables showed that the high interrelatedness of independent variables was not of concern. Moreover, the presence of heteroscedasticity was checked for, and there were no instances in which heteroscedasticity were present.

IV. RESULTS

A. Results for Descriptive Statistics

The results regarding the descriptive statistics of this study are as follows (see Table I).

TABLE I
DESCRIPTIVE STATISTICS

		PC (N=1,862)	Smart device (N=981)
Sex	Male	1,281(68.8%)	731(74.5%)
	Female	581(31.2%)	250(25.5%)
Age	Average (Standard error)	49.0%(12.108)	46.2(11.327)
Number of years educated	Average (Standard error)	10.6(2.875)	11.7(2.385)
Disability type	Crippled	1,303(70%)	743(75.7%)
	Brain disorder	179(9.6%)	53(5.4%)
	Visual disability	201(10.8%)	98(10.0%)
	Auditory disability	157(8.4%)	78(8.0%)
	Lingual disability	22(1.2%)	9(0.9%)
Period of disability occurrence	At or before birth	458(24.6%)	203(20.7%)
	After birth	1,404(75.4%)	778(79.3%)
Employment status	Unemployed	847(45.5%)	398(39.6%)
	Employed	1,015(54.5%)	593(60.4%)
Household income	Below KRW 1M	467(25.1%)	176(17.9%)
	KRW 1M-2M	774(41.6%)	387(39.4%)
	KRW 2M-3M	416(22.3%)	265(27.0%)
	Over KRW 3M	205(11.0%)	153(15.6%)
Status in household	Not head of household	753(40.4%)	390(39.8%)
	Head of household	1,109(59.6%)	591(60.2%)
Region of residence	Rural	275(14.8%)	134(13.7%)
	Urban	1,587(85.2%)	847(86.3%

Firstly, with regard to the sociodemographic aspect, there were more males in both the PC and smart device groups. The average age was higher for the PC group (M=49.0, SD=12.108) than for the smart device group (M=46.21, SD=11.327). Moreover, the number of years of education was also higher for the smart device group than the PC group.

Secondly, with regard to disability factors perspective, the dominant type of disability for both of the PC and smart device groups was physical (PC group 70%, smart device group 75.7%), while language disability was the least common (PC group 1.2%, smart device group 0.9%).

Thirdly, concerning economic factors, more respondents were employed in both groups (PC group 54.5%, smart device group 60.4%) than unemployed (PC group 45.5%, smart device group 39.6%). Household incomes were primarily between KRW 1 million and 2 million for both the PC and smart device group (PC group 41.6%, smart device group 39.4%) and the least common household income level was over KRW 3 million (PC group 11.0%, smart devices group 15.6%).

Fourthly, in terms of the controlled variable, the most common household status of respondents was head of household (PC group 59.6%, smart device group 60.2%). The region of residence was primarily urban for both the PC and smart device groups (PC group 85.2%, smart device group 86.3%).

B. Results of Analysis of the Digital Divide for PC Users

A multiple regression analysis was performed in order to analyze the factors that influence the digital divide regarding disabled users of PCs (see Table II).

TABLE II
RESULTS OF THE DIGITAL DIVIDE OF PCS

		B	t
Sociodemographic factor	Sex	-0.032	-1.169
	Age	-0.197	-8.254***
	Numbers of years educated	0.247	10.075***
Disability factor	Disability type	0.008	0.367
	Period of disability occurrence	-0.079	-0.822
Economic factor	Employment status	0.064	2.742***
	Household income below KRW 1M	-0.001	-0.011
	Household income KRW 1M to 2M	0.052	0.718
	Household income KRW 2M to 3M	0.096	1.539
	Household income over KRW 3M	0.177	3.611***
Control variable	Status in household	0.044	1.576
	Region of residence	-0.003	-0.148
	N=1,862		
	R^2=0.447		
	F=38.437***		

* ρ<0.1, **ρ<0.05, ***ρ<0.01

The factors that were most statistically significant, in terms of influencing the digital divide, were sociodemographic and economic. Among the sociodemographic factors, age had a negative (-) impact at a significance level of 1%, while number of years of education had a positive impact (+) at a significance level of 1%. Moreover, among the economic factors, employment status had a positive (+) impact at a significance level of 1%, while a household income level of over KRW 3 million had a positive (+) impact at a significance level of 1%. However, the disability factor was found not to impact information accessibility for PCs.

Regarding the sociodemographic factor, it was determined that as the age of the disabled decreases, the information accessibility of PCs increases (β = -0.197, ρ< 0.001). This is consistent with the results of preceding research [19], [16], [20]. Moreover, as the number of years of education increases, the information accessibility of PCs also increases (β = 0.247, ρ< 0.001). In other words, it is likely for information inequality to occur according to education history among the disabled. However, it was found that sex does not impact the Information accessibility of PCs for the disabled.

Secondly, some existing research [9] has posited that disability type may influence the information accessibility of PCs. However, this was not found to be the case in this study. This could be explained in terms of Korea's national level of information orientation, as PCs are commonplace in the average household and ultra-high-speed internet connections can be easily accessed in the majority of households.

Thirdly, concerning economic factors, the information accessibility of PCs (β = 0.064, ρ< 0.001) was found to increase for disabled persons who were employed. Among the disabled, participation in the labor market is beneficial for improving information access, and as the majority of work involves using PCs, it could also decrease the digital divide. Moreover, it was found that the information accessibility of PCs (β = 0.177, ρ< 0.001) increases when household income is more than KRW 3 million. This shows that a certain level of household income is required to decrease the digital divide. This is because, in order to access information, a PC, additional software, and supporting devices must be purchased [10], [21].

C. Results of Analysis of the Digital Divide for Smart Device Users

In order to determine the influencing factors for the digital divide among disabled users of smart devices, a multiple regression analysis was performed (see Table III).

TABLE III
RESULTS OF THE DIGITAL DIVIDE OF SMART DEVICES

		B	t
Sociodemographic factor	Sex	-0.078	-2.173**
	Age	-0.174	-5.435***
	Numbers of years educated	0.212	6.462***
Disability factor	Disability type	-0.042	-1.484
	Period of disability occurrence	0.084	2.740***
Economic factor	Employment status	0.033	0.993
	Household income below KRW 1M	0.075	1.257
	Household income KRW 1M to 2M	0.103	1.309
	Household income KRW 2M to 3M	0.121	1.638
	Household income over KRW 3M	0.269	4.243***
Control variable	Status in household	-0.002	-0.063
	Region of residence	0.176	6.144***
	N=981		
	R^2=0.477		
	F=23.790***		

* ρ<0.1, **ρ<0.05, ***ρ<0.01

The results showed that statistically significant factors influencing the digital divide for the disabled included sociodemographic, disability, and economic factors. More specifically, among the sociodemographic factors, sex has a negative (-) impact, with a significance level of 5%, age has a negative (-) impact, with a significance level of 1%, and number of years of education has a positive (+) impact, with a significance level of 1%. Moreover, among the economic factors, a household income level of more than KRW 3 million has a positive (+) impact, with a significance level of 1%.With regard to our results, firstly, all of the sociodemographic factors influenced information accessibility for smart device users. For females, accessibility was lower (β = -0.078, ρ < 0.05). As can be seen from the descriptive statistics shown in Table I, 74.5% of men accessed information via smart device. As with the information accessibility of PCs, a decrease in age increased the information accessibility of smart devices (β = -0.174, ρ < 0.001). Moreover, number of years of education was in line with the results for information accessibility for PCs, and increased with the information accessibility of smart devices (β = 0.212, ρ < 0.001).

Secondly, concerning the disability factor, when disability occurred after birth, the information accessibility of smart devices increased (β = 0.084, ρ < 0.001).

Unlike persons disabled at birth, those that became disabled after birth can utilize their previous experience of using smart

devices like smartphones, which can influence the information accessibility of smart devices.

Thirdly, as with the effect of economic factors on information accessibility for PCs, household incomes of over KRW 3 million were found to increase the information accessibility of smart devices ($\beta = 0.269$, $\rho < 0.001$).

Fourth, among the control variables, residence in an urban area led to the increased information accessibility of smart devices ($\beta = 0.176$, $\rho < 0.001$).

V. Conclusion

In an attempt to analyze the factors influencing the digital divide affecting the disabled, this study has utilized the NIA's "Current State Investigation for the Digital Divide of the Disabled – 2013," and performed multiple regression analyses targeting 1,862 respondents with regard to the information accessibility of PCs, and 981 respondents concerning the information accessibility of smart devices.

The factors that influence the information accessibility of PCs, or the digital divide for PCs, are the sociodemographic factors of age and number of years of education, and the economic factors of employment status and having more than KRW 3 million in household income. As to the factors influencing the digital divide for smart devices, the sociodemographic factors include sex, age, and number of years of education, while disability factors include the period of disability occurrence and economic factors include having a household income of over KRW 3 million. Therefore, the common factors that influence the digital divide for both PCs and smart devices are the sociodemographic factors of age and the number of years of education, and the economic factor of having a household income over KRW 3 million. Based on these results, the following suggestions can be made for reducing the digital divide affecting the disabled.

Firstly, this study determined that the lower a person's age, the less he or she is affected by the digital divide for both PCs and smart devices. This means that the older disabled people are, the lower the information accessibility of PCs and smart devices are to them. Therefore, a method for expanding ICT education for middle-aged and older disabled persons must be considered.

Secondly, this study makes it clear that the more years of education people have, the less they are affected by the digital divide for PCs and smart devices. Therefore, in order to narrow the digital divide, diverse ways must be found to enable less-educated disabled persons to access information.

Thirdly, when a person's household income is more than KRW 3 million, the effects of the digital divide for PCs and smart devices are decreased. In order to reduce the digital divide for disabled persons with low incomes, the accessibility of information should be increased, by using regional community resources from sources such as public institutions, NGOs supporting the disabled and disabled welfare centers [17]. Active policies are required, such as those that construct environments in which low-income disabled persons can utilize the Internet, as well as those that reimburse expenses resulting from improving internet literacy.

This study carries significant meaning, as it analyzes the factors that influence the digital divide for both PCs and smart devices. However, it faces a limitation in that it does not identify influencing factors affecting specific disability types. Therefore, a new analytical method is needed for future studies, which can identify these factors.

References

[1] OECD. (2001). Understanding the Digital Divide. OECD.

[2] NTIA. (1999). Falling through the net: defining the digital divide: a report on the telecommunications and information technology gap in America. Washington, D. C.

[3] Monlar. (2002). Explanation frame of the digital divide Issue. Information Society, 4.

[4] Selwyn, N. (2002). Defining the digital divide: developing a theoretical understanding of inequalities in the information age. Cardiff university school of social sciences occasional paper.

[5] Haywood. (1998), Global networks and the myth of equality: trickle down and trickle away?, in Loader, B. D. (ed). Cyberspace Divide: Equality, Agency and Policy in the Information Society, London & New York: Routledge.

[6] Kim, M. & Kim, J. (2002). Theoretical and policy-related discussions on the digital divide. Korean Journal of Sociology, 36(4).

[7] National Computerization Agency (2001). Study into information technology accessibility guidelines for information access for the disabled.

[8] Na, W. (2002). The digital divide and information communication access for the disabled. 10 years of Asia-Pacific Disabled Persons (1993-2002) Research Paper Compilation. Korean Society for Rehabilitation of Persons with Disabilities.

[9] Jo, J. (2003). The information accessibility for the disabled: Focusing on the type and intensity of disability. Korea Journal of Population Studies, 26(2): 147-173.

[10] Katz, J. & Aspden, P. (1997). Motivations for and Barriers to Internet Usage: Results of a National Public Opinion Survey, In Interconnection and the Internet, Gregory L. Rosston and David Wasterman (ed.), Lawrence Erlaum Association Publishers, Mahwah: New Jersey, pp79-84.

[11] Moss, J. (2002). Power and the digital divide. Ethics and Information Technology, 4(2), 159-165.

[12] Choi, M. & Yoon, Y. (1998). The gender divide in information ability: A social issue? Journal of Cyber communication, 2: 68-98.

[13] Kim, Y. (2000). Female information orientation and policy assignment: Focusing on the female information orientation policy of the Ministry of Information and Communication. Journal of Women's Studies, 10(1): 57-69.

[14] Hudson, H. E. (2000). Accesse to the Digital Economy: Issues in Rural age Developing Regions.

[15] Waddell, C. D. (1999). The growing Digital Divide In Access for People with disabilities: Overcoming Barriers to Participation.

[16] Baek, S. (2003). A study into factors that influence information inequality. Korean Journal of Social Welfare Studies, 22: 81-107.

[17] Lee, J. & Kim, Y. (2011). A study into the influence of socioeconomic characteristic of the auditory disabled on the occurrence of digital divide: Focusing on the mediation effect of language skills. Korean Journal of Rehabilitation Research, 15(4): 159-182.

[18] Song, H. (2006). Study into factors influencing the reception of welfare information services to decrease digital divide for the disabled. Ph.D. graduate thesis for University of Seoul.

[19] Kang, D (2002). A comprehensive analysis of the digital divide factors for disabled persons with employment. Journal of Vocational Rehabilitation. 12(2): 23-42.

[20] Kim, S. (2008). The influence of information access by the deaf and dumb persons on their self-reliance. Master's degree thesis, Kyungnam University.

[21] Hoffman, D. L., & Novak, T. P. (1996). Marketing in Consumption: Emerging Concepts, Methods and Propositions. Journal of Marketing, 6, 50-58.

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Design of Knowledge Management System with Geographic Information System

Angga Hidayah Ramadhan, Luciana Andrawina, M. Azani Hasibuan

***Abstract*—**Data will be as a core of the decision if it has a good treatment or process, which is process that data into information, and information into knowledge to make a wisdom or decision. Today, many companies have not realize it include XYZ University Admission Directorate as executor of National Admission called Seleksi Masuk Bersama (SMB) that during the time, the workers only uses their feeling to make a decision. Whereas if it done, then that company can analyze the data to make a right decision to get a pin sales from student candidate or registrant that follow SMB as many as possible. Therefore, needs Knowledge Management System (KMS) with Geographic Information System (GIS) use 5C4C that can process that company data becomes more useful and can help make decisions. This information system can process data into information based on the pin sold data with 5C (Contextualized, Categorize, Calculation, Correction, Condensed) and convert information into knowledge with 4C (Comparing, Consequence, Connection, Conversation) that has been several steps until these data can be useful to make easier to take a decision or wisdom, resolve problems, communicate, and quicker to learn to the employees have not experience and also for ease of viewing/visualization based on spatial data that equipped with GIS functionality that can be used to indicate events in each province with indicator that facilitate in this system. The system also have a function to save the tacit on the system then to be proceed into explicit in expert system based on the problems that will be found from the consequences of information. With the system each team can make a decision with same ways, structured, and the important is based on the actual event/data.

***Keywords*—**5C4C, data, information, knowledge.

I. Introduction

SELECTION of student candidate admission in XYZ university is one of assignments XYZ University Admission Directorate that has been going on since 2006 until 2014 give good results against the new admissions process in all institutions under XYZ University. Activity that conducted workers to held the selection start from sale the pin for registrant of student candidate. Total of pin sold data become indicator and achievement of this division. Therefore, total of pin sold must meet the target as much as possible.

However, based on the interview, during the time there are many problems that difficult to be solved if the total of pin sold have not meet the target.

A good decision is a decision that has a clear base. The base usually takes from the real information that is converted by data. Generally, data represent a structured codification of single primary entities, as well as of transactions involving two or more primary entities [19]. Besides represent the fact, data also represent the object or event [12]. Thus it can be concluded that information is the result of data processing which is more easily understood and meaningful that describes an event and facts. All this time all of worker in Admission Directorate find the potential market rely on his/her feelings that they get from his/her experience and it is not good if it is not guided by the data, because the perception everyone could have been different, or someone could be wrong if the data does not take sides in it, that means they have not yet make the data as the basis of a decision and the data are only for reports and documentation that is not used at all to support the productivity of employees in decision-making and there is no an evaluating performance. It is necessary for execution of a system that can help improve their productivity and make a decision that will be based on the data with easy and convenient to use. Later the system will be created based on variable attribute data to be displayed, making it easy for workers to seek what data they need to help them decide something. If this information system does not exist or is not used then the workers will not get the productivity effective and efficient decisions in their work

The solution is an information system which is Knowledge Management System (KMS) with Geographic Information System (GIS) that needs feature or tools which have 5c4c Knowledge Conversion to convert data become information then information become knowledge [11]. GIS in this case, only use to make visualize data that adjust to make condensed and comparing process in Knowledge Conversion in order users can better understand their customers and prospects, where these customers or prospects are located, and target them with tailored messages designed just for the target segment [1], [3], [7]. GIS also visualize of data that use some indicator which indicates conditions of each spatial data.

II. Method

A. Conceptual Model

To build the information system needs some method that in this case uses waterfall method. Methods are classic and systematic which is build the software or application regularly [16]. Based on the name "Waterfalls" are systematically to does next process must be done in the previous process. On Fig. 1 explain about conceptual model. Based on the problem, this research has purposes to help the admission directorate team to answer the problem. The solution is to make a system to help the admission directorate team make decision

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knowledge based on the Knowledge Management System (KMS) with Geographic Information System (GIS). This system is a development of an existing system that is BosAdmin that only responsible of registration system to buy pin in each path of selection of registrant/ student candidate. However, BosAdmin have not good data management and process as functions for utilizing data on decision. Besides, BosAdmin should not have a lot of database because it can interfere of registration activities and therefore must be removed every year, therefore must be made other system that can manage the data, then the BosAdmin transfer and insert the registrant data to the master table database (information data of pin sold) that processed by Information System KMS with GIS 5C4C method. With this system each team can make a decision with same ways, structured, and the important is based on the actual event/data.

B. System Working

To support the system and application needs the data as a decision and output of application. A data include province data as a base of venue exam and high school data (school from), path of selection, major data, and information data (pin sold data).

The output is based on the user identification like comparing data between historical data and currently data, analysis data that help entities to decision from evaluate the performance admission directorate team, and the system can define and represent how applications distinguish targets are met and unmet pin each province. This data can show the condensed and the comparing with visualize data use graphic and others that can indicate how data target met or not. This output can be translated by coding. The programming is use Object Oriented Programming (OOP) that make a procedural and function based on the user needed [6], [8], [13], [18].

Based on the Fig. 2 to make a Knowledge Management System with Geographic Information System (GIS), start from convert data into information use 5C and information into knowledge use 4C. Data characteristics (attribute and spatial) can be quantitative and/or qualitative in nature. Attribute data is often referred to as tabular data [2].

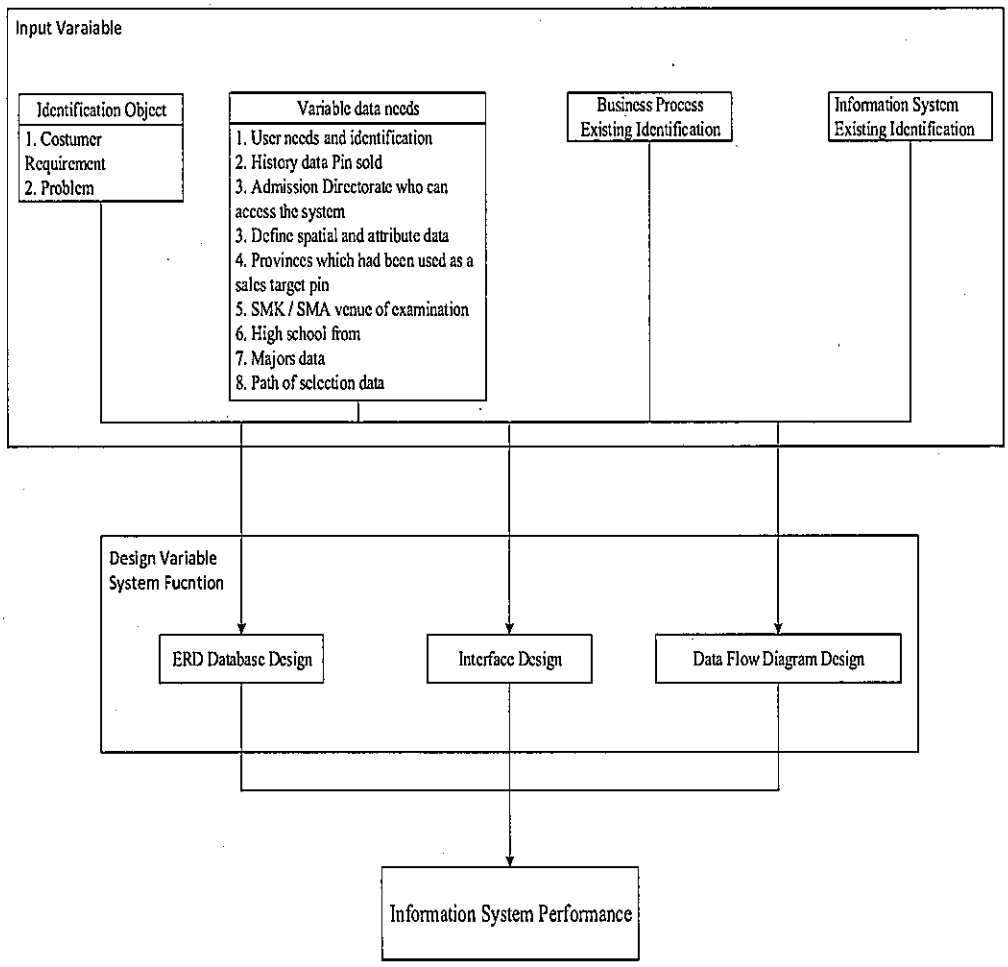

Fig. 1 Waterfall Model and Conceptual Model

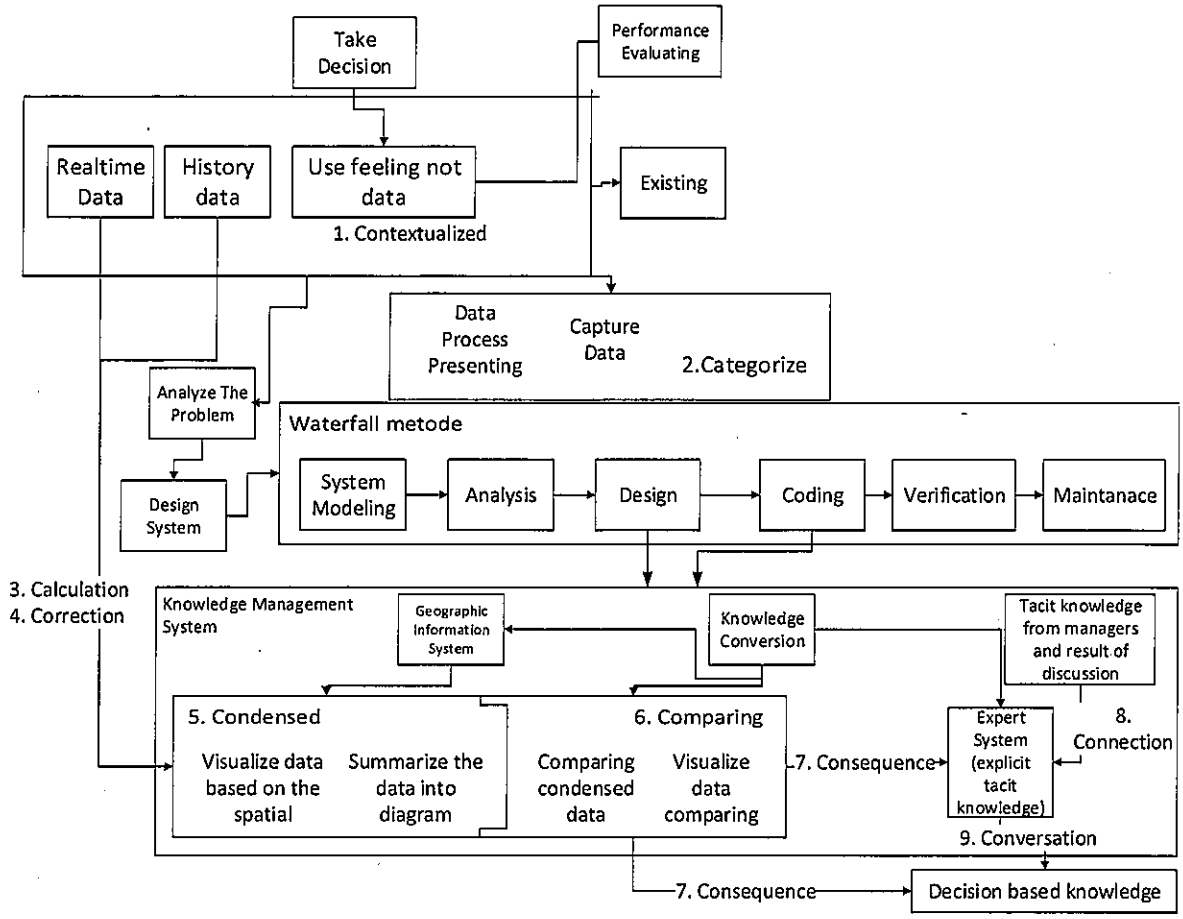

Fig. 2 Process System Working

III. System Analysis

Information system is a system that provides information for management decision-making and also to run the company's operations, in which the system is a combination of people, information technology and procedures are organized [4], [20]. Based on the statement known that information system must be managed to make a decision making so that needs an analysis system before the development of software

A. Business Process Identification

In XYZ University Admission Directorate, some sub or functional division that responsible to documentation of data there is sales and data analysis sub division. Marketing or selection event is held by marketing and cooperation and, planning and selection event that defined by users in the system. So, sales and data analysis team is just the support of the event for documentation of data that still have not manages and process their data on the information system form, in order all of workers especially managers and users in the core process of function can utilize data quickly and accurately as basis of decision when they work. On the Fig. 3 explain about how the sales and data analysis support the core process of this directorate.

B. Business Process Suggestion

This research analyzes critical activity on any support process in the sales and data sub division. There are some critical activities to be improved that explain on Table I. By making, this information system is expected this critical activity can be eliminated and decision of all core process activity made based on the data.

C. Data Flow Diagram (DFD)

Data flow diagram (DFD) is diagram that uses notations to describe the flow of the data systems, which use very helpful to understand the logic of the system, structured and clear [9]. DFD also is alternative that used to information system design and elaboration of context diagram clearly. DFD divided by several levels, basic level or zero level, first or second level that as needed details of information system design. The DFD Level 1 that explain process of the generally system can be seen on Fig. 4. Process specification that describes information of DFD that explains on the Table II.

D. Process Structure

Process Structure will explain hierarchy in process from high level until lowest level. Process Structure can show connection among process. Process Structure will break down each process until the process detailed in accordance with process on data flow diagram that explained on Fig. 5.

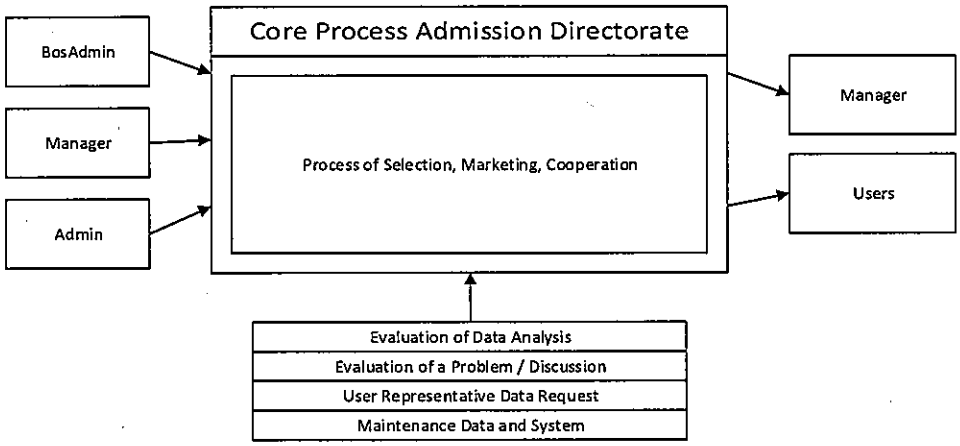

Fig. 3 Black Box of Process

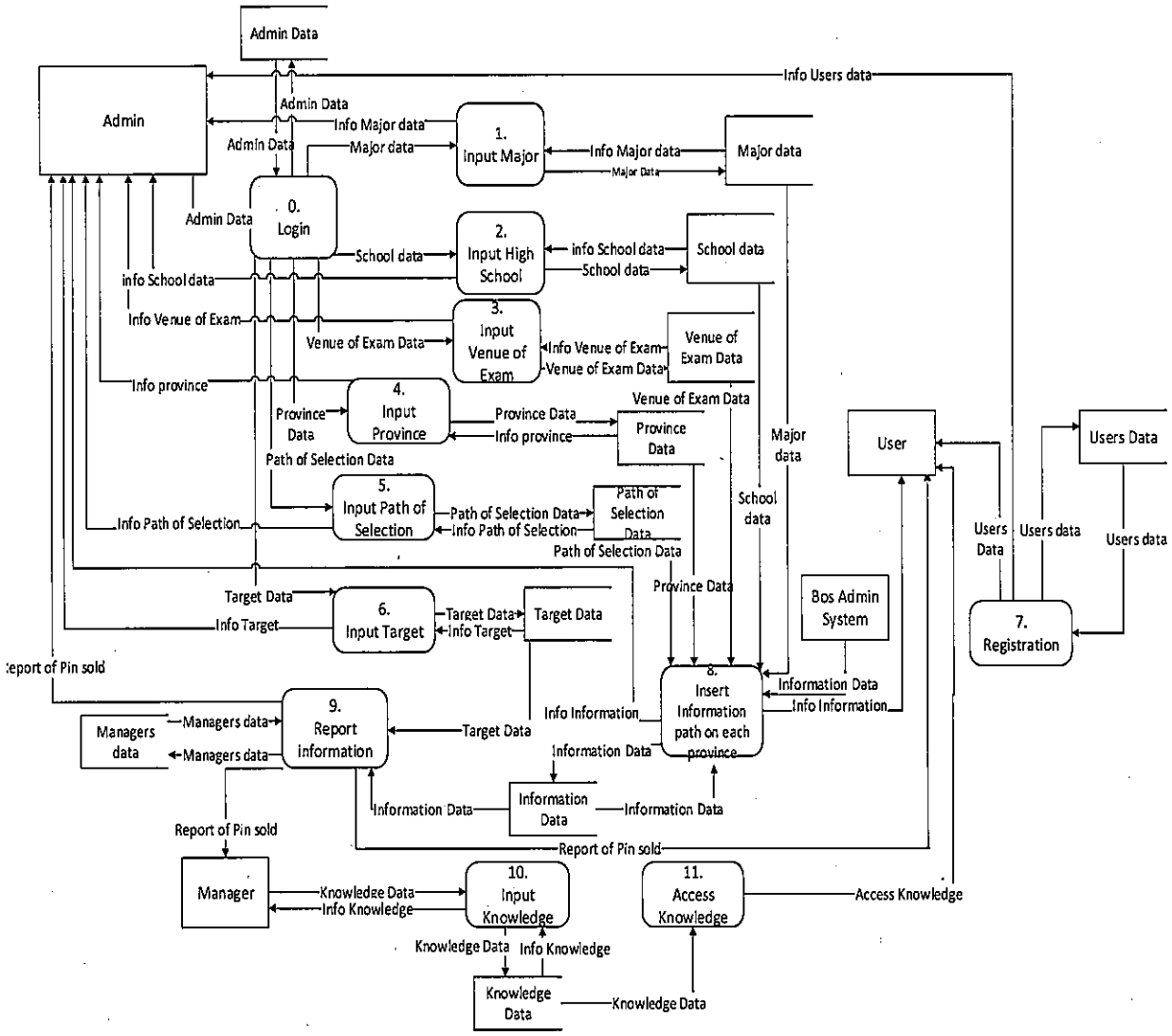

Fig. 4 Data Flow Diagram Level Zero

TABLE I
CRITICAL ACTIVITY OF BUSINESS PROCESS EXISTING

Support Process	Activity	Analysis
Evaluation of a Problem / Discussion	Make the report for all province in Indonesia	Made by retrive the database and calculate use excel to make a report. This method can be a waste of time and risk of human error
	Retrieve data in a boss admin system	Made by retrive the database and calculate use excel to make a report. This method can be a waste of time and risk of human error
	Make the report to visualize the data use excel	Made by retrive the database and calculate use excel to make a report. This method can be a waste of time and risk of human error
	Noted the results of the discussion and evaluation	Users must noted the problem solving and result of discussion to answer the problem. In this way it is traditional because all of worker have different background that effect all worker does not guarantee know the results of the discussions even at risk to forget, moreover the workers are new workers so it can happen lack of knowledge. This method may also cause the knowledge gap among managers who have the experience and capability, senior and new workers
Evaluation of Data Analysis	Make the report of pin sold	Made by retrive the database and calculate use excel to make a report. This method can be a waste of time and risk of human error
User Representative Data Request	Request of the data to Data Analysis and Sales (history data from this year)	Users that as a representative in each province request the data from data analysis and sales function. Request conducted by the ticketing system (kanban). Users can not access the system that affect activity can be prolonged. Therefore, needed a system that could allow users to read data information wherever they are.
	Make the report based on the request each province	This activity conducted by data analysis and sales function. To show the data and information is based on excel that retrive data from BosAdmin System. So that users have to wait long and risk losing information documents
	retrieve data in a boss admin system	This activity conducted by data analysis and sales function. To show the data and information is based on excel that retrive data from BosAdmin System. So that users have to wait long and risk losing information documents
	Make the report to visualize the data use excel	This activity can be removed if the system can directly visualize the data that affect cut the time. However at this time the BosAdmin system only generates tables. Therefore, to facilitate reading data needs some tools that visualize the data in order can read all of workers.
	Print the document report in each province	Dependence on documents would be very risky if they lost their document
	Get the document of report	Dependence on documents would be very risky if they lost their document
Maintenance Data and System	Calculate and visualization the data based on all variable.	After Retrieve the data in all of years on table forms to facilitate reading and summarizing the data in the book, data analyze and sales visualize the information use tools like excel that causing a long time and human error
	Delete data in system	This activity is not to be conducted in the information system, because the history data is needed for evaluation or sales strategy. Therefore, the system must be able to store data in order conducted comparing stage which makes the data more useful and beneficial to help decision or strategy.

TABLE II
PROCESS SPECIFICATION IN EACH PROCESS OF DFD

Process Name	Information
Login	1. Before input all of variable or data, admin must input their data to use system 2. After that, sistem will send the data to databse make the appropriating with the database data 3. Admin can use the system, adjust with his authorized.
Input Major	1. Choose the menu input data, then it will split into all input menu 2. Choose the input Major, then add, edit, and delete it. 3. Then system will send the data into database, and as the info major data in admin system to controlling
Input High School	1. Choose the menu input data, then it will split into all input menu 2. Choose the input School data, then add, edit, and delete it. 3. Then system will send the data into database, and as the info School data in admin system to controlling
Input Venue of Exam	1. Choose the menu input data, then it will split into all input menu 2. Choose the Venue of Exam Data, then add, edit, and delete it. 3. Then system will send the data into database, and as the Info Venue of Exam in admin system to controlling
Input Province	1. Choose the menu input data, then it will split into all input menu 2. Choose the input Province Data, then add, edit, and delete it. 3. Then system will send the data into database, and as the Info province in admin system to controlling
Input Path of Selection	1. Choose the menu input data, then it will split into all input menu 2. Choose the Path of Selection Data, then add, edit, and delete it. 3. Then system will send the data into database, and as the Info Path of Selection data in admin system to controlling
Input Target	1. Choose the menu input data, then it will split into all input menu 2. Choose the Target Data, then add, edit, and delete it. 3. Then system will send the data into database, and as the Info Target data in admin system to controlling
Registration	1. User make the registration with fill the biodata into the system and the system will save into database 2. Then system will send the data into database, and as the Info user data in admin system to controlling and cek for the security
Insert Information each path on each province	1. Bos admin will insert/upload the data from registrant in its system. 2. The information data saved to the database in that system, Then the system will send the info information to all of entity to be processed
Report information	1. All of information data be processed become a report of pin sold 2. Then Target data compare with the information data t get the difference of target data or just total of pin sold 3. Then report of pin sold be processed adjust with the variable that requested by entities in the system too see the information or visualizing data
Input Knowledge	1. Managers will input the knowledge data from his/her experience or result of discussion 2. Knowledge data is saved to the database , then the knowledge data become the info knowledge to make a test or controlling of expert system in the system that conducted by managers
Access Knowledge	After users in the system, users can acces knowledge of expert system if their have a trouble in marketing activity based on the data and information.

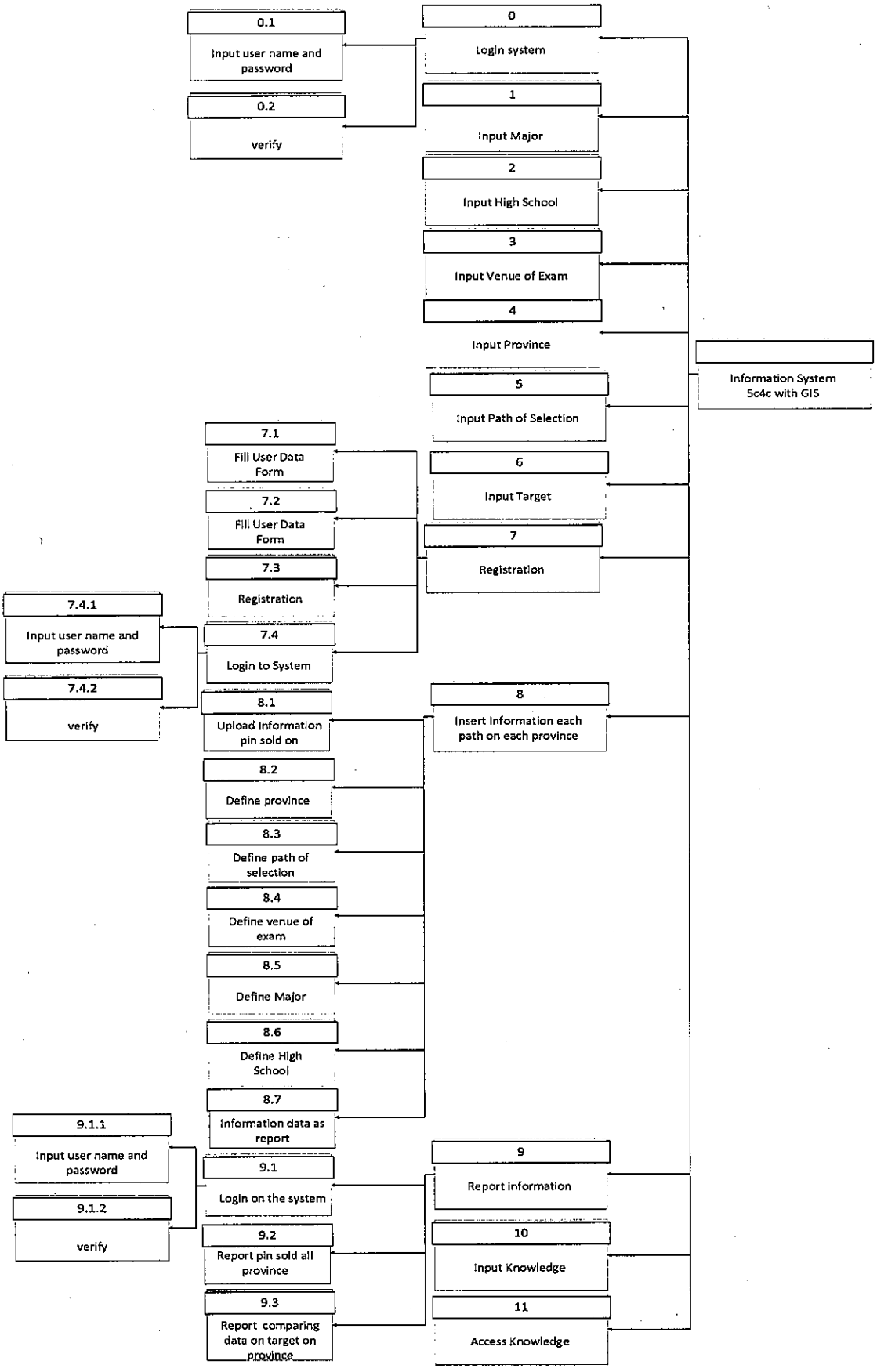

Fig. 5 Data Flow Diagram Level Zero

E. Entity Relation Diagram (ERD)

Entity data diagram shows about how data moved from entity to another entity and indicate how the relation between data entity [17]. Entity relation diagram also explain about attribute data in every data and cardinality among entity. Whole of ERD be explained on Fig. 6. The data that used on the ERD as follow:

1) Spatial Data/Province
   Data spatial collected from enactment of Indonesia that Indonesia administration divided by 34 provinces. This data used to define the spatial data as based on the map to define strategy and target, which is usually done by the team. Marketing team usually use the province to define location of the target to sell Pin, location of examination, and find potential school. Each province has different treatments to choose the right strategy because each province has different condition. This Data only define province in Indonesia because segmenting Admission Directorate in all of around it.
2) Venue of Exam data
   Venue or exam data select by marketing team in each province as lace for exam. Usually use the school that has partnership with XYZ University. This data on the system can add, change or delete by admin to define venue of exam on each province. Data dynamically adjust with team needs. The data have relation with information data.
3) Target Pin Sold in Each Province Data
   Target pin sold is to define target in each province to achieve goals of the marketing team in each province based on sold pin. Target becomes indicator in each province to define how many pin sold and rest. So, it becomes evaluation of marketing team to implement, modify, change, or determine the next strategy to achieve the target. Usually the marketing team define the target by Pin sold at the previous year, but on the system, target can change with adjust user/marketing team needs. Target pin sold data have relation with spatial province data.
4) Type Path of Selection data
   A Type path of selection define path of selection on the system. Path of the selection is usually held in each province on the same time and have a different type. The marketing team can held one of the paths of selection more than one like as has been done. Each type of selection have a different exam and treatments like price of pin until other things technically until the student candidate become official students. Numbers of each path selection adjust with the strategy or target Pin sold would be achieved on each province. Each year marketing team also usually proposes new type of selection like at 2015 have partnership. So, system must adjust this data to input dynamically.
5) Choice of Majors/Department Data
   Majors that offered for registrant or student candidate very much that divided by faculty and majority. XYZ University have seven faculty and 25 majority include postgraduates, undergraduate and vocation school. As a condition to improve and quality of teaching, University usually look their registrant to choice their majority, and it is one of indicator of assessment of Badan Akreditasi Nasional Perguruan Tinggi (BAN-PT) to define how quality of this department/majority. Therefore, system is made must be able to store the data history and shows the data of choice for student candidates and comparing with each priority choices.
6) High School Data
   High School from is define registrants from of school. This data must be stored to define which school from of registrant, which follows path of selection XYZ University selection. This data must be processed into information to define which school has the potential to be used as if it were tests, roadshows, try-out, or other marketing activities or the school can be cooperative with XYZ University. This data have relation with province data to define location province of the high school.
7) Information Data
   Information data is data that will process to get the information or knowledge. Information data obtained from number of registrants that buy pin to follow the exam in each path of selection on each province. This data input by registrants with the others Admission Directorate system namely BosAdmin system that has a function for registration of applicants. BosAdmin system then upload/ insert/ transfer the data number of applicants to the KMS with GIS system 5C4C with a database that has been appropriate. This data then count the number of registrants processed and compared with the target data and data will become the information for the users to analysis, trend market on each province or each type of selection path, define next strategy after information convert into knowledge and others. This data will be save on the database management system dynamically in order previous data can be used to the purposes analysis by users or entities. It is different with the BosAdmin system that every year data have removed. So, system not only process single data but can process multiple data without deleted previous data in every year to use the system even using the data to analysis for users or entities to make a decision. Information data have relation data with all of attribute data.
8) Tacit Knowledge Information
   Tacit Knowledge is get from the Manager that has an experience to solve problem, besides manager have discussion with other worker. Actually this data to make explicit data use Socialization, Externalization, Combination, Internalization (SECI) model data, but this research make assumption to explicit tacit and save the knowledge into system that can tacit knowledge based on the discussion or manager experience can be communicated. Therefore, this research passes several steps to convert tacit on the explicit like internalization, but still do some proses like socialization to transfer the knowledge on other worker, externalization make the tacit on the system and save as database, and Combinations to organizing the tacit systematically on the system in order

can used by workers. Tacit knowledge then, can use on the expert system function. Tacit knowledge on the system can become decision variable of recommendation of problem to define how the target fill or solve the problem. So, the tacit knowledge stored on the system must be made rightly.

9) Entity Data

To make the system work properly and in accordance with its function, System need entity. An entity is a person, place, event or concept that the information will be recorded. Entity differentiated by role that carried each in the system. The entity has an important role in Database Systems, because if there is no set of entities Database Systems will not be formed. Database System formed from a single data and put together then connected to produce clear information to users of the Data Base Systems. On this system based on the research, system needs several entities to carry out their respective roles. The roles of entity in detail are explained on Table III.

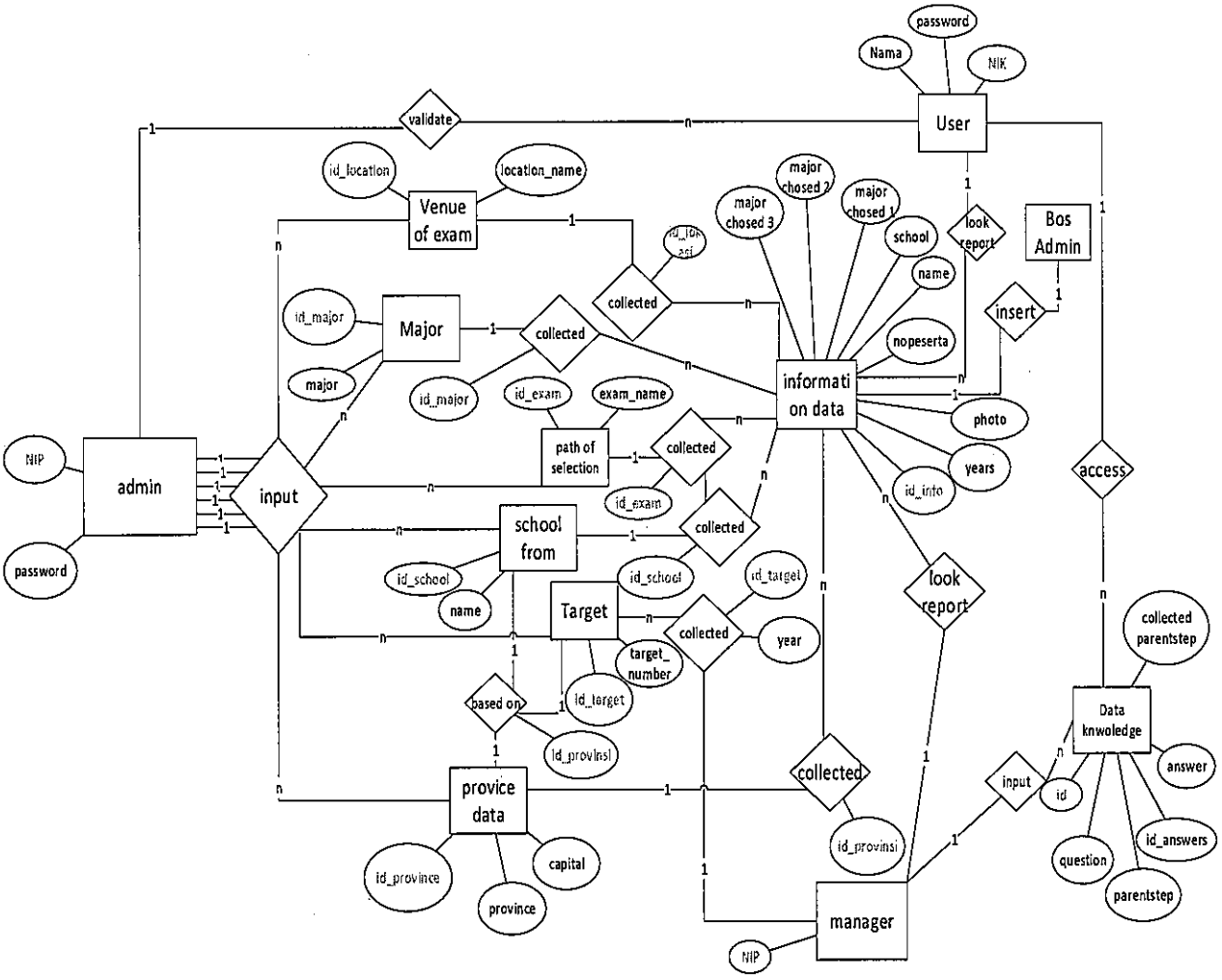

Fig. 6 Entity Relation Diagram

IV. INTERFACE OF SYSTEM

There are some function that include mathematic model to show and comparing data, and also expert system. The information system must have functions that adjust with the problem background and have several steps that have been done until build the system [5]. Fig. 7 shows one function of interface of the system.

There are the functions of this information system:

1. Input function

   This menu is having function to input data needs. However, data pin sold is not directly input from entities on this system but insert directly from BosAdmin system. Besides, this information system can edit, delete, and read the data based table view model.

2. Chart Menu

   This menu has function to show the chart, calculation, categorized of variable and other based on 5C method to convert data into information, which is contextualized to collected the data in all of pin sold after data transferred

by BosAdmin System to this information system, categorized to process to make category data based on the variable like path of selection or others, calculated to calculate the total pin sold based on the category, corrected to is removal errors that in this case this value not done because the data does not contain the elements of the error, and condensed to summarize the data based on the chart that facilitate on this function based on selected categories by entities to be used. Moreover, this functions perform comparison between any information that has been summarizes known as comparison and consequences to find the consequence, event, and problem from information to help the entity find the best decision or wisdom. That value as of 4C method to convert information into knowledge in order that data and information that have a more meaning as knowledge. Chart menu have mathematic model with count the data information and comparing with the target to indicate target have or not achieved.

3. Map Menu
   Map menu is show the data based on the spatial data that can indicate how targets that achieved on each province and known as Geographic Information System (GIS). There are some indicator to show level of importance and priority, which province should be treated first. Indicator becomes outermost layer as approach between spatial data and attributes data [14], [15]. The indicator based on the color. Red indicate away from target, it means pin sales are still far from the target, yellow indicate pins are sold almost reached the target, and green indicate target achieved or more. Besides chart menu, Map menu also as one of function to generate 5C method especially condensed to visualize the information based on the spatial data.
4. Expert System
   After the information have compared from previous menu, the information must be have connection to find the connection or relation between the information and the problem based on the consequence of information to find the best decision or answers of the problem as value of 4C method. Therefore, needs the function to find the connection and the right answers to the problem based on the information. This menu has function to input the tacit knowledge of problem solving based on the manager experience or discussion from the problem that found of information, but input menu is only duty of the manager. Users/workers can access the expert system to solve their problem that has connection of information that had found earlier and find answers from tacit knowledge which already on explicit form on expert system. This expert system is also able to recommend a course of action the user to be able to apply the correction. The system utilizes reasoning capabilities to reach a conclusion [10].
5. Chat Forum
   After discover connection and decision of the problem, to make the decision is better needs the conversation function to find views, opinions and actions relating to information to others. This menu has function to make a conversations and coordination among worker and manager that access this system. Chat forum is a representing of 4C as knowledge management especially on conversation steps.

TABLE III
ENTITY DATA AUTHORITY

Entity	Role / Authority	Form
Admin	- Conduct input of venue of exam data, target data, path of selection data, province data,high school data, Major/department data - Update and check the data that has been entered, add, or replaced - Create reports drawn from the system	Sales and Data Analysis Sub Division ; Human/ worker
User/ represent ative of province	- Have authorithy access expert system to find knowledge of problem solving - Collaborate with managers to make decisions based on report data - Look report of his work on the system and evaluate with manager	Marketing and Coorperation , Planning and Selection Sub Division; human/worker
Manager	- View the work of the representatives - Decide and make the targets to be achieved in each province - Input Explicit knowledge based on the discussion or manager experience on the system in order can acees for the representatives	National Admission Manager ; human/worker
Bos Admin	Insert or transfer all of information data from registrant Automatically	System

V. CONCLUSION

To manage the data of pin sold and help Admission Directorate to talk about data and make the data more understandable, system have to convert data into information and information into knowledge, and method that can solve and meet the requirement is make the system with knowledge conversion 5C4C method. With this information system, the team will be easier to decide something, resolve problems, communicate, and quicker to learn if there are employees who do not have experience. To build that system needs some tools that can define the process, function, needs and others of a system before develop the system. Until the completion system development also requires testing by performing user acceptance test to indicate functions within the system works well, according to the process that was made before, and in accordance with customer needs to answer their problem. From the research that has been done can be concluded as follows:

1. To convert data into information have several steps use 5C (Contextualized, Categorize, Calculation, Corrected, Condensed) and information into knowledge use 4C (Compare, Consequences, Connection, Conversation). This ways is needs to help and support all of worker to make a decision based on data.
2. To make a knowledge management system that convert data into information needs the information system that can function as the knowledge management system 5C method that visualize data based on the some variable in order all of entities make the decision or wisdom based on the data. To make a Geographic Information System that can make visualizing on spatial needs the system function

that can visualize comparing between reports of pin sold and target based on spatial data layers that have indication that can help managers to make a decision or wisdom based on the events that occur in every spatial layer. To make a knowledge management can save tacit knowledge of managers and result of discussion as the function of convert information into knowledge 4C method needs the expert system function that can use by users that can explicit that tacit knowledge in the system function to help them in deciding issue even employees who do not have experience and also prevent the discussion of recurring problems if found the same problem. All of function made in Knowledge Management System with Geographic Information System for Admission Directorate Telkom University.

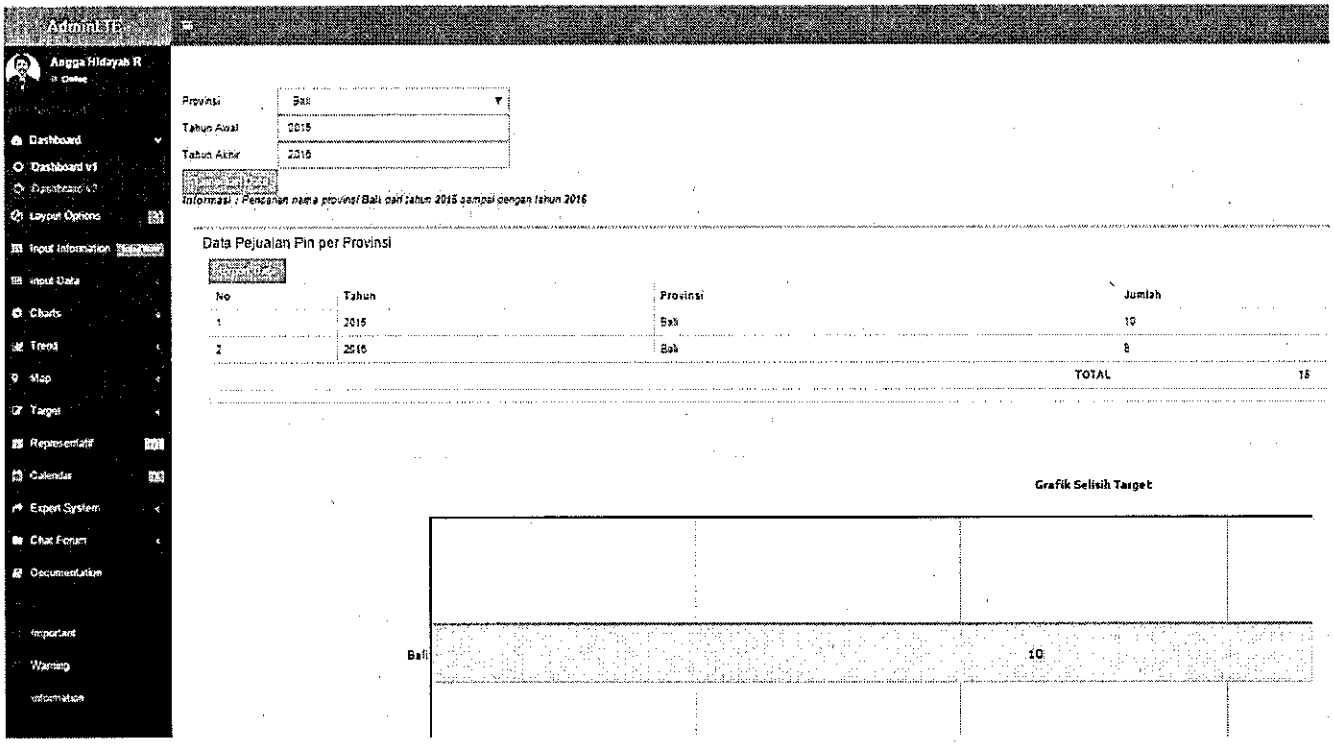

Fig. 7 Interface of the system

REFERENCES

[1] Amos, P. (2009). GIS and Business Applications. Pennsylavania: The Wharton School.

[2] Buckley, D. J. (1997). The GIS Primiere: An Introduction to GIS. Colorado: Pacific Meridian Resource, Inc.

[3] By, R. A. (2001). Principles of Geographic Information. Enschede: The International Institute for Aerospace Survey and Earth Sciences (ITC).

[4] Dennis, A., Wixom, B. H., & Roth, R. M. (2012). System Analysis and Design. Rosewood: John Wiley & Sons, Inc.

[5] Fillipi, S., & Cristhoani, I. (2010). The Design Guidelines Collaborative Framework. Trento: Springer.

[6] Gutmans, A., Bakken, S. S., & Rethans, D. (2004). PHP 5 Power Programming. Maryland: Pearson Education Inc.

[7] John E. Harmon, S. J. (2003). The Design and Implement Geographic Information system. Danvers: Jhon Wiley & Sons, Inc.

[8] Kabir, M. J. (2002). Apache Server 2 Bible. New York: Hungry Minds, Inc.

[9] Kendall, K. E., & Kendall, J. E. (2011). System Analysis and Design 8th Edition. New Jersey: Pearson.

[10] Kusumadewi, S., & S, H. (2003). Artificial Intelligence (Teknik Dan Aplikasinya). Yogyakarta: Graha Ilmu.

[11] Liewbowitz, B. (1999). Knowledge Conversion. CRC Press: Boca Raton.

[12] Munir, & Setiawan, W. (2006). Pengantar Teknologi Informasi: Basis Data. Bandung: Universitas Pendidikan Indonesia.

[13] Pesse, S., & O'Mullan, A. (2014). Learn Javascript. GitBook.

[14] Pick, J. B. (2005). Geographic Information system in Business. London: Idea Group.

[15] Pinto, N. J. (2008). Managing Geographic Information System. New York: The Guilford Press.

[16] Pressman, R. S. (2001). Software Engineering: A Practioners Approach. New York: MacGraw-Hill.

[17] Sharma, N., Perniu, L., Chong, R. F., Iyer, A., Nandan, C., Mitea, A., et al. (2010). Database Fundamentals Ideal for Application Developer and Administrator. Markham: IBM.

[18] Valade, J. (2010). PHP & MySQL for Dummies. Indianapolis: Wiley Publishing.

[19] Vercelis, C. (2009). Business Intelligence: Data mining and optimization for decision making. Milan: Wiley.

[20] Wang, S., & Wang, H. (2012). Information System and Design. Florida: Universal-Publisher.

Teaching English To Rural Students: A Case Study Of A Select Batch At Ssn College Of Engineering, Chennai

Martha Karunakar

Abstract—There exists a wide divide between the urban and the rural students in a vast country like India. This dichotomy is seen in the resources available to them, like the learning facilities, the infra-structure, the learning ambience and meeting of their basic needs of food, clothing and shelter. This paper discusses the effect of English language teaching as a Bridge course on a select batch of rural students at an Engineering college in Chennai, one of the four Metros of India. The study aims to understand how the teacher input and the teacher- peer-student interaction facilitates the acquisition of the basic structures of the English language to a group that is minimally exposed to the language. The objective in conducting the Bridge Course is to integrate these rural students into the mainstream and empower them in terms of English speaking ability; to enable them to comprehend their respective engineering classes where the medium of instruction is English and also to be able to interact with their urban peers. This program is conducted prior to the start of a regular academic session to equip them face the rigors of engineering education. The study is placed within the framework of Interaction theory in second language acquisition. The study evaluates the impact of linking theory and practice by implementing meaningful interaction not only within classrooms but also in the common areas. By providing intensive comprehensible input, it is anticipated that participant's level of English language improves. The teaching methods and classroom activities included individual and group participation, encompassing all the four skills of listening, speaking, reading and writing (LSRW). The diagnostic tests that were administered before the commencement of the course and the exit test after the completion were used to record the impact of the training.

Keywords—comprehensible input, interaction, rural students, teaching English

1.INTRODUCTION

Hard as it maybe to believe, particularly in the twenty first century, where scientific and technological advances have resulted in a global village, there exists a wide divide between the urban and the rural students in a vast country like India. This dichotomy is seen in the resources available to them, like the learning facilities, the infra structure, the learning ambience and meeting the basic needs of food, clothing and shelter. English is taught as a second language in India and acts as a unifying factor in terms of accessibility to global opportunities and a higher standard of life.

This paper discusses the effect of English language teaching as a Bridge course on a select batch of rural students at Sivasubramaniya Nadar College of Engineering (SSNCE) in Chennai, one of the Metropolitan cities of India. The study aims to understand how the comprehensible teacher-peer input and the teacher- peer-student interaction facilitates the acquisition of the basic structures of the English language to a group that is minimally exposed to the language.

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The objective in conducting the Bridge Course is to integrate these rural students into the mainstream and empower them in terms of English speaking ability; to enable them to comprehend their respective engineering classes where the medium of instruction is English and empower them to interact with their urban peers. This program is conducted prior to the start of a regular academic session to equip them face the rigors of engineering education in an urban environment.

The study is placed within the framework of Input and Interaction theory in second language acquisition. The study evaluates the impact of linking theory and practice by implementing meaningful interaction not only within classrooms but also in the common areas. By providing intensive comprehensible input, it is anticipated that participant's level of English language improves.

2.1 CONTEXT OF THE STUDY

SSNCE, one of the premier engineering institutions in India, is an initiative of Dr. Shiv Nadar, the founder of HCL Corporation. Dr. Nadar, the recipient of the 2014 Golden Peacock award, is a well respected philanthropist committed to alleviating the socially marginalised by providing free education. In SSNCE, every year, twenty five students are hand-picked by the management and are provided free engineering education, boarding and lodging facilities. These students hail from rural areas within Tamilnadu, and are toppers in their respective schools.

SSNCE accommodates an eclectic group of students; high income group, urban, English speaking students along with the rural and economically marginalised students. The only unifying factor is that every one of these students has scored a very high percentage in their respective Plus Two (Pre-University) examination. The primary goal in providing this training to the rural students is to equip them with the basic skills of English language speaking, reading, listening and writing in order to integrate them with the mixed ability group of students. It is believed that once they grasp the basics of English required for comprehension, communication and expression, it would enhance their self confidence and personality.

2.2 PROGRAM AIM

SSNCE management understands that the need for learning English Language is no longer a transitional necessity (David Graddol 2010) but an inevitable one. English also is the need of the hour for procuring a well paying job, social status, thereby contributing to upward mobility and an overall well being. So the program aim is to train these less privileged but bright minds to acquire the English language at least to the extent of being able to communicate with others particularly their teachers and fellow students. It is also seen that the English language instead of being a facilitator, acts as an

obstacle for understanding subjects that is taught in their engineering classes. Hence this programme is conducted to bridge the gap.

2.2 DEFINITION OF RURAL

While their geographical location plays a vital role in categorising them as rural students, it is an umbrella term that includes the following conditions: the family background, that is, they belong to socially and economically deprived and marginalised group, their income certificate confirms their income as less than Rs 30,000 per anum; parents are involved in skilled labour like weaving and farming, some parents are engaged in construction work or employed as a daily labourers earning daily wages. Poverty, as a result of failed crops, and owing to under payment for skilled labour in the rural sectors, prevails in most families. Interestingly, these students are also first generation learners.

Some of the other requirements for securing this scholarship are that these students should have studied in rural government schools where medium of instruction is Tamil. They should have scored high marks in all their core subjects and should be school toppers.

On interacting with them, it is learnt that none of these students have had any access to modern technology, internet, personal computers or any modern infrastructure. Only two students had an email account and only four out of the twenty five had mobile phones.

2.3 SELECTION PROCESS

A letter from the college is sent to all government schools in TN villages, even remote ones like Puthoor in Kanyakumari district, Valavallaan in Tuticorin district, Ettamozhi in Tirunelvelli district, just to name a few. The school informs the toppers of this scholarship and makes them fill up the application form which is then forwarded to SSNCE. On receiving the application, it is scrutinised and the eligible students are made to take up an entrance exam which contains an aptitude test, test of English grammar and also attend an interview, through which the final selection is made.

Every year more than 200 students apply and only 25 students are selected. The selected candidates are required to produce a letter from the District C.O. stating that he or she is the topper in his School. These students would generally have a score of around 1100 out of 1200 marks in their Twelfth Standard Final Exams.

This rural student's scholarship is a life changer to all of them. Earlier they have had to face several challenging circumstances and hostile socio-cultural factors that interfered with their studies. After school hours, they would be engaged in household chores; Students from weaver's families usually took to the loom in order to keep the loom running. Hence they had little or no time to pursue their studies after school hours.

They had minimal or no exposure to the English language although English formed part of their curriculum. They did not have access to a computer or the internet through which they could broaden their horizons of knowledge. Also, opportunity to read a newspaper or a magazine in English or watch an English movie was next to impossible. Receiving the scholarship has changed all that.

3.1 THEORETICAL FRAMEWORK: LANGUAGE ACQUISITION

Noam Chomsky while referring to the learning of first language believes that children are born with Language Acquisition device (LAD) which helps them master the significant principles of a language and its grammatical structures. Chomsky argues that linguistic structures are partly innate and reflect a universal grammar. Critics of Chomsky however, are sceptical about LAD. Although they seem to agree that language acquisition may not occur by imitation alone, they argue it may also be due to general learning and interactions with other people.

Chomsky's LAD theory can be applied to the acquisition of second language as well. The theory of imitation does not hold well in the case of these rural students as perhaps maybe the case with their urban counterparts, because there is no role model to imitate. All the conversation at home and most of the instruction at school takes place only in the vernacular or the local language. Hence, these students are not able to model their English language learning on native or good speakers of the language.

Second Language Acquisition (SLA) addresses the fundamental questions of how learners internalise the linguistic system of another language and how they make use of this linguistic system during comprehension and speech production.

3.2 DEFINITION OF INPUT AND INTERACTION THEORY

Comprehensible input and meaningful interaction forms a vital part especially for learners of second language. The nature of interaction is important as it contains input in which messages are understood by the speaker of the second language (Krashen 1985, 1994) and "output" (Swain 1995) which facilitates expression and negotiation of meaning. By interaction, I particularly refer to the conversation that takes place between L2 learner and the instructor and also among the L2 learners and their competent peers.

For any language acquisition to occur 'input' and 'intake' is vital. S. Pit Corder defines input as language that is available from the environment and intake as language that actually makes its way into the learners developing competence (Van Paten and Benatti 2). Interaction promotes both the input and intake as well as helps make changes in their own linguistic output (Swain 1995).

According to Stephen Krashen, a language is acquired through interaction with that language, particularly if there is comprehension of the input they are exposed to (40). Krashen's input hypothesis (1985) states that second language (L2) input must both be comprehended and be at one stage above the learner's current level (i+1) in order to be acquired.

According to Krashen's Input hypothesis, when the language acquisition device is involved, language is subconsciously acquired – while you are acquiring, you don't know you are acquiring; your conscious focus is on the

message, not the form. Krashen terms this "incidental learning" (We Acquire Vocabulary 440).

For the group under study, although conscious efforts are made by them to acquire the second language, much of the input is received from more advanced speakers of the language like some of their urban peers and teachers. In this case study, both input and interaction played a vital role in acquiring language. The students were also taught to negotiate their emotions of fear and embarrassment in using the language, the 'affective filter' which Krashen demonstrates as influencing learning. Appropriate feedback was then given, in order to correct erroneous constructions and reinforce the faultless ones.

4.1 PEDAGOGY

An entry level diagnostic test (KET – Key English Test) was administered to the students to assess their proficiency level in the English language. The test included all the four skills of listening, speaking, reading and writing. So also, a questionnaire to test their personality and emotional well-being was administered. The scores in both the tests were recorded.

It was seen that almost all these students hesitated to speak in English, to the extent that they were apprehensive or nervous to use the language. Probably this has to do with the fact that English is considered an elitist language in India although this attitude is fast changing. The students could construct basic structures in English, but their command over the language was very poor. Interestingly, it was seen that the students were highly motivated, eager to soak in as much information and knowledge as possible.

Although the focus was on learning the English language, the programme imparted a holistic education. Firstly efforts were put in to create a suitable teaching- learning ambience. Since these students are from an economically challenged background, creating a learner friendly atmosphere primarily meant meeting the basic needs of the students such as food, payment of semester fees, boarding and lodging. Free text and note-books were also made available. It also included well equipped language laboratory, technology embedded classrooms, standardised teaching material and intense remedial coaching.

The course was planned for a period of three weeks, before the commencement of the regular first year engineering classes. The day started with exercise and yoga at six in the morning, followed by some personal time and breakfast. Formal classes started at nine with training on the LSRW skills.

The syllabus included, greeting others, introducing oneself and others, framing simple 'wh' questions and eliciting appropriate answers, constructing meaningful and correct sentence structures and speaking on simple topics of current relevance. An email account was created for them, after the first 2 classes, so that, important information could be mailed to them. Also this gave them the opportunity to browse on the internet and learn items of interest.

Every morning, newspapers were distributed and students were encouraged to read it during their leisure. Sometimes, they would speak about an article of interest from the newspaper, in front of the class or discuss a particular news article with their peers.

Since it is largely believed that in SLA, language should be actively used students were encouraged to interact with peers and converse in English even outside the classroom. This included the canteen, common room, hostel rooms or any other common area where they often met each other. Also the students were encouraged not to restrict learning only to classroom but to imbibe from any reliable source like listening to news on English channels. Other sources included watching English movies with English subtitles or in some cases with Tamil subtitles. Clippings of Tamil movies with English subtitles were also viewed. In other words, students were made to 'intake' as much as possible and practise 'output' in every possible situation.

The teaching methods and classroom activities include individual and group participation, speaking exercises like introducing one's self, short speeches on common topics, and pair/ group activities like role-play and group discussion; using of audio-visuals, reading materials, comprehension exercises.

Spoken language was taught and practised every day through various activities like describing and interpreting a picture, summarising a newspaper article, talking about themselves, etc. Modification in pronunciation was done by paying attention to pitch, rhythm and intonation.

Role play and situational conversation was also encouraged for language production. Both these tools serve to animate the teaching language experience. The teacher assumed the role of a facilitator, spectator and participant at intervals. The remaining student audience also gave a feedback to the performing group. Hence the learning experience was two-fold.

Participants were persuaded to learn 5 new English words every day, its etymology and pronunciation and discuss it in the class the following day so that others too would benefit from this exercise. The students were then asked to use these words in their conversation with their friends.

Initially there was a lot of inhibition to use the language outside the classroom. The reasons were several: Peers made fun of them, seniors ridiculed them, they felt tongue-tied, the right words did not come out at the right time, they were terrified of committing mistakes, etc.

Oral corrective feedback and error correction helped the students to rectify their usage. Since they were placed within the comfort zone of students who had similar difficulties in the language, they were not embarrassed to be corrected in front of a group.

Visual scaffolding [1] that included images and words that could be seen and heard was provided with the help of the over head projector. An assortment of pictures like a busy market place, South Indian food thali, streets of NewYork, cow grazing in a village, etc were displayed and students were

asked to describe them in complete sentences with a subject, verb and object and sometimes using adjectives, prepositions and nouns.

Online grammar classes were conducted from 4 to 6pm by a professional online teaching academy. This virtual class was conducted in the language lab and aimed to impart grammar lessons including parts of speech, subject-verb agreement, tenses etc. During this time, the students had a one-on-one interaction with the resource person and hence could ask their doubts and get them clarified privately and immediately.

[1]Scaffolding, a term coined by Jerome Bruner describes the structured interaction between the interlocutor and learner. This term closely resembles Lev Vygotsky's concept of zone of proximal development which is gap between current level and the potential level of development.

This interaction was useful for the students as they had an opportunity to learn without others being judgemental about them or their questions. In general a conscious effort was made to reduce the Teacher Talking Time (TTT) and increase the Student Talking Time (STT) during class hours.

It is proved that we acquire vocabulary and spelling by reading (Krashen 1989). Reading was identified as complementing language acquisition and efforts were made to encourage the target group to read as much as possible. Newspapers were supplied to them every morning. Books containing moral short-stories and biographies of great men in English were distributed. Simple reading comprehension passages were given. Students were made to carefully go through the passage, word meanings were provided and responses elicited which was then followed by error correction.

Although this method of teaching is highly contested, on rare instances, in order to impart the nuances of some English words and sentences it was translated to the vernacular Tamil, as otherwise the students would fail to follow.

The students were constantly made to watch and listen to spoken English either through videos on UTube, or Television. The group watched and responded to prominent English news channels like Times Now, NDTV, CNN and BBC. They were instructed to pay attention to pronunciation, intonation, pitch and stress.

In addition, the students were provided access to computers in the evenings. Senior students were deputed to teach them to use the laptop, to login to the intranet, internet; to use the catalogue in the library and deal with other similar problems they may encounter. Since the college is WiFi enabled, covering all the classrooms, hostel rooms, library and the common areas across the 250 acres of the campus, the learning resources are available to these students 24/7.

Although stress was largely on acquiring the LSRW skills, classes also accommodated important forms of non-verbal communication as these are significant communication markers. In the final week, the students were exposed to various forms of non-verbal communication such as body language: gestures, posture, eye movement, facial expressions and the use of touch and space. In addition, Soft skills on team-building, motivation, interpersonal understanding and interaction were imparted. Although, this may not directly contribute to English language learning, it was taught to instil confidence among the students, to hold their own, while speaking in front of an audience, and during their day-to-day interaction with their teachers and peers.

The students were also taken on a short trip to Mahabalipuram, a popular tourist destination on the outskirts of Chennai. It was interesting to see these students talk in English to the foreign tourists as the latter did not know Tamil which was the only other language these students were proficient in. Thus the students had an opportunity to put to practise, what they had learnt all these weeks.

On the final day, the students showcased their learning by delivering a short speech, on a topic they had chosen. The choice of vocabulary and the structure of sentences used by them showed a marked improvement compared to their original output. The level of confidence they had mastered to stand in front of a group and speak was remarkable. Even the exit test revealed marked improvement in their LSRW abilities and their overall personality.

5.1 RESULTS AND DISCUSSION

An exit test (KET) was administered at the end of the programme to evaluate the impact of this bridge course. It was found that 19 out of the 25 students showed improvement in their scores ranging from 2 out of 80 to 15 out of 80.

The table below shows the listening, reading and writing scores recorded during the entry and exit level tests.

S. No	Name	Entry Level			Exit Level		
		Reading	Listening	Total	Reading	Listening	Total
1	A	30	15	45	26	17	43
2	B	40	13	53	43	16	59
3	C	AB	AB	AB	32	10	42
4	D	24	10	34	33	8	41
5	E	31	11	42	38	9	47
6	F	39	11	50	35	17	52
7	G	28	10	38	30	8	38
8	H	20	10	30	28	10	38
9	I	21	8	29	31	4	35
10	J	34	7	41	34	11	45
11	K	28	12	40	33	9	42
12	L	28	9	37	27	11	38
13	M	27.5	9	36.5	23	13	36
14	N	26	8	34	40	9	49
15	O	24	13	37	29	12	41
16	P	18	12	30	29	9	38
17	Q	28	11	39	32	11	43
18	R	16.5	5	21.5	16	4	20
19	S	38	10	48	36	12	48
20	T	24	6	30	23	4	27
21	U	27	9	36	26	9	35
22	V	25	10	35	31	6	37
23	W	15	12	27	21	12	33
24	X	24	12	36	32	12	44
25	Y	25	5	30	32	6	38

While these quantifiable results are used as an indicator for the impact of the bridge course, several other evaluations were conducted to asses if such a programme has made any difference to them at all. Speaking tests were conducted almost on a daily basis while the students introduced themselves, or when they were engaged in a role-play. Data sources include the participant's written responses, their day to day performance in the tasks and activities given to them, questionnaires, the final presentations of the participants and the author's own personal observation during these three weeks.

At the end of the training, it was seen that the participants were focused, confident and were able to carry on simple conversations with others. The students showed marked improvement in comprehension ability and language production.

Conclusion:

The institutions of higher learning must address such issues of economic and cultural marginality and create a sense of belonging in order to ensure a homogenous campus climate and equitable conditions for all students. Such an atmosphere is vital for institution excellence.

The success of this programme lay largely on the collaborative efforts of the student body with help from the resource persons. The difficulty encountered by Tamil medium students, (and in this case the rural students), while reflecting the wide divide between the rural and the urban societies, also reveal a sense of apathy and complacency on part of the educated few to address such needs.

Findings emanating from this study indicate that this approach to collaborative learning using comprehensible input and interaction provides positive attributes which aids effective communication skills in particular and an overall self development in general.

REFERENCES

[1] Thurmond, V. and Wambach, K. (June, 2004). Towards an Understanding of Interactions in Distance Education. Online Journal of Nursing Informatics (OJNI). Vol. 8, No. 2. [Online]. Available at http://ojni.org/8_2/interactions.htm

[2] Developing New Academics So What Difference does it Make? N. Chitanand International scholarly and Scientific Research & Innovation. 292 Vol 9, No.2, 2015

[3] Gardner, R. C., & Tremblay, P.F. (1994). On motivation, research agendas, and theoretical frameworks. Modern Language Journal, 78, 359-368. [EJ 497 731]

[4] Krashen, Stephen. "We Acquire Vocabulary and Spelling by Reading: Additional Evidence for the Input Hypothesis". *The Modern Language Journal*. Volume 73, Issue 4, pages 440–464, Winter 1989.

[5] Krashen, Stephen. Principles and Practice in Second Language Acquisition University of Southern California. 1982. 2009.

[6] "Suicide pointer to plight of poor students" *The Telgraph*, Calcutta India, Tuesday March, 6 2012 AIIMS http://www.telegraphindia.com/1120306/jsp/nation/story_15217976.jsp#.VH_yxskunIU

[7] Iyer, Rajeshwari Ganesan. "When English turns Greek for rural engineering students". *The New Indian Express*. 10th September 2012.

[8] VanPatten, Bill and Alessandro. G. Benati. *Key Terms in Second Language Acquisition*. London and New York, Continuum. 2010.

The Effects of Applying Linguistic Principles and Teaching Techniques in Teaching English at Secondary School in Thailand

Wannakarn Likitrattanaporn

***Abstract*—**The purposes of this investigation were to investigate the effects of applying linguistic principles and teaching techniques in teaching English through experimenting the Adapted English Lessons and to determine the teachers' opinions as well as students' opinions towards the Adapted Lessons. The subjects of the study were 5 Thai teachers, who teach English, and 85 Grade 10 mixed-ability students at Triamudom Suksa Pattanakarn Ratchada School, Bangkok, Thailand. The research instruments included the Adapted English Lessons, questionnaires asking teachers' and students' opinions towards the Adapted Lessons and the informal interview. The data from the research instruments was collected and analyzed concerning the teachers' and students' opinions towards adapting linguistic principles and teaching techniques. Linguistic principles of minimal pair and articulatory phonetics and teaching techniques of mimicry-memorization; vocabulary substitution drills, language pattern drills, reading comprehension exercise, practicing listening, speaking and writing skill and communicative activities; informal talk and free writing are applied. The data was statistically compiled according to an arithmetic percentage. The results showed that the teachers and students have very highly positive opinions towards adapting linguistic principles for teaching and learning phonological accuracy. Teaching techniques provided in the Adapted English Lessons can be used efficiently in the classroom. The teachers and students have positive opinions towards them too.

***Keywords*—**Applying linguistic principles, teaching techniques, teachers' opinions, students' opinions, teaching English, the adapted English lessons.

I. Introduction

FROM the researcher's earlier investigation about the problems in teaching English at Thai Secondary Schools, some teachers mentioned that their students have difficulties with English segmental phonemes and supra-segmental phonemes. Students cannot pronounce English phonemes such as /v//θ/ /ð//z//ʃ//r/ correctly. They also have a problem with initial and final consonant cluster sounds for example /θr-/ /ʃr-//-sk/ and /-ft/. They do not know when adding -ed in finite verbs the final sounds can be pronounced /-d//-t//-id/ /. Most students do not know which syllable should be stressed. Some of them do not use the pattern of intonation 233 for yes-no questions or 231 for Wh-questions. Consequently, they speak English with neither stress nor intonation.

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Moreover, English subject is taught as a foreign language and Thai language is used as a lingua franca in Thailand. Most Thai secondary students are usually just exposed to English in the classroom for about 4 periods a week. They have little opportunity to use or produce English for communication. Their English communication ability is not high. To solve these problems, the Adapted English Lesson 1- Lesson 3 was constructed. The theme of the lessons is based on language function of asking for and giving directions. Linguistic principles of minimal pair and articulatory phonetics have been applied for teaching consonant sounds and final cluster sounds. VDOs from YouTube are suggested in the Adapted Lessons in order to provide an opportunity for students to listen to sounds from native speakers of English. Furthermore, a variety of teaching techniques are used for the purpose of teaching language accuracy and fluency. Later the Adapted Lessons were experimented with 85 Grade 10 mixed-ability students at Triamudom Suksa Pattanakarn Ratchada School, Bangkok, Thailand, and 5 teachers were in the experiment.

II. Literature Review

A. Linguistic Principles for Teaching English Phonological Accuracy

1) Minimal Pair

The main reason why minimal pair has been used in teaching pronunciation is that it can discriminate 2 phonemes. [1] Spratt, Pulverness and Williams (2005) state that generally teaching materials include activities or exercises which focus on hearing or producing different sounds in a minimal pair. This principle is used in the Adapted English Lessons for teaching a phoneme /θ/ which does not occur in the Thai consonant sound system, most of Thai students cannot distinguish when they pronounce *tree* and *three*. Then the words m*at* and m*ath* are used. The students were asked to pronounce these 2 final sounds repeatedly until they were aware of how /-t/ is different from /-θ/, as well as being able to pronounce these 2 phonemes correctly.

2) Articulatory Phonetics

Articulatory phonetics can assist students on how to pronounce consonant phonemes through 3 main principles; places of articulation, manners of articulation and voicing. [2] (Fromkin, Rodman and Hyams. 2007) Besides practicing the final sound /θ/, the students have to practice the final cluster sounds of /-ft/,/-st/ as they are in the high frequency words

used for asking for and giving directions, such as le*ft*, ea*st*, we*st* etc. To describe the characteristic of these phonemes, articulatory phonetics is used. For instance, teachers can describe or demonstrate using tip of the tongue and alveolar for pronouncing /-t/ or place a tongue between upper lip and lower lip for pronouncing /-θ/. This linguistic principle is used for teaching the cluster sounds as well.

B. Combination of Language Accuracy and Language Fluency

Thai students spend 12 years studying English in primary and high school, however, their English proficiency is low. Thai teachers who teach English always complain that their students are quite poor in linguistic and communicative competency. To solve this problem, several principles from methods of language teaching are taken into account. Exercises or activities that can activate the students to achieve language accuracy prior to using it for communication will be designed in the Adapted English Lessons. Thus teaching techniques from three main methods of language teaching named Audiolingual Method, Cognitive-code Learning Method and Communicative Language Teaching Approach are applied as follows:

Practicing English pronunciation, mimicry-memorization; vocabulary substitution drills and language pattern drills, which focus on practicing language accuracy repeatedly, are from Audiolingual Method. [3] (Richards and Rodgers. 1986)

Comprehension checking exercises after reading passage is from Noam Chomsky who believes that human beings learn language through thinking and understanding mentioned as Cognitive Learning Theory. [4] (Nunan, 2003)

Using the language function of asking for and giving directions as well as communicative activities such as informal talk and free writing are provided. The techniques are from Communicative Language Teaching Approach. [5] Larsen-Freeman and Anderson (2011) referred to Wilkins (1976) who stated that within a social context, language users need to perform certain functions.

III. Methodology

A. Samples of the Study

The samples of the study are 5 English teachers and 85 Grade 10 mixed-ability students at Triamudom Suksa Pattanakarn Ratchada School, Bangkok, Thailand.

B. The Research Instruments

The research instruments used in this study are the Adapted English Lessons, the questionnaires asking teachers' and students' about their opinions towards the Adapted English Lessons and informal interview.

1) The Adapted English Lessons

The Adapted English Lessons consist of three lessons. Details of each lesson are as follows:

Lesson one concentrates on pronunciation. Minimal pair of /-t/ and /-θ/, cluster sounds of /-ft/, /-st/, primary stress on the syllable in front of –ment and –tion are taught and practiced. This lesson also focuses on practicing a dialogue of asking for and giving directions through the teaching techniques of mimicry-memorization; vocabulary substitution drills and language pattern drills.

Lesson two deals with listening to a conversation by native speaker of English, and then practicing by reading aloud. After that they are asked to listen and fill in the blanks to make a short conversation. This conversation is a model for the students, who are asked to work in pairs and make three conversations with his/her friend by using the words provided. Finally, each pair chooses only one conversation to draw a simple map showing the directions of the place.

Lesson three emphasizes on pronunciation of /-t/, /-d/, /-id/ with past tense verbs that end with –ed. This lesson also focuses on reading skills and checking reading comprehension. At the end of the lesson the students are asked to write a short essay about 8-10 sentences describing the directions from school to their house, and they are asked to draw a simple map for their essay.

2) Questionnaires Asking Teachers' and Students' Opinions towards the Adapted English Lessons

Since the purpose of the research is to investigate the effects of applying linguistic principles and teaching techniques applied in the Adapted English Lessons. Then the teachers and students are asked to rate their opinions towards minimal pair, articulatory phonetics, mimicry-memorization, pair work, vocabulary substitution drills, language pattern drills, reading comprehension exercise, practicing listening from CD, reviewing vocabulary and preposition of place, informal talk and free writing exercise. There are 2 questionnaires. One questionnaire is designed for the teachers and the other is for the students. They are constructed with items measured on a five point rating scale plus open-ended questions seeking descriptive data. The five point rating scale are Most, Much, Moderate, Little and Least.

C. Procedures of the Study

1) The research instruments were written and piloted with 1 English teacher, who teaches at Triamudom Suksa Pattanakarn Ratchada School, Bangkok, Thailand.
2) The research instruments were improved according to the teacher's comments and suggestions concerning the format, concepts and wording.
3) Before experimenting on each lesson of the Adapted English Lessons, 5 teachers discussed with the researcher on the purposes of the lesson, how to teach and checking the answer keys.
4) The Adapted English Lessons were experimented with 85 Grade 10 students at Triamudom Suksa Pattanakarn Ratchada School, Bangkok, Thailand. It took 100 minutes to finish teaching each lesson.
5) The samples of the study, 5 teachers and 85 students were asked to complete the questionnaires.
6) Data from the questionnaires was analyzed. The quantitative data was statistically compiled into percentage.

IV. Results of the Study

A. Teachers' Bio-Data

Three female and two male teachers participated in this study. They are in the age range of 27-30. They finished their bachelor's degree majoring in English or teaching English. One of them is studying in master's degree program majoring in teaching English whereas the other three are studying in master's degree program majoring in educational linguistics.

B. Quantitative Data from Rating Scale Questions

TABLE I
Teachers' Opinions towards Linguistic Principles for Teaching Phonological Accuracy

	Most	Much
1. Minimal pair of ma*t* and ma*th* can help students to pronounce final sounds /-t/, /-θ/.	80%	20%
2. Practicing how to pronounce cluster sounds /-ft/, /-st/ is useful for students.	80%	20%
3. Practicing how to pronounce the stress on the syllable in front of the morphemes is appropriate.	80%	20%
4. Practicing how to pronounce /-t/, /-d/, /-id/ for past tense verbs are, appropriate.	80%	20%
5. Articulatory phonetics is useful for describing consonant sounds.	80%	20%

TABLE II
Teachers' Opinions towards Teaching Technique of Mimicry-Memorization

	Most	Much	Moderate
1. Mimicry memorization activity for practicing pronunciation, vocabularies, and sentences in dialogues is appropriate to your students' ability.	40%	40%	20%
2. Practicing in pairs after mimicry-memorization activity encourage your students to ask and answer in dialogues.	40%	40%	20%

TABLE III
Teachers' Opinions towards Teaching Technique for Comprehension Check

	Most	Much
1. There are sufficient vocabularies describing asking for and giving directions in the reading passage.	40%	60%
2. There are sufficient sentence structures describing asking for and giving directions in the reading passage.	40%	60%
3. Wh-questions after reading can check the students' understanding the reading passage.	40%	60%

TABLE IV
Teachers' Opinions towards Teaching Techniques for Teaching Listening Skill

	Most	Much
1. Practicing listening a dialogue from CD spoken by native speaker of English can assist your students gain listening skill.	80%	20%
2. Asking students to repeat after the dialogue can assist your students to pronounce in word and sentence level.	80%	20%
3. Asking students to fill word(s) or phrase that they hear from the dialogue in the blanks can stimulate your students to pay attention in listening.	80%	20%

TABLE V
Teachers' Opinions towards Teaching Techniques for Teaching Vocabulary and Preposition

	Most	Much
1. Reviewing how to spell vocabularies by asking students fill the letters in the blanks to construct words is suitable.	60%	40%
2. Reviewing vocabulary activity used in warm up stage is appropriate.	60%	40%
3. Using a picture and a map help your students understand the meaning of preposition.	80%	20%

TABLE VI
Teachers' Opinions towards Teaching Techniques for Teaching Language Fluency

	Most	Much
1. Pair work can stimulate your students to practice English listening and speaking in a dialogue.	40%	60%
2. Asking students to write 8-10 sentences describing the directions from school to their house is appropriate.	40%	60%
3. Asking students to draw a map describing the directions from school to their house is appropriate.	40%	60%

TABLE VII
Teachers' Opinions towards the Adapted English Lessons

	Most	Much
1. The Adapted English Lesson 1- Lesson 3 can assist your students gain confidence in asking for and giving directions.	40%	60%

C. Qualitative Data from Open-Ended Questions

1) Teachers' Opinions towards Linguistic Principles in Teaching Phonological Accuracy

All 5 teachers mentioned that minimal pair and articulatory phonetics for teaching consonant sounds and teaching how to stress are excellent. They stated that using YouTube for teaching how to pronounce /-t/, /-d/,/-id/ and how to put stress on the syllable in front of the morphemes -tion, -ment is appropriate. Because the students prefer to listen to native speakers of English, who are good models for them to imitate how to stress and pronounce the English words correctly. The teachers also mentioned that the students are aware of pronouncing /-t/, /-d/,/-id/ when they see V_1+ ed.

2) Teachers' Opinions towards Language Function

All 5 teachers agreed that language function of asking for and giving directions can prepare the students use of English language for communication. One of these teachers said that exercises focusing on listening, speaking and writing including a final task of asking the students to draw a simple map and then describe the route to their friends are good. This teacher revealed that these exercises can assist the students to use varieties of sentence for communication.

3) Teachers' Opinions towards Adapting Teaching Materials

One teacher mentioned that the Adapted English Lessons used, as a local teaching material is appropriate. He suggested that there should be a training course for Thai teachers to train how to adapt English supplementary materials. He stated the

advantages of adapting materials by local teachers are it can solve the students' real problems and it can serve what the students really need.

4) Teachers' Opinions towards the Adapted English Lessons

One teacher mentioned that her students are more confident in speaking and writing about asking for and giving directions by the end of the experiment than she first met them in Lesson 1. All 5 teachers were satisfied with the adapted lessons.

D.Students' Bio-data

There are 79 female and 6 male students in this experiment. They are in Grade 10 at Triamudom Suksa Pattanakarn Ratchada School, Bangkok, Thailand. They are in the age range of 15-16.

E. Quantitative Data from Rating Scale Questions

TABLE VIII
STUDENTS' OPINIONS TOWARDS LINGUISTIC PRINCIPLES FOR TEACHING PHONOLOGICAL ACCURACY

	Most	Much	Moderate
1 Practicing how to pronounce final sounds /-t/, /-θ/ is useful.	45%	49%	6%
2. Practicing how to pronounce cluster sounds /-ft/, /-st/ is useful.	74%	22%	4%
3. Practicing how to pronounce stress on the syllable in front of morphemes -tion, -ment by using VDO from YouTube is useful.	49%	40%	11%
4. Practicing how to pronounce /-t/, /-d/, /-id/ for past tense verbs are, appropriate.	50%	46%	4%

TABLE IX
STUDENTS' OPINIONS TOWARDS TEACHING TECHNIQUE OF MIMICRY-MEMORIZATION

	Most	Much	Moderate	Little
1. Mimicry memorization activity for practicing pronunciation, vocabularies, and sentences in dialogues is appropriate to your ability.	57%	37%	5%	1%
2. Practicing in pairs after Mimicry- Memorization activity encourage you to ask-answer in dialogues.	57%	38%	4%	1%

TABLE X
STUDENTS' OPINIONS TOWARDS TEACHING TECHNIQUE FOR COMPREHENSION CHECK

	Most	Much	Moderate
1. Reading passage is appropriate for learning asking for and giving directions.	54%	39%	7%
2. Wh-questions after reading help you to understand the passage.	46%	39%	15%

TABLE XI
STUDENTS' OPINIONS TOWARDS TEACHING TECHNIQUES FOR TEACHING LISTENING SKILL

	Most	Much	Moderate
1. Practicing listening a dialogue from CD spoken by native speaker of English can assist you gain listening skill.	44%	48%	8%
2. Asking you to fill word(s) or phrase that you hear from the dialogue in the blanks stimulate you to pay attention in listening.	39%	50%	11%

TABLE XII
STUDENTS' OPINIONS TOWARDS TEACHING TECHNIQUES FOR TEACHING VOCABULARY AND PREPOSITION

	Most	Much	Moderate
1. Reviewing how to spell vocabularies by asking you fill the letters in the blanks to construct words is suitable.	45%	50%	5%
2. Reviewing vocabularies should be done before learning a lesson.	46%	44%	10%
3. Using a picture and a map help you understand the meaning of preposition.	51%	39%	10%

TABLE XIII
STUDENTS' OPINIONS TOWARDS TEACHING TECHNIQUES FOR TEACHING LANGUAGE FLUENCY

	Most	Much	Moderate
1. Pair work can stimulate you to practice speaking.	48%	46%	6%
2. Pair work can stimulate you to ask for and give directions with your friend.	47%	52%	1%
3. Asking you to write 8-10 sentences describing the directions from school to you house is appropriate.	48%	35%	17%
4. Asking you to draw a map describing the directions from school to your house is appropriate.	49%	38%	13%

TABLE XIV
STUDENTS' OPINIONS TOWARDS THE ADAPTED ENGLISH LESSONS

	Most	Much	Moderate
1. The Adapted English Lesson 1-Lesson 3 can assist you gain confidence in asking for and giving directions.	48%	39%	13%

F. Qualitative Data from Open-Ended Questions

Some students expressed their opinions as follows:

Lesson 1 is very useful for me because I can pronounce English sounds better and correctly.

I know more on how to pronounce English sounds.

It is good because I have an opportunity to practice pronunciation.

It is very difficult for me to pronounce /θ/, but I can practice it with a teacher.

Listening to native speakers of English from YouTube is good. I would like to listen more.

The theme of asking for and giving directions is essential for everyday life. Lessons are understandable.

I learn more vocabularies.

The lessons are easy to understand and I can use the vocabularies and sentences in my everyday life.

V.DISCUSSION

A. The Effects of Applying Linguistic Principles in Teaching Phonological Accuracy

From the data gained both teachers and students express their similar positive opinions towards teaching and learning English pronunciation. The rating scores are quite high in the most and much columns. All 5 teachers agreed that that the minimal pair of ma*t* and ma*th* can help the students to pronounce final sounds /-t/ /-θ/. They also agreed that

practicing how to pronounce cluster sounds /-ft/ /-st/ is useful for their students. In the researcher's opinion, there are three main factors that the Adapted English Lessons can help the teachers teach pronunciation effectively. Firstly, minimal pair can definitely distinguish 2 phonemes of /-t/ /-θ/ as well as articulatory phonetics can help the teachers explain how to pronounce phonemes physically in terms of places of articulation, manners of articulation and voicing. The second factor is the teachers' educational background as mentioned in the teachers' Bio-data earlier. So each teacher can be a good model of pronouncing all phonemes focused in the Adapted English Lessons. Most of the students were satisfied with practicing English pronunciation. Some of them stated that they wanted to practice more with these 5 teachers. The last factor is learning how to pronounce English sounds can serve the students' needs. Normally, Thai students are asked to learn and practice on grammatical knowledge in morphology and syntax rather than phonology in their usual English class. [6] (Sripicarn. 2012).

B. The Effects of Applying Teaching Techniques in the Adapted English Lessons

It is discovered that the opinions from the teachers and students towards the teaching techniques in the Adapted English Lessons are quite high percentage in the most and much columns.

Both teachers and students accepted that using mimicry-memorization is appropriate to their students' ability and it can encourage them to ask in answer in English.

The students mentioned that Wh-questions can help them understand the reading passage. They pointed out that they can use vocabularies and sentence structures from the reading passage in doing related activities; informal talk and free writing.

The teachers agreed that pair work can stimulate the students to speak English as well as the students revealed that pair work can stimulate them to ask and give directions with friends in informal talk activity. Moreover, the students mentioned that writing 8-10 sentences and drawing a simple map describing the directions from school to their house is appropriate. Both of them also appreciated using CD and YouTube for teaching and practicing English pronunciation. They also like the teaching stages in the Adapted English Lessons i.e. warm-up, presentation stage, practice stage and production stage. The teachers are asked to present language for the students in presentation stage and the students do their practices when they are asked to do exercises such as pronounce repeatedly after the teachers or native speakers of English from CD or YouTube, do exercises after listening or reading as well as do gap fill exercises, reorder the words to make sentences and so on. The students are also asked to produce or use their language in informal talk and free writing.

The researcher considers that there are 4 reasons that make teaching techniques adapted in the Adapted English Lessons effectively as discussed below.

1) Language Function

The language function of asking for and giving directions in English is necessary for Thai students. This language function is always used in the students' real life. For each year there are a large amount of tourists who come to visit Thailand. Generally, they use English for communication and they always ask Thais how to get to somewhere. Then the language function of asking for and giving directions applied in the Adapted English Lessons are useful and relevant to Thai students' everyday life. [7] Savignon (2002) states about the importance of the language functions that they can be used for communication purpose.

2) Concept of Accuracy and Fluency

Reference [8] Noom-ura (2013) concludes one of the main problems in teaching English in Thailand is Thai teachers see a high level of problems resulting from students' insufficient background of the language and lack of exposure to English. From her statement, it can be pointed out that Thai students need to practice both language accuracy and language fluency. The main purpose of the Adapted English Lessons is leading the students to gain sufficient language accuracy i.e. they can pronounce and stress sounds correctly and confidently, at the same time they have adequate vocabularies and sentence structures for use in informal talk and free writing task. It is now very clear that fluency and accuracy are both important goals to pursue in communicative language teaching. [9] Ellis and Shintani (2014) point out that there are strong theoretical reasons for claiming that focus on form is not just facilitative of learning but may even be necessary. It is also stated in an article named [10] *Balancing Fluency and Accuracy* that students learning fluency without accuracy is one of the problems in language teaching and learning. Pidgin language as an error might be occurred. Fluency and accuracy are two factors which determine the success of the students, who can communicate fluently with language accuracy.

3) The Multi-syllabus Syllabus

Reference [11] Harmer (2001) defines 'multi-syllabus' as "the syllabus that shows a combination of items from grammar, lexis, language function, situations, topics, tasks, different language skills or pronunciation issues". The Adapted English Lessons can be considered as a multi-syllabus syllabus due to its components of pronunciation, vocabulary, sentence structures, language skills, language function and task-based activities. Harmer also states that as the process of learning goes on by the multi-syllabus syllabus, the grammar syllabus will have to change to accommodate some of the other claims; the list of functions will shift around to accommodate the grammar, and the tasks will have to take account of the language at the students' disposal for the performing of the tasks. In this case the students get the most benefit from practicing varieties of components provided in the Adapted English Lessons.

4) Using Native Speakers of English Sounds from CD and YouTube

From the data gained the teachers are highly satisfied with techniques of using CD and YouTube in the Adapted English Lessons. Many students revealed that they preferred listening

to native speakers of English. They wanted to listen more. An advantage of using YouTube is the students can see the movement of the speech articulations and hear the sound(s) at the same time. It can activate them in practicing phonological accuracy. Reference [12] Ware, Liaw and Warschauer (2012) reveal that digital media can be used to assist students in mastering grammar, vocabulary and pronunciation.

C. Teachers' and Students' Opinions towards the Adapted English Lessons

The teachers and students are satisfied with the Adapted English Lesson 1-3. The teachers think that the Adapted Lessons can help their students to gain the language knowledge and the opportunities to speak and write on the language function of asking for and giving directions. The students say that they prefer learning pronunciation and exercises or activities provided in the Adapted English Lessons. They like working in pairs. They also mention that practicing in pair work after mimicry-memorization activity encourages them to ask and answer in dialogues. They gain more confidence for writing a short essay describing the directions from school to their home.

D. The Need of Constructing Supplementary Materials for Local Use

Reference [13] Matsuda (2012) mentions the problem involved textbooks used in the countries of teaching English as a foreign language is whether they are appropriate for local context or not. Using supplementary materials is one of the choices to solve this problem. The main reason, why the Adapted Lessons can be as the useful supplementary materials at Triamudom Suksa Pattanakarn Ratchada School is that they can serve the students' needs and lacks. That is the students want to practice English that can be used for their everyday life or can solve their problems of pronunciation such as word stress or pronounce final sounds with past verbs adding -ed. [14] Tomlinson (2012) says that recently he has been involved in many projects to develop local materials in many countries. He clarifies that the demands of materials for local use are from teachers, as material writers, want to design materials that can meet the generalized needs and wants of actual students who are learning English in a specific environment with specific objectives.

E. Problems Occurred and the Solution

The researcher noticed that teachers spent time explaining what they are good at. Two teachers took about 130 minutes instead of 100 minutes to finish teaching the Adapted Lesson 1. 75 minutes for teaching pronunciation, they had only 25 minutes left for teaching mimicry-memorization activity. To solve the problem there was a discussion among 5 teachers and the researcher after teaching lesson 1. It was discovered that two teachers who could not finish teaching Lesson 1 in time because it was their first time of teaching these groups of students. They explained in more details on how to pronounce sounds. They agreed that they have to manage time better next lessons.

Another problem is three teachers worried at the reading comprehension. They mentioned that the students copied the answers in the phrase level from the reading passage. They wanted them to write the answers in full sentences using the students' own words. This is one of the misunderstanding teaching concepts. To solve this problem the researcher asked the other three teachers' opinions whether the students should answer wh-questions in full sentences or not. From the discussion all teachers finally agreed that finding out the answers shows the students' comprehension, and it means that the students understand the reading passage. Then it is not necessary to ask students to answer in full sentences. Furthermore, three teachers complained that the students wanted them to teach article and preposition of place even though they had already studied these 2 grammar points. The students also forgot vocabularies and expressions of giving directions when they were asked to describe the way from school to their house. To solve the problem all teachers agreed to use 3 strategies. The first strategy is the teacher's role should be an assistant who walks around the classroom to help when the students forget the grammar points, vocabularies or expressions. The second strategy is whenever the students get the wrong answers the teacher immediately corrects and explains the correct grammars. The third strategy is asking the less-able students to work in pairs with the more-able students who can assist the less-able ones when they have the difficulties with grammar points.

VI. Recommendations

1) Thai teachers who teach English should take notice about what their students' lacks and needs are. In this case they know the students' real problems of teaching and learning English in their school.
2) Thai teachers who teach English should be trained on adapting the efficient local materials used in their school. The idea of constructing local supplement materials should then be encouraged by the Ministry of Education in Thailand.

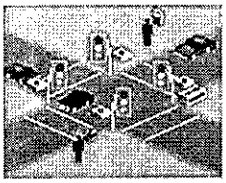
Appendix

The Adapted English Lessons

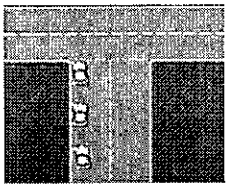
Lesson 1
Asking For and Giving Directions
(Pronunciation and dialogues)
Time 100 minutes

Warm up activity
1. Look at the pictures below. Guess what they are.
2. Look at the following pictures. Write the correct letters to make the words.

1. __r__f__l__h__



2. __ n __ __ r __ __ c __ __ o __



3. T- __ __ n __ __ i __ __

4. s __ __ n __ __ s __ __

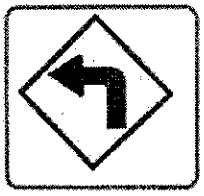
Source: http://leds-news.blogspot.com/2014/01/use-leds-to-show-when-traffic-light-is.html

Source: http://urna.projects.unoc.net/media/traffic-intersection.png

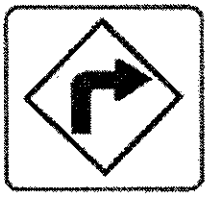
Source: http://www.cambridgedrivingschool.net/how-to-deal-with-junctions.html

Source: http://en.wikipedia.org/wiki/File:Botanic_gardens_belfast_sign_post.JPG

3. Look at the signs. What do they mean?

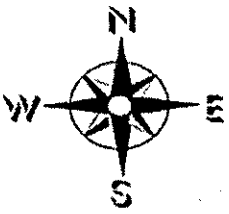


1. t __ __ n l __ __ t



2. __ __ r __ r __ __ h __

4. Write the correct meaning.



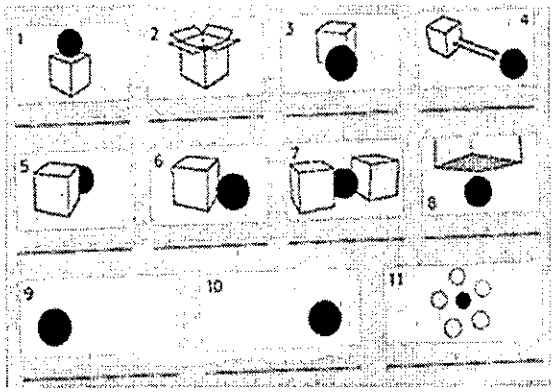
N stands for __ __ __ __ __
S stands for __ __ __ __ __
W stands for __ __ __ __

E stands for __ __ __ __

Review preposition

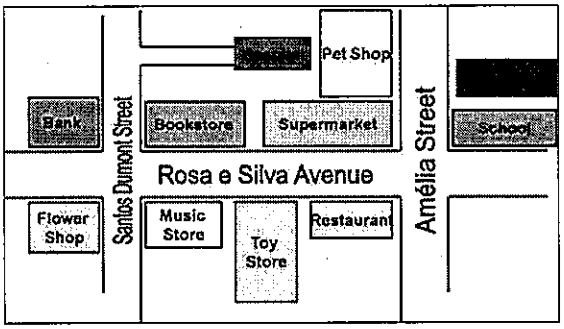
1. Match the preposition with the pictures.

behind between in next to under
in front of in the middle on
opposite on the left on the right



Source: Oxenden Clive and Latham-Koenig, *New English File*, 1997, p.9

2. Look at the map.
Work in pairs within 10 minutes and write the suitable preposition in the blanks.



1. The music store is _____ Santos Dumont Street and Rosa e Silva Avenue.
2. The hospital is _____ the pet shop.
3. The toy store is _____the music store and the restaurant.
4. The supermarket is _____ the restaurant.
5. The fast food restaurant is _____Amelia Street.
6. The bookstore is _____ the supermarket.
7. The bank is on Santos Dumont Street _____the flower shop.
8. The School is _____ Amelia Street and Rosa e Silva Avenue.
9. The pet shop is _____ Amelia Street.
10. The flower shop is _____ Santos Dumont Street

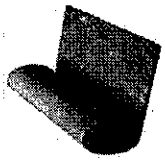
Source: http://www.englishexercises.org/makeagame/viewgame.asp?id=17

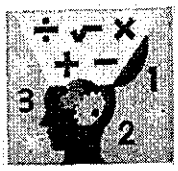
3. Check the answers together.

Warm up activity

Minimal pair: /-t/ /-th/

1. Look at the pictures. What are they?





It is a m__ __. It is about m__ t __.

Source: A picture of a mat is from http://www.google.co.th/search?q=mat&rlz=1T4AURU_enTH497TH497&tbm=isch&prmd=ivnsz&ei=nQo9U6yjMIWqrAe3k4CwBQ&start=60&sa=N
A picture of math is from http://www.pragmaticmom.com/2013/01/2nd-grade-math-facts/)

1. 2. Practice how to pronounce /t/ /th/ with your teacher.

Additional practices: http://www.slideshare.net/garcia58/pronun-t-vs-th
http://www.youtube.com/watch?v=MKtZH0bN0W0http://www.youtube.com/watch?v=MKtZH0bN0W0

Cluster sounds: /-ft/ /-st/

1. Look at the picture. What is it?

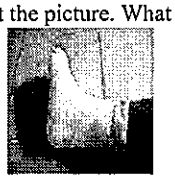
It is a g__ f__.

Source: http://www.horolive.com/astrology-hot/content04-10-2555-2.html#.U8SY5tySw0M

2. Listen to your teacher and repeat the words with /-ft/.
li*ft* le*ft* ra*ft* so*ft* cra*ft*

3.Work in pairs, think of words that end with *ft* and pronounce them.

4. Look at the picture. What is it?



It is a c__ s __.

Source: http://www.bloggang.com/viewdiary.php?id=coffeebake&month=09-2010&date=27&group=9&gblog=13

5. Listen to your teacher and repeat the words with /-st/. be*st* fa*st* la*st* lo*st* mu*st* tru*st*

6. Work in pairs, think of words that end with *st* and pronounce them.

Stress:
Primary stress on the syllable in front of *-tion, -ment*
1. Look at the following words.
act, state, depart, treat
If you want to make them into nouns, you can add –tion and -ment.
Act → action, state → station depart → department
treat → treatment

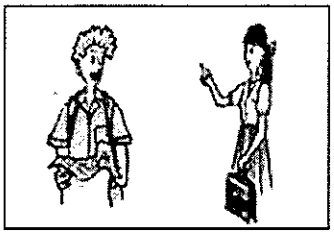
2. Listen to your teacher on how to stress the words that end with –tion and -ment and repeat after him/her.

3. Practice how to stress the words that end with –tion and –ment from the following websites.
http://www.youtube.com/watch?v=WcTFjYSRq_k
http://www.youtube.com/watch?v=X1Rxh-78uZA

Dialogues and practice
Warm up activity
Instructions: Look at the picture of Dialogue 1 and answer the questions.
Who is the man?
Who is the girl? What is the man looking for?

Mimicry-memorization activity
Instructions: Repeat sentences in the dialogue after the teacher. Memorize the dialogue.

Dialogue 1



A tourist: Excuse me. Can you tell me where the nearest ***1.MRT station*** is?
A student: Certainly, it's not far. Walk ***2.north*** for 200 metres and you will see the ***3.traffic lights.***
A tourist: I'll see the traffic lights.
A student: Then turn left. You'll see the ***4. MRT station*** on your right side ***5.opposite*** the cinema.
A tourist: Thank you.
A student: You're welcome.

Dialogue 2

A tourist: Excuse me. Can you tell me where the nearest ***1.department store*** is?
A student: Certainly, it's not far. Walk ***2. south*** for 200 metres and you will see the ***3.intersection.***
A tourist: I'll see the intersection.
A student: Then turn left. You'll see the ***4. department store*** on your right side ***5.next to*** the cinema.
A tourist: Thank you.
A student: You're welcome.

Now work in pairs and practice Dialogue 3 – Dialogue 5 by using the provided words.

Dialogue 3
1.bank 2. east 3. signpost 4. bank 5. in front of

Dialogue 4
1.police station 2. west 3. T-junction 4. police station 5.behind

Dialogue 5
1. railway station 2. north 3. signpost 4. railway station
5. beside

Production Activity
Instructions: Work in pairs. Make your dialogue and present in front of the class

Lesson 2
Asking For and Giving Directions
(Listening, speaking and writing)
Time 100 minutes

Warm up activity
1. Review the students' existing knowledge about asking for and giving directions by watching the VDO clip. http://www.youtube.com/watch?v=DA42nsvtsM.

2. Divide students into small groups of 5-6. Ask them to write down words related "directions and location" for 10 minutes. The group who can get the most words will be the winner.

Listening 1
1. Listen to a conversation.

Winnie: Excuse me. Is there a post office near here?
Man: Yes, there's a post office on Third Avenue.
Winnie: Great! How do I get there?
Man: You can walk. It's easy! Go straight ahead, and turn left onto Main Street.
Winnie: Thanks.
Man: Then turn right at the bus station and go past the bank.
Winnie: Er.... OK. So it's past the bank.
Man: Then turn left onto Park Road.
Winnie: Left onto Park Road. I see.
Man: Yeah. Keep going and the post office is on the right, next to a large supermarket.
Winnie: Hmm. Thanks a lot.
Man: You're welcome.
Winnie: Taxi!

Source: Miles Craven, *Breakthrough Plus Student Book 1*, 2013, p.30

2. Listen and practice. Your teacher will pause sentence by sentence.
3. Read aloud together.
4. Ask your teacher if you do not understand anything in the conversation or you can ask how to pronounce the words.

Listening 2
Instructions: 1. Listen and complete the conversation

A: Excuse me. Is there a 1_____ near here?
B: Yes, there is. It's on 2_____
A: Great. How do I get there?
B: Turn right at the bank and go straight ahead. It's 3_____
A: Thanks. Oh, and is there a 4 _____?
B: Yes. It's 5_____the supermarket.
A: Thanks a lot!

Source: Miles Craven, *Breakthrough Plus Student Book 1*, 2013, p.31

2. Draw a simple map for the conversation above.

3. Work in pairs. Use the words to make more conversations and practice with your friend.

Conversation one: 1. bookstore 2. Fifth Avenue 3. on the right 4. florist 5. across from
Conversation two: 1. stationery store 2. Main Street 3. on the corner 4. music store 5. behind
Conversation three: 1. drugstore 2. Park road 3. near the hotel 4. shoe store 5. in front of

4. In your pair choose one conversation from Conversation one–Conversation three and draw a simple map.

Warm up activity
1. Review how to ask for and give directions with your teacher.
Production Stage
Speaking/ Writing
1. Work in pairs and think of a place that is not far and you can describe how to get to in 5-8 sentences. Draw a simple map, but do not mark the route.
2. Give your map to your friend and describe your route.
3. Ask your friend and check whether your friend can draw the correct route on your map or not. If your friend cannot draw the route correctly, describe your route again.

Lesson 3
Asking For and Giving Directions
(Pronunciation, Reading and Writing)
Time 100 minutes

Instructions:
1. Watch and practice /-t/ /-d/ /-id/ with past tense verbs that end with -ed.
http://www.youtube.com/watch?v=QfDH5BM02lo
http://www.youtube.com/watch?v=2tYErI17g-U
If you do not understand anything on YouTube, ask your teacher to explain more.
2. Find the words that have –ed. in the following reading passage and write on the blackboard.
3. Pronounce the words. If anyone pronounces incorrectly, correct their pronunciation together.

Reading
Instructions: Read the following passage aloud. Underline the words that you do not understand. Then ask your teacher the meaning of those words.

Kim called at Tom's house to tell him how to go to a holiday bungalow at Pine Bay. Tom was not in, and so Kim left the following note.

Dear Tom,
I am sorry I called when you were out. This is how to reach the bungalow on your motorbike. Drive out of Steeltown long Factory Road and watch for a major intersection with traffic lights after about 5 km. The left turn is marked with a sign to Charlton. When you have made this turn, you will be on route 3, which leads directly to Pine Bay. You should then drive for about 130 km and pass through Charlton and Middleton before looking for the Pine Bay signpost.

On the last section of the road before Pine Bay, you will see a large school on the right hand side and you will find a right hand turn soon after this building. There are other turns off the main road but this is the quickest and most direct way. Drive down this small road as far as you can until you can see the sea directly in front of you. Then turn left. (In fact you have no choice because the road goes nowhere else.) You then pass through the small village of Pine View, and after the village you must look again for a right turn. This turn is marked by a

sign which reads "Rock Cottages". You should continue along it for about a kilometer before it divides. Take the left branch for about ½ km and you will find the bungalow near the end of the track on the left. It is far away from other bungalows and is painted red, so there is no possibility of confusion.
I am looking forward to seeing you there around five o'clock on Friday afternoon.

Kim

Instructions: Work in pairs and answer the questions.

1. What two things indicate the left turn off Factory Road?
2. What two things will help Tom to know when he must turn off route 3?
3. Why it is best for Tom to take the turn immediately after the school?
4. Why must Tom turn left when he reaches the sea?
5. When should Tom start looking for the "Rock Cottages" signpost?
6. Approximately how far is it from Pine View village to the bungalow?
7. What two things will help Tom identify the bungalow?

Source: Heaton B. Clark D.F, *Communication Target Book One,* 1980, p. 40

Warm up activity

Grammar Focus

"a" in front of *holiday.*
"the" in front of *bungalow.*
Not "a" and "the" in front of *Pine Bay.*

"a "a" is used when something is mentioned for the first time and is unknown.
"t "the" is used when there is only one example of something or when the thing is well-known and when something is mentioned again.
Names of people, streets and towns do not have "a" or "the".

Practice
Exercise 1
Instructions: Fill the blanks with *a, the* or nothing.
When _____ Gimin drove into _____ Medan, he immediately began to look for _____ petrol station. He was unable to find one and so he asked at _____ restaurant. _____ owner of _____ restaurant told him to drive down New Road until he reached _____ junction with Old Road. _____ Gimin turned to the left at _____ left at _____crossroads and saw _____ petrol station 200 metres away. At that moment _____ car stopped. There was no petrol left in _____ tank. Gimin noticed that he had stopped outside _____ coffee bar and so he decided to have _____ cup of coffee before he pushed _____ car for _____ last 200 metres.
Source: Heaton B. Clark D.F, *Communication Target Book One,* 1980, p. 37

Exercise 2
1. Find the words that have –ed. in Exercise 1 and write down.

_____
_____

2. Pronounce the words. If anyone pronounces incorrectly, correct their pronunciation.
3. Check your pronunciation with your teacher.

W

Exercise 3
Instructions: Choose a suitable preposition from the box to fill in the blanks.

at, in, into, to, off, out of, under, down

1. The boys are playing _____ the yard.
2. Look at all those small boats _____ the harbour.
3. Mr. Lee used to live _____ Singapore, but he has recently moved _____Bangkok. He lives _____ 304 Krung Kasem Road.
4. Miss Wiguna usually shops _____ Robinson"s Supermarket
5. Please take all your books _____ the table and put them _____ this drawer.
6. The explorer set off _____ the South Pole.
7. Kim always sits _____ the back of the class, never _____ the middle.
8. He put the money on the table before he went _____ the room.
9. Several small children were playing _____ the street when I arrived _____Mr. Hassan's house.
10. He ran _____ the hill and found his football _____ a car.

Source: Heaton B. Clark D.F, *Communication Target Book One,* 1980, p. 37

Exercise 4
Instructions: Reorder the words to make sentences.
1. you, Go, way, until, this, station, the, gas, see

_____

2. Take, fifth, lift, the, floor, the, to

_____

3. blocks, minutes, right, then, Walk, and, 10, turn, for, then, walk, two, for

_____
_____

4. at, 145, street, the, the, for, Bus, wait, bus, Cross, stop, and

_____

5. get, Store, 365, Department, Bus, off, and, at, Take, Central

_____
_____

6. lights, Wait, green, light, changes, the, traffic, the, until, at, to

_____
_____

7. you, left, Go, building, bridge, then, on, look, for, tall, under, and, the, a

_____
_____

8. get, and, you'll, intersection, the, the, station, see, When, subway, the, you, road, to, cross

_____
_____

Source: Heaton B. Clark D.F, *Communication Target Book One,* 1980, p. 38

Writing
Instructions: Write 8 -10 sentences that give directions to your friends to reach your house from school. Draw a simple map to help them to find your house easily.
To get to my house,_____

_____
_____
_____
_____

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REFERENCES

[1] Spratt Mary, Pulverness Alan and Williams Melanie, *The Teaching Knowledge Test.* Cambridge: Cambridge University Press, 2005, p.15.

[2] Fromkin Victoria, Rodman Robert and Hyams Nina, *An Introduction to Language.* (7th ed). Boston: Thomson Higher Education, 2003, pp. 242-250.

[3] Richards C. Jack and Rodgers S. Theodore, *Approaches and Methods in Language Teaching.* New York: Cambridge University Press, 1986, ch. 4.

[4] Nunan David, Methodology. in *Practical English Language Teaching (3rd ed.),* Nunan David Ed. New York: McGraw-Hill, 2003, pp. 3-22.

[5] Larsen-Freeman Diane and Anderson Marti, *Techniques & Principles in Language Teaching.* New York: Oxford University Press, 2011, p.115.

[6] Sripicarn Pasphong, Teaching English Grammar. in *Leaw Lung Lae Na (Thai words) English Teaching,* Wiriyachitra Arunee Ed. Bangkok: Asia Press, 2012, pp.70-71.

[7] Savignon J. Sandra, Interpreting Communicative Language Teaching. In *Communicative Language Teaching: Linguistic Theory and Classroom Practice.* Savigon Sandra J. Ed. London: Yale University Press, 2002, pp. 1-28.

[8] Noom-ura Sripathum, English Teaching Problems in Thailand and Thai Teachers' Professional Development Needs. (Online Journal) *English Language Teaching,* vol. 6, no. 11, Oct. 2013, pp. 139-147.

[9] Ellis Rod and Shintani Natsuko, *Exploring Language Pedagogy through Second Language Acquisition Research.* Oxon: Routledge, 2014, pp.15-18.

[10] *Balancing Fluency and Accuracy.* in www.english-for-students.com /fluency-and- accuracy.html, (accessed 23 February 2015).

[11] Harmer Jeremy, *The Practice of English Language Teaching. (3rd ed.),* Essex: Pearson Education. 2001, p.300.

[12] Ware Paige, Liaw Meei-Ling and Warschauer Mark, The Use of Digital Media in Teaching English as an International Language. in *Principles and Practices for Teaching English as an International Language,* Lubna Alsagoff , Sandra Lee McKay, Guangwei Hu and Willy A. Renandya, Eds. New York: Edwards Brothers, 2012, pp. 67-84.

[13] Matsuda Aya, Teaching Materials in EIL. in *Principles and Practices for Teaching English as an International Language,* Lubna Alsagoff , Sandra Lee McKay, Guangwei Hu and Willy A. Renandya , Eds. New York: Edwards Brothers, 2012, pp.168-185.

[14] Tomlinson Brain, Materials Development. in *Pedagogy and Practice in Second Language Teaching,* Burns Anne and Richards Jack C, Eds. New York: Cambridge University Press, 2012, pp. 269-278.

Tertiary Level Teachers' Beliefs About Codeswitching

Hoa Pham

Abstract— Code switching, which can be described as the use of students' first language in second language classrooms, has long been a controversial topic in the area of language teaching and second language acquisition. While this has been widely investigated across different contexts, little empirical research has been undertaken in Vietnam. The findings of this study contribute to our understanding of bilingual discourse and code switching practices in content and language integrated classrooms, which has significant implications for language teaching and learning in general and in particular for language pedagogy at tertiary level in Vietnam.

This study examines the accounts the teachers articulated for their code switching practices in content-based Business English in Vietnam.

Data were collected from five teachers through the use of stimulated recall interviews facilitated by the video data to garner the teachers' cognitive reflection, and allowed them to vocalise the motivations behind their code switching behaviour in particular contexts. The literature has recommended that when participants are provided with a large amount of stimuli or cues, they will experience an original situation again in their imagination with great accuracy. This technique can also provide a valuable "insider" perspective on the phenomenon under investigation which complements the researcher's "outsider" observation. This can create a relaxed atmosphere during the interview process, which in turn promotes the collection of rich and diverse data. Also, participants can be empowered by this technique as they can raise their own concerns and discuss instances which they find important or interesting. The data generated through this study were analysed using a constant comparative approach.

The study found that the teachers indicated their support for the use of code switching in their pedagogical practices. Particularly, as a pedagogical resource, the teachers saw code switching to the L1 playing a key role in facilitating the students' comprehension of both content knowledge and the target language. They believed the use of the L1 accommodates the students' current language competence and content knowledge. They also expressed positive opinions about the role that code switching plays in stimulating students' schematic language and content knowledge, encouraging retention and interest in learning and promoting a positive affective environment in the classroom. The teachers perceived that their use of code switching to the L1 helps them meet the students' language needs and prepares them for their study in subsequent courses and addresses functional needs so that students can cope with English language use outside the classroom. Several factors shaped the teachers' perceptions of their code switching practices, including their accumulated teaching experience, their previous experience as language learners, their theoretical understanding of language teaching and learning, and their knowledge of the teaching context.

Code switching was a typical phenomenon in the observed classes and was supported by the teachers in certain contexts. This study reinforces the call in the literature to recognise this practice as a useful instructional resource.

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Keywords— Codeswitching, language teaching, teacher beliefs, tertiary level.

I. Introduction

THE issue of code switching, which can be described as the use of students' first language (L1) in second language (L2) classrooms has long been a controversial topic in the area of language teaching and second language acquisition. Strong proponents of L2 exclusivity claim that there is a direct relation between teachers' exclusive use of L2 and student L2 progress. A number of empirical studies, as reviewed by Turnbull and Arnett (2002), have provided further support for L2-only use by language teachers in order to maximise students' language development. What is more, advocates of the exclusive use of the L2 propose that in foreign language classrooms, especially where students have limited exposure to the L2-speaking environment, the use of the L1 in class is believed to undermine the L2 learning process (Macdonald, 1993) and harm the development of communicative competence (Simon,2001).In Hong Kong, despite empirical research indicating different functional use of code switching in Hong Kong classrooms, it was disapproved and banned by the Hong Kong government for the efficiency of learning in monolingual instruction (Li, 2008). Similarly, policy makers in Taiwan tend to view code switching as undesirable, favouring 'English-only' classrooms (Raschaka, Sercombe & Chi-Ling, 2009). Some studies reported that individuals engaged in code switching were perceived as victims of colonization (Bentahila, 1988) or arrogance (Gibbons, 1983).

In Vietnam, there has been a dearth of research in this area, and it is not uncommon for teachers to have limited access to expert theories of practice and published research (Nguyen V.L., 2011). In the absence of research to guide them, teachers of English in Vietnam and the teachers at the research site mostly default to their own assumptions and intuitions about best practice for language instruction. In particular, their language choice for instruction appears to be based on their own intuitions and assumptions about what is appropriate, as neither language course books nor teacher guide books include any advice on whether or not to use the L1, and if it is to be used, how the L1 should be employed in their teaching.

Although currently there is no official English-only teaching policy in second language courses such as English for Business Communication, there has been a tendency for

university teachers to maximise the amount of time spent using the target language and there does appear to be a plan to introduce L2-only policy at this research site. This practice is predicated on the belief that increased L2 use will bolster student learning when the primary source of learners' exposure to English is limited to classroom. Teachers of English, and particularly those in content and language-integrated learning environments such as English for Business Communication face a dilemma with respect to the language to be used for instruction (L1 or L2) because the language they use is assumed to have an influence on student learning of both content and language knowledge. Thus, the primary purpose of this study is to explore whether CS by the teachers to the L1 occurs in content and language-integrated teaching in Vietnam. If it does occur, the study also aims to investigate the reasons the teachers give for their CS behaviour. This article, however, only documents the rationales the teachers provided for their CS practices.

II. LITERATURE REVIEW

The role of the L1 in language pedagogy is still contested, particularly whether or not to include the L1 in language teaching. There are theoretical constructs underpinning arguments for and against inclusion, although the recent trend is toward acknowledging the role of CS to the L1 in language teaching and learning (Butzkamm, 2011; Butzkam & Caldwell, 2009; Cook, 2001; Cummins, 2007, 2008; González-Davies, 2014; Hall & Cook, 2012; Jenkins, 2010; Widdowson, 2003). The literature supporting the use of the L1 and translation in L2 pedagogy includes general theories of learning and bilingualisation process, cognitive, sociocultural and sociolinguistic approaches.

2.1 General theories of learning and bilingualisation

Some scholars advocate the use of bilingual instructional strategies because they align with general learning theories and the bilingualisation process in which the L1 plays a crucial role (Cummins, 2008; Skinner, 1985; Widdowson, 2003). Skinner's (1985) support for bilingual instructional strategies is based on general learning theories put forward by Piaget, Vygotsky and Cummins. With regard to Piaget's assertion of learners' developmental stages, Skinner (1985, p.374) posited that the use of the L1 in L2 instruction secures "students' concept development to continue to grow in tune with the child's natural developmental stages". When the L2-only approach is adopted, "learners are forced by the method itself to function at the conceptual level far below their actual cognitive state in the L1". Relating the L2-only instruction approach to the work of Vygotsky which dictates that meaning is constructed "from the unity of 'Thought' and 'Word', Skinner claimed the learner's relatively limited words in the L2 "can only connect a limited number of thoughts to those words"; this affects both immediate and future learning, as concept development is restricted. Cummins' argument is that it is not theoretically sound to assume that L2 learners whose language proficiency is low will rely only on contextual clues for meaning processing. On the basis of such arguments, Skinner (1985) described an alternative approach to L2 instruction involving the use of the L1 to connect learners' thoughts with words and to ensure cognitive transfer of concepts from the L1 to L2, thereby accelerating and enhancing L2 development. This approach also promotes connections between the L2 and prior knowledge and ideas already developed in the L1. In a similar way, others also placed an emphasis on the use of the L1 for connection with prior knowledge based on the fundamental principle of general learning (Cummins, 2008; Lucas & Katz, 1994; Van Lier, 1995). Donovan and Bransford's (2005, p.4) position that "new understandings are constructed on a foundation of existing understandings and experiences" and that learners' pre-existing knowledge is "encoded in their L1" lead Cummins (2008, p.231) to argue that it is important to employ the L1 in L2 instruction to engage learners' prior knowledge. Van Lier (1995, p.39) also showed support for connecting "the known (L1) to the new (L2)" on the ground that "learning is a process of relating the new to the known, and language learning is no exception".

A language pedagogy that makes explicit references to learners' L1 is advantageous in the biligualisation process, as it is natural that learners "draw on the language they know as a resource for learning the language they do not"; thus, it is recommended that explicit reference to the L1 should be made to assist learners to render the input comprehensible and meaningful (Widdowson, 2003, p.159). This argument is also put forward by Stern (1992), who maintained that L2 learners always set out from their L1. Corder (1992) asserted that there is no escaping the fact that L2 learners already have a language system available when they learn an L2 and it is inconceivable that knowledge of the existing language would not play a part - it is "predominantly heuristic and facilitatory" in L2 learners' processes of discovery and creation (p.25).

Cummins (2008) proposed that background knowledge can be built through the L1 where necessary to enable learners to operate at a higher level in their L2 and to ensure L2 learning efficacy. Echoing this position, Krashen (1996) asserted that the background knowledge acquired in the L1 makes the input received in the L2 more comprehensible to the learners. Jenkins (2010, p.459) concurred, stating that the L1 provides learners with the "basis necessary to build solid foundations". Ellis (1985, p.40) observed that "the L1 is a resource of knowledge which learners will use both consciously and subconsciously to help them sift the L2 data in the input and to perform at best as they can in the L2". Cummins (2007, p.238) wrote "...when students' L1 is invoked as a cognitive and linguistic resource ... it can function as a stepping stone to scaffold more accomplished performance in the L2".

L1 explanations and translation ensure precision of meaning, bring out differences between easily confused language items, and are more effective for meaning retention (Butzkam & Caldwell, 2009). Piasecka (1988) and Hopkins (1988) claim that the use of the L1 enables learners to avoid false assumptions and analogies and acquire awareness of the conceptual and cultural differences between the two languages, which creates an authentic interactive teaching mode using both the L1 and L2 (Cook, 2005).

2.2. The cognitive processing perspective

The cognitive processing perspective holds that the L1 acts

as a bridge for L2 meaning processing and for cross-language transfer. Macaro (2009, p.37) stated that there are essential connections between the L1 and L2 that facilitates meaning processing; thus, "to ignore L1 during the process of L2 learning is to ignore an essential tool at the learners' disposal". Butzkam and Caldwell (2009) proposed a common conceptual base mediating semantic processes in bilingual brains; therefore, it is crucial to use the L1 as a scaffolding mechanism for elucidating, clarifying meaning and facilitating conceptual understanding in the L2. The L1-L2 connection in bilinguals minds is exemplified by Kecskes and Papp's (2000, p.64) view about the way adult learners acquire new words in the L2: "they will relate a word in the FL to its translation equivalent in the L1...because the conceptual system of the learner is L1 based, and the right concept can be reached only through a word that denotes the concept in the L1". For learners in the early stage of L2 development, the conceptual base in the L2 is usually not developed enough to function as a channel through which knowledge and skills may be fed - words learned in the L2 are connected to L1 concepts through their L1 equivalents. The strong conceptual connections between L1 translation equivalents and the concepts they represent are also highlighted in the revised hierarchical model by Kroll and Stewart (1994): L2 learners are likely to process the meaning of L2 vocabulary by making links to their L1 translation equivalents, as they have already developed strong links between a concept and its L1 word. Learners are less likely to rely on this route for meaning processing when they achieve higher levels of proficiency.

Aside from functioning as a bridge for L2 meaning processing, Macaro (2005) contended that the use of the L1 and immediate translations from the L2 to L1 lightens the cognitive load for learners, and helps counter the constraints imposed by working memory limitations. Thus, a switch to the L1 can free up "working memory to work on the meaning of larger chunks of input" (p.74).

Cummins'(1991) interdependence hypothesis across languages suggests that learners have one integrated source of thought for both languages and conceptual knowledge and literacy skills are transferrable from one language to the other. According to this hypothesis, instruction in the L1 aids proficiency in the L2 and that proficiency in the L1 transfers to the L2 provided there is abundant exposure to, and adequate motivation for L2 learning. Further, Cummins (2005) indicated that transfer will involve cognitive, linguistic and conceptual elements, although the extent of transfer will vary between similar and dissimilar languages. His interdependence hypothesis implies that language teachers should actively teach for cross-language transfer and develop language awareness by employing bilingual instructional strategies.

2.3 The sociocultural approach

Viewed from a socio-cultural perspective, the L1 in learners' collaborative speech serves as a cognitive tool through which learning is scaffolded. Three important functions have been identified in a number of studies: CS to the L1 by learners provides scaffolding, establishes and maintains relationships, and vocalises one's inner speech.

A substantial body of work on learners' collaborative interactions, particularly among L2 learners sharing an L1 background, but with low level of L2 proficiency, found that the L1 serves as a complimentary tool that learners deploy to provide each other with some level of support in their L2 learning. While undertaking L2 collaborative activities, learners used the L1 to focus their attention on and negotiate target linguistic forms and establish effective task management strategies, which helped them understand and complete tasks (Storch & Aldosari, 2010; Storch & Wigglesworth, 2003; Swain & Lapkin, 2000). These findings were echoed in Anton and DiCamilla's (1999) investigation which found that the L1 was used by the learners to provide each other with assistance, evidenced by them negotiating and evaluating target language knowledge to help them understand the meaning of the text and complete the tasks. Similar conclusions were reached by Villamil and De Guerreo (1996, p.60), who maintained that "the L1 is an essential tool for making meaning of text, retrieving language from memory, exploring and expanding content, guiding actions through the task and maintaining dialogue". Similarly, learners in Storch and Aldosari's (2010) study used the L1 to translate the meanings of L2 vocabulary for themselves.

Further, while attempting to accomplish collaborative tasks, learners switch to their L1 to initiate and sustain interactions with their partners, suggesting the L1 has a role to play in promoting relationships between learners (Anton & DiCamilla, 1999). Other studies found that learners used the L1 for off-task comments and disagreement management, thereby enhancing their personal interactions (Storch & Aldosari, 2010; Swain & Lapkin, 2000; Thoms, Liao & Szustak, 2005). Brooks and Donato's study (1994) also reported that by using the L1 in problem-solving activities, beginner learners of Spanish negotiated meaning and established a shared understanding of the task. They also observed that the use of the L1 by learners is "a normal psycholinguistic process that facilitates L2 production and allows learners both to initiate and sustain verbal interaction with one another" (p.268).

Learners working in collaborative interactions use the L1 to externalise their thoughts, which is essential in the L2 learning processes (Centeno-Cortés & Jimémez-Jiménez, 2004). For example, the learners in Anton and DiCamilla's (1999) study used the L1 for self-evaluating their L2 production, and for regulating their thinking process during cognitively challenging tasks. Confronted by challenging problem-solving tasks, the learners in Centeno-Cortés and Jimémez-Jiménez (2004) shifted into the L1 as part of their reasoning process. These finding are also supported by de Guerrero (2005) who asserts that the L1 plays a cognitive role in the form of an inner voice as learners' silent speech occurs in the L1, and that this facilitates thinking and learning processes.

2.4 The sociolinguistic perspective

From a sociolinguistic perspective, CS to the L1 allows learners to communicate and negotiate their bilingual identities. Collingham (1988) and Piasecka (1988) argued that an individual's sense of identity is inseparably to their mother

tongue. The findings in Ellwood's (2008) study revealed that the learners used the L1 to express their identities in terms of classroom alignment and classroom resistance. When these learners were required to perform some class tasks that were beyond their current capabilities, they used CS to comprehend and complete the task, demonstrating their endeavour "to align both with the task and the role of good students in order to avoid any loss of face" (p.544). Ellwood's study also reported examples of learners using the L1 to resist a "good student identity" and to constitute "criticism of some aspects of the classroom activity" (p.545). When asked to engage in baffling and unhelpful class tasks, they reverted to their L1 as a way to index their discontent and tedium with their peers. In doing so, they did not identify themselves as capable learners, and this was verified in a subsequent interview. From a pedagogical perspective, attending to learners' identity is necessary if the teacher is to foster student engagement and allow students to voice their concerns about tasks and activities as argued by Ellwood. She maintained that CS in this regard is also a form of feedback that teachers can use to evaluate their teaching practices, teaching materials and class activities.

Other studies undertaken from this perspective have revealed how bilingual learners draw on CS to construct their bilingual identity. For example, by relying on CS, learners are able to express their desire to be seen as proficient speakers of a given language and to ally themselves with other learners (Fitts, 2006; Fuller, 2007, 2009). Some learners who could speak German and English fluently switched back and forth between the two languages to get their class work done and concurrently construct their bilingual identity (Fuller, 2009). Other learners in German-English programs were found to repeatedly use more German than their peers in some exchanges, demonstrating their effort to prove their proficiency in German and to claim their membership with the German-dominant groups (Fuller, 2009). Likewise, one student in Fuller's (2007) study fluently switched between Spanish and English with a Spanish-dominant student and then an English-dominant education assistant. Fuller (2007) contended that this CS practice contributed to the identity construction of this student as a proficient bilingual. Some English students engaged in Spanish spoken and written discourse were observed to use CS to prove themselves in response to being excluded by their Spanish-speaking peers because of their assumption that their proficiency level was not sufficient (Fitts, 2006). Fuller (2009, p.130) argued that CS should be considered "as part of language acquisition" for language learners, as switching to the L1 enables learners to associate with their peers, while concurrently developing a new identity when switching to the L2. Similarly, Liebscher and Dailey-O'Cain (2005) proposed that CS allows the learners to communicate their emerging bilingual identity, making them more comfortable with the L2 and, thus making L2 learning practical and achievable.

In summary, the use of the L1 does play a role in SLA. Excluding the L1 from language teaching is counter to the principles of learning, goes against the bilingualisation process, and deprives learners of a beneficial resource for their language learning and identity construction.

2.5Teacher beliefs

Clancey (1997, p.1) claimed that "every human thought and action is adapted to the environment, that is, situated, because what people perceive, how they conceive of their activity, and what they physically do develop together". This position is also discussed by Dufva (2003, p.134) who proposed that

> ...human cognition is best understood as a situated phenomenon...Situatedness refers to the assumption that cognition occurs in time and space and that this spatio-temporal context not only has an impact on cognitive functions but is essentially present in the process of recognising itself. Since cognitive operations develop and occur in a certain physical and social environment, they also bear the mark of that environment. Whatever individuals believe is a consequence of the series of interactions they have been involved in and discourses they have been exposed to.

Thus, this study acknowledges that an individual's beliefs are formulated and continue to evolve through the experiences and the specific and broad contexts of which they are a part.

Pajares (1992) claimed that teacher beliefs are a messy construct. This construct has been termed differently: "beliefs, attitudes and knowledge (Woods, 1996); "teachers' pedagogical systems" (Borg, 1998); "teachers' maxims" (Richards, 1998); "teachers' pedagogic principles" (Breen, Hird, Milton, Oliver & Thwaite, 2001). Borg's (2006) review showed sixteen different labels to describe this mental construct. The difference between the labels appears to centre on the distinction between beliefs and knowledge. According to Pajares (1992, p.313), "belief is based on evaluation and judgment; knowledge is based on objective fact". Ennis (1994), Ernest (1989), and Nespor (1987) all argued that knowledge is often defined as factual information whilst beliefs are more personal and experiential in nature and appear to influence what and how knowledge will be used. Beliefs are more personal and subjective than knowledge, and an individual's beliefs affect the way their knowledge will be used (Nespor, 1987).

In this study, teachers' beliefs are defined as "the information, attitudes, values, expectations, theories and assumptions about teaching and learning that teachers build up over time and bring with them to the classroom" (Richards, 1998, p.66). They function as a guide to their thought and behaviour (Borg, 2001; Pajares, 1992) and exert considerable influence on the decisions teachers make about classroom practices (Johnson, 1994; Pajares, 1992; Shavelson & Stern, 1981; Turner, Christensen & Meyer, 2009). A substantial body of research in mainstream education and language teaching and learning suggests that teachers' beliefs are generated by a cluster of factors, including their prior language learning experience, their accumulated professional experience, their professional education and the institutional and social contexts in which they work.

The literature has documented that the way pre-service, novice and experienced teachers adopt or avoid particular

teaching strategies is informed by their prior learning experience, both positive and negative (Bailey et al., 1996; Borg, 2003; Breen, Hird, Milton, Oliver & Thwaite, 1998; Ellis, 2006; Farewell, 1999; Golombek, 1998; Johnson, 1994; Macaro, 2001; McMillan & Turnbull, 2009; Numrich, 1996; Richards & Pennington, 1998). For example, Bailey et al. (1996), Farewell (1999), Golombek (1998), Johnson (1994), Numrich (1996) provided evidence of the impact of prior learning experience on pre-service teacher beliefs, and hence their instructional practices. Memories of the instruction they encountered as learners may act as a de facto guide when they become teachers themselves (Freeman, 1992, as cited in Borg, 2003). Studies of experienced teachers have also found that teachers' prior learning experiences are a significant influence on their beliefs and instructional decisions (Eisentein-Ebsworth & Schweers, 1997; Woods, 1996). One teacher in Macaro's (2001, p. 543) study explicitly indicated that her belief in the value of L1 in L2 pedagogy derived from her own learning experience: "I grew up doing that... the school used to speak like that". This finding is echoed in McMillan and Turnbull's (2009) study which found that one teacher stated his support for CS in teaching developed as a result of his positive exposure to this practice as a learner. In contrast, Ellis (2006) reported that one teacher viewed CS as a strategic and pragmatic toolin teaching, although this teacher experienced a monolingual teaching approach as a learner.

Along with their schooling experience, teachers' professional experience which is firmly grounded in their practices also exerts influence on their beliefs about teaching (Borg, 1999; Breen et al., 2001; Corcoran, 2008; Crookes & Arakaki, 1999; Phipps & Borg, 2009; Turnbull & Lamoureux, 2001; Xu, 2012). It appears that the teaching process helps them crystallise their perceptions of what works best in their particular teaching situation. Kraemer (2006) observed that less experienced teachers are inclined to engage in CS more than experienced ones. As noted in the literature, teacher beliefs about CS are affected by their professional experience and are evolving. Corcoran (2008) and Turnbull and Lamoureux (2001) reported that teachers believed in the value of CS to the L1 following their practicum.

Another source that has a powerful influence on the development of teacher beliefs is pre-service teacher education (Borg, 1999). According to Borg's observation, one lasting outcome of a teacher training program that encouraged the pre-service teachers to base their L2 teaching on communicative principles was their stated beliefs about the inappropriateness of correcting students' grammatical errors in oral tasks. One teacher in Borg's (1998) study commented on the profound effect of his formal training on his belief about the value of the student-centred inductive approach to grammar teaching, and how this belief was reinforced by further training. Several factors were identified to account for the powerful effect of the training program, including the nature of the course (intensive and had practical orientation) and the teacher's admiration for his educators (Borg, 1998).

The social-cultural and institutional contexts and the classroom environment in which teachers work are factors that also impact on teacher beliefs about language teaching and thereby influence their instructional practices (Borg, 2006, 2009; Cross, 2010; Hu, 2005; Johnson, 2009; Kumaravedivelu, 2001). Contextual factors, such as particular features of the society, school policies, curriculum mandates, high-stakes examinations, time constraints, and learner characteristics prevent teachers from acting in accordance with their beliefs (Borg, 2003). Ng and Farrell (2003) found that although teachers perceived eliciting student responses to error recognition was valuable, they opted to directly correct learners'errors because this approach was faster and more practical in their context. Time constraints were also found to have an impact on language teacher beliefs and practices in Crookes and Arakaki's (1999) study: one teacher's limited time for preparation resulting from a heavy teaching workload led him to select one timesaving exercise, even though he knew there was a better one. Similarly, although believing in the value of using a student-centred teaching approach, the time factor meant that the teacher in Johnson's (1996) study opted for a teacher-centred approach. Perceptions of institutional considerations and norms also frame teachers' beliefs, and therefore, the nature of their practices (Burns, 1996). The findings from Burns' study showed that the teacher's heightened awareness of the de-centralised and needs-based curriculum was pivotal to her thinking about lesson planning, and the content of class tasks and interactions, and she consequently directed her endeavours to "cater for learners' needs" (p.161).

2.6 Teacher beliefs about code switching

Teacher beliefs about CS and its influence on a teacher' use of this strategy have been reported by a number of scholars. Based on the findings of one investigation in 1997, Macaro (2009) postulated that there are three distinct theories regarding CS to the L1: the virtual, maximal and optional position.

Some believe that the classroom is equated with the environment in which only the L2 is used - the virtual position - thereby aiming at total exclusion of the L1. One teacher in Turnbull and McMillan's (2009, p.22) study felt that any use of, or connections with, the L1 "would only cause interference and confusion".

Those teachers subscribing to the maximal position perceive that the L1 has no pedagogical value. Nevertheless, they revert to the L1, as the ideal L2-only teaching and learning condition does not exist. This position is illustrated in Macaro's (2000) study: the majority of teachers considered CS as regrettable, but necessary. Mitchell (1988) reported that the teachers "felt guilty" about using the L1.

The teachers supporting the optimal position acknowledge the pedagogical value in L1 use, and there is a considerable body of evidence in support of this position (Bateman, 2008; Crawford, 2004; Kim & Elder, 2008; McMillan & Turnbull, 2009). Overall, the pedagogical value described by teachers in a range of studies includes aiding student comprehension, communicating aspects of classroom discourse effectively, and facilitating teacher-student relationships.

A recurring theme in most studies investigating teacher

attitudes to CS in language teaching was their perceptions that students' current language competence was not sufficient to comprehend their lecture in the L2, as a result of this, they perceived that CS to the L1 addressed this issue (Bateman, 2008; de la Campa & Nassaji, 2009; Flowerdew et al., 1998; Gauci & Grima 2013; Kim & Elder, 2008; Macaro, 2001). Grammatical structures of the L2 warrant the use of the L1, as are the linguistic terms used in relation to those structures that are challenging and complicated. Thus, it appears that teachers believed that CS to the L1 enables deeper understandings of syntactic structures (Al-Nofaie, 2010; Bateman, 2008; Cheng, 2013; Crawford, 2004; Gauci & Grima, 2013; Inbar-Lourie, 2010; Liu et al., 2004; Macaro, 2001; Tang, 2002; Then & Ting, 2011). The meaning of lexical items in the L2, particularly abstract vocabulary is also perceived to be better understood through the support of the L1, which reduces ambiguity (Cheng, 2013; McMillan & Rivers, 2011). While these beliefs relate CS to L1 as having value in ensuring target linguistic accuracy, teachers in some studies also see this practice as the most appropriate medium for cross-cultural comparisons (Bateman, 2008; Crawford, 2004; House, 2009; Stiefel, 2009), as an effective means of giving learners an overview of the lesson content (Ramos, 2005).

Whilst teachers in language classes are most concerned about student comprehension of different aspects of the L2, teachers in discipline-based classes which use a foreign language as medium of instruction are more concerned about student understanding of the subject content. For example, in Probyn's (2001) study, the secondary school teachers teaching a range of subjects (history, business economics, science, accounting and mathematics) reported their primary focus was to communicate the content of their subject, and the L1 was their preferred means to overcome the barrier the posed to understand the content. More specifically, Flowerdew et al. (1998) found that university level teachers in Humanities and Sciences classes in China highlighted the role of the L1 in conveying subject matter, such as explaining difficult points, translating key terms, clarifying important points, and citing local examples. The teachers in studies by Mafela (2009) and Setati, Adler, Reed and Bapoo (2002) attributed similar value to the L1.

Apart from concerns for student comprehension, teachers in some studies perceived that CS is useful in facilitating classroom interactions (Crawford, 2004). For example, it enables them to give instructions more effectively (Al-Nofaie, 2010; McMillan & Rivers, 2011; Rolin-Ianziti & Brownlie, 2002; Then & Ting, 2011). Some teachers also believed CS assisted students to engage in the activity swiftly, allowing greater practice opportunities in the L2 (de la Campa & Nassaji, 2009) and was useful in keeping students on task (Bateman, 2008; Kim & Elder, 2008; Liu et al., 2004). Other teachers believed that their use of L1 encouraged the students' participation in classroom activities (Flowerdew et al., 1998; Setati, 1998) such as asking questions (Flowerdew et al., 1998), allowed them to control the speed of classroom interactions and keep the lesson moving in the L1 (Wilkerson, 2008), and to effectively highlight some teaching points (Cheng, 2013; Mefela, 2009; Ramos, 2005).

Teachers in some studies supported the value of CS for the organisation of classroom events mostly because of time constraints they worked under, indicating that L1 use is more efficient for outlining procedures (Bateman, 2008; Canagarajah, 1995; Cheng, 2013; Kim & Elder, 2008; Ramos, 2005; Wilkerson, 2008), or that discipline problems are more effectively addressed in the L1 than L2 (Cheng, 2013; Ferguson, 2003; Macaro, 2001; Ramos, 2005).

Teachers also voiced their concern about their aim to establish sound personal relationships with students by CS (Bateman, 2008; Cheng, 2013; Chitera, 2009; de la Campa & Nassaji, 2009; Flowerdew et al., 1998; Gauci & Grima, 2013; McMillan & Rivers, 2011). Teachers suggested they can build rapport with students by making jokes or socialising with them (de la Campa & Nassaji, 2009; Flowerdew et al., 1998), and that it is useful when giving positive feedback or encouragement (Chitera, 2009; Flowerdew et al., 1998; Gauci & Grima, 2013). These views echo what Guthrie (1984) and Setati (2005); namely, that using the language shared by teachers and students signals group membership and helps with the establishment of personal connections. Teachers also believed that they can use the L1 to maintain student interest in learning and highten motivation student learning by individualising their comments or addressing various student expectations (Copland & Neokleous, 2011; de la Campa & Nassaji, 2009; Gauci & Grima, 2013; Kim & Elder, 2008).

In a Vietnamese EFL context aimed at investigating teacher attitudes toward CS practice through the use of a questionnaire to twelve university teachers and interviewing four of them, Kieu and Kim (2010) reported that, overall, teachers viewed these practices in a positive light: they endorsed CS into Vietnamese for the sake of their students' understanding of the target language grammar and vocabulary, and for checking student comprehension. In Le's (2011) study, the teachers generally favoured using CS to Vietnamese in order to secure student comprehension of the target language forms. Indeed, the empirical research on teachers' attitudes toward this phenomenon in Vietnam is still in its infancy; thus, it seems worthwhile to undertake an investigation into teacher beliefs of CS practices in Business English classes where the training focus is both on providing business knowledge and improving English in business contexts.

III. RESEARCH DESIGN AND METHODS

The overarching perspective taken in this study is that "actual meaning emerges only when consciousness engages with the world and objects in the world" (Crotty, 1998, p.43). This is aligned with a pragmatic stance, within which "knowledge arises out of actions, situations and consequences" (Creswell, 2003, p.11). For pragmatists, truth, meaning and knowledge are tentative and subject to change (Johnson & Onwuegbuzie, 2004) and "truth is what works at the time" (Creswell, 2007, p.23). Further, from a pragmatist's viewpoint, "objects of knowledge are instruments for actions, and different worlds, different objects" lead to various opportunities and possibilities for action (Biesta & Burbules,

2003, p.108). This overarching perspective emphasises the choice of multiple tools for collecting and analysing data (Biesta & Burbules, 2003; Creswell, 2007). A mixed methods approach, which this study will adopt, can facilitate a more complete view of the phenomenon being studied (Greene & Caracelli, 1997) within the overarching paradigm. The use of mixed methods has also been advocated by Donmoyer (2006, p.23), who argues that "each perspective might be useful to accomplish different purposes, and at the very least, multiple perspectives can make us aware of different options available to us". Further, employing data generated by different methods has the capacity to lead to more rigorous findings since the use of mixed methods can also facilitate a more comprehensive account of the area of inquiry (Bryman, 2008).

The study took place at a private university in the south of Vietnam. All teachers who were assigned to teach Business English in one semester were approached by email with an invitation to participate and were given an outline of the purpose of the study. At that time, there were eight Business English classes ranging from Elementary Business English 2 to Advanced Business English 1 and 2. Five out of the eight teachers (Teachers 1-5) indicated their willingness to participate in the study, whilst the other three declined due to the time commitments involved. A profile of the five participating teachers is provided in Table 3.1 below.

TABLE I
TEACHER PROFILES

Study code	Gender	Qualification	Years of teaching experience in Business English	Level of Business English class
1	Male	M.A	12	Advanced BE 2
2	Female	M.A	10	Advanced BE1
3	Female	M.A	4	Advanced BE1
4	Male	M.A	2	Elementary BE2
5	Male	M.A	2	Advanced BE1

Subsequent to each observation and video recording session, stimulated recall interviews were organised with participating teachers to discuss the instances of CS in the lesson(s) and to allow them to present retrospective accounts of their CS practices. Most of the teachers attended three interview sessions, but one teacher (teacher 2) attended only two because her second observed lesson was delivered predominantly in English. These interview sessions were conducted on site at mutually convenient times to the teachers and the investigator.

Stimulated recall interviews are an introspective method which deploys tangible visual or aural reminders to prompt the participant to recall thoughts s/he had while performing a task (Gass & Mackey, 2000). Its first use is often attributed to Bloom (1953) who endeavoured to investigate students' thought processes in two different learning situations by playing back audiotapes of lectures and discussions to obtain their commentary. The idea underlying stimulated recall is that, through introspective means, people verbalise their thought processes in a similar way to commenting on external real world events (Gass & Mackey, 2000). The naturalistic context provided by the video recordings can assist participants to present analytical accounts of their actions in situ (Lyle, 2003).

This technique was also selected for this study because it has the potential to uncover cognitive processes which might not be evident through simple observation (Gass & Mackey, 2000). When participants are provided with a large number of stimuli or cues, it is claimed that they will experience an original situation again in their imagination with great accuracy (Bloom, 1953; Calderhead, 1981; Gass & Mackey, 2000; Yinger, 1986). Rowe (2009) asserted that this technique can provide a valuable "insider" perspective on the phenomena under investigation which complements the researcher's "outsider" observation. Also, participants can be empowered by this technique as they can raise their own concerns and discuss instances which they find important or interesting. This can create a relaxed atmosphere during the interview process, which in turn promotes the collection of rich and diverse data (Dempsey, 2010; Rowe, 2009). Speer (2005, p.224) highlighted the benefit of using video-clip playback in researching teacher cognition: the focus is placed on specific examples of teacher practices, as "coarse-grain-sized characterisations of beliefs and general descriptions of teaching practices appear unlikely to do justice to the complex, contextually dependent acts of teaching".

The data generated through this study were analysed, using a constant comparative approach (Cresswell, 1998; Strauss & Corbin, 1990). This inductive method of analysis was selected for a number of reasons: it could be used with virtually all sources of data, including observations, videos and which were the data gathering strategies for this study; it offers a systematic coding of data corpus (Charmaz, 2006); and, "systematic rigour and thoroughness" in the coding provided by constant comparison increases the credibility of the findings (Patton, 2002, p.48).

IV.FINDINGS AND DISCUSSION

4.1 Teacher beliefs about code switching

Contrary to the two first groups of teachers categorised by Macaro (2009) who subscribed to the virtual and maximal position, the teachers in this study held favourable views of the place of CS in their teaching. The teachers described how the L1 plays a significant role in their teaching; for example, it can be used as a teaching aid, as a strategy for promoting student learning, and for supporting the development of a positive affective domain in the classroom.

4.1.1 A Teaching Aid

The teachers delineated how CS to the L1 acts as a teaching aid supporting students' cognitive processes, specifically the

development of content and target language knowledge. Developing understanding was reported as the prime reason prompting teachers to CS. T2 and T3, for example, saw the ultimate objective of their teaching as ensuring student comprehension and identified CS to the L1 as a way to help them achieve this objective.

At the heart of most of the teachers' CS was a concern for improving the students' comprehension of business terms and developing their understanding of related concepts. T2 said that it was critical for the students to obtain a good understanding of business concepts because failing to comprehend a concept when it was first presented would lead to comprehension difficulties with other concepts in the future and switching to the L1 to translate business terms or explain concepts ensured student understanding. T4 commented that business terms must be accompanied by translations into the L1 to aid the students' comprehension. More emphatically, T1 said that his students could only deepen their comprehension of business terms or concepts when his explanations in the L2 were reinforced by their presentation in the L1. T5 concurred and highlighted the problem with conceptually dense reading texts. In the following comment, he described how he initially explained those texts in the L2 and reinforced the reading passages in the L1:

> Making business concepts accessible to the students is a real challenge, particularly those concepts in reading texts in upper-intermediate level. Thus, I illustrate the concepts in English and repeat them in Vietnamese to make them comprehensible.

T4 switched to the L1 to scaffold the students' comprehension of listening transcripts. His following comments illustrate this point:

> The concepts in this listening section are really challenging, and are related to previous part of this exercise. To complicate the issue, the wording of the comprehension questions and recording is different. Thus, I shifted into Vietnamese in order to assist the students to grasp the core message of the transcript.

These findings lend support to those in the literature which show that teachers perceive CS in a positive light, as a way to support student comprehension of content knowledge. For instance, teachers in content-based classrooms in a variety of contexts emphasise the importance of student comprehension of subject matter and propose that student understanding of key subject terms or concepts is considerably promoted when teacher switches to the L1 for reinforcement or explanation (Flowerdew et al., 1998; Mafela, 2009; Probyn, 2001; Setati, 1998).

CS to the L1 is also perceived by most teachers in this study to assist their teaching because it is useful for clarification, a point that is in line with the teachers in the studies by Flowerdew et al. (1998) and Mafela (2009). The teachers in this study described how CS to the L1 provided the students with explanations that helped them appreciate the differences between seemingly similar business terms that have varied meanings in different contexts. T5 gave an example: "team morale" and "team spirit" he said confused the students; thus, he provided L2 definitions and their L1 counterparts to assist students to better distinguish between the two terms. T1 described how he used CS to the L1 to help the students differentiate between such terms as "seasonal work" and "casual work" and commented that it is good practice for teachers to provide students with L1 translations of all those business terms that are widely used in Vietnam. T1 and T2 justified their use of CS to the L1 for the two terms "code of conduct" and "capital punishment" as lessening student confusion: T1 commented that students might confuse the word "code" with "law", while its L1 counterpart, "quy tắc ứng xử" [code of conduct] is quite transparent in its meaning. T2 reported that, without CS to the L1, students might associate the word "capital" in the term "capital punishment" with "money". T3 said that the Vietnamese equivalent of the term "cash flow" is comprehensible, as it is commonly used in the mass media, yet its definition in the L2 is not and may lead to misunderstanding. T2 claimed the use of CS for elaboration is justified for some context-specific business terms, reporting that although in the observed lessons she had repeatedly defined and illustrated the term "specification" in the L2, the students still gave her the Vietnamese equivalent, which was not appropriate to the context of the text. This experience strengthened her belief in the need to use CS in order to assist the students to better differentiate between similar terms.

However, while teachers of content-based lessons in other studies expressed their concern about student understanding of disciplinary terms as a reason for CS (Flowerdew et al., 1998; Mafela, 2009; Martin, 1996; Probyn, 2001), the teachers in this study believed their use of CS also assisted student comprehension of L2 knowledge. In this regard, these teachers' viewpoint is in line with those of second-language teachers in a number of other studies who felt that their teaching of English grammar warrants the complementary use of the L1 (Bateman, 2008; Crawford, 2004; Gauci & Grima, 2013; Macaro, 2001). T5 emphasised the role of CS in English grammar teaching. He said that it is mandatory for him to CS to the L1 to differentiate "might not, may not and could not have done" so that any confusion on the part of the students is minimised, because "could not have done" expresses impossibility while the other two do not. T5 commented that some grammatical points are best differentiated by means of clarification in the L1. To exemplify this, he stated that the students associate "must" with obligation, but "must have done" has a different meaning, and by using the L1 he could draw a distinction between the two grammatical points. His following comments provided an insight into this:

> I reckon the students think "must" is used to express obligation although they are in upper-intermediate level. However, in today's lesson, "must" is used to make deductions or guesses with some levels of certainty. The term "ắt hẳn là" [must have done] can help them figure out the difference in meaning.

T4's rationale for his switch to the L1 for grammar teaching

echoed that of T5, adding that his focus in English grammar teaching is on improving the students' abilities to use it rather than explaining linguistically specific terms.

Aside from English language structures, T4 engaged in CS to help the students grasp the phonetic rules. He commented that the students would give him a blank stare indicating incomprehension if he used the L2 only to explain the pronunciation of the auxiliary verb "can" in its strong and weak forms and to differentiate the stress rules on "precedent" as a noun and as an adjective. Thus, in his view, CS made his explanation of the pronunciation of these words more comprehensible.

Some teachers wanted to ensure that students of all language proficienvy levels and content background could follow their class. Thus, they described the incorporation of CS to the L1 as a resource that accommodated their students' language capabilities and level of content knowledge. This was reflected in their discussion about the relationship between their perceptions of the students' linguistic abilities and content knowledge and their decisions to CS. T1 explained that he uses some Vietnamese in his speech in the L2, as the students' level of L2 proficiency is not sufficiently developed to use only the L2. This rationale resonated with that of T5, who stated that his reason for CS was the students' current level of proficiency in the L2. He also described how he determined the students' language capabilities and adjusted his use of the L2 to accommodate these capabilities:

> I always use a mini-test at the beginning of each course to learn about my students' language competence. I also refer to the students' learning experience in previous courses to adapt my English use because they might find it hard to deal with sudden changes in their teacher's use of English. For example, I would speak 60% English and 40% Vietnamese if their teacher in previous course spoke 40% English and 60% Vietnamese.

Where teachers in this study had concerns about their students' language capabilities, they believed that CS to the L1 was useful in bridging the students' language gaps. In doing so, they mirrored the findings of several studies that have reached the same conclusion (Bateman, 2008; de la Campa & Nassaji, 2009; Flowerdew et al., 1998; Gauci & Grima 2013; Kim & Elder, 2008; Macaro, 2001).

In addition to taking into account her students' language competence, T2's motive for CS involved her concerns about their content knowledge. She said that if she exclusively speaks in the L2, only students with a good command of the L2 who regularly update their business knowledge can follow her class, while those students who are struggling linguistically and who also have limited business knowledge have comprehension problems. Therefore, she overcomes her students' limited knowledge of the content by supplying background concepts in the L1 prior to her class. This point is illustrated in the following comment:

> One of the challenges when teaching this unit is that the students' background knowledge of business is limited, so I always provide the students with the gist of business concepts in Vietnamese and continue my explanations in the L2.

T1 briefed his students using their L1 to provide them with a foundational understanding of a concept prior to explaining it in greater detail in the L2. This finding parallels the reason provided by the Spanish teachers teaching English to Spanish immigrant children in Ramos' (2005) study, who supported the practice of CS to the L1 in order to provide an overview of the lesson.

In addition to aiding comprehension, CS to the L1 was believed to be useful for dealing with the management of the class, particularly in relation to the pace and timing of what occurs in the lessons. T3 commented that it is time-consuming to explain complicated business terms, such as "dividend" in the L2, whereas she needs only two words to convey its meaning in the L1. T1 said that CS to the L1 is more effective when he is explaining the meanings of business terms, particularly when working within the prescribed class time limits. T2 explained that she used CS to save time within a tight teaching time frame, especially when her other attempts to develop understanding in the L2 had been futile. Similarly, switching to the L1 to give complicated and lengthy procedural instructions about classroom activities was found by T1 to be effective, as it freed up considerable class time to spend on practising the L2. T4 also reported that he shifted into the L1 to give procedural instructions; his rationale being that it allowed for greater consistency in his language use over the course of his teaching. This finding confirms the reasons for CS provided by the teachers in studies by Bateman (2008), Canagarajah (1995), Kim and Elder (2008), and Wilkerson (2008).

Not only is CS to the L1 perceived to facilitate comprehension, some of the teachers also suggested that it is a useful technique for checking students' comprehension. T3 recounted her use of the question "What is the L1 equivalent?" to assure herself of her students' comprehension. Similarly, T2 claimed that her students' utterances or responses in the L1 can indicate that they have comprehended her class and, more specifically, the business terminology she used.

> After explaining business terms in English, I purposely require my students to provide Vietnamese labels for those terms in order to confirm that they have understood my explanations.

Further, use of CS is seen as a means of reinforcing and highlighting salient teaching points. T4 described his preference for CS for revision purposes, requiring students to provide the L1 equivalents of two terms he used in the previous lessons. T5 also used CS for revision purposes, as well as outlining the various phases of a project, in which he used CS as a way to highlight to his students those aspects to which they needed to pay most attention. He believed that the students register important information when it is provided in the L1.

These findings coincide with those of previous research showing that CS to the L1 is deemed a more efficient way of

communicating instructions than using the L2 alone (Al-Nofaie, 2010; Canagarajah, 1995, Bateman, 2008; Kim & Elder, 2008; McMillan & Rivers, 2011; Song & Andrew 2009). Other studies have described teacher beliefs about the role of CS in increasing productivity and providing opportunities for practising the L2 (de la Campa & Nassaji, 2009); acting as a vehicle for checking comprehension and focusing students' attention (Cheng, 2013; Liu et al., 2004; Probyn, 2001); and, emphasising the main points of a lesson (Probyn, 2001; Ramos, 2005).

4.1.2 Facilitating student learning

It was the perception of some teachers that their use of CS assisted students to relate their learning to their pre-existing knowledge. T5, for example, stated that he used the L1 following his explanations of business terms in the L2, so that the students could make connections with their existing knowledge. He added that the practice of making the link between the L2 and L1 is imperative, as it facilitates the students' learning of Business English. T4 explained that he prefers to provide the students with business phrases in the L1 in order that they learn new terms based on something familiar. Mirroring the views expressed by the teachers studied by Inbar-Lourie (2010) and McMillan and Turnbull (2009), T3 commented that it was beneficial for student learning to draw on the L1 to enable connections to be made between the L2 and L1, as students may have pre-existing conceptual knowledge in their L1 which can be used in their learning of new concepts.

Similarly, when eliciting topics from his students that would be appropriate to use to start a conversation with a stranger at a networking event in Vietnam, T1 reformulated into the L1 the two expressions "How are you?" and "Hi Phi, your top looks nice". T1 held the view that the L1 facilitates the students' connection with Vietnamese culture and forces them prior to a conversation to consider whether Vietnamese people actually use those expressions as ice-breakers:

> On a number of occasions, utterances in Vietnamese can help students picture themselves in the scene and think twice whether Vietnamese people use those expressions to start a conversation with someone.

Some teachers contended that students are better able to retain language and content knowledge when their explanations in the L2 are reinforced in the L1. For instance, both T3 and T5 reported shifting into the L1 to assist the students to retain the meaning of business terms. T5 believed that it was hard for the students to retrieve the meanings of business terms given the number of such terms provided in each teaching session and that anything that assisted retrieval, such as CS, was beneficial. T2 said that after her explanations in the L2, she purposely asked students to translate the terms she had used into L1 equivalents, as she believed this practice can help the students brainstorm and subsequently recollect the terms. In case their attempts to retrieve the meanings of business terms failed, her support in the L1 significantly increased their recollection. T4 added that he switches to the L1 to draw on local examples with which students were familiar to illustrate business concepts, as he believed this practice fostered the students' deep learning of both content and language knowledge, a finding that is in line with one teacher's conviction in Flowerdew et al.'s (1998) investigation.

4.1.3 Dealing with affective aspects of the classroom

Teachers believed that CS to the L1 created a favourable affective environment for students. Some teachers mentioned that they used CS to encourage positive feelings amongst the students and to create a relaxed classroom atmosphere, claiming that students' frustration, distress, pressure, shock or embarrassment was reduced by CS to the L1. T2 believed that using the L2 exclusively in teaching would "discourage or frustrate" her students, so she does not use the L2 predominantly in her teaching, nor does she forbid her students from using the L1. T1 described the stress students experienced when learning through the medium of an undeveloped language (if teachers spoke only the L2 in a four-period class); thus, he perceived that CS to the L1 created a level of comfort for students which enabled them to engage with the lesson content, although this may be at the expense of learning the L2. T4 remarked that his students were "shocked" to experience a predominant L2 approach, mostly because their previous teachers had mostly used the L1. T3 reported an agreement she had with her students, whereby they could approach her at break time for any explanations in the L1, if necessary. She explained that this agreement spared students the embarrassment of requesting the L1 in class, explaining that some students needed explanations in the L1, but were not comfortable to raise questions in class because they feared they were the only ones who did not understand the points made in the L2.

Teachers in previous studies have expressed the belief that their CS practices were conducive to keeping students interested and motivated (Copland & Neokleous, 2011; de la Campa & Nassaji, 2009; Gauci & Grima, 2013; Kim & Elder, 2008). These findings are echoed in the current study: the teachers believed that their students' interest in learning was maintained through their CS. T4 adjusted the amount of the L2 and L1 he used to arouse his students' interest in learning, claiming that this practice was significant, as once students' interest in learning was piqued, their self-study was encouraged. T5 expressed a similar belief, arguing that teachers struck a balance in their use of the L2 and L1 in such content-based business classes in order to motivate students' autonomous learning:

> I think teachers should use English and Vietnamese to some extent as it can encourage student autonomy.

In this study, the beliefs of teachers were compatible with those in a number of other studies who believed that CS to L1 is a mechanism for building rapport with students (Bateman, 2008; Cheng, 2013; Chitera, 2009; de la Campa & Nassaji, 2009; Flowerdew et al., 1998), a way to create an enjoyable learning environment and a means of enabling teachers to socialise with students (de la Campa & Nassaji, 2009; Flowerdew et al., 1998). The teachers' other arguments in

favour of CS centred on its importance in contributing to the creation of a relaxed classroom atmosphere, which in turn helps them build rapport with their students. Most teachers underscored the importance of maintaining an enjoyable classroom climate, which they believed can be created by the use of jokes in the L1. T1 and T4, for example, both said that they embedded some Vietnamese jokes in their teaching, noting that these are culturally-bound and are interpreted differently from one culture to another. T4 reported that on some occasions he tried telling funny stories to become closer to his students, but when he did so in the L2 he found he was the only one who laughed. T2's rationale for telling jokes in the L1 is that it created a positive learning environment and lessened the social distance between her and her students. In much the same way, T3 claimed she injected humour into her class and her interactions with the students are in the L1 in order to relieve classroom tension and foster the relationship with her students.

4.2 Teachers' Perceptions of Students' Language Needs

Teachers asserted that students have current and long-term language needs and these needs underpinned their beliefs about their CS practices.

4.2.1 Meeting students' current language needs

Teachers firmly believed that they must respond to the students' learning needs. T2 stated she believed that her students are more satisfied when they were provided with business terms in the L1, commenting that the students appeared pleased and/or satisfied when she explained things, such as different types of companies in the L2 and then named each company type in the L1:

> For example, in unit 1 after I explained different types of businesses in English and labelled each in Vietnamese, I noticed that students were very happy, nodding their heads indicating their understanding.

This teacher reported using CS to address students' expectations based on her assessment of those expectations: shifting into the L1 to reinforce or translate business terms. T5 stated during his class, particularly when he was elaborating on business terms, he felt the students expect to be supplied with L1 translations. He explained that he used the L1 because that was what he thought students wanted:

> I have a gut feeling that the students expect corresponding terms in Vietnamese for every business term explained in English.

Other teachers explained their shift into the L1 as a direct response to the students' requests for translations. T2, T3 and T5 reported that, despite repeated explanations and examples in the L2, they engaged in CS to the L1 when students asked for it, because students claimed they could not follow the class otherwise.

4.2.2 Preparing for students' long-term language needs

Longer-term language needs were frequently raised by the teachers to explain their CS into the L1 in their class. Most teachers indicated that it was their perception that students definitely needed L1 equivalents for their future work. T1 stated that, whenever he taught a business term, he liked the students to swiftly switch that term to the L1 so that they understood and applied these terms to their future careers. T3 said that providing students with an L1 translation of business terms commonly used in Vietnam was necessary for students who would enter the job market in the next few years. Specifically, T3 explained that the students might say something like "mời anh chị nhận tiền lãi từ cổ phần" [you are kindly invited to receive the interest from your shares], an uncommon expression in Vietnamese. She, therefore, relies on the L2 to explain the term "dividend" and her repetition of the lexical item "dividend" in the L1 as "cổ tức " to prepare her students for their prospective workplace needs (if they are asked to compose a letter to shareholders). Although T5 did not give specific examples of how his students will need the L1 for their future careers in business, he maintained that they will not exclusively use the L2 in the future, as most will be working in their home country and students need to know business terms in the L1.

Some teachers expressed the view that CS to the L1 is a technique they employed to enlarge students' linguistic repertoire which they may then use in other studies, such as subsequent courses of the Business English and the Translation-Interpreting units. T1 reported that discussion on topics of non-Business themes expanded students' vocabulary (asking them to provide the L2 equivalents of the lexical item "ngưỡng nghèo" [poverty line]) and had the long term benefit of allowing the students to accumulate a considerable vocabulary, in particular lexical items relevant to their study in the Translation-Interpreting unit. T2 asserted that she tries to cultivate the students' vocabulary, particularly high-frequency vocabulary available in the mass media or in workplace settings, so they can use it in their future study. T2 repeatedly attributed the need to learn L1 equivalents of L2 business terms. T3 said that when she switched to the L1 equivalent (of terms such as "dividend"), she does so to inform the students who might have known this in the L1 but not in its L2 form, a view that was also discussed by one teacher in McMillan and Turnbull's (2009) study.

Some teachers believed that their CS to the L1 prepares students for future language use. T1 stated that his CS to the L1 for business terms was essential because this practice assisted students to use the terms accurately and students reduced the mistakes they made in their translation tasks:

> It is essential for teachers in such Business English classes to switch into Vietnamese for explaining or reinforcing business terms. This can promote students' deep understanding of business terms which, in turn, develops accuracy in L2 production so errors in translation or interpreting can be reduced.

Consistent with two teachers in Kim and Elder's (2008) study, who reported the use of the students' L1 in response to the need to prepare their students for their upcoming translation tasks, T1's perceptions of learners' language needs appeared to exert a strong influence on his choice of linguistic code. He said that if the students were not supplied with thorough explanations and L1 equivalents for some terms such

as "seasonal work, casual work, piece work and out work", they would not be able to perform a translation task involving those terms in the future. If students were required to translate these terms from the L2 into the L1, their wording in the L1 may not be appropriate or they may be unable to select the proper vocabulary in the L2. T4 outlined how his CS use for certain business phrases assisted students to use these phrases properly in the L2. He also believed that once phonetic rules were explained in the L1, his students had a deeper understanding of them and were able to avoid some common mispronunciation errors - for example, when his students were made aware of how to pronounce weak and strong sounds, they would be better able to converse with and comprehend people in the workplace:

> I would like to raise the students' awareness of pronunciation issues so that they can be well-prepared for their conversations in their future workplace settings.

4.3 Factors Shaping Teachers' Beliefs about Code Switching Practices

All the participating teachers stated that they maximised their use of the L2 as the medium of instruction on the grounds that the students' exposure to the L2 would otherwise be quite limited. The teachers discussed their awareness of the need to use the L2 and their attempts to minimise their use of CS as illustrated in the following comments:

> T5: I am well aware that students need to be exposed to as much English as possible, therefore, prior to providing the L1 equivalents, I explained business concepts in English in the contexts.
>
> T4: Using the target language is my priority and I am conscious that extensive use of Vietnamese adversely affects students' English learning. They might have difficulties making themselves understood in English the concepts of which they have a good understanding.

However, they also felt the need to switch to the L1 in specific circumstances. These teachers expressed the strong belief that it is not essential to use the L2 entirely, but that using the L2 predominantly is undesirable or pedagogically defensible. It is clear that they support CS as part of their teaching practice. T1 remarked that the exclusive use of the L2 is not necessary and emphasised the need for CS to the L1 in Business English classes. Similarly, but more emphatically, both T3 and T5 said that it is mandatory to use the L1 in some instances when teaching Business English. T3 believed:

> I do not think teachers have to prove themselves to be knowledgeable about English by speaking exclusively in English. It is not necessary to ideologically preclude Vietnamese in English teaching.

The data indicates that the teachers explicitly advocated the use of the L1, as it has particular value in their teaching. T2 said that, for her, the L1 is a complementary instructional strategy. Four other teachers claimed that the L1 is a valuable instructional resource. The data reveals that their beliefs about CS practices have been shaped by multiple elements, including their previous professional experience, their prior experience as language learners, their understanding of theories of language learning and teaching and their knowledge of contextual factors.

4.3.1 Previous professional experience

Teaching experience in other units or programs has reinforced the belief of some teachers of the need to use both the L1 and L2. Both T1 and T2 reported they taught Interpreting-Translation and Business English units concurrently, which prompted them to CS to the L1. These two teachers observed that students can competently apply business terms in their Interpreting- Translation tasks once they are provided with the L1 equivalents. T2 gave an example of a student in the Interpreting-Translation unit asking her for the L2 equivalent of the term "dự án khả thi" [a feasible project], a high-frequency term in the Business English unit, to complete a translation task. T1 stressed the need to use the L1 on the basis of his teaching experience:

> I'm currently teaching a Interpreting-Translation unit which sheds light for me that providing the students with business terms in Vietnamese or widely used terms in everyday English will help them use the terms properly in this class.

The strong belief that the use of the L1 in teaching is warranted was strengthened by some teachers' previous unsuccessful experience of predominantly using the L2 in instruction. T2 recalled that she had attempted to exclusively teach in the L2, but noticed the students' boredom or disinterest, which encouraged her to switch to the L1. Similarly, T4 reported doing a listening comprehension lesson in which he spoke entirely in the L2 and the students could not complete all the tasks, indicating to him that his teaching was not successful. Based on this experience, when he undertook a second lesson with the same level, he adjusted his teaching strategies to include the use of CS to the L1 to explain core concepts in the listening transcript.T4 also recounted his experience with an L2-only policy in a training course, an approach which lasted a very short time due to the students' comprehension difficulties. He further spoke of his university's plan to adopt a L2-only policy - one that did not come into effect due to perceived concerns about the comprehension capacity of the students. These experiences confirmed his belief about the need to switch to the L1 in his teaching.

The teachers' descriptions indicated that their professional experience has informed the beliefs they hold about the value of CS in their pedagogy. These findings reflect the view in the literature that a teacher's beliefs about teaching and learning a language are generated during the teaching process (Borg, 1999; Breen et al., 2001; Crookes & Arakaki, 1999; Xu, 2012), based on the "knowledge and information gained from their trial and error" (Crookes & Arakaki, 1999, p.16). On the basis of classroom experience, one teacher in Borg's (1999) study reported his understanding of the students' need for, and comfort with, explicit talk about L2 grammar, while a teacher in Phipps and Borg's study (2009) believed in the theoretical

value of group work in grammar teaching. However, students' negative responses to his organisation of grammar teaching led him to use teacher-student interaction instead. Some teachers in Brazilian ELT schools in Corcoran's (2008, p.157) study believed "there is a place for L1 use" as a result of their experience working with beginner learners, as well as observing the difficulties in using the L2 only. Prior to their practicum, some pre-service teachers in an investigation by Turnbull and Lamoureux (2001) perceived that the optimal approach for language teaching was the use of L2 only. However, following their practicum, many of them had come to accept the value of CS to the L1 for instructional purposes, similar to the teachers in the current study.

4.3.2 Prior experience as language learners

Their own prior experience as language learners played a critical part in shaping their perceptions about CS to the L1 in their teaching. Some told of the comprehension problems they had encountered as language learners and how this informed their belief that CS can be used to overcome this. For three teachers, their own learning experience was the basis for them anticipating their students' learning difficulties. T5 revealed that his experience of learning the L2 and his need for L1 translations to enhance his comprehension underpinned his decision to CS. T3 said that she used to have comprehension difficulties when her teacher predominantly used the L2, but the problems were resolved when the explanations were repeated in the L1. T3 added that from her experience as a teacher who was in the process of learning Business English herself, she needed to know specific modes of expressions for content terms in the L1, and believed that the students shared this need. T4 recounted his negative language learning experience in upper secondary school when his teacher used the L2 only for the exposition of phonetic rules involving a range of linguistic terms, which remained beyond his comprehension at that stage. These teachers' negative experience with English-only helped them to empathise with their students and pre-empt a similar experience: "understandings that come through shared life experience and cultural background" are important (Auerbach, 1993, p.28).

These findings indicate that the teachers' beliefs about language learning and teaching and their use of the L1 seem to be related to their own school English language learning experiences. Thus, their "apprenticeship of observation" (Lortie, 1975, as cited in Borg, 2006) represents the basis upon which they chose to use CS for some aspects of their teaching. These findings support other studies which show that teachers' prior language learning experience, either positive or negative, has a significant influence on their beliefs about how a language should be learnt (Bailey et al., 1996; Borg, 2003; Breen et al., 1998; Ellis, 2006; Farewell, 1999; Golombek, 1998; Johnson, 1994; Macaro, 2001; McMillan & Turnbull, 2009; Numrich, 1996; Richards & Pennington, 1998). In Farewell's (1999) study, based on their own experiences as learners, some pre-service teachers decided to adopt an inductive teaching approach to grammar instead of a deductive one, which they believed lead to student passivity. In other studies, teachers reported that they avoided interrupting their students' flow of speech to provide correction because of the negative experiences they had being 'hyper-corrected' (Golombek, 1998; Numrich, 1996). In contrast, Numrich (1996) reports in his study one teacher consciously incorporating a cultural component into her language teaching, as she found this to be an enjoyable part of her own learning experience. Some teachers in a study by Breen et al. (1998), with previous experience of learning a language other than English appeared to understand the anxiety their students might experience. Thus, these teachers adopted practices to reduce their students' anxiety level such as encouraging them to take risks in using English or organising group work activities. Breen et al. also described how one teacher who experienced the need to understand everything to learn a second language reported her endeavour to render her input comprehensible to every student in her class. Teachers who had exposure to CS and had positive learning experience from this practice expressed a positive attitude toward its value in teaching (Macaro, 2001; McMillan & Turnbull, 2009).

In summary, the teachers' descriptions of the value they attached to CS in language pedagogy indicated that their experience as language learners and as teachers had convinced them of its value, and this then shaped how they used the L1 - their experience was an important contributor to their beliefs about CS, and thereby their CS practices.

4.3.3 An understanding of theories of language learning and teaching

Theories of language learning and teaching appear to have had an impact on one teacher's beliefs about the value of L1. T5 referred to Krashen's (1985) theory of comprehensible input and expressed his support for it. As he put it, among the several ways to make the teachers' input comprehensible was a switch to the L1 in order to create lessons at appropriate levels of difficulty:

> I really like Krashen who developed the comprehensible input hypothesis which means that learners should not be provided with input beyond their comprehension level. The input provided by teachers should be slightly challenging and it is advisable that teachers use a range of strategies including occasional L1 use to facilitate learner comprehension.

4.3.4 Knowledge of contextual factors

The teachers' knowledge of the context also played an important role in moulding their beliefs about CS in their teaching. Their knowledge of the institution's training orientation affected their beliefs about the role of CS in their instruction. T2 explained:

> In today's lesson I consciously used the L1 for some particular business terms which the students will most likely to come across in the Interpreting-Translation unit. I am aware that the students will undertake the Interpreting-Translation unit as required in the training program.

For T1, the need to use CS to aid student learning of business terms relevant to the Interpreting-Translation units was seen even more pressing:

I know that the students are doing Translation-Interpreting unit; thus, my use of the L1 is useful for their study of this unit or when they enter the job market.

V.CONCLUSION

CS was a typical phenomenon in the observed classes serving particular pedagogical functions and was supported in certain contexts. This study reinforces the call in the literature to recognise CS as a useful instructional resource.

Teacher beliefs about CS derive from both their experiences and contextual learning factors. Therefore, one implication for practice is that rather than adopting a top-down model dictating a "one-size-fits-all" approach to L1 and L2 use, the need is for an informed pedagogical eclecticism that focuses on "what language learning and teaching mean to local participants in the full context of their lives, within but also beyond the classroom" (Tudor, 2003, p.8). This call is consistent with that of Widdowson (2003, p.159) who advocates for an English pedagogy "which is global in its use, and local in its learning" and the need to consider the context of learning and the specific goals being pursued by learners (Auerbach, 1993; Stern, 1992). Cook (2001, p.403) believes that "language teaching methodology has to be responsive to the multiple goals within one educational context and the varying aims across contexts". Thus, the key to dealing with language choices in instruction is flexibility, encompassing an approach that is responsive and pragmatic, according to the context.

In this study, CS was clearly evident in different aspects of teaching, appeared to serve sound pedagogical functions and was favoured by the teachers. The findings of this study suggest that language teachers should not suppress the use of CS or endeavour to use the L2 entirely. Rather, use of CS should be encouraged, provided that most of the interaction between teachers and learners is in the L2, and that a variety of strategies are used along with CS. To assist the appropriate use of CS practices, teachers should be encouraged to develop personalised and localised strategies for CS use, based on their own evidence and reflections together with improved theoretical understanding, which align with their own beliefs and the specific factors of their teaching contexts.

REFERENCES

[1] Al-Nofaie, H. (2010). The attitudes of teachers and students towards using Arabic in EFL classrooms in Saudi public schools - A case study. *Novitas-Royal - Research on Youth and Language*, 4(1), 64-95.

[2] Anton, M., & DiCamilla, F. (1999). Socio-cognitive functions of L1 collaborative interaction in the L2 classroom. *Canadian Modern Language Review*, 54, 414-342.

[3] Auerbach, E.R. (1993). Reexamining English only in the ESL classroom. *TESOL Quarterly*, 27(1), 9-32.

[4] Bailey, K.M., Bergthold, B., Braunstein, B., Fleischman, N.J., Holbrook, M.P., Tuman, J., Waissbluth, X., & Zambo, L.J. (1996). The language learner's autobiography: Examining the "apprenticeship of observation". In D. Freeman & J.C. Richards (Eds.), *Teacher learning in language teaching* (pp.11-29). Cambridge, UK: Cambridge University Press.

[5] Bateman, B.E. (2008). Student teachers' attitudes and beliefs about using target language in the classroom. *Foreign Language Annals*, 41(1), 11-28.

[6] Bentahila, A. (1988). *Language attitudes among Arabic-French bilinguals in Morocco*. Clevedon: Multilingual Matters.

[7] Biesta, G.C.C., & Burbules, C.N. (2003). *Pragmatism and educational research*. Lanham, MD: Rowan & Littlefield Publishers Inc.

[8] Bloom, B.S. (1953).Thought-processes in lectures and discussions. *Journal of General Education*, 7(3), 160-169.

[9] Borg, M. (2001). Key concepts in ELT. Teachers' beliefs. *ELT Journal*, 55(2), 186-188.

[10] Borg, S. (1998). Teachers' pedagogical systems and grammar teaching: A qualitative study. *TESOL Quarterly*, 32(1), 9-37.

[11] Borg, S. (1999). Studying teacher cognition in second language grammar teaching. *System*, 27(1), 19-31.

[12] Borg, S. (2003). Teacher cognition in language teaching: A review of research on what language teachers think, know, believe, and do. *Language Teaching*, 36(2), 81-109.

[13] Borg, S. (2006). *Teacher cognition and language education: Research and practice*. London: Continuum.

[14] Borg, S. (2009). Language teacher cognition. In A. Burns & J.C. Richards (Eds.), *The Cambridge guide to second language teacher education*. Cambridge: Cambridge University Press.

[15] Breen, M.P., Hird, B., Milton, M., Oliver, R., & Thwaite, A. (1998). *Principles and practices of ESL teachers. A study of teachers of adults and children*. Centre for Applied Language and Literacy Research. Edith Cowan University.

[16] Breen, M. P., Hird, B., Milton, M., Oliver, R., & Thwaite, A. (2001). Making sense of language teaching: Teachers' principles and classroom practices. *Applied Linguistics*, 22(4), 470-501.

[17] Brooks, F., & Donato, R. (1994). ' Vygotskyan approaches to understanding foreign language learner discourse during communicative tasks. *Hispania*, 77, 262– 274.

[18] Bryman, A. (2008). *Social research methods* (3rd ed.). Oxford: Oxford University Press.

[19] Burns, A. (1996). Starting all over again: From teaching adults to teaching beginners. In D. Freeman & J. C. Richards (Eds), *Teacher learning in language teaching* (pp. 154-177). Cambridge: Cambridge University Press.

[20] Butzkamm, W. (2011).Why make the crawl if they can walk? Teaching with mother tongue support. *RELC Journal*, 42(3), 379-391.

[21] Butzkamm, W., & Caldwell, J.A.W. (2009). *The bilingual reform. A paradigm shift inforeign language teaching*. Tu¨bingen: Narr Francke Attempto Verlag.

[22] Calderhead, J. (1981). Stimulated recall interview: A method for research on teaching. *Journal of Education Psychology*, 51, 211-217.

[23] Canagarajah, A.S. (1995). Functions of codeswitching in ESL classrooms: Socialising bilingualism in Jaffna. *Journal of Multilingual and Multicultural Development*, 6(3), 173-195.

[24] Centeno-Cortés, B., & Jiménez-Jiménez, A. (2004). Problem solving tasks in a foreign language: The importance of the L1 in private verbal thinking. *International Journal of Applied Linguistics*, 14, 7–35.

[25] Charmaz, K. (2006). *Constructing grounded theory. A practical guide through qualitative analysis*. London: Sage.

[26] Cheng, X. (2013). Research on Chinese college English teachers' classroom code-switching: Beliefs and attitudes. *Journal of Language Teaching and Research*, 4(6), 1277-1284.

[27] Chitera, N. (2009). Code-switching in a college mathematics classroom. *International Journal of Multilingualism*, 6(4), 462-442.

[28] Clancey, W. J. (1997). *Situated cognition: On human knowledge and computer representations*. Cambridge: Cambridge University Press.

[29] Collingham, M. (1988). Making use of students' linguistic resource. In S. Nicholls & E. Hoadley-Maidment (Eds). *Current issues in teaching English as L2 to adults*. London: Edwart Arnold.

[30] Cook, V. (2001). Using the first language in the classroom. *Canadian Modern Language Review*, 57(3), 402– 423.

[31] Cook, V. (2005). Basing teaching on the L2 user. In E. Llurda (Ed.). *Non-native language teachers: Perceptions, challenges and contributions to the profession* (pp.47-62). New York: Springer.

[32] Copland, F., & Neokleous, G. (2011). L1 to teach L2: Complexities and contradictions. *ELT Journal*, 65(3), 270-280.

[33] Corcoran, J.N. (2008). *L1 in the L2 classroom: Framing Brazilian teacher beliefs and practices* (Unpublished Master's Thesis). University of Toronto, Canada.

[34] Corder, S.P. (1992). A role for the mother tongue. In S.M. Gass & L. Selinker (Eds.), *Language transfer in language learning* (pp.18-31). Amsterdam: John Benjamins Publishing.

[35] Crawford, J. (2004). Language choices in the foreign language classroom: Target language or the learners' first language? *Regional Language Centre Journal*, 35(1), 5-20.

[36] Creswell, J.W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.

[37] Creswell, J.W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage.

[38] Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). London: Sage.

[39] Crookes, G., & Arakaki, L. (1999). Teaching idea sources and work conditions in an ESL program. *TESOL Journal*, 8(1), 15-19.

[40] Cross, R. (2010). Language teaching as sociocultural activity: Rethinking language teacher practice. *The Modern Language Journal*, 94(3), 434-452.

[41] Crotty, M. (1998). *The foundations of social research: Meaning and perspectives in the research process*. St Leonards, NSW: Allen & Unwin.

[42] Cummins, J. (1991). Interdependence of first and second language proficiency in bilingual children. In E. Bialystok (Ed), *Language processing in bilingual children* (pp 7-89). Cambridge: Cambridge University Press.

[43] Cummins, J. (2005). *Teaching for cross-language transfer in dual language education: Possibilities and pitfalls*. TESOL symposium on dual language education: Teaching and learning two languages in the EFL setting. Bogazici University, Istanbul, Turkey.

[44] Cummins, J. (2007). Rethinking monolingual strategies in multilingual classrooms. *Canadian Journal of Applied Linguistics*, 10(2), 221-240.

[45] Cummins, J. (2008). Teaching for transfer: Challenging the two solitudes assumption in bilingual education. In J. Cummins & N.H. Hornberger (Eds.), *Encyclopedia of Language and Education*. New York: Springer Science, Business Media LLC.

[46] de la Campa, J.C., & Nassaji, H. (2009). The amount, purpose, and reasons for using L1 in L2 classrooms. *Foreign Language Annals*, 42, 742-759.

[47] de Guerrero, M. C.M.(2005). *Inner speech-L2: Thinking words in a second language*. Boston, US: MA, Spinger.

[48] Dempsey, N.P. (2010). Stimulated recall interviews in ethnography. *Qual Sociol*, 33, 349-367.

[49] Donovan, M.S., & Bransford.J.D. (2005). *How students learn: History, mathematics, and science in the classroom*. Washington, DC: National Academy Press.

[50] Donmoyer, R. (2006). Take my paradigm ... please! The legacy of Kuhn's construct in educational research. *International Journal of Qualitative Studies in Education*, 19(1), 11-34.

[51] Dufva, H. (2003). Beliefs in dialogue: A Bakhtinian view. In P. Kalaja & A. M. F. Barcelos (Eds.), *Beliefs about SLA: New research approaches* (pp.131-151). Dordrecht, the Netherlands: Kluwer Academic Publishers.

[52] Eisenstein-Ebsworth, M., & Schweers, C.W. (1997).What researchers say and practitioners do: Perspectives on conscious grammar instruction in the ESL classroom. *Applied Language Learning*, 8, 237–6.

[53] Ellis, E. M. (2006). Language learning experience as a contributor to ESL teacher Cognition. *TESL-EJ*, 10 (1).

[54] Ellis, R. (1985). *Understanding second language acquisition*. Oxford: Oxford University Press.

[55] Ellwood, C. (2008). Questions of classroom identity: What can be learned from codeswitching in classroom peer group talk? *The Modern Language Journal*, 92 (4), 538–557.

[56] Ennis, C. D. (1994). Knowledge and beliefs underlying curricular expertise. *Quest*, 46, 164-175.

[57] Ernest, P. (1989).The impacts of beliefs on the teaching of mathematics. In P.Ernest (Ed.), *Mathematics teaching: The states of the art* (pp. 249-254). London: Falmer Press.

[58] Farewell, T.S.C. (1999). The reflective assignment: Unlocking pre-service English teachers' beliefs on grammar teaching. *RELC Journal*, 30(1), 1-17.

[59] Ferguson, G. (2003). Classroom code-switching in post-colonial contexts. Functions, attitudes and politics. In S. Makoni & U.H.Meinhof (Eds.), *AILA Review. Africa & Applied linguistics* (pp.38-51). Amsterdam: John Benjamins Publishing Company.

[60] Fitts, S. (2006). Reconstructing the status quo: Linguistic interaction in a dual-language school. *Bilingual Research Journal*, 29(2), 337-365.

[61] Flowerdew, J., Li, D., & Miller, L. (1998). Attitudes towards English and Cantonese among Hong Kong Chinese university lecturers. *TESOL Quarterly*, 32(2), 201-230.

[62] Fuller, J.M. (2007). Language choice as a means for shaping identity. *Journal of Linguistic Anthropology*, 17(1), 105-129.

[63] Fuller, J.M. (2009). How bilingual children talk: Strategic codeswitching among children in dual language programs. In M.Turnbull & J. Dailey-O'cain (Eds). *First language use in second and foreign language learning*. Bristol: Multilingual Matters.

[64] Gass, M.S., & Mackey, A. (2000). *Stimulated recall methodology in second language research*. Mahwah, New Jersey: Lawrence Erlbaum Associates.

[65] Gauci, H., & Grima, C.A. (2013). Codeswitching as a tool in teaching Italian in Malta. *International Journal of Bilingual Education and Bilingualism*, 16 (5), 615-631.

[66] Gibbons, J.P. (1983). Attitudes towards languages and co-mixing in HongKong. *Journal of Multilingual & Multicultural Development*, 4(2), 129-147.

[67] Golombek, P.R. (1998). A study of teacher's personal practical knowledge. *TESOL Quarterly*, 32, 447-464.

[68] González-Davies, M. (2014). Towards a plurilingual development paradigm: from spontaneous to informed use of translation in additional language learning. *The Interpreter and Translator Trainer*, 8(1), 8-31.

[69] Greene, J.C., Caracelli, V. J., & Graham, W. F. (1989). Toward a conceptual framework for mixed methods evaluation design. *Educational Evaluation and Policy Analysis*, 11, 255-274.

[70] Hall, G., & Cook, G. (2012). Own language use in language teaching and learning. *Language Teaching*, 45(3), 271-308.

[71] Hopkins, S.M. (1988). Use of mother tongue in the teaching of English as a second language to adults. *Language Issues*, 2(2), 18-24.

[72] House, J. (2009). *Translation*. Oxford: Oxford University Press.

[73] Hu, G. (2005). Contextual influences on instructional practices: A Chinese case for an ecological approach to ELT. *TESOL Quarterly*, 39(4), 635-660.

[74] Inbar-Lourie, O. (2010). English only? The linguistic choices of teachers of young EFL learners. *International Journal of Bilingualism*, 14(3), 351-367.

[75] Jenkins, S. (2010). Monolingualism: An uncongenial policy for Saudi Arabia's low-level learners. *ELT Journal*, 64(4), 459-461.

[76] Johnson, K.E. (1994). The emerging beliefs & instructional practices of presence English as a second language teachers. *Teaching & Teacher Education*, 10(4), 439-452.

[77] Johnson, K.E. (1996). The vision versus reality: The tensions of the TESOL practicum. In D. Freeman & J.C. Richards (Eds.), *Teacher learning in language teaching* (pp. 30-49), Cambridge: Cambridge University Press.

[78] Johnson, K.E. (2009). *Second language teacher education. A sociocultural perspective*. New York: Routledge.

[79] Johnson, R.B., & Onwuegbuzie, A.J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7), 14-26.

[80] Kecskes, I., & Papp, T. (2000). *Foreign language and mother tongue*. Mahwah, N.J.: Lawrence Erlbaum Ass.

[81] Kieu, H., & Kim, A. (2010). Use of Vietnamese in English language teaching in Vietnam: Attitudes of Vietnamese university teachers. *English Language Teaching*, 3(2), 119-128.

[82] Kim, S., & Elder, C. (2008). Target language use in foreign language classrooms: Practices and perceptions of two native speaker teachers in New Zealand. *Language, Culture and Curriculum*, 21(2), 167-185.

[83] Kraemer, A. (2006). Teachers' use of English in communicative German language classrooms: A qualitative analysis. *Foreign Language Annals*, 39 (3), 435-450.

[84] Krashen, S.D. (1985). *The input hypothesis: Issues and implications*. New York: Longman.

[85] Krashen, S.D. (1996). *Under attack: The case against bilingual education*. California: Language Education Associates.

[86] Kroll, J.F., & Stewart, E. (1994). Category interference in translation & picture naming: Evidence for asymmetric connections between bilingual memory representations. *Journal of Memory and Language*, 33, 149-714.

[87] Kumaravedivelu, B. (2001). Toward a postmethod pedagogy. *TESOL Quarterly*, 35(4), 537-560.

[88] Le, V.C. (2011). *Form-focused instruction: A case study of Vietnamese teachers' beliefs and practices*. (Unpublished Doctoral Dissertation), University of Waikato, New Zealand.

[89] Leech, N. L., & Onwuegbuzie, A. J. (2008). Qualitative data analysis: A compendium of techniques for school psychology research and beyond. *School Psychology Quarterly*, 23, 587–604.

[90] Li, C.S.D. (2008). *Understanding mixed code & classroom code switching: Myths & realities*. New Horizons in Education, 56(3), 75-87.
[91] Liebscher, G., & Dailey-O'Cain, J. (2005). Learner code-switching in the content-based foreign language classroom. *Canadian Modern Language Review*, 60(4), 501-525.
[92] Liu, D., Ahn, G.S, Baek.K.S., & Han, N.O. (2004). South Korean high school English teachers' code switching: Questions and challenges in the drive for maximal use of English in teaching. *TESOL Quarterly*, 38 (4), 605-637.
[93] Lucas, T., & Katz, A. (1994). Reframing the debate: The roles of native languages in English-only programs for language minority students. *TESOL Quarterly*, 28 (3), 537-561.
[94] Lyle, J. (2003). A report on its use in naturalistic research. *British Educational Research Journal*, 29 (6), 861-878.
[95] Macaro, E. (2000). *Issues in target language teaching. In K. Field (Ed.) Issues in modern foreign languages teaching* (pp.171-189). London: Routledge/Falmer.
[96] Macaro, E. (2001). Analysing student teachers' code switching in foreign language classrooms: theories and decision making. *The Modern Language Journal*, 85(4), 531-548.
[97] Macaro, E. (2005). Codeswitching in the L2 classroom: A communication and learning strategy. In E. Llurda (Ed.), *Non-native language teachers: Perceptions, challenges and contributions to the profession* (pp.47-62). New York: Springer.
[98] Macaro, E. (2009). Teacher use of codeswitching in the second language classroom: Exploring 'optimal' use. In M. Turnbull & J. Dailey-O'Cain (Eds.), *First language use in second and foreign language learning* (pp.35-49). Bristol: Multilingual Matters.
[99] MacDonald, C. (1993). *Using the target language*. Cheltenham, UK: Mary Glasgow Publications.
[100] Mafela, L. (2009). Code switching in Botswana history classrooms in the decade of education for sustainable development. *Language Matters*, 40(1), 56-79.
[101] Martin, P.W. (1996). Code switching in the primary classroom: One response to the planned and the unplanned language environment in Brunei. *Journal of Multilingual and Multicultural Development*, 17(2), 128-144.
[102] McMillan, B., & Turnbull, M. (2009). Teachers use of the first language in French immersion: Revisiting a core principle. In M.Turnbull & J. Dailey-O'cain (Eds). *First language use in second and foreign language learning*. Bristol: Multilingual Matters.
[103] McMillan, B., & Rivers, D.J. (2011). The practice of policy: Teacher attitudes toward "English-only" policy. *System*, 39, 251-263.
[104] Mitchell, R. (1988). *Communicative language teaching in practice*. London: CILT.
[105] Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies*, 19 (4), 317-328.
[106] Ng, J., & Farrell, T.S.C. (2003). Do teachers' beliefs of grammar teaching match their classroom practices? A Singapore case study. In D. Deterding, A. Brown & E. Low (Eds.), *English in Singapore: Research on grammar* (pp. 128-137). Singapore: McGraw Hill.
[107] Nguyen, V.L. (2011). *Dynamic conceptions of input, output and interaction: Vietnamese EFL lecturers learning second language acquisition theory*. (Unpublished Doctoral Dissertation). The University of Waikato, New Zealand.
[108] Numrich, C. (1996). On becoming a language teacher: Insights from diary studies. *TESOL Quarterly*, 30(1), 131-153.
[109] Pajares, M.F. (1992). Teachers' beliefs and educational research: Cleaning up a messy construct. *Review of Educational Research*, 62(3), 307-332.
[110] Patton, M.Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks: Sage.
[111] Phipps, S., & Borg, S. (2009). Exploring tensions between teachers' grammar teaching beliefs and practices. *System*, 37(3), 380-390.
[112] Piasecka, K. (1988). The bilingual teacher in the ESL classroom. In S. Nicholls & E. Hoadley-Maiment (Eds.), *Current issues in teaching English as a second language* (pp.97-101). London: Edward Arnold.
[113] Probyn, M. (2001). Teachers' voices: Teachers' reflections on learning and teaching through the medium of English as an additional language in South Africa. *International Journal of Bilingual Education and Bilingualism*, 4(4), 249-266.
[114] Raschaka, C.,Sercombe, P.,& Chi-Ling, H. (2009).Conflicts and tensions in codeswitching in Taiwanese in EFF classroom. *International Journal of Bilingual Education & Bilingualism*, 12 (2), 157-171.
[115] Ramos, F. (2005). Spanish teachers' opinions about the use of Spanish in mainstream English classrooms before and after their first year in California. *Bilingual Research Journal*, 29(2), 411-500.
[116] Richards, J. C. (1998). *Beyond training: Perspectives on language teacher education*. Cambridge: Cambridge University Press.
[117] Richards, R.C., & Pennington, M. (1998). The first year of teaching. In J.C. Richards (Ed.) *Beyond Training* (pp-173-190). Cambridge Language Teaching Library: Cambridge University Press.
[118] Rolin-Ianziti, J., & Brownlie, S. (2002). Teacher use of learners' native language in the foreign language classroom. *The Canadian Modern Language Review*, 58(3), 402-426.
[119] Rowe, V.C. (2009). Using video-stimulated recall as a basis for interviews: Some experiences from the field. *Music Educational Research*, 11 (4), 425-437.
[120] Setati, M. (1998). Code switching in a senior primary class of second language mathematics learners. Learning of Mathematics, 18(1), 34-40.
[121] Setati, M. (2005). Teaching mathematics in a primary multilingual classroom. *Research in Mathematics Education* , 36(5), 447-466.
[122] Setati, M., Adler, J., Reed, Y., & Bapoo, A. (2002). Incomplete journeys: Code-switching and other language practices in mathematics, science and English language classrooms in South Africa. *Language and Education*, 16(2), 128-149.
[123] Shavelson, R. J., & Stern, P. (1981). Research on teachers' pedagogical thoughts, judgements, decisions, and behaviour. *Review of Educational Research*, 51,455-498.
[124] Simon, D.L. (2001).Towards a new understanding of codeswitching in the foreign language classroom. In R. Jacobson (Ed.), *Codeswitching worldwide II* (pp.311-342). Berlin: Mouton de Gruyter.
[125] Skinner, D.C. (1985). Access to meaning: The anatomy of the language/learning connection. *Journal of Multilingual and Multicultural Development*, 6(5), 369-388.
[126] Song, Y., & Andrews, S. (2009). *The L1 in L2 learning-Teachers' beliefs and practices*. München: Lincom.
[127] Speer, N.M. (2005). Issues of methods and theory in the study of mathematics teachers' professed and attributed beliefs. *Educational Studies in Mathematics*, 58(3), 361-391.
[128] Stern, H. H. (1992). *Issues and options in language teaching*. Oxford: Oxford University Press.
[129] Stiefel, L. (2009). Translation as a means to intercultural communicative competence. In A.,Witte, T. Harden & A. Ramos de Oliveira Harden (Eds.). *Translation in second language learning and teaching* (pp.99-118). Bern: Peter Lang.
[130] Storch, N., & Aldosari, A. (2010). Learners' use of first language (Arabic) in pair work in an EFL class. *Language Teaching Research*, 14(4), 355-375.
[131] Storch, N., & Wigglesworth, G. (2003). Is there a role for the use of the L1 in an L2 setting? *TESOL Quarterly*, 37(4)760 -70.
[132] Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage.
[133] Swain, M., & Lapkin, S. (2000). Task-based second language learning: The uses of the first language. *Language Teaching Research*, 4(3), 251-274.
[134] Tang, J. (2002). Using L1 in the English classroom. *English Teaching Forum*, 36-43.
[135] Then, D.C.O., & Ting, S.H. (2011). Demystifying the notion of teacher code switching for student comprehension. *Journal of English as an international language*, 5,182-197.
[136] Thoms, J., Liao, J., & Szustak, A. (2005). The use of L1 in an L2 online chat activity. *The Canadian Modern Language Review*, 62(1), 161-182.
[137] Tudor, I. (2003). Learning to live with complexity: Towards an ecological perspective on language teaching. *System*, 31-1-12.
[138] Turnbull, M., & Arnett, K. (2002).Teachers' Use of the target and First Languages in Second and Foreign Language Classrooms. *Annual Review of Applied Linguistics*, 22,204-218.
[139] Turnbull, M., & Lamoureux, S. (2001). *L1 and L2 use in core French: A focus on pre-service students' views and classroom practice*. Paper presented at the Annual Conference of the Canadian Association of Applied Linguistics, Quebec, Canada.
[140] Turner, J. C., Christensen, A., & Meyer D. K. (2009). Teachers' beliefs about student learning and motivation. In L. J. Saha & A. G. Dworkin (Eds.), *International handbook of research on teachers and teaching* (pp. 361-371). New York: Springer.
[141] Van Lier, L. (1995). The use of L1 in L2 classes. *Babylonia*, 2, 37-43.

[142] Villamil, O., & De Guerrero, M. (1996). Peer revision in the L2 classrooms: Social-cognitive activities, mediating strategies, and aspects of social behaviour. *Journal of Second Language Writing*, 5, 51–75.
[143] Widdowson, H.G. (2003). *Defining issues in English language teaching.* Oxford: Oxford University Press.
[144] Wilkerson, C. (2008). Instructors' use of English in the modern language classroom. *Foreign Language Annals*, 41(2), 310-319.
[145] Woods, D. (1996). *Teacher cognition in language teaching.* Cambridge: Cambridge University Press.
[146] Xu, L. (2012). The role of teachers' beliefs in the language teaching-learning process. *Theory and Practice in Language Studies*, 2(7), 1397-1402.
[147] Yinger, R.J. (1986). Examining thought in action: A theoretical and methodological critique of research interactive teaching. *Teaching & Teacher Education*, 2(3), 263-282.

A Voice Retrieved from the Holocaust in New Journalism in Kazuo Ishiguro's *The Remains of the Day*

Masami Usui

Abstract—Kazuo Ishiguro's The Remains of the Day (1989) underlines another holocaust, an imprisonment of human life, dignity, and self in the globalizing sphere of the twentieth century. The Remains of the Day delineates the invisible and cruel space of "lost and found" in the postcolonial and post-imperial discourse of this century, that is, the Holocaust. The context of the concentration camp or wartime imprisonment such as Auschwitz is transplanted into the public sphere of modern England, Darlington Hall. The voice is retrieved and expressed by the young journalist and heir of Darlington Hall, Mr. David Cardinal. The new media of journalism is an intruder at Darlington Hall and plays a role in revealing the wrongly-input ideology. "Lost and Found" consists of the private and public retrieved voices. Stevens' journey in 1956 is a return to the past, especially the period between 1935 and 1936. Lost time is retrieved on his journey; yet lost life cannot be revived entirely in his remains of life. The supreme days of Darlington Hall are the terrifying days caused by the Nazis. Fascism, terrorism, and militarism destroyed the wholesomeness of the globe. Into blind Stevens, both Miss Kenton and Mr. Cardinal bring out the common issue, that is, the political conflicts caused by Nazis. Miss Kenton expresses her own ideas against anti-Semitism regarding the Jewish maids in the crucial time when Sir Oswald Mosley's Blackshirts organization attacked the Anglo Jews between 1935 and 1936. Miss Kenton's half-muted statement is reinforced and assured by Cardinal in his mention of the 1934 Olympic Rally threatened by Mosley's Blackshirts. Cardinal's invasion of Darlington Hall embodies the increasing tension of international politics related to World War II. Darlington Hall accommodates the crucial political issue that definitely influences the fate of the house, its residents, and the nation itself and that is retrieved in the newly progressive and established media.

Keywords—Modern English literature, culture studies, communication, history.

I. Introduction

IN his 2009 book review on Lawrence James' *Aristocrats: Power, Grace and Decadence*, Paul Callan, an eminent British journalist and editor, begins with Kazuo Ishiguro's *The Remains of the Day*; "Lord Darlington was adamant. The two young German maids would have to go. Miss Kenton, the housekeeper, was close to tears as she explained that they would have to return to Germany – a terrible risk considering both were Jewish" (n.pag).

Ishiguro's *The Remains of the Day* (1989) underlines the idea of criticizing the British pro German sympathies which appeases the wartime Holocaust. Christine Berberich remarks that this novel "examines the appeasement politics pursued by Britain in the 1930's and the popular support for the German and Italian fascists amongst the aristocracy" (118). Ishiguro challenges this historical icon since a term Holocaust represents an imprisonment of human, the wartime dignity, and self in the globalizing sphere of the twentieth century. *The Remains of the Day* delineates the invisible and cruel space in the postcolonial and post-imperial discourse of this century. The metaphorical context of Auschwitz is transplanted into the public sphere of modern England, Darlington Hall. Lord Darlington is misguided and even lost in the middle of international political conflicts and Darlington Hall is transfigured as the center of hate crime.

In this cell-like space, however, the voice against Holocaust is retrieved and expressed by the young journalist and possible heir of Darlington Hall, Mr. Reginald Cardinal. Ironically, he is the son of Sir David Cardinal who influences Lord Darlington and shares the pro German sympathies. Against his own father and god father, Mr. Cardinal at twenty-three expresses his anti-fascist and anti-Nazi opinions. Moreover, he works as a journalist and dies in Belgium during World War II. Whether invited as a guest or not, Mr. Cardinal plays a role as an intruder to Darlington Hall whose lord is misguided by the wrongly-input ideology. As a journalist who conveys the scoop and stories to the public, Mr. Cardinal possesses his mission to fight courageously a battle of words in the dangerous circumstances. Young Reginald Cardinal's death in Belgium, therefore, demonstrates the victimization of the growing needs for the public opinions in confronting the global chaos.

II. The Holocaust in Darlington Hall

Darlington Hall is gradually occupied by pro German sympathies in the 1930's. Stevens' journey in 1956 is a return to the past, especially the period between 1935 and 1936. As the 1930's is a critical period, the 1956 Suez Canal crisis represents "the symbolic and official collapse of Britain's imperial powers and ambitions" (Lang 152). The prewar and postwar eras are witnessed and revived by Stevens, so that the serious political conditions of Darlington Hall are somehow veiled in fog. Because of its vagueness and obscurity, Stevens' memory has to be reviewed right from the start.

Lost time is retrieved on his journey; yet lost life cannot be revived entirely in his remains of life. The supreme days of Darlington Hall are the terrifying days caused by the Nazis. Fascism, terrorism, and militarism destroyed the wholesomeness of the globe. Into blind Stevens, however, both Mr. Cardinal and Miss Kenton bring out the common issue, that is, the political conflicts caused by Nazis. Though

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different in social and educational background, Mr. Cardinal and Miss Kenton can access those political matters as a journalist and a reader respectively.

The conference of March 1923, in Stevens' memory, is the starting of Lord Darlington's obsession with pro German sympathies. Lord Darlington has a private reason of this obsession since her intimate German friend, Herr Karl-Heinz Bremann, ultimately committed suicide in the 1920's during the postwar period when he lost his pride, dignity, and fame due to the defeat of German in World War I. After Bremann's suicide, Lord Darlington "began to devote more and more hours to the matters of the crisis in Germany" (74). This tragic incident, moreover, motivates Lord Darlington to conduct "an 'unofficial' international conference – a conference that would discuss the means by which the harshest terms of the Versailles treaty could be revised" (75). The summer of 1932 is counted as the turning point at Darlington Hall. In her "regular presence" at the Hall during that period, Mrs. Carolyn Barnet who "came to wield an unusual influence over" Lord Darlington (145) is described as a member of Sir Oswald Mosley's blackshirts organization. With two Foreign Office ministers, Sir David Cardinal becomes a member of Lord Darlington's "home team" (80). Sir David Cardinal as a regular guest at Darlington Hall makes a speech on the 1923's informal conference at the Hall. Even if Stevens misses much of his speech because of his duty, Stevens affirms that Sir David Cardinal's speech, "close to his lordship's, concluding with a call for a freezing of German reparation payments and the withdrawal of French troops from the Ruhr region" (92).

By the mid 1920's, the "fascist gentlemen" was an international phenomenon in Europe. Especially in Britain, anti-Semitic aristocrats increased rapidly due to the official support by King Edward III and Neville Chamberlain's appeasement. Hitler and Mussolini were entirely opposed to Communism which spread among the Jews. As both Sir David Cardinal and Lord Darlington are infected by the political disease of pro German sympathies and anti-Semitism, British aristocrats were infected by fascism during the 1930's (James). Those aristocrats are Lord Redesdate, Duke of Westminster, the 22nd Earl of Erroll, the 5th Duke of Wellington, the Marquess of Graham, the Duke of Buccleuch, Lord Londonderry, and Sir Oswald Mosley. Among them, Lord Londonderry, Wiston Churchill's cousin, and Sir Oswald Mosley were most influential.

Sir Oswald Mosley was most aggressive to establish the British Union of Fascists (BUF). Mosley's failure in founding the New Party and his meeting with Mussolinil in Italy in 1932 led him to reorganizing a new party, that is, the BUF. In this BUF, women also became involved as supporters as if they pretend to be another suffragists. Like Mrs.Barnet in the novel, such women members as Mary Richardson and Norah Elam were active members of the blackshirts. Especially, Norah Elam played a role of leadership over other women members because of her political background as one of the leaders of Women's Social and Political Union (Gottlieb). The 1935 to 1936 conference at Darlington Hall, therefore, demonstrates a more intensified conditions of anti-Semitism among the aristocrats. Those aristocrats were, however, arrested and imprisoned, or even killed in the 1940's when British government issued Defence Regulation 18B on 22nd May, 1940. On the next day, Sir Oswald Mosley was arrested. Lord Darlington is one of those who were accused of being responsible for the war.

Darlington Hall is transfigured into the house of hate crime which hurts not only its victims but also its offenders.

III. The Wave of Journalism

The news of international affairs becomes most important for citizens between World War I and World War II due to their increasing awareness of public incidents and also their increasing opportunities of accessing the news.

It is said that by the 1930's, over two-thirds of the British population was estimated to read a newspaper everyday. In the wake of World War I, the newspaper became "a social institution" which "oriented its readers to the world and to the day," giving "them an intelligible space and moment in relation to all that's going on amongst people one cannot know but can claim to understand" (Inglis 29). Darlington Hall accommodates the crucial political issue that definitely influences the fate of the house, its residents, and the nation itself and that is retrieved in the newly progressive and established media.

The newspaper topics and influences can be shared by the dwellers of Darlington Hall. Miss Kenton expresses her own ideas against anti-Semitism regarding the Jewish maids in the crucial time when Sir Oswald Mosley's blackshirts' organization attacked the Anglo Jews between 1935 and 1936. Miss Kenton's half-muted statement is reinforced and assured by Mr. Cardinal in his mention of the 1934 Olympic Rally threatened by Mosley's blackshirts. Cardinal's invasion of Darlington embodies the increasing tension of international politics related to World War II. After World War II, Lord Darlington is harshly criticized in the newspaper as Stevens says "*that* newspaper in particular" (235). Because of the newspaper's attack on Lord Darlington's wartime pro German sympathies, his fame and dignity were "destroyed" until he becomes an invalid, and finally dies.

Instead of Sir David Cardinal who was killed in an accident "some three or four years prior to the evening" when Miss Kenton was sobbing in her aunt's death, Mr. Cardinal becomes a regular guest of the Hall, attends the 1930s conference, and moreover, pays an unexpected visit to Darlington Hall. However, his purpose is quite different from his father's from the beginning. Stevens remembers his visits at the busiest time of the Hall.

It was around this point, in the midst of dealing with the many demands being made on my attention, that I happened to glance out of a window and spotted the figure of the young Mr. Cardinal taking some fresh air around the grounds. He was clutching his attaché case as usual and I could see he was strolling slowly along the path that round the outer perimeter of the lawn, deeply absorbed in thought. (88)

Without noticing Mr. Cardinal's real purpose, Stevens

attempts to fulfil his mission that Sir Cardinal asks to teach his son about "the glories of nature" and startles him accidentally. At that moment, Mr. Cardinal "immediately pulled his attach case away from" Stevens and "clutched it to his chest with both arms" (89). For Stevens, Mr. Cardinal is a possible groom so that his father wants him to know about the marriage life. The odd dialogue between Stevens and Mr, Cardinal is, however, an evidence that Mr. Cardinal is nervous enough to wait for a scoop as his attaché case shows his secret mission of writing the news.

Mr. Cardinal's invasion into Darlington Hall embodies the intensified condition of international affairs. Around 1930's, Mr. Cardinal is already known as "a columnist, specializing in witty comments on international affairs" (213). Though Lord Darlington cannot agree with him, he always accepts him as a guest. Mr. Cardinal's sudden visit in that evening is, however, an unusual incident. His visit is well-planned because he looks for a scoop. Mr. Cardinal attempts to know the expected guests at Darlington Hall at dinner, yet he is entirely rejected by Lord Darlington who insists that it is "[s]trictly confidential" (216). Moreover, there was an argument between Lord Darlington and Mr. Cardinal in the smoking room after dinner. When Lord Darlington welcomes his secret guests, "two distinguished gentlemen" and also Her Ribbentrop, the German Ambassador, in the drawing room, Mr. Cardinal withdraws to the library. In the library, Mr. Cardinal confesses to Stevens that he does not happen to visit by accident, yet he has "a tip off" of "what's going on" in Darlington's drawing room. He is convinced that the two distinguished gentlemen are the British Prime Minister and the Foreign Secretary. Mr. Cardinal's frequent appearance in Darlington Hall signifies the increasing influence of journalism that reports the latest information to the public.

Mr. Cardinal's another mission as a journalist is to make Lord Darlington realize that he is politically misguided. Cardinal insists that Darlington is practically "made a fool of" and "being manoeuvred" (222). Mr. Cardinal is sure of his comment, saying that "I've done a lot of investigating, I know the situation in Germany now as well as anyone in this country" (222)

'You don't understand, Stevens. Well, we're friends and so I'll put it to you frankly. Over the last few years, his lordship has probably been the single most useful pawn Herr Hitler has had in this country for his propaganda tricks. All the better because he's sincere and honourable and doesn't recognize the true nature of what he's doing. During the last three years alone, his lordship has been crucially instrumental in establishing links between Berlin and over sixty of the most influential citizens of this country. It's worked beautifully for them. Herr Ribbentrop's been able virtually to bypass our foreign office altogether. And as if their wretched Rally and their wretched Olympic Games weren't enough, do you know what they've got his lordship working on now? Do you have any idea what discussed now? (224)

Mr. Cardinal's attitude towards Lord Darlington shows the right attitude of journalism that reforms the wrong conducts and politics.

The wave of journalism spread rapidly since it was improved and established with the technological advances and also the wars. Especially, the beginning of the twentieth century is blessed with the establishment of the newspapers as well as of the radio and television broadcasting. During World War I and II, especially, war correspondents, that is, journalists who cover stories firsthand from the battlefield and the warzone, were flourished. There appeared a group of journalism in broadcasting and its famous one is so-called "Murrow Boys," which Edward R. Murrow invented as an assembly of radio reporters in Europe. Between 1941 and 1943, George Orwell worked on propaganda for the BBC. Among World War II's scoop journalists, Clare Hollingworth, a British woman journalist, scooped the outbreak of the war in the *Daily Telegraph*, when she happened to witness the head of the German invasion in the border from Poland to Germany in August, 1939. On the other hand, John Russell, another British journalist, worked as a spy in 1939, in Berlin, Germany. Malcolm Muggeridge served in British intelligence during World War after working for newspapers in 1930's. The wars helped to establishing the journalism for the public, yet at the same time, deprived the journalists of the right mission.

Because of the urgency of information and intelligence, however, there was a conflict between the right news and the rumors, especially those which were made up on purpose. There existed a tension even between the British government and journalism. According to Marc Argemi, the wartime British government intended to gather a group of journalists and founded "a sort of rumor factory"; consequently, merely 8,000 false stories were issued.

In spite of the emerging journalism for the public civilians, there was a strong tie between the British aristocrats and the newspaper. Lord Rothermere who was an owner of the *Daily Mail* and the *Sunday Dispatch* supported the BUF until his withdrawal his support for Mosley in July 1934. During the short period time, Lord Rothermere (Harold Harmsworth) and Lord Norhcliff (Alfred Harmsworth) are deeply connected with the blackshirts and there appeared such articles in the *Daily Mail*: ""Oswald Mosley and 'Hurrrah for the Blackshirts" on 22nd January, 1934. The journalism is employed as the tool to present the wrong ideology and to misguide the public to the wrong path.

In addition, there was a gap between the British and American journalism and the journalism in France and Belgium, that is, the resistance's press. In Belgium, where Mr. Cardinal is killed, there existed an underground press which was flourished just after the Belgium defeat. The Clandestine press issued the Clandestine newspaper that was faster than the BBC's radio broadcasts because of Belgian urgency. "The Rape of Belgium" is a term historically coined to embody the German's cruel treatment of Belgium civilians during the First World War, and also to represent the German invasion and occupation of Belgium during the Second World War. According to Larry Zuckerman's *The Rape of Belgium: the Story of World War*, this term describes a series of German war crimes during the world wars. In 1941, the Holocaust in

Belgium and Belgian opposition to Jewish persecution during the war were recovered and their honor was retrieved by Queen Elizabeth, Cardinal von Roey, and Archbishop of Malines.

"The Rape of Belgium" ended after the Battle of the Bulge during 16th Dec. 1944 to 28th Jan. 1945, yet the Belgian conflicts and sufferings remain as the truth. It is possibly what Mr. Cardinal dares to report.

IV. Conclusion

The Remains of the Day does not echo the nostalgia of the good old days of British traditional values and life represented by those of Darlington Hall. Instead, this novel becomes entrapped in a plot that reveals the concealed and even ignored story as if a well-trained journalist writes the truth in a veiled background. The power of writing stories is examined and challenged by Ishiguro. In this writing, the voice is retrieved and remains as far as there are its audience, and we, the readers.

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References

[1] Berberich, Christine. "Kazuo Ishiguro's The Remains of the Day: Working
[2] through England's Traumatic Past as a Critique of Thatcherism."
[3] Groes and Lewis 118-30.
[4] Buchanon, Ian, and Bill Mallon. Historical Dictionary of the Olympic Movement. Lanham, MD: Scarecrow, 2006. Print.
[5] Callan, Paul. "Hitler's Aristocratic Admirers." Daily Express 12 Sep. 2009.
[6] Express. Co. UK. Web. 14 Aug. 2015.
[7] Cooper, Lydia R. "Novelistic Practice and Ethical Philosophy in Kazuo Ishiguro's The Remains of the Day." Groes and Lewis 106-117.
[8] Feldman, David. Englishmen and Jews: Social Relations and Political Culture 1840-1914. New Haven: Yale UP, 1994. Print.
[9] Garter, Lloyd P. The Jewish Immigrant in England 1870-1914. London: Vallentine Mitchell, 1960. Print.
[10] Gottlieb, Julie V. Femine Fascism: Women in Britain's Fascist Movement.
[11] London and New York: I. B. Tauris, 2000. Print.
[12] Groes, Sebastian, and Barry Lewis, eds. Kazuo Ishiguro: New Critical Visions of the Novels. New York: Palgrave MacMillan, 2011. Print.
[13] ---, and Sean Matthews, eds. Kazuo Ishiguro: Contemporary Critical Perspectives. London: Continuum, 2009. Print.
[14] Hammond, Meghan Marie. "'I can't even say I made my own mistake': the Ethics of Genre in Kazuo Ishiguro's The Remains of the Day." Groes and Lewis 95-105.
[15] Inglis, Fred. Media Theory: An Introduction. Oxford: Blackwell, 1990. Print.
[16] Ishiguro, Kazuo. The Remains of the Day. London: Faber and Faber, 1989. Print.
[17] James, Lawrence. Aristocrats: Power, Grace and Decadence. London:
[18] Little, Brown. 2009.
[19] Krinder, Dylan Otto. "Rooted in a Small Space: An Interview with Kazuo Ishiguro." The Kenyon Review 20.2 (Spring 1998): 146-54. Print.
[20] Lang, James M. "Public Memory, Private History: Kazuo Ishiguro's The Remains of the Day." Clio 29.2 (Winter 2000): 143-65. Print.
[21] Rothfork, John. "Zen Comedy in Postcolonial Literature: Kazuo Ishiguro's The Remains of the Day." Mosaic 29.1 (Mar.1996): 79-102. Print.
[22] Sato, Tadayuki. Eikoku Yudayajin [Anglo-Jews]. Tokyo: Kodansha, 1995. Print.
[23] Shaffer, Brian W. , and Cynthia F. Wong. Conversations with Kazuo Ishiguro. Jackson: U P of Mississippi, 2008. Print.
[24] Sim, Wai-chew. "Kazuo Ishiguro." Review of Contemporary Fiction 25.1 (Spring 2005): 80-115. Print.
[25] ---. Kazuo Ishiguro. New York: Routledge, 2010. Print.
[26] Teo, Yugin. Kazuo Ishiguro and Memory. London: Palgrave MacMillan, 2014. Print.
[27] United States Holocaust Memorial Museum. "The Nazi Olympics Berlin 1936." United States Holocaust Memorial Museum Org. Web. 19 Nov. 2014.
[28] Volz-Lebzelter, Gisela. Political Anti-Semitism in England 1918-1939. Boston Spa, Wetherby: The British Library Document Supply Center, 1997. Print.
[29] Vorda, Allan, ed. Face to Face: Interviews with Contemporary Novelists. Houston: Rice UP, 1993. Print.
[30] Watarai, Yoshiichi. Yudayajin to Igirisuteikoku [The Jews and British Empire]. Tokyo: Iwanami, 2007. Print.
[31] Westerman, Molly. "Is the Butler Home? Narrative and the Split Subject in The Remains of the Day." Mosaic 37.3 (Sep. 2004): 157-70. ProQuest Research Library. Web. 10 Oct. 2014.
[32] Wong, Cynthia F. "Like Idealism is to the Intellect: An Interview with Kazuo Ishiguro." Clio 30.3 (Spring 2001): 309-25. Print.
[33] ---. "Kazuo Ishiguro's The Remains of the Day." Ed.Brian W. Shaffer.
[34] A Companion to the British and Irish Novel 1945-2000. Oxford:
[35] Blackwell, 2005. 493-503. Print.
[36] Zackerman, Larry. The Rape of Belgium: The Story of World War. New
[37] York: New York UP, 2004. Print.

Robust Adaptation to Background Noise in Multichannel C-OTDR Monitoring Systems

Andrey V. Timofeev, Viktor M. Denisov

***Abstract*—**A robust sequential nonparametric method is proposed for adaptation to background noise parameters for real-time. The distribution of background noise was modelled like to Huber contamination mixture. The method is designed to operate as an adaptation-unit, which is included inside a detection subsystem of an integrated multichannel monitoring system. The proposed method guarantees the given size of a nonasymptotic confidence set for noise parameters. Properties of the suggested method are rigorously proved. The proposed algorithm has been successfully tested in real conditions of a functioning C-OTDR monitoring system, which was designed to monitor railways.

***Keywords*—**Guaranteed estimation, multichannel monitoring systems, non-asymptotic confidence set, contamination mixture.

I. Introduction

THE detection of targeted noise-like signals observed on the noise-background is topical in multichannel large scale monitoring systems. An example of such a system is brand-new C-OTDR-systems [1]-[4] for monitoring of super-extended objects (oil & gas pipelines, national borders, railways, etc.). There is a prior uncertainty about statistical characteristics of noise and signals, and there are tens of thousands of C-OTDR-channels, whose data need to be processed in real-time. An important factor is the dynamics of noise statistical characteristics in different channels. For example, in C-OTDR monitoring systems (CMS) this dynamics depends of time of the day, the season, and various external factors (technological works on monitoring objects and in its vicinity, vibrations of highways, sounds of underground rivers etc.). So at different times and different places the conditions of the observation are dramatically different. These circumstances influence sensors systems very strongly. The influence implies an increase in Type I and Type II errors. While noise level may be dramatically different in various time intervals for one and the same channel, the industrial noise power and its spectral characteristics as a rule are stable for extended periods of time (no less than a few minutes or sometimes even hours). Unlike the industrial noises, targeted signals have high power and a short duration (no more than a few minutes). So, targeted signals have a shorter stability period with respect to the stability period of noises. The important feature of multichannel monitoring systems which are designed for monitoring of super-extended objects is an enormous quantity of channels. The quantity of the channels may be up to 100 000 and more, and channel data have to be processed in real time. In this case, without real-time estimates of the background noise parameters (BN) it is not possible to build a target signal detector which would guarantee prescribed level for Type I and Type II errors. So, there is an objective necessity to design a real-time adaptation procedure (RTAP) which guarantees the quality of the BN-parameter estimation. In this paper it is proposed to find this problem solution from the standpoint of sequential analysis inside of the linear models class. The basic assumption, which has been used in suggested approach, is an existence of a long enough periods, which we call the period of the initial system adjustment or ISA-period. During the ISA-period we can observe only noise in each channel of the monitoring system, and we can use this period for an initial adaptation to noise in every channel. During this phase, the parameters of noise are calculated to be used in the subsystem of targeted signals detection. But the channel noise continues to change its characteristics, hence the results of the initial adaptation gradually becomes irrelevant. Because of that, the process of adaptation to noise has to be continued, and we will call this process a "regular adaptation" (RA). During the RA-process, channel observations are used, which do not contain the targeted signals. The time intervals which contain detected signals are cut out from the channel data stream; and the only remainders are used for adaptation. In CMS, the BN intensity is approximated well by a linear regression with unknown parameters. Those parameters are constant during certain time intervals, which we call as BN-intervals. The BN-intervals durations are enough to build a confidence set with a given size. The set of BN-intervals includes the ISA-period and all time intervals without signals. The main idea is to build the confidence sets for the BN-parameters from the standpoint of sequential analysis. Those sets will be having the given size, and they will be built for finite time. This approach was successfully used for detection of targeted signals in C-OTDR monitoring systems. Systems of that class are new monitoring systems and they are very effective in controlling the seismoacoustic field in the vicinity of the monitored objects. An ordinary fiberoptic cable buried close to the object is used as a sensor. The basis of this method is the use of a vibrosensitive infrared stream injected into a standard monomode fiber by means of a coherent semiconductor laser at the wavelength of 1550 nm. Probing is carried out in the pulsed mode, with the frequency of 8-15 kHz at the pulse length of 20-100 ns. The optical fiber (system sensor) is put into the ground, at the depth of 30-50 cm, at the distance of 5-10 m from the monitoring object. When a pulse is moving

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along the optical fiber, the Rayleigh elastic backscattering is realized on its natural irregularities, which due to high coherence of the used laser of 3B class leads to formation of the so-called stable interference structures of chaotic type, otherwise called speckles or speckle images. A sequence of speckles is received in the point of emanation using an ordinary welded coupler or a circulator. The central moment of the concept is the phenomenon that any seismic vibration arising on the surface of the optical fiber due to propagation of seismoacoustic waves from the sources of elastic oscillations, changes its local refractive index. Changes of the local refractive index are reflected in the time-and-frequency structure (TFS) of the respective speckle. Knowing the pulse duration and the velocity of wave propagation in the optical fiber, it is easy to determine the section where the TFS speckle deviation took place. Analysis of the sequence of speckle structures using wavelet conversion apparatuses (the phase of singling out of primary signs of target signals) and Lipschitz classifiers (the phase of target signals classification) makes it possible not only to reliably detect the target source of seismoacoustic radiation, but also to determine its type and area of occurrence. In particular, location of the target source of seismoacoustic radiation is determined with the accuracy of up to 5 m at the distance of up 40 km from the laser location. Actually, as a result of logical processing, several thousands of the so-called C-OTDR channels are formed on the monitoring distance, each of which transfers information on seismoacoustic activity at the well-defined point of the space. It is obvious that the width of the typical C-OTDR channel is 5 m. The following problems are solved in the process of analysis of seismic activity in C-OTDR-systems: a) Target Seismic-Acoustic Events (TSAE's) detection, [5]; b) TSAE location assessment; and c) TSAE type classification, [6]. Proposed RTAP belongs to the detection subsystem (this subsystem must guarantee the upper bounds for the probability of errors of the first and the second kinds). The RTAP is guaranteed the BS-parameters estimate quality in non-asymptotic sense, hence, BS-parameters guaranteed estimates are a basis for building the TSAE-detection procedure with prescribed characteristics (the detection procedure must guaranteed TSAE detection with given upper bounds for Type I and Type II errors). The proposed algorithm has been successfully tested in real conditions of a functioning of C-OTDR system, which was designed to monitor the ballast of railway tracks. Since the meaning of the RA-process is similar to meaning of the ISA procedure, in this article we will describe the RTAP for the initial phase only.

II. Research Objective

Let us assume that we have a multichannel monitoring system. There are array of channels, which are used for getting targeted signals. Indexes of system channels in conjunction form a set:

$$\mathbf{Z} = \{1, 2, ..., z\}$$

Observations are made at successive times, which form a set $N = \{1, 2, ...\}$ .Thus, the observations are form the following sets:

$$\mathbf{X} = \{X(n) | n \in N\}, \quad X(n) = \left(x_1(n), x_2(n), ..., x_z(n)\right) \in R^z,$$
$$x_j(n) = \left\langle X(n) \right\rangle_j$$

are measurement of j-th channel at moment n.

For each channel $j \in \mathbf{Z}$ observations are described by:

$$\forall n < \tau_j : x_j(n) = a_j \theta_j^* + \xi_j(n). \quad (1)$$

Here, $\{\xi_j(n)\}$ are random variables; distributions of $\{\xi_j(n)\}$ are described by:

$$Q_{jn}(x) = (1-\varepsilon)F_{jn}(x) + \varepsilon C_{jn}(x), j \in \mathbf{Z},$$

Here ε is unknown probability of outliers; $C_{jn}(x)$ is unknown distribution of outliers;

$$\int x^2 dC_{jn}(x) = \infty; \; F_{jn}(x)$$

is unknown distribution:

$$\mathbf{E}_F \xi_j(n) = 0, \mathbf{E}_F \xi_j^{\,2}(n) \le b_j(n), \underset{k \ne p}{\forall} \mathbf{E}_F \xi_j(k) \xi_j(p) = 0$$

- noise parameters $\theta^* = \left(\theta_1, \theta_2, ..., \theta_z\right)$ are priori unknown;
- parameters $\{a_j\}, \{d_n\}$ are given.

The research objective is to build the procedure of adaptation to background noise parameters in real time. This procedure has to guarantee the BS-parameters estimate quality in non-asymptotic sense: the prescribed estimation quality has to be achieved while using a finite number of observations only. The solution will be found in form of sequential plan (τ, δ), where τ the stopping moment, $\delta = \left(\delta_1, \delta_2, ...\delta_z\right)$ is given z-vector (vector δ components are prescribed sizes of confidence set Ξ_τ), and besides:

- $\mathrm{P}(\tau < \infty) = 1$,
- $\|\Xi_\tau\| < \delta$,
- $P\left(\theta^* \in \Xi_\tau\right) \ge P_c$,

for prescribed values $\delta_j > 0, P_c \in (0,1)$.

III. Solution Method

A. Case When Probability of Outliers ε Equals to Zero

Let us write (1) in following form:

$$X(n) = A(n)\theta^* + \xi(n), \quad (2)$$

where

- $\theta^* = (\theta_1^*, \theta_2^*, ...\theta_z^*) \in R^z$
- $\xi(n) = (\xi_1(n), \xi_2(n), ..., \xi_z(n)) \in R^z$, $\mathbf{E}\xi(n) = 0$, $\mathbf{E}\xi(n)\xi^T(n) \le \mathbf{B}(n) = \|b_{ij}(n)\|$;
- $\{\mathbf{B}(n)\}$ are given sequence of $(z \times z)$ matrixes;
- $\{A(n)\}$ are given sequence of $(z \times z)$ matrixes;
- $\eta(n) = \sum_{i=1}^{n} \mathbf{A}^T(i)\xi(n)$.

Let us denote:

- $\Gamma(n) = \left(\sum_{i=1}^{n} \mathbf{A}^T(i)\mathbf{A}(i)\right)^{-1}$,
- $c(n) \in R^z, \forall i : \langle c(n) \rangle > 0$.

Let the matrices $\Gamma(n)$ exist for any n. Consider:

$$\theta^-(n+1) = \Gamma(n+1)\left(\Gamma^{-1}(n)\theta^-(n) + c(n) + \mathbf{A}^T(n+1)X(n+1) - c(n+1)\right),$$

$$\theta^+(n+1) = \Gamma(n+1)\left(\Gamma^{-1}(n)\theta^+(n) - c(n) + \mathbf{A}^T(n+1)X(n+1) + c(n+1)\right).$$

Let us denote:

$$\theta_l(n) : \left(\forall j : \langle \theta_l(n) \rangle_j = \min\left(\langle \theta^-(n) \rangle_j, \langle \theta^+(n) \rangle_j\right)\right),$$

$$\theta_h(n) : \left(\forall j : \langle \theta_h(n) \rangle_j = \max\left(\langle \theta^-(n) \rangle_j, \langle \theta^+(n) \rangle_j\right)\right).$$

Expressions $\theta_l(n)$ and $\theta_h(n)$ are a low bound and an upper bound of a rectangular parallelepiped $\Xi(n) \in R^z$. Let us consider matrices:

$$D(n) = \left[d_{ij}(n)\right] = \mathbf{E}\eta(n)\eta^T(n) = \sum_{k=1}^{n} \mathbf{A}^T(k)\mathbf{B}(k)\mathbf{A}(k),$$

$$D^+(n) = \left[d_{ij}(n)\left(d_{ii}(n)d_{jj}(n)\right)^{-0.5}\right], n \ge 1.$$

We define the sequence of vectors $\{c(n)\}$ as:

$$c(n) = \left(\mathbf{J}(u_n^+)/(1-P_c)\right)^{0.5} \mathbf{S}(n),$$

where

$$\mathbf{S}(n) = \left(|d_{11}(n)|, |d_{22}(n)|, ..., |d_{zz}(n)|\right),$$

$$\mathbf{J}(x) = z^{-2}\left(x^{0.5} + \left((z^2 - x)(z-1)\right)^{0.5}\right)^2,$$

$$u_n^+ = \varepsilon_z D^+ \varepsilon_z^T, \varepsilon_z = (1, 1, ..., 1) \in R^z.$$

Let us denote

$$\forall n \ge 1 : \pi(n) = 2\Gamma(n)c(n) = \theta_h(n) - \theta_l(n).$$

The sequential plan for estimation of parameter θ^* we introduce in following form $(\pi(n), \tau)$, where τ is moment of observations stop:

$$\tau = \inf\left\{n \ge 1 \mid \forall j : \langle \pi(n) \rangle_j \le \delta_j\right\}.$$

The following theorem describes properties of sequential plan $(\pi(n), \tau)$.

Theorem 1. Let:

$$\lim_{n \to \infty} \Gamma(n)\mathbf{S}^T(n) \to 0.$$

Then

1. $\mathbf{P}_{\theta^*}(\tau < \infty) = 1$.
2. $\mathbf{P}_{\theta^*}\left(\theta^* \in \Xi(\tau)\right) = 1, \Xi(\tau) = \left\{\theta \mid \theta_l \le \theta \le \theta_h\right\}$.

Proof of Theorem 1 is based on usage Theorem 4.1, p. 510 [7]. So, the confidence rectangular parallelepiped $\Xi(n)$ with given sizes will be built by the time moment τ.

The estimation of value $\mathbf{E}\tau$ (the mean duration of observation in sequential plan $(\pi(n), \tau)$ is an important task for practice. We propose a new approach to obtain the upper bound of $\mathbf{E}\tau$. Let us rewrite (1) in following form:

$$X(n) = \mathbf{A}(n)\theta^* + G(n)\varepsilon(n),$$

$$\forall n \ge 1 : \xi(n) = G(n)\varepsilon(n), \mathbf{B}(n) = G^T(n)G(n),$$

$$\mathbf{E}\varepsilon(n) = 0, \mathbf{E}\varepsilon(n)\varepsilon^T(n) = E.$$

$G(n) - (m \times m)$ matrix, E - the identity $(m \times m)$-matrix. Further, we rewrite $\pi(n)$ in following form:

$$\forall n \ge 1 : \pi(n) = 2\mathbf{y}(n)\left(1 - P_c\right)^{-1}, \mathbf{y}(n) = \Gamma(n)\left(\mathbf{J}(u_n^+)\right)^{0.5} \mathbf{S}(n).$$

For some positive constants k and β we have:

$$\forall n \ge 1 : \mathbf{P}_{\theta^*}\left(\|\xi(n)\|^2 \ge k\|\varepsilon(n)\|^2\right) = 1, \tag{3}$$

$$\forall n \ge 1, j : \langle \mathbf{y}(n) \rangle_j \le \left(\beta\left(\sum_{i=1}^{n} \|X(i)\|^2\right)^{0.5}\right)^{-1} \tag{4}$$

For some $H > 0$ let us denote:

$$\eta(H) = \inf\left\{n \ge 1 \left| \sum_{i=1}^{n} \|\varepsilon(i)\|^2 \ge H\right.\right\}$$

$\eta(H)$ is the random variable, which have the finite $\mathbf{E}\eta(H)$.

Theorem 2. Let distribution density g(z) of random variables $\{\varepsilon(n)\}$ is a centrally symmetric density. Thus, g(z)= g(-z), the set $K(u)=\{x \mid g(x)\geq u\}$ is a convex set for any u, $0<u<\infty$. In this case, when (3) and (4) are true for process X(n) we have:

$$\mathbf{E}\tau \leq \mathbf{E}\eta(H)+1,$$

where

$$H=4\left(\beta^2 \inf_{1\leq i\leq z}\langle\delta\rangle_i^2 (1-P_c)k\right)^{-1}$$

The proof is based on usage of the process *X(n)* special decomposition. The question arise: how to estimate the $\mathbf{E}\eta(H)$? If $\{\varepsilon(n)\}$ are gauss variables we have:

$$\mathrm{E}\eta(H)=\begin{cases} H+2, if\ z=1; \\ H/2^{\nu}+1, if\ z\geq 2. \end{cases}$$

$\nu=[\log_2 z]$, $[a]$ is the integer part of a. If $\{\varepsilon(n)\}$ are mutually independent, and they have uniform distribution, we have:

$$\mathbf{E}\,\eta(H)=\begin{cases} H+3, if\ z=1; \\ H/2^{\nu}+2, if\ z\geq 2. \end{cases}$$

B. Case When Probability of Outliers ε Not Equal to Zero

Let us consider the following recurrent estimations:

$$\tilde{\theta}(n+1)=\Gamma(n+1)\left(\Gamma^{-1}(n)\tilde{\theta}(n)+\mathbf{A}^T(n+1)X(n+1)\right),$$

for some k>0, n>k,

$$\theta_r^-(n+1)=\begin{cases} \theta^-(n), if\ \tilde{\theta}(n+1)\notin\Xi(n) \\ \theta^-(n+1), if\ \tilde{\theta}(n+1)\in\Xi(n), \end{cases}$$

$$\theta_r^+(n+1)=\begin{cases} \theta^+(n), if\ \tilde{\theta}(n+1)\notin\Xi(n) \\ \theta^+(n+1), if\ \tilde{\theta}(n+1)\in\Xi(n). \end{cases}$$

Further,

$$\theta_l^{(r)}(n):\left(\forall j:\left\langle\theta_l^{(r)}(n)\right\rangle_j=\min\left(\left\langle\theta_r^-(n)\right\rangle_j,\left\langle\theta_r^+(n)\right\rangle_j\right)\right),$$

$$\theta_h^{(r)}(n):\left(\forall j:\left\langle\theta_h^{(r)}(n)\right\rangle_j=\max\left(\left\langle\theta_r^-(n)\right\rangle_j,\left\langle\theta_r^+(n)\right\rangle_j\right)\right).$$

So, $\theta_l^{(r)}(n)$ and $\theta_h^{(r)}(n)$ are boundaries of the robust confidence rectangular parallelepiped $\Xi_r(n)\in R^z$. Let $\forall n\geq 1:\pi_r(n)=\theta_h^{(r)}(n)-\theta_l^{(r)}(n)$. Consider the moment of observations stop as:

$$\tau_r=\inf\left\{n\geq 1 \mid \forall j:\left\langle\pi_r(n)\right\rangle_j\leq\delta_j\right\}.$$

It is easy to see that

- $\mathbf{P}(\tau_r<\infty)=1$,
- $\forall\theta_1,\theta_2\in\Xi_r(\tau_r):\forall j:\left|\left\langle\theta_1-\theta_2\right\rangle_j\right|\leq\delta_j$,
- $\mathbf{P}\left(\theta^*\in\Xi_r(\tau_r)\right)\geq P_c$,
- $\mathbf{E}\tau_r\leq(1-\varepsilon)^{-1}\mathbf{E}\tau$,

for prescribed values $\delta_j>0, P_c\in(0,1)$, if $0<\varepsilon<1$ and $\forall n<k:Q_{jn}(x)=F_{jn}(x), j\in\mathbf{Z}$.

IV. Results of Practical Use

Table I contains results of usage the suggested approach to estimate the BN-parameters. In the experiment, the length of sensor of C-OTDR monitoring system was equal to 1200m. There were 1200 C-OTDR channels. The matrix $\mathbf{B}(n)=\mathbf{B}$ was prior estimated on base of serial BN-observations. The BN-parameters had been different for each channel. It was due to difference in seismoacoustic medium types along the sensor, and difference of the noise-sources distribution along the sensor. There were three basic types of BN: "underwater collector" (UP), "technological devices" (TD) (three types), "channel-noises"(CN). Combinations of those types could be in each channel. For practical reasons, the δ_i were choose as $0.2\left(b_{jj}\right)^{0.5}$. There are three types of TD:

- TD1: "perforator";
- TD2: "diesel generator";
- TD3: "traction substation".

For each combination of BN-types the $\overline{\mathbf{E}\tau}_r$ (average of τ_r in serial tests) was estimated. The minimal value of $\overline{\mathbf{E}\tau}_r$ corresponds to CN-case. This was due to by low level of CN variance. On another hand, the maximal value of $\overline{\mathbf{E}\tau}_r$ corresponds to TD1&CN combination. In this case we had the maximal level of the observation process variance, and it implies the maximal value of $\overline{\mathbf{E}\tau}_r$ (for compensate of high variance we need use bigger sample size in compare of low variance case). The findings demonstrate acceptable characteristics of suggested adaptation method for practical usage.

TABLE I
THE PRACTICAL DETECTION RESULTS

№	Types of BN	$\overline{\mathrm{E}\tau}_r$ (sec)
1	CN	7
2	UP&CN	12
3	TD1&CN	19
4	TD2&CN	21
5	TD3&CN	18

V. CONCLUSIONS

Proposed sequential method for robust adaptation to background noise parameters for real-time is nonparametric (not require to know probabilistic distribution of noises) and this method is non-asymptotic (the required estimation quality is achieved for finite time). The method is designed to operate as an adaptation-unit, which is included inside a detection subsystem of an integrated multichannel monitoring system. Proposed method guarantees the given size of a nonasymptotic confidence set for noises parameters. Properties of the suggested method are rigorously proved. The proposed algorithm has been successfully tested in real conditions of the functioning of C-OTDR monitoring system, which was designed to monitor the railways.

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REFERENCES

[1] K. N. Choi, J. C. Juarez, H. F. Taylor, "Distributed fiber optic pressure/seismic sensor for low-cost monitoring of long perimeters", Proc. SPIE 5090, Unattended Ground Sensor Technologies and Applications, 2003, pp. 134-141.

[2] J. C. Juarez, E. W. Maier, K. N. Choi, and H. F. Taylor, "Distributed Fiber-Optic Intrusion Sensor System", *Journal of Lightwave Technology*, Vol. 23, Issue 6, 2005, pp. 2081-2087.

[3] S. S. Mahmoud, Y. Visagathilagar, J. Katsifolis., "Real-time distributed fiber optic sensor for security systems: Performance, event classification and nuisance mitigation". *Photonic Sensors*, Vol.2, Issue 3, 2012, pp. 225-236.

[4] V. Korotaev, V. M. Denisov, A. V. Timofeev, and M. G. Serikova, "Analysis of seismoacoustic activity based on using optical fiber classifier," in Latin America Optics and Photonics Conference, OSA Technical Digest (online) (Optical Society of America, 2014), paper LM4A.22.

[5] Timofeev A.V. The guaranteed detection of the seismoacoustic emission source in the C- OTDR systems, *International Journal of Mathematical, Computational, Physical and Quantum Engineering*, Vol.8, Issue 10, 2014, pp. 1213-1216.

[6] Timofeev A.V., Egorov D.V., Multichannel classification of target signals by means of an SVM ensemble in C-OTDR systems for remote monitoring of extended objects, MVML-2014 Conference Proceedings Prague, 2014, V.1.

[7] S. Karlin, V. Studden, "Tchebycheff systems: with applications in analysis and statistics", Interscience, 1966 .

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Comparison of Microwave-Assisted and Conventional Leaching for Extraction of Copper from Chalcopyrite Concentrate

Ayfer Kilicarslan, Kubra Onol, Sercan Basit, Muhlis Nezihi Saridede

***Abstract*—**Chalcopyrite ($CuFeS_2$) is the most common primary mineral used for the commercial production of copper. The low dissolution efficiency of chalcopyrite in sulfate media has prevented an efficient industrial leaching of this mineral in sulfate media. Ferric ions, bacteria, oxygen and other oxidants have been used as oxidizing agents in the leaching of chalcopyrite in sulfate and chloride media under atmospheric or pressure leaching conditions. Two leaching methods were studied to evaluate chalcopyrite ($CuFeS_2$) dissolution in acid media. First, the conventional oxidative acid leaching method was carried out using sulfuric acid (H_2SO_4) and potassium dichromate ($K_2Cr_2O_7$) as oxidant at atmospheric pressure. Second, microwave-assisted acid leaching was performed using the microwave accelerated reaction system (MARS) for same reaction media. Parameters affecting the copper extraction such as leaching time, leaching temperature, concentration of H_2SO_4 and concentration of $K_2Cr_2O_7$ were investigated. The results of conventional acid leaching experiments were compared to the microwave leaching method. It was found that the copper extraction obtained under high temperature and high concentrations of oxidant with microwave leaching is higher than those obtained conventionally. 81% copper extraction was obtained by the conventional oxidative acid leaching method in 180 min, with the concentration of 0.3 mol/L $K_2Cr_2O_7$ in 0.5M H_2SO_4 at 50 °C, while 93.5% copper extraction was obtained in 60 min with microwave leaching method under same conditions.

***Keywords*—**Extraction, copper, microwave-assisted leaching, chalcopyrite, potassium dichromate.

I. Introduction

COPPER can be extracted from chalcopyrite by conventional hydrometallurgical or pyrometallurgical process [1], [2]. Production of copper by hydrometallurgical methods has more attention due to the some significant advantages of the process such as the possibility of application on complex and low grade ores, less energy consuming and little environmental impact [2]. Therefore, several technologies have been developed to leach copper from chalcopyrite concentrates. However, there are still few commercial scale operations for copper production from chalcopyrite concentrates due to various technical and economic issues [3]-[5]. Chalcopyrite leaching in acidic solutions is known to be very slow by the reason of formation of insoluble non-porous layer that prevents further mineral dissolution. The slow dissolution kinetics of chalcopyrite is main challenge for leaching operation [6], [7]. For this reason, there is much interest in developing new alternative leaching techniques to improve copper extraction from chalcopyrite concentrates or ores in the presence of some additives [8].

The use of microwave in leach processes is one of the most promising technique for improving metal extraction and reducing process time in connection with the increasing necessity for environmentally sensitive processes [9]-[11]. Microwave heating in leaching process offers following advantages when compared conventional heating [12].

- rapid heating;
- controllable heating;
- homogenous heating;
- selective heating;
- quick start-up and stopping;
- higher level of safety and automation.

Microwave heating is a kind of electro-heat process such as induction, radio frequency, direct resistance, and infrared heating, that utilize specific parts of electromagnetic energy [13]. Microwave energy is non-ionized electromagnetic radiation which has frequencies changing in the range of between 300 MHz to 300 GHz [14].

Several research studies in the use of microwave energy to enhance copper recovery from chalcopyrite have been conducted recently [15] and consequently reported that there is a serious disagreement with respect to the influence of microwaves on hydrometallurgical systems and the reason behind the higher recovery of the metal during microwave leaching compared to that of conventional leaching has not yet to be explained clearly. [13]. The aim of this study is to compare the oxidative leaching process of chalcopyrite concentrate by microwave-assisted leaching and conventional leaching. Sulfuric acid and potassium dichromate were used as leaching media and oxidizing agent respectively. Parameters affecting leaching process such as sulfuric acid concentration, leaching temperature and oxidizing agent have been examined.

II. Experimental Procedure

Chalcopyrite concentrate that was obtained from copper ore plants (Eti Copper Inc.) in Turkey was used in the experiments as raw material. Prior to the leaching, the samples of concentrates were sieved into size fraction <100 micron. The chemical analyses of samples were determined by atomic absorption spectrometry (AAS, Perkin-Elmer Analyst, 800)

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and given in Table I.

TABLE I
CHEMICAL ANALYSIS OF CHALCOPYRITE CONCENTRATE

	Cu	Fe	Co	Zn	Ni	Au(ppm)	
(%)	24	48	0.10	0.13	0.35	4.25	21

The conventional acid leaching experiments were carried out in a shaking water bath (GFL, 1083) which was set at the desired temperature. H_2SO_4 solutions at required concentrations were mixed with various concentrations of $K_2Cr_2O_7$ as oxidant in 250 ml beakers. The beakers were placed in the shaking water bath. The temperature of the solutions was measured using a thermometer. When the temperature reached at adjusted value, the samples of chalcopyrite were added into the solution with the constant pulp density of 10 g/L. The pulp in the beaker was stirred for 180 min. Samples of solution were withdrawn from the beakers at every 30 minutes periodicity.

Microwave-assisted leaching experiments were carried out in a Microwave Accelerated Reaction Systems device (MARS -Xpress.) A volume of 50 ml with 0.5 mol/L H_2SO_4 solutions mixed with selected concentrations of $K_2Cr_2O_7$ in PTFE vessels with same pulp density with conventional method. The pulp in the vessels were heated to adjusted temperature for 5 min and leached with microwave energy for 30 and 60 min. After leaching procedure was completed the vessels were cooled to the room temperature for 5 minutes.

Samples taken from both conventional and microwave-assisted leaching experiments were filtrated to separate solid residues from solutions. Finally, separated solutions were analysed by AAS in order to determine the copper extraction efficiency.

III. RESULTS AND DISCUSSION

A. Effect of Sulfuric Acid Concentration

The effect of sulphuric acid concentration on chalcopyrite dissolution (Fig. 1) shows increasing copper extraction with increasing sulphuric acid concentration from 0.1M to 0.5M

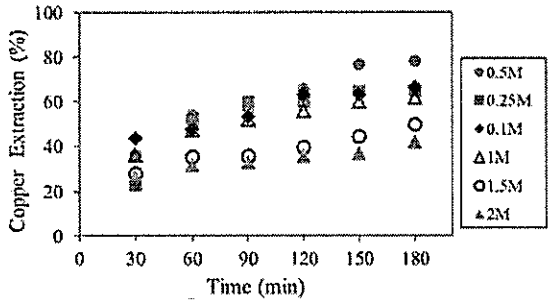

Fig. 1 Effect of H_2SO_4 concentration on copper extraction ($K_2Cr_2O_7$: 0.15 mol/L; temperature: 50°C)

However, above the H_2SO_4 concentration of 0.5M, the chalcopyrite extraction decreases with increasing acid concentration. The copper extracted after 150 min at 50°C with 2M and 0.5M H_2SO_4 in the presence of 0.15 mol/L $K_2Cr_2O_7$ was 37% and 76%, respectively. However, earlier it was reported that the dissolution of copper after 150 min at 50°C with 0.5M H_2SO_4 and 0.1mol/L $K_2Cr_2O_7$ was about 56% [7].

B. Effect of Temperature

Fig. 2 shows that temperature has positive effect on the oxidative leaching of chalcopyrite concentrate in the presence of 0.15 mol/L $K_2Cr_2O_7$.

The leaching efficiency of copper increased significantly with increasing the reaction temperature of chalcopyrite dissolution from room temperature to 50°C and reached about 78% after 180 min. At the temperatures of 50°C and 70°C; there are no significant differences between the efficiencies of copper extractions from 30 to 150 min leaching time. However, at the end of the 180 min, it was increased from 78% to 88.74% when temperature raised from 50°C to 70°C.

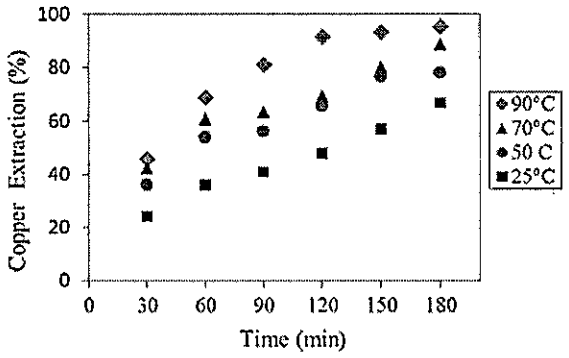

Fig. 2 Effect of temperature on copper extraction ($K_2Cr_2O_7$:0.15M; H_2SO_4:0.5M)

The achieved highest extraction efficiency of Cu was 95.41% at 90°C after 180 min. In order to investigate the other leaching parameters, 50°C was chosen for the leaching temperature.

C. Effect of Potassium Dichromate Concentration

The effect of $K_2Cr_2O_7$ concentration (0.01-0.4 mol/L) on the copper extraction from chalcopyrite using 0.5M H2SO4 is given in Fig. 3 and it is indicated that the concentration of dichromate influenced the dissolution of chalcopyrite positively. The copper extraction increased from 14.33% to 86% after 180 min when the concentration of $K_2Cr_2O_7$ was increased from 0.01 mol/L to 0.4 mol/L.

The achieved highest extraction efficiency of Cu was 95.41% at 90°C after 180 min. In order to investigate the other leaching parameters, 50°C was chosen for the leaching temperature.

D. Microwave Leaching

The microwave leaching of chalcopyrite has also been investigated as complementary method to conventional oxidative sulphuric acid leaching. The extractions of copper obtained as a result of microwave leaching in 0.5M H_2SO_4 using 0.03 mol/L and 0.5 mol/L $K_2Cr_2O_7$ at 50°C and 90°C are presented in Fig. 4.

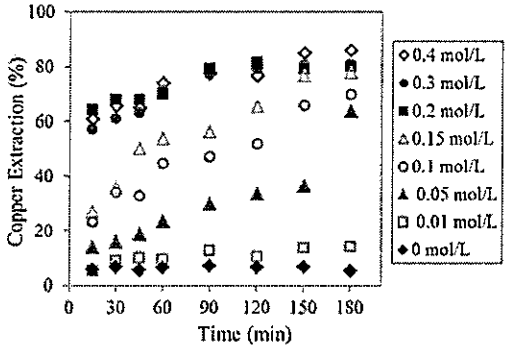

Fig. 3 Effect of potassium dichromate concentration (mol/L) on copper extraction (H_2SO_4: 0.5M; temperature: 50°C)

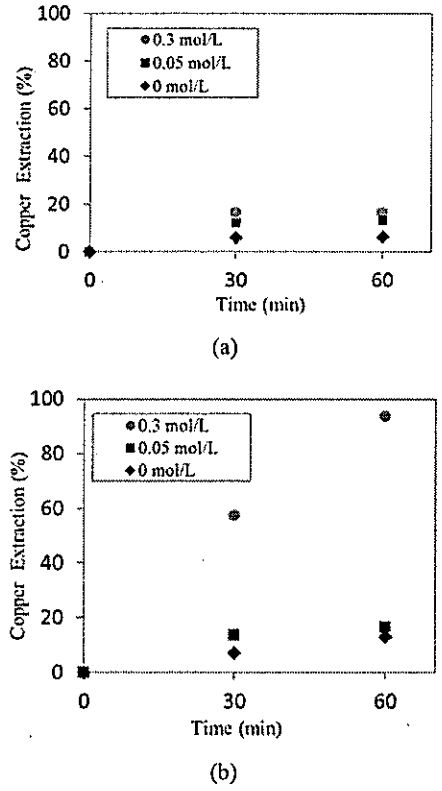

Fig. 4 Copper extractions of microwave leaching in 0.5M H_2SO_4, without oxidant and in the presence of 0.05 mol/L and 0.3mol/L $K_2Cr_2O_7$ at a) 50°C and b) 90°C

When the temperature was 50°C, the extraction of copper was only 6.33%, 13.07% and 16.48% after 60 min, without oxidant and in the presence of 0.03 mol/L and 0.5 mol/L $K_2Cr_2O_7$, respectively. This may be attributed that the dissolution reactions (with or without oxidant) are not proceed completely in limited microwave leaching duration of chalcopyrite. However, microwave digestion devices are not suitable for prolonged dissolution times.

It can also be seen from Fig. 4 (b) that when the temperature increased to 90°C, the extraction of copper has only a little difference between in the lack of oxidant (13.16%) and with the addition of 0.03 mol/L $K_2Cr_2O_7$ (16.45%) for 60 min reaction time. But, when the concentration of $K_2Cr_2O_7$ increased to 0.5 mol/L, the extraction of copper is up to 93.52% for same reaction time. Therefore, it is reasonable that microwave heating has remarkable positive effect on the copper extraction on high temperatures and high oxidant conditions.

IV. Conclusion

In this study, leaching of chalcopyrite concentrate in sulfuric acid was carried out using $K_2Cr_2O_7$ as oxidant under both conventional acid and microwave-assisted acid leaching conditions for hydrometallurgical copper extraction. The following conclusions can be drawn from the present study:

1. $K_2Cr_2O_7$ is an effective reagent for both the conventional and microwave oxidative acid leaching of chalcopyrite concentrate to extract copper in H_2SO_4.
2. Although the microwave leaching process did not show competent copper extraction under the lower concentrations of $K_2Cr_2O_7$ and lower temperature, it effectively increased the extraction of copper and reduce the maximum copper extraction time under relatively higher conditions compared to conventional leaching.
3. 81% of copper were leached with addition of 0.3 mol/L $K_2Cr_2O_7$ to 0.5M H_2SO_4 solution at 50°C after 180 min leaching time in conventional acid method whilst, more than 93% copper were extracted under same conditions after 60 minutes in microwave leaching.

References

[1] S. Wang, "Copper Leaching from Chalcopyrite Concentrates." *JOM*, Vol. 7, 2005, pp 48-51.

[2] C. K. Gupta, T. K. Mukherjee, "Hydrometallurgy in Extraction Processes," CRC Press. Vol. 1, 1964.

[3] H. R. Watling, "Chalcopyrite Hydrometallurgy at Atmospheric Pressure: 1. Review of Acidic Sulfate, Sulfate–Chloride and Sulfate–Nitrate Process Options," *Hydrometallurgy*, vol. 140, 2013, pp 163-180.

[4] D. Dreisinger, "Copper Leaching from Primary Sulfides: Options for Biological and Chemical Extraction of Copper," *Hydrometallurgy*, Vol. 83, 2006, pp 10-20.

[5] C. Klauber, "A Critical Review of the Surface Chemistry of Acidic Ferric Sulphate Dissolution of Chalcopyrite with Regards to Hindered Dissolution," *International Journal of Mineral Processing*, Vol. 86, 2008, pp 1-17.

[6] E. M. Córdoba, J. A. Muñoz, M. L. Blázquez, F. González, A. Ballester, "Leaching of Chalcopyrite with Ferric Ion. Part I: General Aspects, " *Hydrometallurgy*, vol 93,2008, pp 81-87.

[7] S. Aydogan, G. Ucar, M. Canbazoglu, "Dissolution Kinetics of Chalcopyrite in Acidic Potassium Dichromate Solution" *Hydrometallurgy*, vol 81, 2006, pp 45-51.

[8] K. Onol, M.N Saridede, "Investigation on Microwave Heating for Direct Leaching of Chalcopyrite Ores and Concentrates," *International Journal of Mineral Metallurgy and Material*, Vol. 20, 2013, pp 228-233.

[9] X. Zhai, Q. Wu, Y. Fu, L. Ma, C. Fan, N. Li, "Leaching of Nickel Laterite Ore Assisted by Microwave Technique" *Transactions of Nonferrous Metals Society of China*, Vol. 20, 2010, pp. 77-81.

[10] T. Suoranta, O. Zugazua, M. Niemelä, P. Perämäki, "Recovery of Palladium, Platinum, Rhodium and Ruthenium from Catalyst Materials Using Microwave-Assisted Leaching and Cloud Point Extraction," *Hydrometallurgy*, Vol. 154, 2015, pp. 56-62.

[11] G. Chen, J. Chen, J. Peng, R. Wang, "Green Evaluation of Microwave-Assisted Leaching Process of High Titanium Slag on Life Cycle Assessment", *Transactions of Nonferrous Metals Society of China*, Vol. 20, 2010, pp. 198-204.

[12] D.A. Jones, T.P. Lelyveld, S.D. Mavrofidis, S.W. Kingman, , N.J. Miles, "Microwave Heating Applications in Environmental Engineering-A Review", *Resources, Conservation and Recycling*, Vol. 34, 2002, pp.75-90.

[13] M. Al-Harahsheh, S.W. Kingman, "Microwave-Assisted Leaching-A Review, *Hydrometallurgy*, Vol. 73, 2004, 189 -203.
[14] K.E. Haque, "Microwave Energy for Mineral Treatment Processes-A Brief Review", *International Journal of Mineral Processing*, Vol. 57, 1999, pp. 1-24.
[15] M. Al-Harahsheh, S. Kingman, "The Influence of Microwaves on the Leaching Kinetics of Chalcopyrite", *Minerals Engineering, Vol.* 18, 2005 pp. 1259-1268.