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2. Reviewing discussions of new issues related to higher education and scientific research.

3. Developing scientific research and encouraging academic specialists to carry out scientific research.

4. Monitoring important scientific activities such as conferences, symposiums and workshops.

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**OMANI JOURNAL OF APPLIED SCIENCES (OJAS)**
***Bi-annual refereed scientific journal***

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# A NOTE FROM THE GUEST EDITORS

Dear Readers and Contributors,

Season's Greetings.

It gives us immense pleasure to place the first issue of third volume of the Omani Journal of Applied Sciences (OJAS) before you which encapsulates a variety of practical issues with the aim to provide empirical evidence and practical guidance. At this point in time, we have two strong reasons to feel proud of our selves. First, the Sultanate of Oman is celebrating the 40th glorious National Day on 18 November, 2010 which commemorates the beginning of His Majesty Sultan Qaboos bin Said's leadership on that day in 1970, and the start of the Renaissance of Oman. We are pleased to bring out this issue of OJAS on this happy occasion. Second, OJAS has successfully completed one fruitful year. At the threshold of the second year, we have taken all necessary efforts with more valued and relevant features to make this issue of OJAS an educative and informative document to our readers, researchers, practitioners and policy makers.

Oman is a remarkably stable country in the Middle East region. The government aims to carry out a substantial transformation in the structure of the national economy by developing a multiplicity of income sources, instead of depending mainly on oil, in order to achieve economic balance and sustainable growth, through economic diversification. Oman liberalized its market in an effort to accede to the WTO and gained membership in 2000. In this background, OJAS adopts a region-specific as well as an international orientation with a comparative approach to inform policy makers and practitioners of Oman as well as other countries. The OJAS contains both theoretical and applied empirical studies on key aspects related to the area of applied sciences in Communication, Design, Information Technology, International Business Administration, Engineering and English language. Hence, there is considerable diversity in the topics addressed by the contributors in OJAS.

We received several submissions for this issue of OJAS from researchers across the globe. After reviewing by independent referees, a collection of four quality articles were selected for publication in this issue of OJAS. The research papers in this issue give a significant contribution to the body of knowledge and practice in the specific areas of Applied Sciences on current contemporary issues. As an interdisciplinary Applied Science Journal, we have tried to make OJAS more useful to our readers by balancing and focusing the themes of the research articles on Information Technology, Education, and Tourism, in this issue.

The current issue of OJAS includes three research articles and one case study. The first paper entitled "*Active Learning for Computer Engineering Students: An Alternative Approach to Teaching and Learning"* authored by Ms. Solane D. Basister evaluates the concept of Active Learning as an alternative method for teaching and learning Basic Logic Gates concept in Digital Electronics in the classroom. The study suggests that students can

understand better concepts taught through experiential learning or active participation in the class.

The second paper entitled *"IT Impacts on Homeland Security"* authored by Dr. Elsayed Abdel Aziz Soleit examines the application of object identification and recognition techniques for person identification in the service of homeland security. This study considers a small online data-base of different faces of persons and analyzed them by using the methodology of feature coding and recognition. This paper proposes a scheme of automatic face recognition of face images.

The third paper entitled "*Responsible Tourism: An African Overland Example"* co-authored by Dr. Kenneth F. Backman and Dr. Susan L. Slocum focuses on responsible tourism by observing a group of overland travelers touring in Southern Africa. This case study attempts to identify the complexities of responsible tourism using participatory observation to analyze both the actions of an overland tourism company and individual tourist behaviors in Southern Africa.

The fourth paper entitled *"Efficient Compilation through Demand Driven Register Allocation Framework (DDRAF) for Subword Parallelism in Programmable Media Processors"* authored by Mr. Munesh Singh Chauhan demonstrates a technique to allocate registers that takes care of subword operations. This paper introduces Demand Driven Register Allocation Framework with an aim to make minimum and non-invasive changes in the existing *gcc* global register allocator.

This issue also provides an update on Doctoral and Master degree dissertations completed recently by Omani research scholars. A brief summary of important conferences held in Oman during 2009-2010 is also reported in this issue of OJAS.

We would like to gratefully acknowledge the time and support of the Ministry of Higher Education, contributors, referees, members of the Academic Publications Governing Board, Editorial Board and International Advisory Board in all our endeavours, which have inspired us to reach new height over a year.

We invite your valuable feedback and constructive suggestions for further improvement of OJAS in the coming years. Finally, we wish you a Happy and Prosperous New Year 2011 to all our esteemed readers, contributors, patrons and well wishers.

With best regards,

**Dr. Ananda. S.**
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## SHORT BIOS OF CONTRIBUTORS

### Ms. Solane D. Basister

**Ms. Solane D. Basister** holds a B.Sc. in Computer Engineering from the AMA Computer University and a MSc in Engineering Education from the Rizal Technological University in the Philippines. She started her career in industry in 1996 but has been an academic since 1999. She has taught in the Philippines and Oman and is currently teaching at Ibra College of Technology, Sultanate of Oman. She has published research papers and presented at conferences both in the Philippines and Oman. Her current research interests are teaching and learning through Active Learning methods. She is a reviewer for the Applied Power Electronics Colloquium (APEC), and the International Journal of Engineering and Technical Education (IJETE) in Malaysia.

### Dr. Elsayed Abdel Aziz Soleit

**Dr. Elsayed Abdel Aziz Soleit** Holds B.Sc.1976 and M.Sc.1983 both in Electronic Engineering, Engineering College, Cairo University, Egypt. He holds PhD in Electronic Engineering, The Faculty of Information Technology, University of Kent UK.,1989.

He is a Professor of Data Communication and Computer Networks, IT Department, Sur College of Applied Sciences , Ministry of Higher Education, Sultanate of Oman since 2008.

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## Dr. Kenneth F. Backman

**Dr. Kenneth F. Backman** is an Associate Professor in the Department of Parks, Recreation and Tourism Management at Clemson University in the United States. He received his doctoral education at Texas A&M University and his undergraduate education at Acadia University in Canada. Dr. Backman is the Editor-in-Chief of Event Management: An International Journal and is on several journal editorial boards such as the Journal of Ecotourism, and Tourism Analysis. His research areas of interest are sustainable community tourism development, ecotourism, international tourism development and events.

## Dr. Susan L. Slocum

**Dr. Susan L. Slocum** specializes in sustainable economic development through tourism and policy implementation at the regional and national level. Working with communities to enhance the backward linkages between tourism and traditional industries, Dr. Slocum has worked with rural communities across the UK to develop food tourism initiatives and with indigenous populations in emerging tourism destinations in Tanzania. In particular, she is interested in balancing policy development and integration to provide a more bottom-up form of planning within tourism destinations and has approached sustainable tourism from a contemporary view which includes the addition of institutional reform and social justice. Her aim is to reduce poverty and provide quality, as well as quantity, economic gains for community members. Dr. Slocum is current employed by the Institute of Tourism Research at the University of Bedfordshire in the UK.

## Mr. Munesh Singh Chauhan

**Mr. Munesh Singh Chauhan** carries 10 years of experience in academics. He has taught different courses at various levels.

The major subjects taught are Compiler Design, Automata Theory, Algorithms and Operating System. Besides teaching, Munesh has published many research papers in various national and international conferences. He is the recipient of ITRI (Taiwan), Outstanding Graduate Student Scholarship Award, June, 2009.

# "ACTIVE LEARNING FOR COMPUTER ENGINEERING STUDENTS: AN ALTERNATIVE APPROACH TO TEACHING AND LEARNING"

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## ABSTRACT

An experimental research method using the single group with a pre-test and post-test design was conducted on 33 Computer Engineering students to introduce Active Learning as an alternative method for teaching Basic Logic Gates concept in Digital Electronics in the classroom and determine whether gains in learning is associated with exposing the students to the experimental factor. The experimental factor was the researcher-made instructional materials specifically designed to demonstrate digital electronics concepts and functions using pre-fabricated Printed Circuit Board (PCB) which the student has to assemble and the accompanying Manual as guide which also contains series of experiment that the students have to perform using the assembled PCB.

The results of the students' performances during the pre-test and post-test showed mean distribution scores of 5.79 and 29.91, with standard deviations of 5.787 and 7.539, respectively in the 40-items assessment tests. The z-test for correlated sample @ 0.05 level of significance is 13.797 ($Z_{CV} = \pm 1.96$), which indicates that there is significant difference in the performance of the students during the pre-test and post-test as a result of the experimental factor.

The results of the study suggest that gains in learning is associated with the use of alternative teaching methods in the classroom like Active Learning as it allows students to understand better the concepts taught through experiential learning or active participation in the class. Hence, it is recommended that teachers explore different methods of teaching in order to motivate students to facilitate better learning.

***Keywords*:** Active Learning, Basic Logic Gates, Digital Electronics, Printed Circuit Board, pre-test, post-test.

## 1. INTRODUCTION

Active Learning is an umbrella term that refers to several models of instruction that focus the responsibility of learning on learners (http://en.wikipedia.org). In this set-up, the teachers are not the founts of information but are simply facilitating classroom learning. Researches conducted have suggested that students must read, write, discuss, be engaged in solving problems, or must be allowed to do things and think about what they are doing in order for learning to take place (Bonwell & Eison, 1991).

Studies further suggest that the use of different teaching techniques in the classroom has powerful impacts upon students' learning. In fact, gains in learning have been associated with the application of different teaching strategies like the Active Learning techniques. Some cognitive researches have also pointed out the some individuals' learning styles are actually best served using other pedagogical styles other than the lecture method (Meyer & Jones, 1993).

The Lecture method is the widely used pedagogical strategy which offers advantages in promoting the mastery of content but researches have showed proof that Active Learning strategy is comparable to lecture method in promoting mastery of content but superior in developing the students' skills and engaging them in higher-order analysis (Bonwell & Eison, 1991). Hence, it is recommended that educators explore other teaching strategies that will allow students to be actively involved in the learning process and not just act as listeners or passive participants – as in the case of the Lecture Method.

Reforms in the classroom practices must begin with the Faculty, teachers are therefore encouraged to engage in self-reflection and explore his/her personal willingness to experiment with different teaching methods and applying the one which he/she is most comfortable with and where gains in learning is most likely achieved.

In this study, the lecturer-researcher has designed instructional materials specifically for Computer Engineering students - applying technical skills in Engineering Design and teaching strategies to introduce Active Learning as an alternative method for teaching.

## 2. TECHNICAL DESCRIPTION OF THE DESIGN

The researcher-made instructional materials were consisted of the Basic Logic Gates Printed Circuit Board (PCB) and Manual. The PCB is a 3" x 5" pre-fabricated single-sided board with silk-screened parts placement layout, drill, and pre-etched artwork designed for students to assemble and experiment with using the accompanying Manual. The Schematic Diagram was designed using Orcad while the PCB Artwork was done in CADPCB.

The Manual is subdivided into three parts – the Part I is a guide on how to construct the PCB, with guides on how to test for the basic components, proper soldering techniques, and other information needed in project development; Part II contains instructions on how to test for the operational function of the assembled PCB; and Part III contains the nine (9) experiments that cover basic logic gates operations – AND, OR, NOT, NAND, NOR, XOR and XNOR.

Materials included in the project were Toggle Switches as input lines, Dip Switch as selector, Integrated Chips (IC), Limiting Resistors, and Light Emitting Diodes (LEDs) as indicators.

### 2.1 The Basic Logic Gates Printed Circuit Board

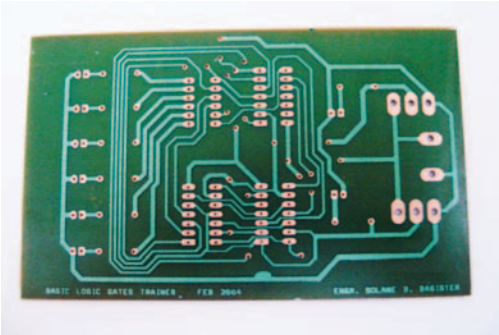

**Figure 1. The PCB Design**

Figure 1 shows the 3" x 5" Printed Circuit Board (PCB) layout with solder mask.

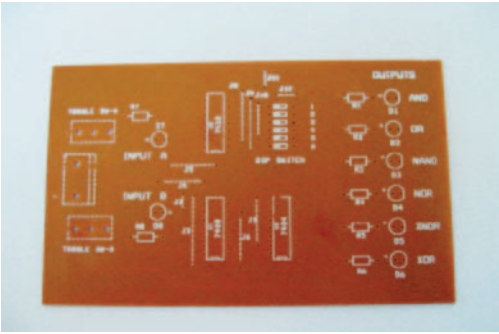


**Figure 2. The Parts Placement Layout**

Figure 2 shows the parts placement layout on the face of the PCB which shows where specific components should be placed.

### 2.2 Statement of the Problem

The study purports to use the researcher-made instructional materials as a tool to introduce Active Learning in the classroom as an alternative method for teaching Computer Engineering students and determine whether there is significant difference in the performance of the students during the pre-test and post-test as a result of using these materials. Specifically, it sought answers to the following sub-problems:

1. What is the mean score of the students during the pre-test?
2. What is the mean score of the students during the post-test?
3. Is there significant difference in the mean scores of the students during the pre-test and the post-test?
4. What is the evaluation of the students in the use of the materials in terms of:
   Content
   Usability
   Cost
5. How did the students find the information included in the Manual?
6. What are the problems encountered by the students during laboratory experimentation?

### 2.3 Hypothesis

There is significant difference in the mean scores of the students during the pre-test and the post-test.

## 3. METHODS OF RESEARCH AND PROCEDURES

### 3.1 Method of Research

The Single group with a pre-test and post-test Experimental Design was used in this study. In the experimental design, the group was given a test (pre-test) prior to being exposed to an experimental factor, after which, a similar test (post-test) is administered to the group. The difference between the pre-test and the post-test was computed and was considered caused by the experimental factor.

### 3.2 The Sampling Design

The non-probabilistic sampling design had been adapted in selecting the students/ respondents of the study. One group from among 3 classes was selected as the experimental group.

### 3.3 Procedures

A class comprised of thirty-three (33) Computer Engineering Students during the 1st Semester 2004-2005 at the Rizal Technological University Philippines, was selected as the experimental group. At the start of the semester, the group was advised of the study being conducted. They were informed that, as an experimental group, they will be assessed solely on their performances during the experiments and that the assessment exams will not have any bearing on their grades (to avoid the pressure of memorizing) but will be used only to measure if gains in learning may be associated with the experimental factor (PCB and Manual).

The first few sessions (1-2 weeks) were lectures on the different logic gates – (the AND, OR, NOT, NAND, NOR, XOR, and XNOR Gates) – with an emphasis on their algebraic functions, symbols, and the truth tables. An unannounced assessment exam was conducted following the lecture method. This was the pre-test.

The following sessions (3-4 weeks) were lectures on resistor color-coding, proper mounting and soldering techniques, and testing for basic components and explanation of some aspects of the Manual. A project was assigned to enhance the students' soldering skills in preparation for the actual requirement.

The students were then asked to assemble the PCB using the Manual as their guide. Students were instructed to just follow the guidelines in Part I of the Manual to assemble their individual PCB and little intervention came from the researcher/teacher. As soon as the students completed assembly of their PCB, they were required to do Part II to test for the operational function of their assembled board. During this stage, students have to trouble-shoot the board in case it does not function as it should. The researcher checked the individual board to ensure its operational condition and students were asked to proceed with Part III – Experiments. As soon as the students completed all the nine (9) experiments in the Manual, the post-test was administered.

The difference between the post-test and the pre-test was measured and tested for significance using SPSS (Statistical Package for the Social Sciences).

### 3.4 Statistical Treatment of the Data

To answer the hypothesis of the study, the z-test for correlated samples, @0.05 level of significance, was used.

***Presentation, Analysis and Interpretation of Data***

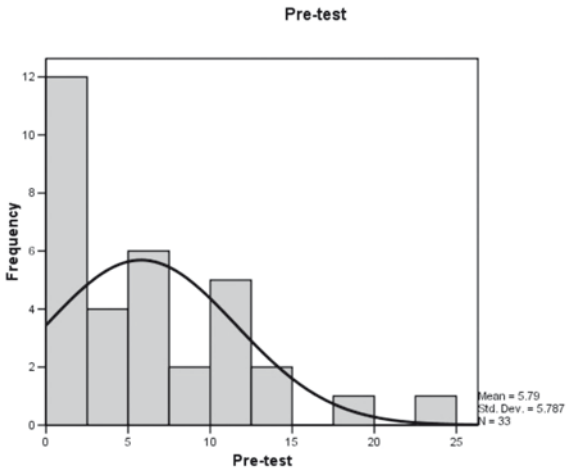


**Figure 3. Mean Distribution of the Pre-test**

Figure 3 shows that the mean distribution score of the 33 students, in the 40-items pre-test, is 5.79 with a standard deviation of 5.78.

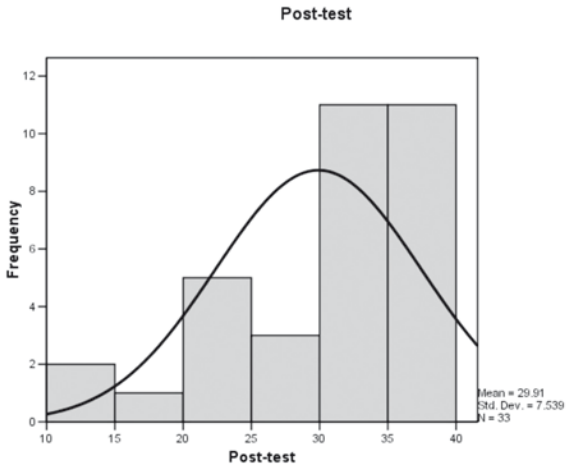


**Figure 4. Mean Distribution of the Post-test**

Figure 4 shows that the mean distribution score of the 33 students in the 40-items post-test is 29.91 with a standard deviation of 7.539.

**Table 1. Frequency and Percentage Distribution of the Pre-test and the Post-test.**

| Class Interval | Pre-test | | Post-test | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| 36-40 | 0 | 0.00 | 7 | 21.21 |
| 31-35 | 0 | 0.00 | 13 | 39.39 |
| 26-30 | 0 | 0.00 | 4 | 12.12 |
| 21-25 | 1 | 3.03 | 5 | 15.15 |
| 16-20 | 1 | 3.03 | 2 | 6.06 |
| 11-15 | 4 | 12.12 | 0 | 0.00 |
| 6-10 | 8 | 24.24 | 2 | 6.06 |
| 0-5 | 19 | 57.58 | 0 | 0.00 |

Table 1 shows that during the pre-test, 57.58% of the students scored 0-5, 12.12% scored 11-15, 24.24% scored 6-10, and only three percent (3%) scored 16-20, and 21-25 in the 40-item assessment test.

During the post-test, 39.39% scored 31-35, 21.21% scored 36-40, 15.15% scored 21-25, 12.12% scored 26-30, and 6.06% scored 6-10 and 16-20, in the 40-item assessment test.

A total of 3.03% or only one (1) student passed during the pre-test while a total of 87.87% or 29 students passed during the post-test.

In addition, 96.97% or 32 students failed during the pre-test, and 6.06% or two (2) students failed during the post-test.

**Table 2. Frequency and Percentage Distribution for the AND Function**

| Inputs | | AND Functions | | | |
|---|---|---|---|---|---|
| X | Y | Pre-Test | Percentage | Post-Test | Percentage |
| 0 | 0 | 8 | 24.24 | 30 | 90.91 |
| 0 | 1 | 10 | 30.30 | 30 | 90.91 |
| 1 | 0 | 10 | 30.30 | 30 | 90.91 |
| 1 | 1 | 10 | 30.30 | 30 | 90.91 |
| Symbol | | 19 | 57.58 | 31 | 93.94 |
| Algebraic Function | | 0 | 0.00 | 18 | 54.55 |

Table 2 shows the item analysis of the correct answers for the AND Gate functions (Questions 1-6). From the table, it can be seen that 90.91% of the students got the inputs 0-0 right during the post-test as compared with only 24.24% during the pre-test. 90.91% got inputs 0-1, 1-0 and 1-1 during the post-test as compared to only 30.30% during the pre-test. For the AND Gate symbol 93.94% of the respondents answered correctly during the post-test while only 57.58% got it during the pre-test. For the algebraic function, 54.55% of the respondents got the correct answers during the post-test but no one answered it correctly during the pre-test.

The results shown in Table 2 suggests that the respondents were able to remember the AND Functions - the truth table, symbol and algebraic function, after performing the experiments using the PCB and Manual than during the lecture method.

**Table 3.Frequency and Percentage Distribution for the NAND Functions**

| Inputs | | NAND Functions | | | |
|---|---|---|---|---|---|
| X | Y | Pre-Test | Percentage | Post-Test | Percentage |
| 0 | 0 | 3 | 9.09 | 30 | 90.91 |
| 0 | 1 | 3 | 9.09 | 30 | 90.91 |
| 1 | 0 | 3 | 9.09 | 30 | 90.91 |
| 1 | 1 | 3 | 9.09 | 30 | 90.91 |
| Symbol | | 10 | 30.30 | 28 | 84.85 |
| Algebraic Function | | 0 | 0.00 | 12 | 36.36 |

Table 3 shows the item analysis of the correct answers for the NAND Gate functions (Question 7-12). From the table, it can be seen that 90.91% of the students got the correct answers for inputs 0-0, 0-1, 1-0 and 1-1 during the post-test as compared to only 9.09% during the pre-test. For the NAND Gate symbol, 84.85% got the correct answer during post-test but only 30.30% got it during the pre-test. For the NAND Gate algebraic function, 36.36% of the respondents got the correct answers during the post-test but no one answered correctly during the pre-test.

The results shown in Table 3 suggests that the respondents were able to remember the NAND Functions - the truth table, symbol and algebraic function, after performing the experiments using the PCB and Manual than during the lecture method.

**Table 4. Frequency and Percentage Distribution for the OR Functions**

| Inputs | | OR Functions | | | |
|---|---|---|---|---|---|
| X | Y | Pre-Test | Percentage | Post-Test | Percentage% |
| 0 | 0 | 10 | 30.30 | 30 | 90.91 |
| 0 | 1 | 11 | 33.33 | 30 | 90.91 |
| 1 | 0 | 11 | 33.33 | 30 | 90.91 |
| 1 | 1 | 9 | 27.27 | 28 | 84.85 |
| Symbol | | 13 | 39.39 | 28 | 84.85 |
| Algebraic Function | | 0 | 0.00 | 19 | 57.58 |

Table 4 shows the items analysis of the correct answers for the OR Functions (Questions 13-18). From the table, it can be seen that 90.91% of the students got the correct answers for inputs 0-0, and 0-1 during the post-test as compared with 30.30% and 33.33%, respectively during the pre-test. For the 1-0 and 1-1 inputs, 90.91% and 84.85% respectively got the correct answers during the post-test as compared to only 33.33% and 27.27% respectively during the pre-test. For the OR Symbol, 84.85% answered correctly during the post-test but only 39.39% got it during the pre-test. For the OR Gate algebraic function, 57.58% of the respondents got the correct answers during the post-test but no one answered correctly during the pre-test.

The results shown in Table 4 suggests that the respondents were able to remember the OR Functions - the truth table, symbol and algebraic function, after performing the experiments using the PCB and Manual than during the lecture method.

**Table 5. Frequency and Percentage Distribution of the NOR Functions.**

| Inputs | | NOR Functions | | | |
|---|---|---|---|---|---|
| X | Y | Pre-Test | Percentage | Post-Test | Percentage |
| 0 | 0 | 2 | 6.06 | 28 | 84.85 |
| 0 | 1 | 2 | 6.06 | 27 | 81.82 |
| 1 | 0 | 2 | 6.06 | 27 | 81.82 |
| 1 | 1 | 2 | 6.06 | 27 | 81.82 |
| Symbol | | 8 | 24.24 | 26 | 78.79 |
| Algebraic Function | | 0 | 0.00 | 11 | 33.33 |

Table 5 shows the item analysis of the correct answers for the NOR Functions (Question 19-24). From the Table, it can be seen that for inputs 0-0, 0-1, 1-0 and 1-1, during the pre-test only 6.06% got the correct answers while 84.85% got the 0-0 input correctly, and 81.82% got the 0-1, 1-0 and 1-1 inputs correctly. For the NOR Symbol, 78.79% of the respondents got the correct answer during the post-test but only 24.24% answered correctly during the pre-test. For the NOR Gate algebraic function, 33.33% of the respondents got the algebraic function correctly during the post-test but no one answered correctly during the pre-test.

The results shown in Table 5 suggests that the respondents were able to remember the NOR Functions - the truth table, symbol and algebraic function, after performing the experiments using the PCB and Manual than during the lecture method.

**Table 6. Frequency and Percentage Distribution for the XOR Functions.**

| Inputs | | XOR Functions | | | |
|---|---|---|---|---|---|
| X | Y | Pre-Test | Percentage | Post-Test | Percentage |
| 0 | 0 | 0 | 0 | 27 | 81.82 |
| 0 | 1 | 0 | 0 | 27 | 81.82 |
| 1 | 0 | 0 | 0 | 26 | 78.79 |
| 1 | 1 | 0 | 0 | 26 | 78.79 |
| Symbol | | 6 | 6 | 22 | 66.67 |
| Algebraic Function | | 0 | 0 | 0 | 0 |

Table 6 shows the item analysis of the correct answers for XOR Functions (Questions 25-30). From the table, it can be seen that none of the respondents answered correctly the truth table and algebraic function of the XOR Gate during the pre-test, and only 6% got the XOR symbol right. However, during the post-test, 81.82% of the students answered correctly the XOR functions 0-0 and 0-1, and 78.79% answered correctly the XOR functions 1-0 and 1-1, and 66.67% got the correct XOR symbol.

The results shown in Table 6 suggests that the respondents were able to remember the XOR Functions - the truth table, symbol and algebraic function, after performing the experiments using the PCB and Manual than during the lecture method.

Although the respondents were able to get the correct truth table for the XOR, the group still finds difficulty in remembering the algebraic function of this gate.

**Table 7. Frequency and Percentage Distribution of the XNOR Functions.**

| Inputs | | XNOR Functions | | | |
|---|---|---|---|---|---|
| X | Y | Pre-Test | Percentage | Post-Test | Percentage |
| 0 | 0 | 1 | 3.03 | 24 | 72.73 |
| 0 | 1 | 1 | 3.03 | 24 | 72.73 |
| 1 | 0 | 1 | 3.03 | 24 | 72.73 |
| 1 | 1 | 1 | 3.03 | 22 | 66.67 |
| Symbol | | 7 | 21.21 | 22 | 66.67 |
| Algebraic Function | | 0 | 0 | 1 | 3.03 |

Table 7 shows the item analysis of the correct answers for XNOR Functions (Questions 31-36). From the Table, it can be seen that 3.03% of the respondents answered correctly the truth table of the XNOR Gate during the pre-test but 72.73% answered correctly the inputs 0-0, 0-1 and 1-0, and 66.67% answered correctly the inputs 1-1, during the post test. Also, only 21.21% got the correct answer for the XNOR symbol during pre-test but 66.67% got it right during the post-test. None of the respondents got the correct answer for the XNOR algebraic function during pre-test and only 3.03% got it right during the post-test.

The results shown in Table 7 suggests that the respondents were able to remember the XNOR Functions - the truth table, symbol and algebraic function, after performing the experiments using the PCB and Manual than during the lecture method.

The XNOR algebraic function is another gate which students have difficulty understanding or remembering. It is also note worthy that if students do not understand the XOR function, they also do not understand the XNOR function because these two logic gates are complementary.

**Table 8. Frequency and Percentage Distribution for the NOT Functions**

| Input | NOT Functions | | | |
|---|---|---|---|---|
| X | Pre-Test | Percentage | Post-Test | Percentage |
| 0 | 0 | 0 | 14 | 42.42 |
| 1 | 0 | 0 | 14 | 42.42 |
| Symbol | 6 | 18.18 | 7 | 21.21 |
| Algebraic Function | 0 | 0 | 0 | 0 |

Table 8 shows the item analysis of the correct answers for NOT Functions (Questions 37-40). From the table, it ca be seen that 42.42% of the students got the correct answers for inputs 0 and 1 during the post-test while no one got it right during the pre-test. For the NOT symbol, 21.21% got the correct answer during the post-test, and 18.18% got the correct answer during the pre-test.

It was noted that none of the students got the NOT Gate algebraic function correctly both in the pre-test and post-test. The NOT function is one of the logic gates where students got the lowest correct answer because this function was no taken up independently (as with other logic gates) but was integrated in the functions of NAND, NOR and XNOR. This further suggest that students were not able to get the correct answers for this NOT function during the post-test because this logic gate was not part of the experiment and hence was not directly experienced.

**Table 9. Summary of the Means and Standard Deviation**

| | Pre-test | Post-test |
|---|---|---|
| Mean | 5.790 | 29.910 |
| Standard Deviation | 5.787 | 7.539 |
| N | 33 | 33 |

Table 9 shows the summary of the mean distribution and standard deviation of the pre-test and post-test of the 33 students during the pre-test and post-test, which is the basis for computation of the z scores. (@0.05, $Z_{CV} = \pm 1.96$)

The computed value for the z-test for correlated sample was Z = 13.797.

Based on the compute value for Z, there is significant difference in the mean scores of the students during the pre-test and post-test, hence the hypothesis is accepted.

**Table 10. Evaluation Results of the Materials**

| CRITERIA | Agree | Disagree | No Answer |
|---|---|---|---|
| *CONTENT* | | | |
| Instructions in the Manual are clear and easy to follow | 88% | 9% | 3% |
| The information included in the Manual is complete and interesting | 94% | 3% | 3% |
| The Basic Logic Gates Board and Manual are supplemental to classroom lectures | 67% | 21% | 12% |
| Results gathered in the experiments are satisfactory | 85% | 12% | 3% |
| ***The use of Basic Logic Gates Board and Manual improved your understanding of concepts taught during lectures*** | 94% | 3% | 3% |
| *USABILITY* | | | |
| The Prototype and Manual are easy to use | 88% | 12% | 0% |
| The experiments included are of acceptable length and duration | 55% | 39% | 6% |
| The use of the Materials is recommended for use in the subject | 70% | 27% | 3% |
| *COST* | | | |
| The cost of the Project is expensive | 48.5% | 48.5% | 3% |

Table 10 shows the evaluation results of the Manual in terms of Content: Eighty-eight (88%) of the students agreed that the instructions in the Manual are clear and easy to follow; ninety-four percent (94%) agreed that the information is complete and informative; sixty-seven percent (67%) agreed that the materials are supplemental to classroom lectures; and ninety-four percent (94%) agreed that the use of the Basic Logic Gates Board and Manual improved their understanding of the concepts taught during classroom lectures.

In terms of Usability: eighty-eight percent (88%) of the students agreed the PCB and Manual are easy to use; fifty-five percent (55%) agreed that the experiments are of acceptable length and duration; and seventy percent (70%) recommends the use of the instructional materials.

In terms of Cost, forty eight percent (48%) of the students find the cost of the materials expensive.

**Table 11. Weighted Means of the Difficulties Encountered by the Students**

| Difficulties | Weighted Mean | Rank |
|---|---|---|
| Inability to read Schematic Diagrams | 3.39 | 1 |
| Inability to understand and construct the circuits | 3.45 | 2 |
| Inability to relate classroom lecture with laboratory experiments | 3.55 | 3 |
| Poor understanding of the Basic Logic Gate Operations | 3.61 | 4 |
| Incomplete Tools (i.e.micro-nipper, long nose, etc.) | 3.64 | 5 |
| Too lengthy Experiments | 3.67 | 6 |
| Incomplete Materials | 3.76 | 7 |
| Experiments are not properly explained | 3.85 | 8 |
| Instructions are hard to understand | 3.97 | 9.5 |
| Lack of Interest in the subject | 3.97 | 9.5 |

**Table 11 shows the ranking of the difficulties encountered by students during laboratory experiments,**

(1) inability to read schematic diagrams;

(2) inability to understand and construct the circuit;

(3) inability to relate classroom lecture with laboratory experiments;

(4) poor understanding of the basic logic gates operations;

(5) incomplete tools;

(6) too lengthy experiments;

(7) incomplete materials;

(8) experiments are not properly explained;

(9.5) instructions are hard to understand; and lack of interest in the subject.

It is surprising to find that *lack of interest in the subject*, in fact, is the last reason why students have difficulty performing laboratory experiments. It is actually, their inability to read the schematics that make the experiments hard for them. Other factors that contribute as well are lack of tools and materials. If students therefore may be provided the materials they need, and with proper guidance from the teachers, students may find laboratory experiments easier.

**Table 12. Frequency and Percentage Distribution of Students' Evaluation on the Usefulness of the Information in the Manual.**

| Description of Information | Useful | | Not Useful | |
|---|---|---|---|---|
| | Frequency | Percentage | Frequency | Percentage |
| Safety Guidelines on your Workbench | 33 | 100 | 0 | 0 |
| Resistor Color Coding | 32 | 97 | 1 | 3 |
| Tests for Basic Components | 31 | 94 | 2 | 6 |
| Parts Placement Lay-Out | 32 | 97 | 1 | 3 |
| Schematic Diagram | 32 | 97 | 1 | 3 |
| Proper Soldering Techniques | 32 | 97 | 1 | 3 |

Table 12 shows the evaluation results of the usefulness of the information provided in the Manual. Results showed that one-hundred percent (100%) of the students agreed that the *Safety Guidelines on Your Workbench* is a useful information; ninety-seven percent (95%) agreed that the *Resistor Color Coding Scheme* is useful; ninety-four percent (94%) agreed that the *Test for Basic Components* is useful, ninety-seven percent (97%) agreed that the *Parts Placement Lay-out* guide is also useful, ninety-seven percent (97%) agree that the *Schematic Diagram* is useful, and ninety-seven percent (97%) agreed that the *Proper Soldering Techniques* is useful.

On interview, those who did not find the information necessary or useful are those who already know how the information.

## 4. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

### 4.1 Summary

The study introduced an alternative method for teaching the basic logic gates concepts to Computer Engineering students at the Rizal Technological University Philippines during the 1st Semester 2004-2005. The experiment was conducted with the use of the researcher-made instructional materials – the PCB and Manual, and using the single group with a pre-test and post-test experimental research design, tried to determine whether the use of such alternative method called Active Learning will improve students' understanding of the underlying concepts in digital electronics.

Findings of the study showed that during the pre-test, the students' mean distribution score in the 40-item assessment test was at 5.79 with a standard deviation of 5.787. However, in

the post-test, the mean distribution score of the students was 29.91 with a standard deviation of 7.539.

The z-test for correlated samples showed that there is significant difference in the mean scores of the students during the pre-test and post-test.

The evaluation results of the students showed that: in terms of *Content:* the instructions in the Manual are clear and easy to follow (88%); the information is complete and informative (94%); the materials are supplemental to classroom lectures (67%); the use of the Basic Logic Gates Board and Manual improved their understanding of the concepts taught during classroom lectures (94%).

In terms of *Usability***:** the PCB and Manual are easy to use (88%); the experiments are of acceptable lengths and duration (55%); and the use of the materials in the subject is recommended (70%). In terms of *Cost*: forty-eight percent (48%) of the students find the materials expensive.

In addition, in terms of usefulness of the contents in the Manual, students agree on the following: *Safety Guidelines on Your Workbench (100%); Resistor Color Coding Scheme (97%); Test for Basic Components (94%)*; *Parts Placement Lay-out (97%); Schematic Diagram (97%)*; and *Proper Soldering Techniques (97%).* On interview, the student who did not find *Parts Placement Layout* useful answered the same Parts Placement Layout was on the face of the PCB so that he did not need to refer to the Manual for guide, the student who answered he did not find the *Proper Soldering Technique* useful said, he already knew how to solder, two students who did not find the *Tests for Basic Components* useful said they already knew how to test for basic components, and one who answered he did not find the *Schematic Diagram* useful said he referred to the lectures for schematics of each logic gates.

The following are the problems encountered by the students during laboratory experiments*: (1) Inability to read Schematic Diagrams; (2) Inability to understand and construct the circuits; (3) Inability to relate classroom lecture with laboratory experiments; (4) Poor understanding of the Basic Logic Gate Operations; (5) Incomplete Tools (i.e.micro-nipper, long nose, etc.); (6) Too lengthy Experiments; (7) Incomplete Materials; (8) Experiments are not properly explained; (9) Instructions are hard to understand; and (10) Lack of Interest in the subject.*

**4.2 Conclusions**

The design and use of instructional materials (PCB and Manual) to foster Active Learning as an alternative method to teaching and learning resulted in a significant difference in the mean scores of the students during the pre-test and the post-test.

Findings of the study showed that students scored better during the post-test. The results suggested that students can understand better the underlying principles and concepts when they are actively involved in the learning process than when they are just passive participants – as in the conventional lecture method.

Teachers have the power to condition the classroom for effective learning by motivating students to participate actively in each and every topic discussed, or s/he may devise ways to

**4.3 Recommendations**

In light of the findings, the following are the recommendations:

1. The Active Learning method is an alternative method for effective teaching and learning and teachers are encouraged to introduce this method for better teaching and learning.
2. The use of the Basic Logic Gates PCB and Manual resulted in the improvement of the students' scores during the post-test. It is therefore recommended that the materials be used for subjects that cover basic logic gates operations;
3. Similar materials may be developed for other topics in digital electronics;
4. Teachers and administrators are advised to take into considerations the different difficulties encountered by students during experiments;
5. Similar research using a standardized assessment test for the pre-test and post-test can be used to validate the results;
6. Parallel study may be conducted and teachers are encouraged to develop similar instructional materials innovate teaching;
7. Studies on different teaching method may be conducted to improve quality of teaching and learning.

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# IT IMPACTS ON HOMELAND SECURITY

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## ABSTRACT

*This paper focuses on the application of object identification and recognition techniques in the service of homeland security. Online face images are captured, preprocessed and applied to a feature extraction unit. Then, a linear prediction code (LPC) process is executed. The linear prediction coefficients represent the principle features to an image classifier where these features are compared with those of preprocessed ones. The minimum Euclidian distance recognizer is used. In this work a small data base of the faces of different people is built up. The assumed attributes are personal data and the features of the facial image. The recognition accuracy is enhanced and is of the order of 80%. The recognition accuracy can be improved using an adaptive recursive LPC.*

## KEYWORDS:

*Home Land, Security, Identification, Recognition, Linear Prediction, Feature Extraction.*

## 1. INTRODUCTION

The application of image processing and system modeling algorithms in automatic object recognition is attractive. Information technology applications are now widely used on a large scale at airports, police stations and border crossings to screen suspicious persons. Pattern recognition and image processing algorithms are applied to identify unknown objects based on reference templates that are created *a priori*. Finger-printing has been used for a long time to identify people. However, the usage of fingerprinting alone exhibits a degree of uncertainty and the recognition accuracy is low. (Moghaddam et.al. 1994). Liu (2000).

Face and ear profiles have been used recently to significantly improve recognition accuracy. Online face images captured from a digital camera or scanner are reprocessed and are applied to a feature extraction unit. The principle features such as the face profile, the wavelet transform coefficients and the linear prediction coefficients are applied to an image classifier where these features are compared with an assigned data base that contains the features of all of the suspicious persons. The minimum Euclidian distance used to implement the decision unit that displays the results of the recognition decisions. (Srsuk (2003).

In this paper we focus our attention on using the automatic object recognition techniques for person identification . A small data-base of different faces of persons is formed. The data base attributes are personal identity, features of the face and ear image. The decision accuracy of the proposed algorithms is encouraged .Moon (2001).

This paper includes six sections. Section two explains the face recognition scheme. Section three introduces the adaptive linear prediction whose coefficients represent the feature components of the face image. A proposed methodology of feature coding and recognition is given in section four. Section five presents system implementation and results and section six highlights the conclusions.

## 2. FACE RECOGNITION SCHEME

Recognition accuracy is encouraged and the proposed system can be applied in practical life. The proposed scheme is explained in Figure 1.

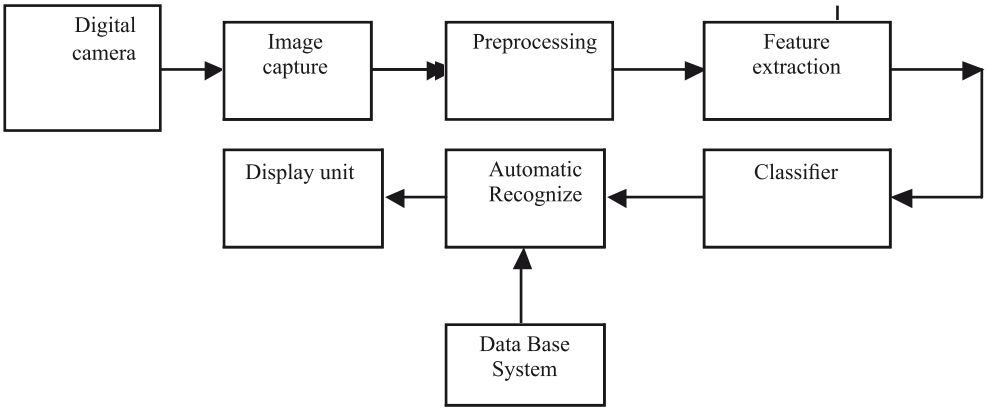


**Fig. 1 A proposed Scheme of an Automatic Face Recognition System**

### 2.1 Image Capture unit

This unit is responsible to capture the received image from the digital camera. The resulting image is encoded to the assigned compression type. The resulting image is named, sized to assigned frame size and stored in the data base images (Viola. Et.al.2004), Zhang (2009).

### 2.2 Preprocessing unit

The background noise in captured image is removed and enhanced using the digital filtering algorithms to improve signal to noise ratio.

### 2.3 Feature extraction unit

The feature extraction unit transforms each filtered image into a quantization vector with bounded order. The elements of the quantization vector depend on the type of the processing algorithms. In this paper an adaptive linear prediction (LPC) technique is used to transform the captured image into a certain quantization vector of the LPC coefficients.

### 2.4 Classifier unit

The resulting quantization vectors of the LPC coefficients of faces for known persons are classified, indexed and each one has its own index. The total number of indices denotes to the whole size of the data-base. Chao (2009).

### 2.5 Data Base unit

Standard data base is created from the identity information of the people whose face images are priory captured. The face indices are stored.

### 2.6 Automatic Recognizer unit

The role of the automatic recognizer unit is to detect and identify the identification of the unknown person whose image is captured the obtained feature vector is compared with the stored quantization vectors. If a good match with one of the stored quantization vector exists, the whole identity information is displayed.

## 3. A PROPOSAL OF ADAPTIVE LINER PREDICTION MODULE

The adaptive linear prediction scheme is depicted in Fig. 2. The input pixels of the face image are applied to LPC input. The adaptive digital filter represents the basic module of the LPC scheme. The objective of the adaptive filter is to produce a good estimate of the input pixel based on the preceding L pixels. L denotes the order of the adaptive filter. The filter output is expressed as: Soleit (2007):

$$y(n) = \sum_{r=0}^{L} a_r I(i, j, n - r - D) \tag{1}$$

$\{a_i\}$ Denotes to the LPC coefficients and $I(i, j, n)$ represents the input pixel. Also, D dedicates to the value of the delay that determines the prediction step.

The filter output is subtracted from the input pixel to result in the linear prediction error.

$$\begin{aligned} &(n) = I(i, j, n) - y(n) \\ &i = 1,2,3,\ldots\ldots\ldots\ldots\ldots\ldots, N \\ &j = 1,2,3,\ldots\ldots\ldots\ldots\ldots\ldots, M \end{aligned} \tag{2}$$

The size of the image is equivalent to NM bytes. The filter coefficients are updated so that the mean square of prediction error is minimized. The well-known least mean square adaptation algorithm is used to update the filter coefficients each sample. [12]. Hence,

$$\begin{aligned} &a_r(n+1) = a_r(n) + 2 \quad (n) I(i, j, n - D - r) \\ &r = 0,1,2,3,\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots, L \end{aligned} \tag{3}$$

At the end of the image pixels, the filter coefficients converge to its optimal value. The obtained values represent the elements of the quantization vector.

Define the quantization vector, A as:

$$A^T = [a_0, a_1, \ldots\ldots\ldots\ldots, a_L] \quad (4)$$

Where L is defined as the length of the vector. Soleit (2007).

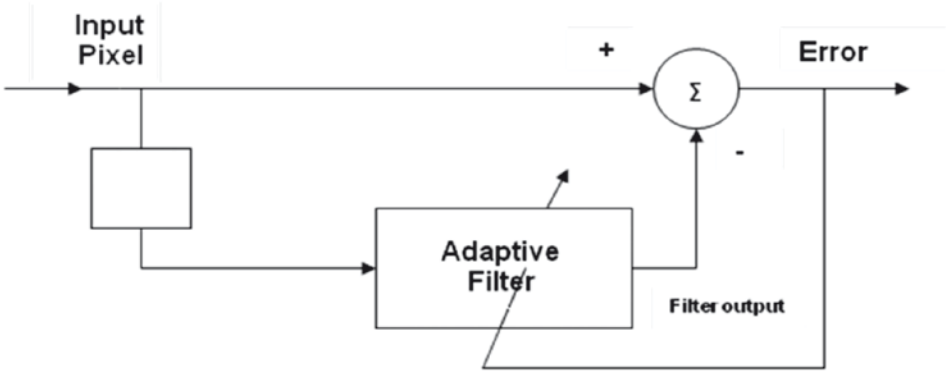


**Fig. 2 The adaptive linear prediction scheme**

## 4. A PROPOSED METHODOLOGY OF FEATURE CODING AND RECOGNITION

The obtained coefficient vector is stored in the assigned data-base. Each vector has its own index. The automatic recognizer unit calculates the Euclidian distance between the quantization vector of an unknown image, B and all stored ones as (Gonzalez et.al.2004):

$$S_i = Min(\|B - A_i\|) \quad (5)$$
$$i = 1,2,3,\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots K$$

Where K is the size of the available data-base

Then, the decision unit determines the index of the corresponding vector that it is closer to the measured one (i.e. the vector that has a minimum distance). Then, the identity and the image of the assigned person are visualized.

In case of no matching, the decision unit decides that there is no data for this persons and display clearance to pass. The data-base is updated continually for the new criminal and suspicious people.

## 5. SYSTEM IMPLEMENTATION AND RESULTS

The proposed technique is implemented and evaluated through computer simulation [Hanseleman2005]. The data-base model is chosen to have 39 face images. Each image is formed from 11 positions. The average coefficient vector for each image is calculated and an index is assigned for each. We chose twenty images randomly as unknown persons. Also, the recognition accuracy for different number of coefficients and delay periods is explained in Fig.3.

It is clear that the recognition accuracy is optimal as the coefficient vector increases to N=7 and the best number of delay periods is equal to one. The maximum recognition accuracy is nearly 83%. In further research, we will aim to increase the recognition accuracy for large numbers of tested persons.

## 6. CONCLUSION

A proposed scheme of automatic face recognition of face images has been proposed. This scheme has been tested and evaluated using a data base of 39 male images. Each image included 11 positions. An adaptive linear prediction coding (LPC) was used to determine the features that were represented by the coefficient vectors of the adaptive LPC module. The features of these images were determined and indexed. The resulting recognition accuracy obtained was 80 % which encourages the advance research to increase the recognition accuracy using different algorithms of classifier and recognition. Also, the Infinite Impulse Response (IIR) model of the adaptive LPC is recommended

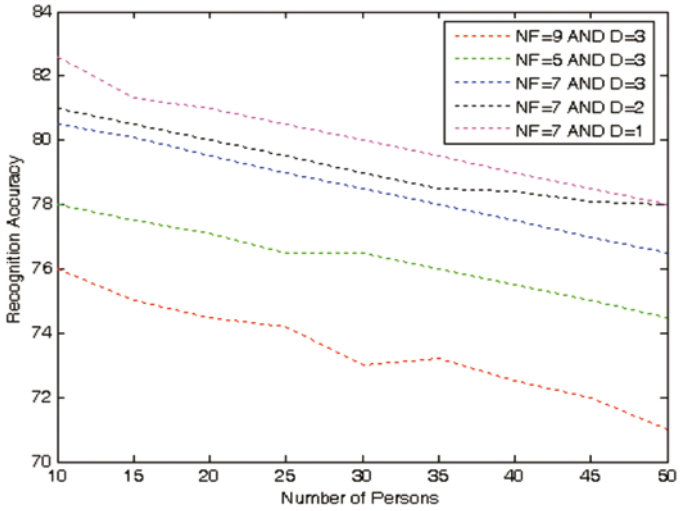


**Fig.3 The recognition accuracy for different number of coefficients**

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# RESPONSIBLE TOURISM: AN AFRICAN OVERLAND EXAMPLE

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## ABSTRACT

This paper presents a case study of responsible tourism by observing a group of overland travelers touring Southern Africa in the summer of 2007. The goal of this paper is to provide a general overview of overland travel as a form of responsible tourism and to discuss the complexities involved in responsible tourism packages through an in-depth study of the behaviors and actions of the tourist participants and the tour company. There are no assumptions that the company presented is different or similar to other overland travel companies, or that the group members behaved uniquely. Instead, an inside look at the operations of an overland tourism company may provide the reader with insights into the difficulties of conducting responsible tourism.

As a researcher and member of the tour group, the principle method of data collection was participatory observation in the form of complete participant and selective observation. The responsible tourism company (herein called RTC) in this study advertised their commitment to responsible tourism through the adoption of the Tourism Concern Sustainable Practices Policy developed in South Africa. The sustainable actions taken by the tour company to reduce traveler impacts to rural areas was provided to prospective travelers through both written information before the trip and verbal explanations during the trip.

**Keywords:** responsible tourism; Africa; overland tours; tour group; sustainable tourism

## RESPONSIBLE TOURISM: AN OVERLAND EXAMPLE

Tourism research requires a broad understanding of society, history, economics, culture, nature, and human behavior (Dieke, 2000). This multi-disciplinary aspect of the tourism phenomenon requires researchers and practitioners to be conscious of the values that are preached in the name of responsibility. A deliberate approach to planning and implementation of sustainable tourism principles involves a general background in sustainable practices coupled with a specific awareness of the resources, politics, needs, and values specific to the region in which we are applying these practices (Mowforth, Charlton, & Munt, 2008). The effects of tourism are far reaching and are influenced by the tourist, the destination, the host, and the numerous intermediaries. In approaching tourism as a system, responsible tourism moves individuals to grasp the complexity of doing the right thing. Tourism has both positive and negative consequences on a number of aspects affecting quality of life, and most problems are inseparable from the structure of the industry and the policy surrounding tourism expansions (Dieke, 2000; Wall & Mathieson 2006). Therefore, analysis of specific situations helps highlight the interdependence of activities, relationships, and resulting impacts of the stakeholders in the tourism value chain.

## DEFINING RESPONSIBLE TOURISM

Responsible tourism, as a concept, is neither new nor revolutionary in the progression of tourism studies (Mowforth, Charlton, & Munt, 2008). Unlike sustainable tourism, ecotourism, or innovative tourism, responsible tourism has no clear definition and is often used as a catch-all term (McLaren, 2003). Its definition is derived through its implementation, either from the perspective of tourism behavior, industry standards, or development practices. A definition that reflects tourist behavior might be phrased as "a type of tourism practiced by tourists who make responsible choices when choosing their holidays. These choices reflect responsible attitudes to the limiting of the extent of the sociological and environmental impacts their holiday may cause" (Beech & Chadwick, 2005). From an industry perspective, responsible tourism can be defined as managing the tourism business in a way that benefits the local community, natural and business environment, and itself (Honey, 2008).

For tourism development projects, responsible tourism is defined as "encompass[ing] a framework and a set of practices that chart a sensible course between the fuzziness of ecotourism and the well-known negative externalities associated with conventional mass tourism" (Harrison & Husbands, 1996, p. 5). The common element in all these definitions is the concept of balancing choices.

Responsible tourism has become an umbrella concept that applies to both the traveler and the travel industry (Wheeler, 1997, p. 62). For travelers, the 'green movement' indicates

consumer interest in reducing environmental degradation and becoming accountable to the communities in which they visit.

From an industry perspective, responsible tourism applies sound business practices that include the involvement of local communities in tourism-related decision making (Tourism Concern, 2000a). Elements of responsible tourism are found in ecotourism, pro-poor tourism, and sustainable tourism, which focus specifically on increasing the benefits for the host populations through job creation, environmental protection, and reducing the costs associated with traveler impacts. Responsible tourism is "not a tourism product or brand, it is a way of doing tourism" (Harrison & Husbands, 1996, p. 2). Increasing responsible tourism requires a "need for changes in human values, attitudes, and behaviors in order to achieve a sustainable transition that will meet human needs and reduce hunger and poverty while maintaining the life support system of the planet" (Leiserowitz, Kates, & Parris, 2006, p. 414). Focus is placed on educating the traveler, which is a daunting task because responsible tourism still lacks a unified focus or image and is often left to the industry or individual consumer to define for themselves.

In 2003, the Ministry of Environmental Affairs and Tourism in South Africa published the *Responsible Tourism Handbook: A Guide to Good Practice for Tourism Operators* that outline practical examples and tips on how to operate more conscientiously. It defines responsible tourism as "a tourism management strategy embracing planning, management, product development, and marketing to bring about positive economic, social, cultural, and environmental impacts. For tourism operators it is about providing a more rewarding holiday experience for guests while enabling local communities to enjoy a better quality of life and conserving the natural environment" (p. 1). The handbook delineates "the issues and actions you can take to operate more responsibly" (p. 2).

An overview of the guidelines is presented in table 1.

Table 1.

| *Responsible Tourism Goals.* | | |
|---|---|---|
| **Economic Guidelines:** | **Social Guidelines:** | **Environmental Guidelines:** |
| Assess economic impacts before developing tourism. | Involve local communities in planning and decision making. | Reduce environmental impacts when developing tourism. |
| Maximize local economic benefits by increasing linkages and reducing leakages. | Assess social impacts of tourism activities. | Use natural resources sustainably. |

| | | |
|---|---|---|
| Ensure communities are involved in and benefit from tourism. | Respect social and cultural diversity. | Maintain biodiversity |
| Assist with local marketing and product development. | Be sensitive to the host culture. | |
| Promote equitable business and pay fair prices. | | |
| *Source: Responsible Tourism Handbook: A guide to good practice for tourism operators* (p. 4-5). | | |

A variety of global tourism initiatives, including the World Tourism Organization's Global Code of Ethics, and the Tour Operators Initiative, among others, (p. 6), were influential in the development of the Responsible Tourism Handbook. The handbook clearly lays the framework for responsible tourism behavior and is aimed at owners and operators of tourism establishments (p. 2). The goals of the Responsible Tourism Handbook are used to provide the framework for assessment of the overland case study detailed in this paper, and are used to measure the level of success for corporations that are adopting responsible tourism practices.

## THE CASE STUDY

### The Company

The RTC with which we traveled was a privately owned enterprise based out of the United Kingdom. They operate tours in South America, Africa, and the Middle East, and they are beginning a cross-Asia trip that starts in Tunis, Tunisia and finishes in Beijing, China. They have been in business since 1997 and the owners had previously worked in overland and bicycle tours for eight years. The company is fully insured and bonded and claims to have a crisis management plan in case of natural disasters or terrorism outbreaks. In the scope of other international overland travel companies, this company was considered a low cost excursion.

The RTC that was selected was affiliated with Tourism Concern, a key spokes group for responsible tourism. Tourism Concern is an educational charity that began in 1988 in the United Kingdom. They operate as facilitators rather than a development agency and focus on fair trade policies in tourism and on tourist education as a means to "fight exploitation in tourism, particularly in poorer countries.

(They) believe everyone – from government to tour operators to travelers - must help in challenging and changing tourism" (Tourism Concern, 2007).

Their goal is to educate individual travelers on how they can play their part in being more "people friendly" by making things more equitable between the travelers, the tourism

industry, governments of the countries visited, and above all, the people among whose homes are visited. Table 2 provides a summary of Tourism Concern's fair trade policies. They are listed as a supporter of the Ministry of Environmental Affairs and Tourism in South Africa's *Responsible Tourism Handbook*. Both the RTC's website and brochure stressed responsibly tourism practices.

*We believe tourism should be a gratifying experience for you, as well as for the communities we encounter, and that protecting the natural condition and beauty of the areas we visit is essential. For this reason, we support Tourism Concern. Their aim is to inform travelers on the positive and negative consequence that tourism has on indigenous communities and their culture. Along with Tourism Concern and our crew we have developed our own practical and prudent environmental policy which will be explained at the start of your trip".* (paraphrased)

While Tourism Concern is not a responsible tourism certification agency, by adopting its rigorous standards of ethical tourism practices, the overland RTC was promoting sustainable practices. It was a major selling point of the tour for my colleague and me.

Table 2.

*Tourism Concern's Mission Statement and Goals.*

| **Mission Statement** | **Goals** |
|---|---|
| Tourism for Communities | Raising awareness of the negative impacts of tourism |
| The Tourism Industry | Working with the tourism industry rather than against it |
| Education | Linking tourism to development issues both in schools and universities |
| Campaigning | To create clear UK ministerial responsibility for out-going tourism |
| Fair Trade in Tourism | Working with the travel industry to make things fairer for people living in destinations |
| Community-based Tourism | Enabling communities to market directly to potential customers |
| Public Awareness | Debates, public events, exhibitions and publications |
| A Fairer Future for Tourism | Help developing countries develop appropriate and responsible tourism |
| UK Black and Minority Ethnic Diaspora | Raising awareness of tourism, heritage, overseas development and tourism and racism, and the perspective of the UK BME Diaspora |

*Source: Tourism Concern at http://www.tourismconcern.org.uk/about-us/about-us.html (accessed 12/06/2007)*

## METHODOLOGY

The idea of traveling to Africa came about when a colleague of mine read a newspaper article on traveling overland from Cairo to Cape Town. As a doctoral student, she was considering researching overland travel, a form of travel where participants are carried in a self contained truck and nights are spent sleeping out under the stars. I needed no further encouragement. My only stipulation was that I wanted to travel with a company that was owned by indigenous Africans. Due to the large overhead cost of operating overland vehicles, we were unable to find an indigenously owned alternative. We compromised on a company that had a responsible tourism statement published within their brochure and on their website.

This paper presents a case study using participatory observation. Participant observation was chosen because the focus of this paper is not on the traveler's experience, but on tourist behavior while participating in a responsible tourism company's offerings in Southern Africa. Participant observation allows the researchers to not only observe the phenomenon at hand, but to incorporate conversations and personal reflection about tourist actions (Bowen, 2002). Babbie (1986) explains four levels of observation along a continuum that begins with complete participant, participant-as-observer, observer-as-participant, and complete observer (Stafford and Stafford, 1993). I choose complete participant observation because it allowed an inside view of behaviors that many participants conducted inadvertently. Since I was a member of the group under examination, I formed bonds based on trust with both the participants and staff.

This method allowed the "subjects (to) continue to exist and interact normally" and I was "able to achieve a deeper understanding of the meaning of the phenomenon" (p. 69). Denzin and Lincoln (2005) divide observational research into three broad categories: descriptive observation ("the annotation and description of all details"); focused observation ("where the researcher only looks at material that is pertinent to the issue at hand"); and selective observation ("focusing on a specific form of a more general category") (p. 732). I employed select observation, recording only events and behaviors that applied to responsible tourism.

While as a participant of the RTC group, I recorded my observations twice daily during the 23-day trip. I recorded the day's activities before dinner, and then recorded the nightly activities after breakfast the next morning. I was careful to treat every conversation with full attention, saving my note taking for quiet moments later in the day. My goal was to avoid untruthful responses brought about from "fear of reprisal or potential embarrassment" (Stafford and Stafford, p. 69) or changed performance on behalf of those being observed (p. 67). This method draws attention to memory fatigue, or the susceptibility of forgotten conversation details. However, trust and group membership were enhanced by utilizing this method. Furthermore, I was open and honest during my written reflections, allowing participants to observe and question the content of my notes.

## THE TRIP

The trip was broken into three itineraries, each of which could be taken separately or combined together. It originated in Nairobi, Kenya and began with a 19 day loop through northern Kenya and Uganda.

From there the truck traveled through Tanzania, Malawi and Zimbabwe, stopping in Victoria Falls 31 days later. My colleague and I joined the trip in Victoria Falls at the start of its third itinerary, and spent 23 days going across Botswana, Namibia and finishing in Cape Town, South Africa (Figure 1). The key sites we visited included Chobe National Park, the Okavango Delta, Etosha National Park, Swakopmund, the Namib-Naukluft Park, Stellenbosch wine country, and Cape Town. We also visited a number of lesser known destinations including Tsodilo Hills World Heritage Site, the Otjitotongwe Cheetah Park, the Brandburg Mountains, the Skeleton Coast, Cape Cross Seal Colony, Sossusvlie (world's tallest sand dune), and Fish River Canyon. At the end of the tour, members of the group traveled for three days around Cape Town and the Cape of Good Hope independently.


*Figure 1.* Travel Itinerary

The trip payment was broken down into four parts. Each participant paid a fee directly to the company before the reservation was confirmed. I paid 350 British pounds plus a 2.5% credit card fee for the 23 day portion of my trip. Travel insurance was extra. We were also required to pay 100 British pounds and 90 British pounds converted into US dollars as our local payment (it came to approximately 190 USD). The purpose of the local payment was to bring hard foreign currency into the African communities that we visited. This money was used to buy groceries, gasoline, campsite accommodations, and other incidentals. At the end of the trip, the cash balance was spent on a group dinner in Cape Town. Lastly, there were numerous meals and a few accommodations that were not included in the tour. I spent approximately 400 US dollars on additional meals and accommodations, although one person who had traveled with the group since Kenya claimed to have spent upwards of 1700 US dollars on additional meals and rooms.

Our group fit the model of "rough" tourists as described by Lesley France (1997). The "rough" tourist is young to middle-aged who travel as individuals or in small groups and opt for cheap, often locally owned accommodations. They prefer to eat locally and enjoy sport and adventure activities (p. 19). There were nineteen participants in our group, of which five completed all three legs of the trip, eight joined the tour before Tanzania and six of us joined in Victoria Falls. The demographics of our group included three people below the age of 20, ten between the ages of 20 and 30, four between the ages of 30 and 40 and two between 40 and 50. The group consisted of three Americans, four Canadians, three British, two Scottish, 1 New Zealander, five Australians and one Serbian.

All three participants under 20 years of age were traveling during their gap-year and were scheduled to attend university at the conclusion of the trip. Three had not attended college and thirteen were college graduates, of which three possessed graduate degrees or were scheduled to attend graduate school in the fall. Five of the participants rotated between working for six to nine months and then traveling for six months. There were seven women and 12 men on our leg of the trip.

There were two company employees on the trip, a tour leader and the truck driver. Our tour leader was a 23 year old woman from England who had extensive experience working for nongovernmental organizations in Tanzania before working for the overland company. The driver was a 32 year old man from New Zealand who had been with the company over five years. It was explained that Africans could not work for the company, because of current immigration and refugee situations throughout Africa. With frequent border crossings throughout the trip, it is impossible to hire indigenous Africans. The employees were very adamant about being called tour leaders and not tour guides, as their role was mainly administrative and local guides were hired when we arrived at particular sites. The employees' job description included tasks such as truck maintenance, organizing border

crossings and arranging visas, pre-booking excursions and guides, assisting with shopping, and making sure things ran smoothly. The staff interacted as group members, joining the parties and social outings if their duties allowed. Romantic interactions between group members and staff were not considered unethical.

The truck driver was responsible about his alcohol consumption on the nights before long drives. Both staff members frequently participated in outings and non-included excursions with the group.

As stated, overlanding is a form of self contained travel in the back of a truck or bus. In order to create a visual picture of our trip across southern Africa, I must explain our vehicle. The truck was named Gunga, meaning madness in Swahili. It was bright yellow and measured four meters in height, 13 meters in length and 10 meters in width. Gunga could seat 26 people and had a sun deck upon which people would sleep or view wildlife. The chassis was made by Saab, Kenya and weighed 5,000 pounds. The truck bed was custom made in England and weighed 15,000 pounds. Combined, Gunga weighed 12 tons empty or 16.5 tons fully loaded. It had two gas tanks that could hold 1,000 liters of fuel and got 3 kilometers per liter fuel efficiency. It could travel for five days without refueling. The truck was registered in England and had its own passport that was stamped when tolls were paid at border crossings. Every country required a toll except South Africa. The truck only traveled full during its southbound excursions as South African companies have a monopoly on northbound travel. The truck would return to Nairobi empty after every trip.

As a means of keeping participant costs down, the trip featured extensive camping and participants were required to participate in cooking meals. A majority of our accommodations were tents in national and regional parks. In Victoria Falls, Swakopmund, Stellenboch and Cape Town we stayed in youth hostels, and when in extremely remote location we were required to "bush camp", which involved pulling over on the side of the road and camping in the desert or at a rest area. We were divided into cook groups and cooked our own meals over an open fire while camping. When in larger communities we ate in restaurants, the most popular of which was Kentucky Fried Chicken. Often we would stop along the side of the highway to serve picnic lunches. Food was purchased at local grocery stores or markets by the guests every other day.

## RESPONSIBLE TOURISM

The heart of responsible tourism lies with maximizing the economic benefits and reducing the environmental and cultural costs associated with tourism. The World Business Council for Sustainable Development (1998) concludes that "corporate social responsibility by business is to behave ethically and contribute to economic development while improving the quality

of life of the workforce and their families as well as the local community and society at large" (Tourism Concern, 2000a). Using the framework provided by the *Responsible Tourism Handbook: A guide to good practice for tourism operators*, specific examples are applied from the overland tour across Southern Africa.

## ECONOMIC IMPACTS

Responsible tourism strives to maximize the economic impacts locally by keeping as much tourism revenue locally in order to benefit the communities that provide tourism destinations (Tourism Concern, 2001). Within this concept lies the importance of frequenting locally owned business, the use of local products and materials, negotiating fair prices and enforcing domestic competition policy against anti-competitive practices by tour operators. Additionally, tourism must support traditional livelihoods so as to increase the employment opportunities for indigenous populations without replacing one form of economic opportunity with another at the expense of tradition and culture. The purpose of our local payments was specifically designed to increase foreign currency and support local businesses in the regions through which we traveled.

When considering the economic impact of the RTC's practices, specific attention must be given to back-linkages and leakages. An example of back-linkages includes increasing demand for locally produced goods and services by developing new local industries that consume or process these commodities. The term "back-linkages" refers to an industry's supply chain. An obvious example is "tourism related spending on…locally produced goods (that) provide economic stimuli to maintain or reinvigorate the viability of the local primary and production processing sectors" (Boyne, Hall & Williams, 2003). The goal is to provide reciprocal benefits and reduce leakages in an effort to lessen the competition for land, water, and labor between traditional industries and tourism (Telfer & Wall, 2000, p. 423). Leakages refer to financial assets that leave the region through the purchase of support supplies, services and profits returning to corporate headquarters outside the region. One of the key ways to increase linkages and prevent leakages is to frequent locally owned businesses because "locally owned and operated businesses … can have a much higher input of local products, material and labor" and "the profits accrue locally instead of flowing back to the parent country" (Cater, 1994, p. 71).

While all our food shopping was conducted at local chain grocery stores, our accommodation and excursions were occasionally with foreign-owned companies. The only accommodation that we stayed in that was owned by an indigenous black African was on our first night at a hostel in Victoria Falls, Zimbabwe before we joined our group. Four of the campsites we visited while on the tour were owned by white Afrikaners.

We also spent a number of nights in nationally run camp grounds including one night in the Okavango Delta (situated within the Moremi Game Reserve and was community owned), three nights in Etosha National Park (Namibia Ministry of Environment and Tourism), and one night free of change at Tsodilo Hills World Heritage Site (owned by the Botswana Government, controlled by the Tawana Land Board, and managed by the Botswana National Museum). There were eight 'bush camp' accommodations where we camped in the wilderness without paying a fee and the remaining campsites were owned by foreign-nationals. For four nights while in the larger urban areas, we stayed in hostels which were also owned by expatriates.

Tourism has been hailed as a means to create new jobs in impoverished regions although many times researchers fail to acknowledge the indirect employment created by the tourism industry (Lea, 1997). Economic impact analysis recognized the importance of both direct and indirect output, employment, and value added. Direct effects are those goods and services purchased by visitors, whereas the indirect effects are those goods and services purchases by businesses to supply the tourists with goods and services. In the case of employment, indirect effects refer to job created to support businesses in their tourism operations. Observed during the trip were direct and indirect economic effects, while in Victoria Falls, where I encountered a young man whose job was to run the internet office at the local youth hostel. He was 17 years old and was the eldest male in a family of six children as his father had passed away three years prior. His family had fallen on hard times and food had not always been available for the children. A friend had notice the families demise and that the eldest son had managed to stay out of trouble as he was growing up.

He was offered a job working for the indigenously owned computer internet company and trained in computer repair and software use. He was in charge of the tourist hostel internet sites, a job that would not have existed if tourism had not been prevalent in the area. While his mother still had to work, the two of them were able to adequately supply for the family and he was looking forward to buying a second hand car for the family.

Tourism Concern strives to encourage fair trade practices by tour companies in developing countries. Specifically, they have developed criteria that address the provision of a fair share of benefits for local stakeholders. These include the negotiation of a fair price with local suppliers, fair competition between foreign and domestic competitors, a fair distribution of assets that benefit local people, and the use of local products where appropriate (Tourism Concern, 2001b, p. 3) Our tour leader was straight-forward when she explained that part of her compensation package involves kickbacks from tour companies. One specific example occurred in Swakopmund, the adventure playground of Africa. An American-owned excursion company gave our group a briefing about selected activities when we first arrived. Shortly afterwards, members of our group found a different excursion company that was

cheaper and owned by indigenous Africans. The trips were exactly the same, only our guide informed us that the African company did not carry liability insurance, which is required by the overland company for all vendors. The price difference represented the commission our tour leader received when we used the American-owned company. We all booked our sand-boarding and ATV excursions through the indigenously owned company and luckily none of us needed the liability insurance.

It is important to note that all of the excursion companies we encountered were owned by white foreigners or Afrikaners who visibly had strong contacts with our tour leader and the overland company.

Parts of the principals of responsible tourism are practices that involve an ethical consideration for other industries and income sources important to local populations. Furthermore, invasive species and diseases can be easily transmitted in cross-border travel (Thuiller et al., 2005). In particular, foot and mouth disease is a serious threat to the livestock of Botswana and the government is actively trying to prevent its spread. Foot-and-mouth disease is a highly contagious viral disease of livestock that can rapidly spread through a region if control and eradication practices are not implemented (Aftosa, 2007). Once an outbreak has been detected, solutions include vaccination and/or the slaughter of infected animals, both of which incur high economic costs to the regions. During our border crossing and sporadically throughout Botswana, the truck was required to stop at check points where all passengers had to get out and dip their shoes into a chemical that prevented the spread of the virus. The truck itself was also required to drive through a chemical wash to clean the tires of any diseases it may have encountered. We were informed by the tour company that all guards required us to wash two pairs of shoes as they are aware that tourists usually travel with multiple pairs. Many of the travelers had more than two pairs of shoes, however our tour leader told us to only bring two since much of our belongings were packed in a cumbersome area below the seats. Most of the group used hiking boots when exploring, yet sandals when they were riding on the bus. I rarely saw a group member pull out their hiking boots to be cleansed, which could have lead to a potential problem.

## CULTURAL IMPACTS

Tourism and indigenous cross-cultural exchange can take two forms. Frequently, local culture is commodified and sold to visiting tourists; however personal contact between tourists and locals can facilitate mutual understanding and result in shared cultural exchanges. The commodification of culture occurs when tourists exchange money to experience unique cultural traditions or pay to witness local cultural ceremonies. Whether the reader feels that the commodification of culture is an advantage or disadvantage to indigenous populations, one of the goals of responsible tourism is to allow local people the opportunity to profit from

commodification and to control, which forms of their culture can and should be commodified for tourism consumption (Burns, 2005). Participation in the sale of culture includes indigenous crafts, theatrical or dance productions, and the photography of traditional peoples.

There were two memorable occurrences involving feelings of disrespect on behalf of the local populations and the travellers themselves. First, our group was less than considerate in the photography of local people and traditional villages. Frequently, pictures were taken of people in and around their homes without asking permission. On one occasion, an older woman was upset when a member of our group took pictures of her. Instead of apologizing or offering compensation, the tourist ran and hid inside the truck. Another situation developed while we were at the Okavango Delta when we hired a company to take us out in mokoros, hollowed out tree logs used as traditional boats. We were to spend one night camping in the delta and were told to expect an evening of traditional dancing and singing around the campfire. During the day, there was no interaction between the local guides and the tourists, as the tourists swam and sunbathed in a separate area from the guides.

In the evening, the groups ate separately and little or no interaction occurred outside of a one-hour guided walking safari. We never received the promised performances and extensive complaints were made to the proprietor upon our return. This experience added to the feeling of victimization on the part of the tourists who felt that they were repeatedly being taken advantage of by the Africans. Apparently it was not the first time they had purchased an excursion based on promises that were not fulfilled. The question that lingered is whether the guides were aware of the promised cultural exchange or whether the tour owner was making promises that were false. Either way, the tourists blamed the guides and not the proprietor for the lack of following through.

Two other interesting stories that came from the Okavango Delta trip included how the guides were selected for employment and how the owner from New Zealand had adapted his business practices to accommodate the local culture. All the guides that worked for the excursion company had family ties to the delta. One guide's grandfather had been a guide for the colonial tourists in the early 20$^{th}$ century. Another guide's father had been a commercial fisherman on the delta, and the guide had grown up travelling the length of the delta as a child. These tour guides claimed that all the guides within the company had a long family history that included members who had earned their living through the use of the Okavango Delta.

Second, the tour company owner had begun his business by hiring a director who went on all trips (thus getting paid more often) rather than being rotated like the rest of the guides. This created tensions between the guides, which resulted in a curse being put on the director.

The man eventually died and our tour operator developed a rotation system for the remaining guides as he believed strongly in the power of local customs and practices. Currently the company employs 190 guides who rotate approximately every three weeks and receive the same pay as all the other guides. There is always a leader on each overnight trip who is paid slightly more, but once a guide has been a leader, he goes to the bottom of the list and upon the next rotation he works as a standard guide. Each guide makes approximately $25 for a three-day trip and none of the guides I spoke with had access to any further employment.

One of the best aspects of overland travel for the participant is the ability to visit sites off the beaten path. We visited two spiritual sites, including Tsodilo Hills. This recently created national park is the home to over 4500 rock paintings, some as old as 10,000 years (UNESCO.org, 2007). Held in high esteem by the local residents, the three mountains jutting out of the desert house 350 hiking trails and a newly established cultural centre. The brochure accurately highlights "an atmosphere of mystery and intrigue surrounds this unusual place, believed by the San (Bushmen) to be the site of first Creation" (Botswana Department of Tourism, 2007). Guided tours are required in order to protect tourists from the many poisonous snakes that inhabit the area. I was surprised to see that many of our group members were uninterested in both this site and a similar cultural site in Brandberg, Namibia. Instead, some of the group sat in the truck and listened to music.

At the conclusion of the trip, the main complaint by the travellers was the lack of cultural interaction with the local people. Our tour leader was adamant that there were plenty of opportunities and the vacationers must not have taken the initiative if they felt they had been isolated from the African people.

One of the guests who had travelled with our company across the Middle East previously exclaimed that this was the most culturally isolating experience she had ever had. Our day consisted of early mornings, long drives, and isolated campgrounds that catered specifically to tourists. Other than grocery shopping, there were rarely opportunities to mingle or approach any locals outside of the guides we encountered at tourism sites. Only on one occasion during the overland trip did my travel companion and I get an opportunity to spend extended time with local residents. We had met a friend of a friend who lived in Soweto Township outside of Johannesburg, South Africa before we began the trip. He had kindly shown us his neighbourhood and given us an opportunity to visit his family. While in Swakopmund, we decided to compare our Soweto experience with a formalized tour of Medesa Township. It was an optional excursion encouraged by our tour leader and all the tourists could have chosen to participate as well. The tour involved local dancing, a traditional meal (which included caterpillars), a visit to a school, and beers at the local shebeen. We thoroughly enjoyed our $30 trip while the rest of the group enjoyed a day of sky diving, costing over $200 per person.

## ENVIRONMENTAL IMPACTS

Environmental preservation is a vital component of responsible tourism because the natural attractions will otherwise suffer degradation, reducing the aesthetic value and discouraging tourism visitation (Cater, 1994). In particular, "the less developed world has an undeniable comparative advantage in terms of the variety and extent of unspoiled natural environments" (p. 69), yet tourism results in some environmental impacts. One solution has been the rapid increase in the creation of national parks, wildlife reserves and national biosphere reserves. An example can be taken from the term 'externality' which refers to hidden costs that are not incorporated into a destination's pricing structure. Such costs to the environment may include new pollution sources from tourism, such as increased vehicle emissions, animal stress from constant human and animal interactions, and strain on local public service budgets in the form of safety and security, water and sewage treatment. Many times these costs are paid by locals, as these "external" costs are not incorporated into tourism payments. Recently, communities have begun to realize the importance of user fees as one way to internalize and recoup the costs of these externalities. However, responsible tourism requires that tourists and tourism companies be aware of their actions on the environment as they travel through unregulated areas.

There are several drawbacks to truck travel in rural areas, one being the possibility of vehicle malfunctions. In Etosha National Park, we broke a fuel line and began leaking diesel fuel along the roadways within the park boundaries.

Etosha is unique in that it allows visitors to travel independently in personal vehicles throughout the park. As such, Etosha has very strict rules about safety, one of which is to not leave your vehicle while inside the park as a matter of personal protection from wildlife. Therefore, even though our driver knew that we were leaking fuel we had to continue driving. Another drawback to truck travel is the possibility of accidents with animals. On day nine, Gunga collided with a calf along the highway in Botswana. The driver explained that our tour staff have strict rules about stopping for traffic accidents: it is strictly forbidden. Our driver explained that on one occasion an overland truck arrived at the scene of a bus accident and stopped to assist only to be blamed for causing the misfortune. After some jail time and extensive fines, the driver was allowed to leave although the trip had been ruined for many of the guests. The calf appeared to have survived but, with a crushed leg, not only was he doomed; but some farmer had lost part of his livelihood. In all, our driver claimed responsibility for the lives of two monkeys, three dogs, and a cow during his overland career.

The desert is a fragile ecosystem that is easily susceptible to drought, fire and erosion. Much of Botswana and Namibia is located in the Kalahari Desert, an area that is not technically a desert yet receives only five to 10 inches of rainfall each year. It is covered with

dry grass lands that are susceptible to threats from fire. Each night we had an open, controlled fire on which to cook our meals and occasionally had open bonfires for our enjoyment. The driver was very conscientious about fire and imposed strict restrictions on recreational fires when we were in grassy areas. Water was also an issue and our tour leader often reminded us to take short showers and preserve water. The guests were unconcerned and regularly took long showers when hot water was available.

One participant mentioned that he really did not care about the water shortage as he had already visited the area and would not be returning. He felt it was not his concern. At Sossusvlie, in the Namib Desert, travellers would frequently run down the sand dunes in an uncontrolled fashion, destroying the native grasses and furthering the erosion of the dunes.

Tourism Concern specifically addresses the minimization of environmental impacts especially the "promotion of clean energy systems and proper waste disposal" (Tourism Concern, 2000a). Energy sources that were used during the trip were mainly for the cooking of meals, which occurred over open fires. Our fires were made of charcoal except in Namibia when we used wood. We had access to propane, but our tour leader explained that is was cost preventative, as propane was expensive and hard to come by. It was kept for emergencies when the group purchased bad charcoal or when it was raining. We only used propane once during the 23 days with the group. The disposal of trash was a reoccurring problem. On a morning hike to view animals in the Okavango Delta, I witnessed the extreme accumulation of toilet paper around our campsite. When I returned from the hike, the local guides had cleaned up the mess. I asked one guide if discarded toilet paper was a problem and they informed me that cleaning up the campsite was part of their morning routine for all groups camping on the island. Additionally, our group discarded cigarette butts out the truck window and along the side of the road when we stopped. This even occurred while travelling through the excessively dry areas of the desert.

Animal stress another impact from tourism is frequently a result of extensive visitor interaction with wildlife in ecotourism settings. Safaris in particular can cause extensive stress to the animals when tourists are loud and/or approach too closely. The consequences of continued exposure to human caused stresses can lead to long term problems for animals, such as decreases in reproduction (Edington & Edington). Weaver and Lawton (2007) found that "not surprisingly, (the)…distance between the viewer and the viewed (were) the single most critical variable affecting wildlife stress" (p. 1173). While camping in Etosha National Park, each evening we would walk down to the watering hole to gaze at animals while they drank. Our group was genuinely interested in observing the animals, but other camping guests were very loud and disrespectful towards the animals. When we first arrived, there were three elephant families with small babies. While the babies played and drank, the males snorted and charged the fence separating the people from the watering hole. They were

visibly stressed by the human interaction and, after a short time; the male elephants took their families away from the area.

The Otjitotongwe Cheetah Park is a great example of linking tourism to support the preservation of endangered species. With an estimated 7500 cheetahs left in the world, Namibia is home to 2500 of them, 95% of which are kept in private reserves. The owners of Otjitotongwe have rescued 19 cheetahs, most acquired through local farmers who would have otherwise shot the animals if the refuge was not available. The park provides incentives to the farmers by paying them approximately 350USD for each animal. The park boosts 40 hectares of land on which the cheetah roam freely.

Tourists are invited to go on morning and evening rounds to feed these wild animals at a nominal cost. All proceeds are used to purchase food for the animals that eat approximately 2 kilograms of fresh meat each day. This partnership provides the revenue to support the preservation of one of Africa's most endangered species.

## DISCUSSION

Responsible tourism is a vague notion that can incorporate similar concepts to alternative, appropriate, sustainable, green, soft, and eco tourism (Wheeller, 1997). One of the key differences between these former forms of tourism and responsible tourism is that responsible tourism can be applied to the practices adopted by businesses and travellers rather than just tourism development and policies. In particular, responsible tourism focuses both on tour operators and their clients in an attempt to affect behaviours and action while visiting host countries. Because responsible tourism is largely unregulated, it is up to the individual tour operators and participants themselves to adopt a code of travel ethics. However, while strong ethical motivations may occur in the beginning of a trip, it is sometimes difficult to maintain responsible behaviour over the long run, especially in developing countries when travel is more arduous and the comforts of home feel very far away, but every effort must be made to do so.

Tour operators, such as the overland company used in this case study, are constantly torn between providing quality service to their customers and respecting the needs and wishes of the communities that they visit. Organizations like Tourism Concern provide guidelines for business practices to their operators, but neglect to integrate strategies and recommendations for travel businesses they deal with who are operating in developing countries.

A good example is the use of wood and charcoal for cooking by our group. Since these are the only constant sources of fuel, and propane requires a substantial increase in costs, our company could see no alternative to using this cooking source. Perhaps the alternative

would have been to eat more meals in restaurants owned by foreign proprietors, a practice that, again, conflicts with responsible tourism. In an attempt to buy local produce and keep hard currency in rural areas, the company felt it was necessary to use non-environmentally sensitive fuel sources rather than any of the alternatives available to them.

In an attempt to keep the trip affordable for the company's target market, the staff were paid low wages (250 USD per week) and relied on kickbacks from suppliers to supplement their income. If this type of company wants to become more responsible, it could drastically increase the cost to the participant and pay the staff higher wages, possibly limiting access of overland travel to only the wealthy and changing the target market of the company. This in turn would change the expectations of the tourists leading to a more upscale form of travel. Most customers appreciate the need for liability insurance and other safety nets required of contractors for the protection of the tour company and the traveller. Yet responsible tourism neglects to acknowledge that high cost liability insurance may be out of reach for indigenously owned companies, especially if they are required to pay the added commissions to tour leaders. When left to their own devices, tour companies must err on the side of caution and the principals of responsible tourism.

Furthermore, our group leader ate, slept and lived with some of us for almost 3 months. Should she be a constant mother, correcting the traveller's behaviour at every turn, or should she advice the group on the repercussions of their actions and then allow the individuals to enjoy their vacation and make up their own minds about their behaviour? At what point is the tour operator no longer responsible for the travellers' actions? Logically, her ultimate alliance is to the paying customer, without which she would have no job. We did witness two occasions where members of our group behaved so poorly that they were publicly chastised and made to apologize. Both occasions were well warranted but left the group with a feeling of melancholy.

That said there are always ways of improving business practices in an attempt to offer more responsible tourism products. In this case study, simple changes could be made to increase the benefits received by the indigenous people of Southern Africa. Working with locally owned companies can provide more jobs and economic benefits that working with foreign owned companies. Respect for the repercussions of foot and mouth disease by requiring all shoes to be treated may be a small inconvenience to the tourist, but could avoid a huge outbreak of a disease that may devastate the cattle industry in Botswana. Furthermore, instilling a level of respect for the natural environment by tourists could be achieved by having the tourist sign an oath to remove their waste products from all sites, which can be a simple solution to litter problems. Lastly, if a more integrated itinerary was provided to the travellers that allowed the participants more exposure to local customs and traditions could encourage a deeper understanding and compassion for the host peoples that may motivate tourists to act more responsibly.

The conversation then turns to the individual traveller, who has the power to demand responsible behaviour from their tour companies that is assuming responsible behaviour is a concept that is easily understandable and executable by the consumer. Yet many tourists spend a limited time in any particular destination, especially on overland tours where the group is constantly moving. With such short exposure, to new environments and people many tourists are uninformed of the repercussions of their behaviour during their visit. Many are unaware that while their stay was short, more tourists will arrive the next day and the next day, and all the little impacts can add up and take a much larger toll on environments and populations. Krippendof (1997) writes, "those who censure tourism are in fact not criticizing individual travellers, but the passivity of the phenomenon" (p. 46). Therefore tourist education becomes a critical role in responsible tourism. Table 3 provides a list of tourist practices that follow the responsible tourism objectives.

A new trend in the tourism industry is the application of eco labels on tourism products. Eco labelling has been defined as a description associating a business or product principally with the environment that provides the potential purchaser information from the label rather than the product itself (Buckley, 2002). They may be used as a form of environmental certification, or just a set of practices with which a company agrees to oblige. The goal is to target consumers that are the most concerned about environmental and social issues. In tourism, in particular, the practice of eco labelling trips and/or destinations is exploding worldwide.

Organizations, such as Green Globe 21, Business Enterprises for Sustainable Travel, and Partners in Responsible Tourism are providing a set code of conduct that businesses are touting as environmentally and culturally safe practices. One negative result of such campaigns is "green washing", the process of misleading travellers into counterfeit operations that only use eco labelling only as a marketing tool (Medina, 2005). Medina claims to have found 104 certification or eco labelling programs in 2005 and the number is still climbing (281). This practice has further complicated the process of finding responsible companies that truly practice the behaviour that they preach.

Table 3.

*Tourist Code of Ethics.*

| | |
|---|---|
| 1. | Enjoy our diverse natural and cultural heritage and help us to protect and preserve it. |
| 2. | Assist us in our conservation efforts through the efficient use of resources including water and energy. |
| 3. | Experience the friendliness of our people and the welcoming spirit of our communities. Help us to preserve these attributes by respecting our traditions, customs, and local regulations. |
| 4. | Avoid activities which threaten wildlife or plant population, or which may be potentially damaging to our natural environment. |
| 5. | Select tourism products and services, which demonstrate social, cultural and environmental sensitivity. |
| 6. | Ensure that your behaviour has no impact on the wildlife you so enjoy and remember that picking flowers, removing seeds and buying souvenirs such as shells and skins can only cause harm in the long run. |
| 7. | Always ask permission before photographing people. |
| 8. | When you are shopping, remember that the bargain you obtained may only be possible because of the low wages paid to the maker. |
| 9. | Respect local laws and regulations |
| 10. | Travel in a spirit of humility and with a genuine desire to learn more about the people of your host country. Be sensitively aware of the feelings of other people, thus preventing what might be offensive behaviour on your part. |

*-Source: Global Code of Ethics for Tourism, UNWTO (1999), and the Tourism Industry Association of Canada (1991).*

## CONCLUSION

When the idea came about to conduct this study, we were sceptical. But reading about responsible tourism, we found comments like the one below:

"*Even though a few tour companies follow strict codes of conduct, many operators do not demonstrate social and ecological responsibility. There are many programs that fail to fulfil the required standards and philosophies of (responsible tourism), seeing money as the main objective rather than supporting local cultures and preserving the environment, yet they advertise themselves as "(responsible) tourism projects." These operators do not work towards the long-term sustainability of indigenous communities. Instead they aim to make as much money as they can in the shortest possible time, and then leave the area and move on to another location to make more money using (responsible) tourism as a catch word*" (Tourism Concern, 2000a).

Yet, upon our return, we realized the enormity of the task facing tour operators and tourists alike globally to implement the principals of responsible tourism.

Using participatory observation, this paper has attempted to identify the complexities of responsible tourism. We have used the *Responsible Tourism Handbook: A guide to good practice for tourism operators* as a framework to analyze both the actions of overland tourism company and individual tourist behaviours in Southern Africa. Utilizing the policies of Tourism Concern's fair trade policy, the company in this study promised an economic, cultural, and environmentally sound excursion. What resulted was a case study explicitly showing the complexities of promoting such a policy. While it is important to note that not all tourism is responsible and, as with any industry, deceptive practices abound, and organizations like the one featured in this article are making strong efforts at responsible practices while attempting to maintain a standard of quality service for their guests. This dichotomy makes the adoption of the practices of responsible tourism an overwhelming task. Clearly, specific management frameworks for the travel provider are needed for responsible tourism objectives to be implemented and to offer guidelines that support responsible tourism for tour operators and tourists alike.

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# EFFICIENT COMPILATION THROUGH DEMAND DRIVEN REGISTER ALLOCATION FRAMEWORK (DDRAF) FOR SUBWORD PARALLELISM IN PROGRAMMABLE MEDIA PROCESSORS

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## ABSTRACT

*The focus of our paper is on the architectural and compiler support for subword parallelism. We introduce an intelligent Demand Driven Register Allocation Framework (DDRAF). This scheme addresses the fundamental bottleneck of global register allocation for subword sized variables. This will lead to high performance media processors that exploit parallel behavior in a program at run-time on fine grain (subword) level. Further the future aim is to fine tune compilers for latency reduction for media applications. It has been seen that the quality of the audio/ video data depends on the ability of the processors to execute multiple subword data in parallel.*

## KEYWORDS:

*Subword, register spilling, speculative register allocation, media processor*

## 1. INTRODUCTION

With the present requirements for very short-time-to-market processors, it has become essential to devise customizable processors to reduce non-recurring engineering (NRE) costs. Word sizes in conventional processors have increased over time. It is common these days to have 32-bits and 64-bits processors. Particularly, application specific processors for multimedia can become suitable candidates for exploiting subword parallelism. Subword parallelism is sometimes referred to as microSIMD parallelism. Little research has been done in the field of subword parallelism for media processors. Multimedia data is characterized by small width of 8 bits and 16 bits which is highly suitable for subword parallelism. Further, memory utilization in media processors improves, as a single load or store instruction fetches/ stores multiple subwords, thereby increasing opportunities for parallelism (Lee, 1996).

Subword parallelism is complex to attain due to many factors. Some recent research focuses on the following broad domains:

**a.** The subword inside a word can be treated as contiguous or non-contiguous. Non-contiguity of subwords is difficult to handle. So most of the research is on contiguous subwords.

**b.** Very few architectures have been designed to handle parallelism in subwords. As mentioned earlier, SIMD architectures are one of the most suitable architecture for this purpose.

**c.** Instruction sets tailor-made to facilitate subword parallelism are still in their development phase. For example MAX-2 (Multimedia Acceleration eXtensions) instructions for 64-bit PA-RISC 2.0 architecture. Other instruction sets include Intel's MMX, SSE (Nurmi, 2007) and Sun's VIS. Specialized instructions for multimedia can be extended in a similar manner as extensions for floating point instructions are done (Brunelli et al. 2005)

**d.** The logic and arithmetic for implementing subword execution in parallel is done by packing subword integer quantities in a double precision floating point word (Zucker, 1997). The advantage of this technique is that it works even for architectures that do not have extended media instruction execution abilities.

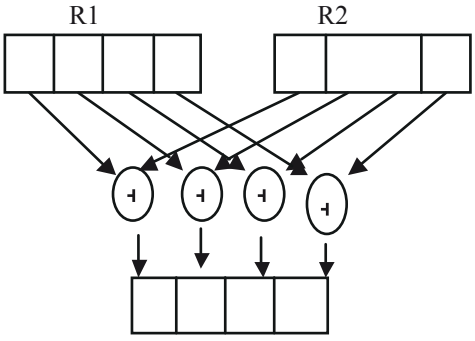


**Figure 1:Subword Parallelism- Word Splitting**

## 2. OUR SYSTEM

In order for an efficient and fast use of subword functionality, this paper proposes a two-pronged strategy to deal with the subword data.

Firstly, we suggest extension and addition of primitive data types to deal with subwords. This can be done either in the form of a shared library or a complete overhaul of the Instruction set architecture. This has already been attempted before and we see different Instruction set extensions like Intel's MMX, SSE and Sun's VIS (Nurmi, 2007; Brunelli et al. 2005). These extensions have focused primarily on multimedia because it provides wide opportunity of subword parallelism. This subject will be covered in more detail below.

Secondly, the provision of multimedia support has now become common in many processor architectures. The General Purpose Processor Architectures provide support for multimedia through extensions in Instruction sets for example MMX in Intel processors or by extended hardware units in the form Graphic Accelerator Cards (for example Nvidia Graphic Card Accelerator for Gaming). Both of these solutions provide a piecemeal approach which results in limited multimedia performance and rendering. The prime reason is the distancing and often separation of complex multimedia computations away from the CPU. This is often one of the causes of hardware related latencies in multimedia output. Thus, we propose a workaround to deal with this diminished performance of media applications in GPUs (General Processing Units). Our idea is to dynamically reserve a group of registers which we call *Demand Driven Register Allocation Framework* (DDRAF) scheme. The DDRAF scheme enables allocation of subword capable registers during run time. We suggest two options for the register set architecture:

**a.** A dedicated register set may be incorporated along with the CPU that deals with small bit-sizes (subwords). This has to be done during the design and fabrication of the CPU. Since with the affordable cost of adding semi-conductor memories, we feel that it should not be an overhead for CPUs tailor-made for conventional computers. Obviously, increasing the die area will not be a suitable option for battery-powered portable embedded processors. The second option below takes care of the issue in particular to embedded media processors.

**b.** Another approach is to dynamically allocate registers on the fly and map the subword data capability using hardware or a shared library mapping tool. This needs some modification in the global register allocation as will be shown later. We have chosen it to be our focus in this paper.

| *Benchmark* | *Dynamic Bitwidth* | *Variables ≤ 16 bits* |
|---|---|---|
| g721.decode<br>g721.encode | 17.43<br>18.99 | 49%<br>44% |
| Epic<br>unepic | 16.35<br>19.52 | 61%<br>45% |
| mpeg2.decode<br>mpeg2.encode | 17.59<br>15.87 | 45%<br>59% |
| adpcm.dec<br>adpcm.enc | 17.07<br>16.87 | 50%<br>54% |
| Drr | 18.81 | 35% |
| Frag | 20.52 | 33% |
| Reed | 20.74 | 38% |
| Rtr | 19.03 | 38% |

**Table 1. Narrow width data statistics**

The reservations can be performed using a hardware mapping unit or through a software approach using shared library. This flexibility of opting for a hardware mapping unit or a shared library will depend on the nature of media performance desired. Thus, if processor is used for intensive media applications the hardware mapping unit should be the preferred option and vice versa. The functionality and details are explained in section 3.

## 3. RELATED WORK

Register allocation has been a major research issue since the advent of compilers. In the beginning register allocation was done in steps and groups, which was not optimal (Chaitin et al. 1980). But Gregory Chaitin and others with their pioneering work on register allocation via graph coloring changed the paradigm and the register allocation problem was addressed globally as one issue in a computer program. They implemented this for the first time in an experimental compiler PL/I for the IBM System/370. The graph coloring problem is the assignment of non-similar color to two adjacent nodes in a graph (nodes are adjacent if they are connected by an edge). A problem is denoted as n-color if the number of colors that can be used for coloring nodes are not more than n. we term the chromatic number as the minimum number of colors that can be assigned to each node in a given graph. Chaitin et al. showed in their work by building an interference graph that takes care of all interferences that occur. By interference they mean that two variables that reside in the same register interfere with each other if both are live at the same time. The interferences are encouraged thereby resulting in a robust register allocation using the graph coloring.

Subword parallelism though coarser in terms of granularity than ILP (Instruction Level Parallelism), it provides good avenues to speed up programs at least to 3-4x. This is because the data in a register can be packed to a maximum of 4 separate units (though this is application dependent). Since most of the computations in media processing takes place inside loops, subword parallelism is studied as an integral part of loop level parallelism. A short summary on subword parallelism research is mentioned by Jason Fritts (Fritts, 2000).

Since data types are the key anchor for implementing subword parallelism, it is important to automatically find out the minimum data sizes of variables in media applications. The work by Neil Pollard et al. gives a good insight on how to handle data type sizes automatically (Pollard and May, 1998).

Application-specific extensions to enhance the computational performance of baseline processors have seen a major trend in multimedia related support efforts. Numerous works have dealt with extending the instruction set architectures to cater to media applications. This mainly caters to the architectural support for implementing subword-capable operations.

One of the extensions to ISAs is shown in MAX-2 by Ruby B. Lee (Lee, 1996). The paper proposes MAX-2 which is a RISC like media acceleration primitives for 64-bit PA-RISC 2.0 architecture. MAX-2 deals with different issues related to data alignment in subwords, conditional execution and the transfer of data between processor registers and memory. These extensions provide applications to exploit 16-bit subword parallelism thereby enhancing media performance.

Since these extensions are done manually and require being hand-coded for each processor, we find it to be not sustainable as application-specific processors have very short shelf life as well the time-to-market window size is also too small. So, a way to automate the instruction generation for customizable processors has been shown by Nathan T. Clark, et al. (Clark et al. 2005). The authors have described a custom instruction utilization framework that uses data flow graph analysis to identify candidate subgraphs for instruction set extensions. The main contention for using DFGs is that they can be easily implemented in hardware and results in better performance and reduced code size as compared to their equivalent primitive opcode implementations. The works centers around discovery of candidate DFGs using a proposed guide function.

Another closely related work looks for speculative techniques for register allocation (Li et al. 2004). The subwords can be divided into two types, *static* and *dynamic*. The *static* term applies to those subwords whose bitwidth is known before. If we consider a word size of 32-bits, then the *static* sense would mean that the variable sizes cannot be greater than 16-bits and thus two variables can be packed in a single 32-bit register. The *dynamic* subword

variable type would mean that the variable has been declared as word size but its width will remain 16-bits most of the time. In the *speculative subword register allocation scheme* (SSRA) another variable is assigned to an already assigned register. This allocation decision is made using profile information which indicates that the two variables will fit into a single register. This scheme is an improvement in the author's previous work titled *Bitwidth aware global register allocation* (Tallam and Gupta, 2003). We consider that this scheme is suitable for a particular set of applications but may have disadvantages when the speculation process fails for a larger number of register allocation requests. This will again lead to *register spilling* which take place when the compiler fails to find a register to allocate to a variable. So the variable is saved in memory which requires extra load and store instruction to handle it thus increasing the code size.

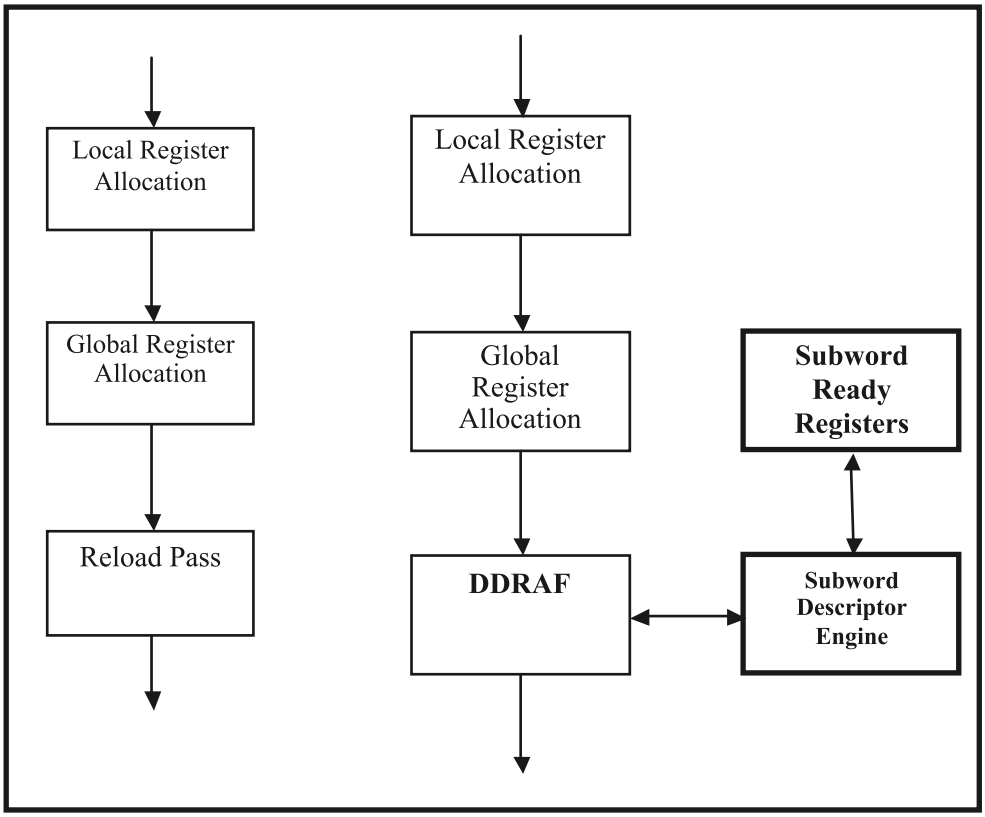


**Figure 2 a. GCC Register Allocator b. Demand Driven Register Allocation Framework**

# 4. THE DDRAF ALGORITHM

## 4.1 Architecture Support

The framework provides for dynamic mapping of register allocation strategies using our proposed algorithm (Figure 2). Hence, it does not need any modifications/ extensions in the Instruction sets. This results in reduced code size which is the primary concern in RISC-type embedded processors. The *DDRAF* scheme is integrated with the *gcc*. The *gcc* register allocator is shown in Figure 2b. The *gcc* compiler conducts allocation of registers in three passes: *local register allocation, global register allocation* and *reload pass*. Initially, all the variables names and constants are mapped to a set of virtual registers. The virtual registers are finally allocated to physical registers during these three passes. The first two passes operate on a set of intermediate languages called as RTL *(Register Translation Language)*. Initially the local register allocator pass is conducted for a single basic block. All the virtual registers during this pass are allocated physical registers. This is normally a simple pass as it works on linear code. The global register pass allocates registers to the remaining virtual registers. The reload pass takes care of those registers which are left uncolored (unallocated) (Chaitin et al. 1980). Automatic register allocation is done using graph coloring. Reload pass takes care of spills and in the process also modifies RTL. Most of the research work has up till now has focused on Instruction set extensions resulting in increased manual efforts in programming media processors. Our system makes these issues transparent to the programmer thus simplifying the programmability of media processors.

## 4.2 Mechanism

DDRAF scheme provides different bitwidth sized data types in addition to the regular ones. We believe that to explore the opportunity to exploit subword parallelism the effort should start at the data types. Since in media applications, the data is in form of streams, the signals are either 8-bit or 16-bit length; it becomes convenient to handle such bit lengths at the primitive type's level. This further reduces any requirement for modifications or extensions in instruction sets. DDRAF provides the following primitive type information in addition to the prevailing data types in GCC:

| ***Data type name*** | ***Bitwidth*** | ***Parent data type*** |
|---|---|---|
| Quart | 8-bits | short int |
| Halfword | 16-bits | short int |

**Table2: New Primitive Datatypes**

Since the new data types inherit all the features from their parent data type, no new modifications are required in the mneumonics of the machine code. Every operation (opcode) that works for short int type will also work for the two new data types. These data types can also be defined using *typedef* preprocessor directive in the GCC compiler after some modifications. But we suggest these two new data types be built-in rather than user-defined taking into account the performance issues in media processors.

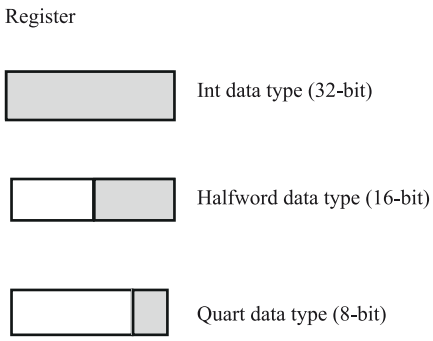


**Figure 3: Built-in data types**

The bit width shown in figure 3 assumes word size of 32-bits (it is machine dependent). It is observed that in media applications, the most common subword size requirement is of *Halfword* data type (16-bits).

*DDRAF* provides a suitable framework for common operations to be performed on the new data types. P,Q halfword ADD P,Q//the contents of //P and Q are //added and stored //in P. The overflow (if there) is treated in a similar fashion as in a conventional addition using int data types. The only difference is that the result of this operation is stored in a virtual register, which we will call the *alias* of P. If the result to be stored in P is of size >16, then it will be stored in a conventional way. But if the result is of size<16 then the result will be stored on the lower precision (address) of a register as under:

Let P′ be a virtual register (it is actually a memory location) and P′ has to be allocated a physical register. Then there exists two conditions:

**a.** If the available physical register (R1) is completely free (i.e. the lower half and the upper half is free) or the lower half (address) is free then
R1 à R1 AND P′

*(It should be stressed that the availability of free subword-ready registers is searched from the subwords ready register database as highlighted in figure 2b. Each available free register is added to a linked list data structure. We leave this task for our later work. This task is performed by the subword descriptor engine of DDRAF)*

The final result is stored on the lower address of R1.

**b.** Else if the available physical register (R1) is free on its higher address (the lower address is occupied), then we apply the following algorithm:

Input: R1 (its higher address (MSB 16-bits) is free), P′ (virtual register with 16-bit data)
Output: R1 storing the content of P′ in its higher address.

```
for(i=0;i<16;i++) {
shl P′          // shl—shift left //(P′ is shifted //left(multiplied //by 2) 16 times
}
R1 à R1 OR P′
```

Thus we have shown how subword data can be stored at different register locations (low and high) using very basic GATE-level operations, like SHIFT, AND and, OR. Since these operations can be easily implemented in hardware, we propose a dedicated hardware DDRAF unit to deal with this process especially for embedded media processors. We also propose another alternative of treating each single register as two virtual 16-bit half register. This will reduce the overhead of packing and unpacking registers to exploit subword parallelism.

## 5. FUTURE WORK

In this paper the focus has been on deriving a framework that supports subword parallel architectures. The streaming media applications are computation-intensive. This is one of the factors that induce latency and other related overheads in the execution of these applications. Later we intend to solve and minimize the latency metrics of media applications.

DDRAF framework utilizes base-level GATE logic. This requires a hardware approach to implement DDRAF. This hardware logic unit can be subsequently integrated into GPUs (General Processing Units) as well as Application specific processors. We intend to extend the hardware further by creating level two registers (similar to L2 cache) where virtual registers are stored in actual fast semi-conductor memories. These will speed up the register allocation process.

*Subword ready register* (figure 2) is a repository that holds collection of free registers ready to be allocated. We intend to later on implement a suitable data structure to store and search appropriate registers for allocation.

## 6. CONCLUSION

In this paper we have demonstrated a technique to allocate registers that takes care of subword operations. The primary aim was to make minimum and non-invasive changes in the existing *gcc* global register allocator. Since this is just a framework which depicts ways

to exploit subword level parallelism, the next step will involve implementing the hardware and structural support modules to this framework.

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## DOCTORAL AND MASTERS DISSERTATIONS

# PROBLEM SOLVING IN BIOLOGY AT UNIVERSITY LEVEL

**Dr. Sharifa Ali Al Qasmi**

## ABSTRACT

Problem-solving has received some attention in Biology, focused largely on Genetics. It has been suggested that the presence of nodes of knowledge and accessible links between the nodes of knowledge, play a vital role in determining success in problem-solving. The purpose of this study was to examine this issue, focusing on first year Biology students. A total of 524 students were involved in a preliminary study at the University of Glasgow, while 1167 students participated in the main experimental work. The main experiment had three stages. In each stage, batteries of tests (cognitive and attitudinal) were used and the outcomes related to students' performance on an open-ended problem. Four new open-ended problem-solving units were developed.

In the first stage, 642 students completed True-False tests, a Word Association Test, a Structural Communication Grid test and assessments of attitudes to learning ( using a Perry Position Questionnaire). Several open-ended problems were devised and used, but the outcomes from the cognitive tests were related to one individual problem-solving unit on the topic: Forests that Need Fires. This stage attempted to gain insight into the extent to which nodes and links in long term memory contribute to success in problem-solving. The results indicated that problem-solving success might be related to factual knowledge, links between nodes of knowledge and understanding. However, generic ability in Biology might offer an alternative explanation.

To test the latter, the second stage involved the same sample of students in a second battery of tests, most of which were on a parallel, but unrelated topic: Evolution. The outcomes showed that, although generic knowledge of Biology was a factor, this did not seem to explain all the correlations observed in the first stage.

The third stage approached the issue from a fresh perspective. Working with 525 students, this involved the same four problem-based units but a new set of tests was applied: tests of lateral thinking, a test of convergency/divergency, another ranking test and a self-report questionnaire. The results suggested that the number of accessible nodes and links in long term memory (reflecting 'brain architecture' and, perhaps, aspects of cognitive styles) do seem to be related to success in problem-solving tasks. However, it is recognized that the validity of the test battery is an important issue in drawing such conclusions.

# AN INVESTIGATION ON FACTORS AFFECTING OMANI FACULTY MEMBER'S ADOPTION OF INFORMATION AND COMPUTING TECHNOLOGY

**Dr.Said Al-Senaidi**

## ABSTRACT

The purpose of this study was to explore the factors influencing information and computing technology (ICT) adoption for Omani faculty members from a framework of Rogers' theory of diffusion of innovation. Three hundred Omani faculty members from Sultan Qaboos University (SQU) participated in the study. The survey used consisted of five parts: (a) an 18-item questionnaire on ICT uses and skills, (b) a 1-item questionnaire on adopter category, (c) a 44-item self-constructed questionnaire on perception of barriers to adopting ICT, (d) a 50-item questionnaire on ICT attributes from a published source, and (e) a 15-item questionnaire on demographic and job-related variables.

Descriptive statistics indicated that the faculty members overall used ICT at the "Sometimes" level and had ICT skills at the "Intermediate" level. The most frequently used and skillful ICT functional areas were website browsing, Internet search engine, and word processing. One-way ANOVAs found significant group differences of ICT uses and skills, perception of barriers, and perception of ICT attributes in the category of adopter. Early adopters used ICT more, had higher ICT skills, perceived fewer barriers in the adopting process, and recognized higher values of ICT attributes than later adopters did.

Multiple regression analysis showed the level of ICT uses could be predicted by ICT skills, adopter category, perception of barriers, ICT attributes, and the selected demographic and job-rated background variables, to a large magnitude with an adjusted $R^2$ value of .70. The level of ICT skills was the most salient predictor. Perception of ICT attributes and the number of traditional classes taught appeared to be important as well. Results supported Rogers' theory at the macro level but not at the micro level. A major implication of this study is that SQU needs to help its faculty members improve ICT skills.

# STUDY OF PERFORMANCE OF THE INVERTED SOLAR STILL INTEGRATED WITH A REFRIGERATION CYCLE

**Yousuf Yauqob Nasser Al- Hatmi**

## ABSTRACT

As the population of the world grows there is an ever-increasing demand for good quality water for both domestic and industrial use. Therefore, worldwide scientists and engineers are pursing research to obtain less expensive and less complicated methods treating it.

Solar distillation is an attractive process for the purification of sea water. Inverted solar stills are simple in design, manufacture, operation and use free energy. However, the low productivity of fresh water is the biggest challenge and limits its application. Therefore scientists are working hard to find ways to enhance their productivity.

Several investigators studied many factors that affect the solar stills to enhance their productivities. This work present experimental results obtained using a comparison between a standard inverted solar still and refrigerated inverted solar still (i.e., the same system, but the refrigerated system was added to them). The experiments were conducted in the Sultanate of Oman, using sea water at different inlets temperatures and depths. An optimum production was found at the inlet temperature of 30˚C, depth of 6 cm for the refrigerated system and of 30˚ C, depth 2 cm for the standard system. The results show that water production by refrigerated system is higher than the standard one.

# DESIGN AND EVALUATION OF A CALL ADMISSION CONTROL SCHEME FOR MULTI-CLASS SERVICE WIRELESS CELLULAR NETWORKS

**Sharifa Abdullah Salim Al Khanjari**

## ABSTRACT

Recent advances in wireless mobile communication technologies have led to a wider range of requirements. Currently, third generation (3G) wireless cellular networks aim to provide multimedia services in addition to voice and data. However, the challenges facing 3G and next generation cellular networks are in maintaining the quality of service (QoS) requirements for each class of the multi-service traffic in face of the limited radio resources and the mobility of users. In addition, the growing demand of mobile users for integration with the global communication infrastructure would necessitate their demand for having reliable services similar to wired communication and data networks. Accordingly, many issues should be addressed in 3G and next generation cellular networks to achieve the requirement for seamless roaming and internetworking.

The aim of this project is to develop an adaptive scheme for Call Admission Control (CAC) for multi-class service wireless cellular networks. The proposed CAC scheme is based on complete sharing of the available bandwidth among all traffic class. This work proposes a CAC adaptive scheme that can be achieved through call bandwidth borrowing and call pre-emption techniques according to the priorities of the traffic classes. However, maintaining the QoS in each class to avoid performance deterioration is essential. Therefore, this research introduces mechanisms for call bandwidth degradation, and mechanisms for call bandwidth upgrading based on the Min-Max and Max-Min policy for resource de-allocation and allocation, respectively.

In addition, the scheme applies call pre-emption according to the class of calls priorities, and call reactivation whenever the traffic conditions permit. In general, the proposed adaptive CAC scheme assumes an online monitoring approach of the system, to determine the amount of bandwidth to be borrowed from calls, or the amount of bandwidth to be returned to calls. The proposed adaptive CAC scheme is evaluated by simulation for performance evaluation. A discrete event simulation model is developed for the scheme, using randomly generated calls, assuming a one cell in a wireless cellular network. The simulation results show that the proposed CAC scheme using bandwidth adaptation techniques improves blocking probability, dropping probability, and bandwidth utilization significantly, in addition, the simulation results show that some parameters can improve the performance of the simulation such as the utilization threshold.

## CONFERENCES & SYMPOSIUMS

# "LIVING LANDSCAPES OF OMAN" 10TH -12TH OCTOBER 2010

The Ministry of Tourism, Sultanate of Oman has hosted the 4th International Conference on Responsible Tourism in Destinations on 10-12 October, 2010 at the Intercontinental Hotel, Muscat under the theme 'Living Landscapes of Oman'. The conference was organized by the Ministry of Tourism in collaboration with the UN World Tourism Organization (UNWTO) and the International Centre for Responsible Tourism, Leeds Metropolitan University, United Kingdom. This was the first ever conference held in the Arab world on Responsible Tourism. The objective of the Conference was to apply the principles of Responsible Tourism, which are declared in the UNWTO's Global Code of Ethics and the 2002 Cape Town Declaration on Responsible Tourism in Destinations.

The Conference discussed topics previously unaddressed in responsible tourism conferences and presented real-world experiences. The participation of prominent international organizations such as UNWTO, the UN Environment Programme (UNEP), the UN Educational, Scientific and Cultural Organization (UNESCO) and the International Union for Conservation of Nature (IUCN) provided a broad global perspective on the future of sustainable tourism. The conference discussions were

focused on four interrelated themes: ‹Tourism, Livelihoods, Local Economic Development and Human Resources;› 'Responsible Tourism in a World of Finite Resources;› ‹The Responsible Tourist, Tangible and Intangible Heritage;› and ‹Responsible Destinations and Marketing.›

The Conference was co-chaired by Her Excellency Dr Rajiha Abdul Ameer Ali, Minister of Tourism, Sultanate of Oman and Professor Harold Goodwin from Leeds Metropolitan University's International Centre for Responsible Tourism. The opening ceremony of the three-day conference was held under the auspices of Sayyid Hamoud bin Faisal Al Busaidi, Minister of Environment and Climate Affairs. He pointed out in his speech that the Sultanate of Oman is rich with important environmental tourism potentials that will secure a bright future for the tourism industry, especially as the Sultanate is known for its security and stability. Moreover, the Sultanate›s approach focuses on striking a balance between openness to tourism and maintaining the true identity of Omani society, with its rich values, traditions and costumes.

At the opening session, Dr. Rajha bint Abdul Ameer bin Ali, Tourism Minister affirmed in her speech that the principles and foundations of sustainable tourism have been fundamental

to Oman›s tourism industry from the very start. The Tourism Ministry in collaboration with the respective governmental bodies sought to preserve natural and biological heritage. Additionally, it has provided opportunities to maintain our rich cultural heritage, both tangible and intangible, and for jobs creation in the sector, boosting small to medium businesses, and as a means of using local produce and products, again to help local communities. She added that to further this great progress, this International Conference provides us with an important opportunity to review the latest developments in responsible tourism, key challenges facing our sector, and ways to deal responsibly with them. Further, the Conference will look at the experience and mechanisms used to successfully translate sustainable tourism policies and principles into solid practices.

The first day of the conference was devoted to research and academic studies from the Sultanate and other countries. The discussions focused on tourism and economic development, human resources and responsible tourism in the light of scarce resources, management of tangible and intangible aspects of heritage, as well as, responsible management of tourist destinations. Over the following two days, more than 50 working papers were presented in the conference by 28 lecturers from different countries around the world, including 16 working papers from the Sultanate. The working papers covered the economic, social and environmental aspects for the sustainable development.

A general framework for responsible tourism was created in the conference by the key speakers, decision-makers and tourism experts from all over the world. This Conference also provided an opportunity to hear about Oman's new Responsible Tourism Policy being developed to inform the Ministry of Tourism's strategy for the next five year plan 2011- 2015.

More than 500 delegates from 34 countries actively participated in the conference and shared responsibility for contributing to sustainable development through tourism. Experts from international and regional tourism organizations, government officials, heads of tourism companies, senior tourism experts and representatives from universities, colleges and research centres attended the conference.

There was also an exhibition at the conference venue featuring the latest and best technologies and services for managing tourism responsibly in hotels and destinations. The delegates were provided with pre- and post-conference tour options specially prepared for them to discover the diverse cultural and natural heritage of Sultanate of Oman.

For more details about the topics and presentations of this Conference, please browse www.http://www.rtd4.om

# H.M. ACADEMIC CHAIRS› SYMPOSIUM OPENS ACADEMIC VISTAS

## 1st-3rd November 2010

Sayyid Ali bin Hamoud al Busaidi, Minister of the Diwan of the Royal Court presided at SQU over the opening of the symposium "Academic Chairs of His Majesty Sultan Qaboos bin Said and their Contributions in the Development of Human Knowledge". The symposium was organized by the Ministry of Higher Education in collaboration with SQU from November 1st-3rd . The ceremony was attended by the Chairmen of the State Council and Majlis A'Shura, a number of ministers, advisors and SQU academics and staff.

A number of professors holding the academic chairs that carry the name of His Majesty at leading universities around the world took part in the deliberations of the symposium. The symposium discussed a number of important themes, namely oriental studies, international relations, applied sciences and human resources with the participation of 11 professors, who presented working papers related to theses themes. H.E. Sayyid Ali bin Hamoud al Busaidi, Minister of the Diwan of the Royal Court and chief guest said that the establishment of these academic chairs by His Majesty the Sultan in a number of prestigious organizations, reflects a noble human aspiration that emphasises the connections and diverse interactions between individuals and peoples over the ages.

H.E. Dr. Rawiyah bint Saud al Busaidiyah , Higher Education Minster delivered the welcome speech and affirmed the importance of organizing this symposium, which arose from His Majesty the Sultan's attention to knowledge and science and their role in the development and progress of communities, and the development of shared values across cultures though scientific and academic interaction.

The first session was chaired by Sayyid Badr bin Hamad bin Hamoud al Busaidi, Secretary General of the Ministry of Foreign Affairs. The theme of the session was oriental studies and international relations. It included a working paper by Professor Francis Robinson , Sultan of Oman Professor of Islamic Studies at the Centre for Islamic Studies, Oxford, on '*Western and Southern Asia from the 13th century till date; security, resources and influence.*' It also included a working paper by Professor Abdul Majeed, Sultan Qaboos Professor of Arab language Studies at Beijing University in the Peoples' Republic of China on '*The Arabic language in China.'*

## GUIDELINES TO AUTHORS AND SUBMISSION OF MANUSCRIPTS

1. Contributions submitted for publication should be in English.

2. Applied and academic papers in the fields of Science in Communication, Design, Information Technology, International Business, Engineering and English language will be published in the OJAS.

3. Papers should be original and should not have been published or under consideration for publication elsewhere in any form.

4. The OJAS subjects each submitted paper to a blind refereeing process with at least two independent referees.

5. The cover page of the manuscript should contain the following:

   (a) the title of the manuscript
   (b) name(s), address(es), institutional affiliation(s)of the author(s), E-Mail address(s) of the author(s) and the telephone number(s)
   (c) an abstract not exceeding 150 words and describing the aims, methods, findings and conclusions of the study.
   (d) key words of the article
   (e) acknowledgments and references to grants etc of not more than 75 words - should appear as a footnote to the author's name on the cover page.

6. Manuscripts should follow the standard format as indicated below:

   (a) Microsoft Word format typed in single line space on A4 size format leaving 1" wide margin on all sides.
   (b) All pages should be numbered consecutively.
   (c) All text should be in Times New Roman with 12 size font.
   (d) Major and secondary headings should be numbered, left-justified, in lower case and in bold.
   (e) Figures and tables should be inserted in the preferred location.
   (f) Equations should be referenced by consecutive numbering throughout the text, on the right-hand side of the page, using (1), (2), etc.
   (g) Notes, footnotes and endnotes are to be listed at the end of the paper in numerical order as they appear in the text.
   (h) Follow the Author-date system for citations in text reference: e.g.

Gautham (2003), (David et.al. 2005).

(i) Detailed references should be on a separate page.

(j)Manuscript should not be more than 9000 words in length or not more than 30 pages including references and appendices.

7. **References should be placed in alphabetical order at the end of the paper. The APA style of referencing must be observed as follows:**

(a) **Books**

**Bernstein, D. K., & Tiegerman, E. (1989).** *Language and communication disorders in children* (2nd ed.). **Columbus, OH: Merill**

(b) **Edited Book**

Pressley, M., & Brainerd, C. J. (Eds.). (1985). *Cognitive learning and memory in children*. New York: Springer-Verlag.

*(c)* **Article or chapter in an Edited Book**

Rogoff, B., & Mistry, J. (1985). Memory development in cultural context. In M. Pressley & C. J. Brainerd (Eds.), *Cognitive learning and memory in children* (pp. 117-142). New York: Springer-Verlag.

(d) **Electronic Book**

Burton, R. (1832). *The anatomy of melancholy.* Retrieved from http://etext.library.adelaide.edu.au/b/burton/robert/melancholy/

(e) **Journal Articles**

Klimoski, R., & Palmer, S. (1993). The ADA and the hiring process in organisations. *Consulting Psychology Journal: Practice and Research, 45*(2), 10-36.

(e) **Online periodical article**

Kawasaki, J. L., & Raven, M.R. (1995, May 2). Computer-administered surveys in extension *Journal of Extension, 33*(3), 252-255. Retrieved November 20, 2000, from http://journals.apa.org/prevention/volume3/pre0030001a.html

(f) **Magazine article (no volume number)**

Beemster, M. (2008, December). Saving the Southern Bell Frog. *Australian Landcare*, 27-29.

(g) **Dissertations (retrieved from an institutional or personal Web site)**

McDonald, J. (2007). *The role of online discussion forums in supporting learning in higher education* (Doctoral dissertation, University of Southern Queensland, 2007). Retrieved from http://eprints.usq.edu.au/3588/2/McDonald_2007_whole.pdf

(h) **Published proceedings, published contribution to a symposium**

Rice, D. N., Houston, I. B., & Lyon, I. C. T. (1983). Transient neonatal tyrosinemia. In H. Naruse & M. Irie (Eds.), *Proceedings of the International Symposium on Neonatal Screening for Inborn Errors of Metabolism* (pp. 306-310). Amsterdam: Excerpta Medica.

8. Author(s) should submit a request for publishing his/ her contribution stating that it has not been published before. Contributions that do not conform to the above mentioned conditions will be ignored.

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10. Publications are not returned to authors whether published or not in the OJAS.

11. The Ministry of Higher Education, Sultanate of Oman retains the copyright to any articles published in the Oman Journal of Applied Sciences.

12. A copy of the issue in which the article is published, as well as a PDF of the final published article, will be supplied to authors free of charge.

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