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Attractor Cellular Automata

Automated Protein Structure

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Discovering Thoughts, Inventing Future

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AIS-PSMACA: Towards Proposing an Artificial Immune System for Strengthening PSMACA: An Automated Protein Structure Prediction using Multiple Attractor Cellular Automata

By P. Kiran Sree, Dr. Inampudi Ramesh Babu & SSSN Usha Devi N
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Abstract- Predicting the structure of proteins from their amino acid sequences has gained a remarkable attention in recent years. Even though there are some prediction techniques addressing this problem, the approximate accuracy in predicting the protein structure is closely 75%. An automated procedure was evolved with MACA (Multiple Attractor Cellular Automata) for predicting the structure of the protein. Artificial Immune System (AIS-PSMACA) a novel computational intelligence technique is used for strengthening the system (PSMACA) with more adaptability and incorporating more parallelism to the system.

Keywords: *protein structure, cellular automata, MACA.*

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AIS-PSMACA: Towards Proposing an Artificial Immune System for Strengthening PSMACA: An Automated Protein Structure Prediction using Multiple Attractor Cellular Automata

P. Kiran Sree [α], Dr. Inampudi Ramesh Babu [σ] & SSSN Usha Devi N [ρ]

Abstract- Predicting the structure of proteins from their amino acid sequences has gained a remarkable attention in recent years. Even though there are some prediction techniques addressing this problem, the approximate accuracy in predicting the protein structure is closely 75%. An automated procedure was evolved with MACA (Multiple Attractor Cellular Automata) for predicting the structure of the protein. Artificial Immune System (AIS-PSMACA) a novel computational intelligence technique is used for strengthening the system (PSMACA) with more adaptability and incorporating more parallelism to the system. Most of the existing approaches are sequential which will classify the input into four major classes and these are designed for similar sequences. AIS-PSMACA is designed to identify ten classes from the sequences that share twilight zone similarity and identity with the training sequences with mixed and hybrid variations. This method also predicts three states (helix, strand, and coil) for the secondary structure. Our comprehensive design considers 10 feature selection methods and 4 classifiers to develop MACA (Multiple Attractor Cellular Automata) based classifiers that are build for each of the ten classes. We have tested the proposed classifier with twilight-zone and 1-high-similarity benchmark datasets with over three dozens of modern competing predictors shows that AIS-PSMACA provides the best overall accuracy that ranges between 80% and 89.8% depending on the dataset.

Keywords: protein structure, cellular automata, MACA.

I. Introduction

Proteins are molecules with macro structure that are responsible for a wide range of vital biochemical functions, which includes acting as oxygen, cell signaling, antibody production, nutrient transport and building up muscle fibers. Specifically, the proteins are chains of amino acids, of which there are 20 different types, coupled by peptide bonds [2]. The three-tiered structural hierarchy possessed by proteins is typically referred to as primary and tertiary structure. Protein Structure Predication from sequences of amino acid gives tremendous value to biological community. This is because the higher-level and secondary level [1], [2] structures determine the function of the proteins and consequently, the insight into its function can be inferred from that.

As genome sequencing projects are increasing tremendously. The SWISS-PORT databases [3],[4] of primary protein structures are expanding tremendously. Protein Data Banks are not growing at a faster rate due to innate difficulties in finding the levels of the structures. Structure determination[5], [6] procedure experimental setups will be very expensive, time consuming, require more labor and may not applicable to all the proteins. Keeping in view of shortcomings of laboratory procedures in predicting the structure of protein major research have been dedicated to protein prediction of high level structures using computational techniques. Anfinsen did a pioneering work predicting the protein structure from amino acid sequences [6], [7]. This is usually called as protein folding problem which is the greatest challenge in bioinformatics. This is the ability to predict the higher level structures from the amino acid sequence.

By predicting the structure of protein the topology of the chain can be described. The tree dimensional arrangement of amino acid sequences can be described by tertiary structure. They can be predicted independent of each other. Functionality of the protein can be affected by the tertiary structure, topology and the tertiary structure. Structure aids in the identification of membrane proteins, location of binding sites and identification of homologous proteins[9], [10],[11] to list a few of the benefits, and thus highlighting the importance, of knowing this level of structure This is the reason why considerable efforts have been devoted in predicting the structure only. Knowing the structure of a protein is extremely important and can also greatly enhance the accuracy of tertiary structure prediction. Furthermore, proteins can be classified according to their structural elements, specifically their alpha helix and beta sheet content.

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II. Related Works in Structure Prediction

The Objective of structure prediction is to identify whether the amino acid residue of protein is in helix, strand or any other shape. In 1960 as a initiative step of structure prediction the probability of respective structure element is calculated for each amino acid by taking single amino acid properties consideration[1], [3],[6]. This method of structure prediction is said to be first generation technique. Later this work extended by considering the local environment of amino acid said to be second generation technique. In case of particular amino acid structure prediction adjacent residues information also needed, it considers the local environment of amino acid it gives 65% structure information. So that extension work gives 60% accuracy. The third generation technique includes machine learning, knowledge about proteins, several algorithms which gives 70% accuracy. Neural networks[10],[11] are also useful in implementing structure prediction programs like PHD, SAM-T99.

The evolution process is directed by the popular Genetic Algorithm (GA) with the underlying philosophy of survival of the fittest gene. This GA framework can be adopted to arrive at the desired CA rule structure appropriate to model a physical system. The goals of GA formulation are to enhance the understanding of the ways CA performs computations and to learn how CA may be evolved to perform a specific computational task and to understand how evolution creates complex global behavior in a locally interconnected system of simple cells.

III. Cellular Automata

Cellular Automata (CA) is a simple model of a spatially extended decentralized system, made up of a number of individual components (cells). The communication among constituent cells is limited to local interaction. Each individual cell is in a specific state that changes over time depending on the states of its neighbors. From the days of Von Neumann who first proposed the model of Cellular Automata (CA), to Wolfram's recent book, A New Kind of Science", the simple and local neighborhood structure of CA has attracted researchers from diverse disciplines.

Definition: CA is defined a four tipple <G, Z, N, F>
Where G -> Grid (Set of cells)
Z -> Set of possible cell states
N -> Set which describe cells neighborhoods
F -> Transition Function (Rules of automata)

The concept of the homogeneous structure of CA was initiated in early 1950s by J. Von Neumann. It was conceived as a general framework for modeling complex structures, capable of self-reproduction and self-repair. Subsequent developments have taken place in several phases and in different directions.

a) Artificial Immune Systems

Artificial immune systems are motivated by the theory of immunology. The biological immune system functions to protect the body against pathogens or antigens that could potentially cause harm. It works by producing antibodies that identify, bind to, and finally eliminate the pathogens. Even though the number of antigens is far larger than the number of antibodies, the biological immune system has evolved to allow it to deal with the antigens. The immune system will learn the criteria of the antigens so that in future it can react both to those antigens it has encountered before as well as to entirely new ones. In 2002, de Castro and Timmis [17], suggested that "for a system to be characterized as an artificial immune system, it has to embody at least a basic model of an immune component (e.g. cell, molecule, organ), it has to have been designed using the ideas from theoretical and/or experimental immunology.

IV. Design of MACA based Pattern Classifier with Artificial Immune System

An n-bit MACA with k-attractor basins can be viewed as a natural classifier. It classifies a given set of patterns into k number of distinct classes, each class containing the set of states in the attractor basin. To enhance the classification accuracy of the machine, most of the works have employed MACA to classify patterns into two classes (say I and II). The following example illustrates an MACA based two class pattern classifier.

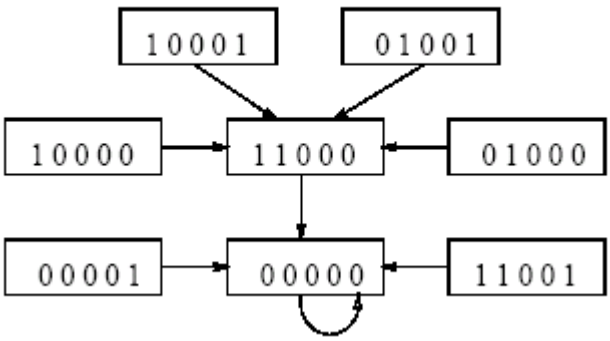

Figure 1 : Example of MACA with basin 0000

a) The Proposed Artificial Immune Algorithm

such that

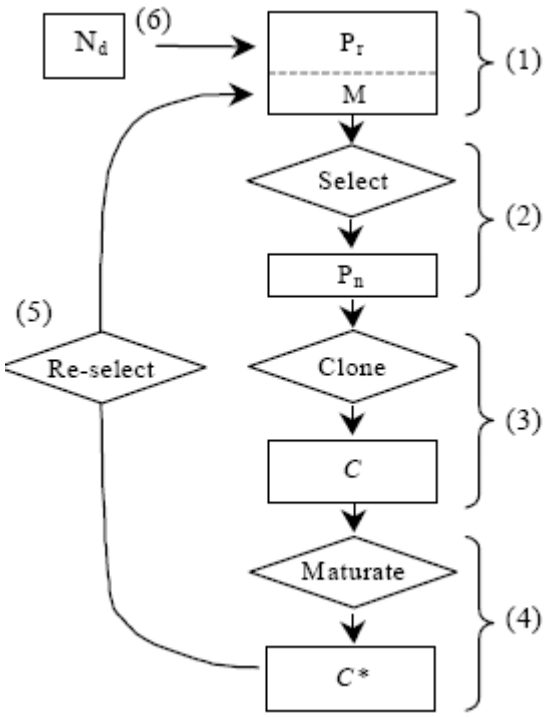

Figure 2 : Proposed Algorithm

The algorithm works as in Figure 3 (after each six steps we have one cell generation):

1. Generate a set (P) of candidate solutions, composed of the subset of memory cells (M) added to the remaining (Pr) population (P = Pr + M);
2. Determine (Select) the n best individuals of the population (Pn), based on an affinity measure;
3. Reproduce (Clone) these n best individuals of the population, giving rise to a temporary population of clones (C). The clone size is an increasing function of the affinity with the antigen;
4. Submit the population of clones to a hypermutation scheme, where the hyper mutation is proportional to the affinity of the antibody with the antigen. A maturated antibody population is generated (C*);
5. Re-select the improved individuals from C* to compose the memory set M. Some members of P can be replaced by other improved members of C*;
6. Replace d antibodies by novel ones (diversity introduction). The lower affinity cells have higher probabilities of being replaced.

b) AIS- PSMACA Tree Building

Input : Training set S = {S1, S2, · ·, SK}

Output : PSMACA Tree.

Partition(S,K)

Step 1: Generate a AIS-PSMACA with k number of attractor basins.

Step 2: Distribute S into k attractor basins (nodes).

Step 3: Evaluate the distribution of examples in each attractor basin

Step 4: If all the examples (S‟) of an attractor basin (node) belong to only one class, then label the attractor basin (leaf node) for that class.

Step 5: If examples (S‟) of an attractor basin belong to K‟ number of classes, then Partition (S‟, K‟).

Step 6: Stop.

A special class of non-linear CA, termed as Multiple Attractor CA (SPECIAL MACA), has been proposed to develop the model. Theoretical analysis, reported in this chapter, provides an estimate of the noise accommodating capability of the proposed SPECIAL MACA based associative memory model. Characterization of the basins of attraction of the proposed model establishes the sparse network of non-linear CA (SPECIAL MACA) as a powerful pattern recognizer for memorizing unbiased patterns. It provides an efficient and cost-effective alternative to the dense network of neural net for pattern recognition. Detailed analysis of the SPECIAL MACA rule space establishes the fact that the rule subspace of the pattern recognizing/classifying CA lies at the edge of chaos. Such a CA, as projected in [20], is capable of executing complex computation. The analysis and experimental results reported in the current and next chapters confirm this viewpoint. A SPECIAL MACA employing the CA rules at the edge of chaos is capable of performing complex computation associated with pattern recognition.

c) Algorithm Single Point Crossover

Input : Two randomly selected rule vectors (Parent 1 and 2).

Output : Resultant rule vectors (Offspring 1 and 2).

Step 1: Randomly generate a number „q‟ in between 1 and n.

Step 2: Take the first q rules (symbols) from first rule vector (Parent 1) and the (n-q) rules of Parent 2. Form a new rule vector (Offspring 1) concatenating these rules.

Step 3: Form Offspring 2 by concatenating the first q rules of Parent 2 and the last (n-q) rules of Parent 1.

Step 4: Stop.

d) Random Generation of Initial Population

To form the initial population, it must be ensured that each solution randomly generated is a combination of an n-bit DS with 2m number of attractor basins (Classifier #1) and an m-bit DV (Classifier #2). The chromosomes are randomly synthesized according to the following steps.

1. Randomly partition n into m number of integers such that

$$n1 + n2 + \cdots + nm = n.$$

2. For each ni, randomly generate a valid Dependency Vector (DV).
3. Synthesize Dependency String (DS) through concatenation of m number of DVs for Classifier #1.
4. Randomly synthesize an m-bit Dependency Vector (DV) for Classifier #2.
5. Synthesize a chromosome through concatenation of Classifier #1 and Classifier #2.

V. Experimental Step

- Select the target CA protein (amino acid sequence) T, whose structure is to be predicted.
- Perform a AIS-PSMACA search, using the primary amino acid sequence Tp of the target CA protein T. The objective is being to locate a set of CA proteins, S = {S1, S2…} of similar sequence
- Select from S the primary structure Bp of a base CA protein, with a significant match to the target CA protein. A AIS-PSMACA [16],[18] search produces a measure of similarity between each CA protein in S and the target CA protein T. Therefore, Bp can be chosen as the CA protein with the highest such value
- Obtain the base CA protein‟s structure, Bs, from the PDB
- Using Bp, create an input sequences Ib (corresponding to the base CA protein) by replacing each amino acid in the primary structure with its hydrophobia city value. The output sequences Ob is created by replacing the structural elements in Bs with the values, 200, 600, 800 for helix C, strand and coil respectively
- Solve the system identification problem, by performing CA de convolution with the output sequences Ob and the input sequence Ib to obtain the CA response, or the sought after running the algorithm.
- Transform the amino acid sequence of Tp into a discrete time sequences It, and convolve with F; thereby producing the predicted structure (Ot = It*F) of the target CA protein
- The result of this calculation Ot is a vector of numerical values. For values between 0 and 200, a helix C is predicted, and between 600 and 800, a strand is predicted by CA. All other values will be predicted as a coil by MACA. This produces mapping for the required target structure Ts of the target CA protein T.

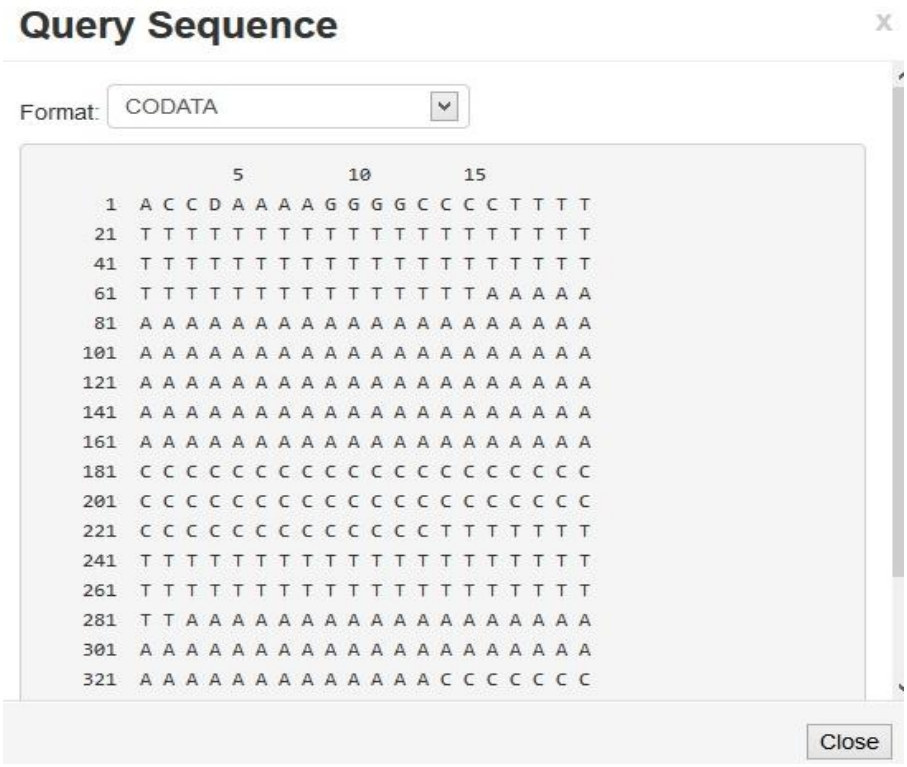

Figure 3 : Amino Acid Sequence

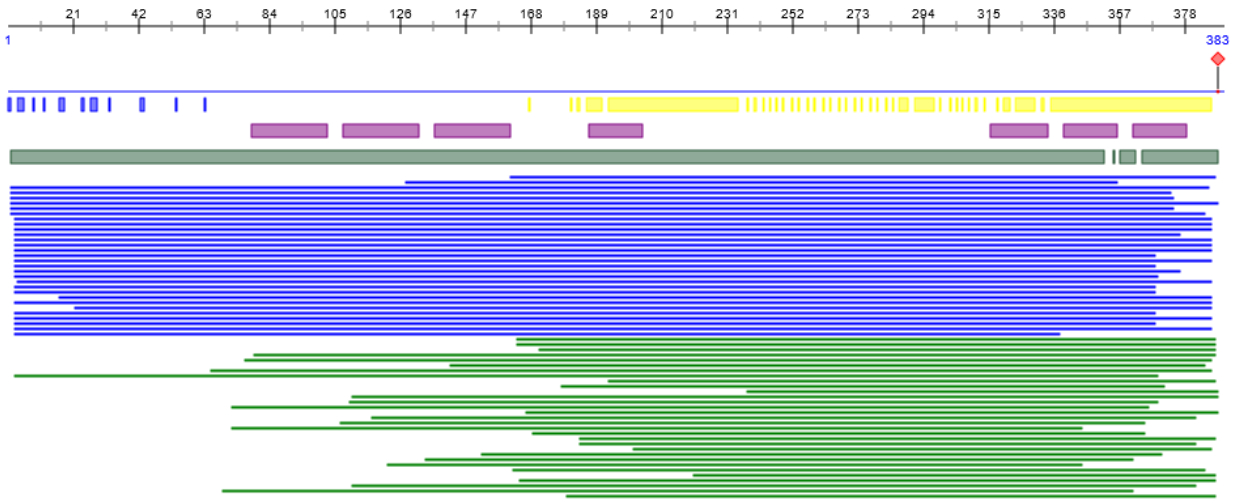

Figure 4 : Protein Structure Prediction interface with green as positive

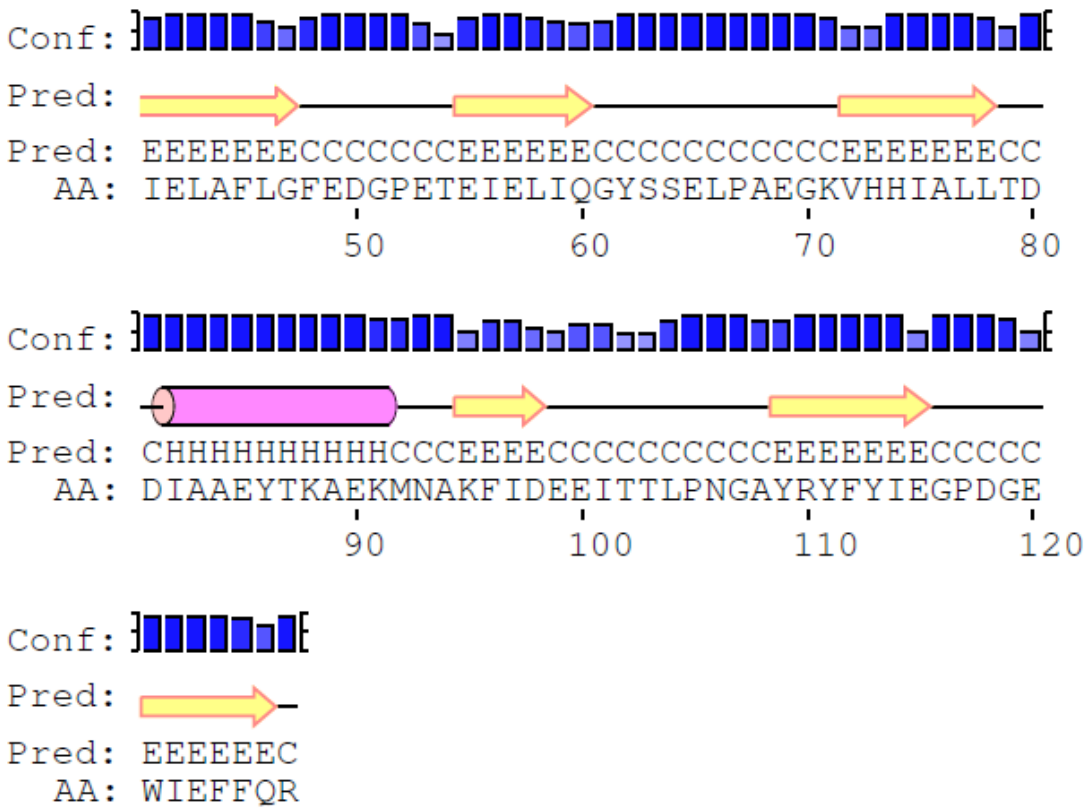

Figure 5 : Protein Structure Prediction Analysis

VI. Experimental Results

In the experiments conducted, the base proteins are assigned the values 300,700,900 for helix C, strand and coil respectively. We have found an structure numbering scheme that is build on Boolean characters of CA which predicts the coils, stands and helices separately. The MACA based prediction procedure as described in the previous section is then executed, and each occurrence of each sequences in the resulting output, is predicted. The query sequence analyzer was designed and identification of the green terminals of the protein is simulated in the figure 4. The analysis of the sequence and the place of joining of the proteins are also pointed out in the figure 5. Experimental results Figure 7, 8 which include the similarity and accuracy graph with each of the components are separately plotted.

Target : 1PFC	Prediction Accuracy	Target: 1PP2	Prediction Accuracy	Target: 1QL8	Prediction Accuracy
Exp 1	65%	Exp 5	85%	Exp 9	85%
Exp 2	65%	Exp 6	90%	Exp 10	90%
Exp 3	69%	Exp 7	83%	Exp 11	82%
Exp 4	71%	Exp 8	87%	Exp 12	91%

Figure 7 : Prediction Accuracy

Prediction Method	Prediction Accuracy for 1PFC	Prediction Accuracy for 1PP2	Prediction Accuracy for 1QL8
DSP	92%	70%	96%
PHD	70%	68%	84%
SAM-T99	68%	77%	87%
SS Pro	70%	73%	81%
AIS-PSMACA	90%	85%	97%
AIS-AIS-PSMACA	92%	83%	96%

Figure 8 : Prediction Accuracy for AIS--AIS-PSMACA

VII. Conclusion

Existing structure-prediction methods can predict the structure of protein with 75% accuracy. To provide a more thorough analysis of the viability of our proposed technique more experiments will be conducted .Our results indicate that such a level of accuracy is attainable, and can be potentially surpassed with our method. AIS-AIS-PSMACA provides the best overall accuracy that ranges between 80% and 89.8% depending on the dataset.

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IT Adoption Process in Pakistani SMEs

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Abstract- Information technology plays an important role in every field of life. Implementation and acceptance of IT always remain an important topic for researchers, engineers and practitioners. This study explores IT adoption factors influencing SMEs performance in developing countries. Relative advantages, complexity, ease of use, trialabiliy, observability were found frequently used factors to investigate SME performance. Frequently used factors and new identified factors from advance literature were profitability, communication improvement and attitude of employees for different SMEs.

Keywords: *SMEs, it adoption factors, sme performance, technology acceptance.*

GJCST-G Classification: *K.4.3*

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IT Adoption Process in Pakistani SMEs

Shreehan Shahid [α] & Irfan Anjum Manarvi [σ]

*Abstract-*Information technology plays an important role in every field of life. Implementation and acceptance of IT always remain an important topic for researchers, engineers and practitioners. This study explores IT adoption factors influencing SMEs performance in developing countries. Relative advantages, complexity, ease of use, trialabiliy, observability were found frequently used factors to investigate SME performance. Frequently used factors and new identified factors from advance literature were profitability, communication improvement and attitude of employees for different SMEs.

A questionnaire based survey was distributed personally to 240 respondents of SMEs of academic, pipe industry distribution, passport office, post office, nut bolt industry, hotels, banks, hospitals, carpet and fashion industry sector using IT. In response to survey, 162 valid responses were received. The response rate was 77.1%. Among the respondents male percentage is approximately 80.6% and female percentage is 19.4%.

The finding indicates that the proposed model over all explains 81% variation in the performance. While relative advantage, acceptability, eases of use, profitability, communication improvement and attitude were significant factors that indicating SME performance. Majority of the respondents were agreed to use computer for their daily purpose.

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I. Introduction

Over the last decades, information technology plays an important role in every field of life. The business world is changing due to the advances and developments in technology. Information Technology (IT) has played a significant role in business since the 1950s and the use of technology to decrease costs, improve operations, augment customer service, and improve communications has progressed swiftly over the past four decades (Peslak, 2005).Progress in computer technology has been creating a tough need for organizations to adopt this technology in order to remain spirited. However, these computer technologies are unable to bring improvement in the organizational performance without the presence of their effective utilization (Davis, Bagozzi & Warsaw, 1989). IT has been adopted and used within many organizations for many years. Many theorists, practitioners and researchers have shown the usefulness of information technology in the business (Adam, Nelson & Todd, 1992, Andrews & Papp, 2000, Kelly, Guinea & Hunter, 2005, Sarkar & Sawy, 2003, Weill & Clair, 1999). There are number of potential factors that influence the usage of information system. That is why the role of SME concerns deeply in the development of developed and developing countries (Aragon- Sanchez & Sanchez- Marin, 2005, Beal, 2000, Chau and Turner, 2002, Clapham, 1985, Diermen, 1997, Drew, 2003, Hill, Levy & Powell, 2005, Levis & Cockrill, 2002, Mehrtens, Craggs & Mills, 2001, O'Regan & Ghobadiah, 2004, Rothwell & Zegveld 1982, Sadowski, Maitland & Dongen, 2002). SMEs run the existence of the economies of the countries. Due to the participation in the well developed as well as developing countries SME sector is playing a major role in employment generation, decreasing poverty, accelerated growth, and raised the level of income to spend a stable high class living standard. The only way to reduce poverty and to promote economic growth, through wealth and employment creation SME is the source of income, a growing seed for entrepreneurs and employment providers (UNIDO, 2003). SMEs are important because SMEs comprises over 95 percent of the economy. Computer application act as a catalyst in the growth of economy that enables people to convert knowledge into digital form easily, which can be accessible anywhere around the world. SMEs are different and unique from other bigger businesses, so to manage SME differently from managing bigger businesses (Aragon- Sanchez & Sanchez- Marin, 2005, Beal, 2000, Chau and Turner, 2002, Clapham, 1985, Diermen, 1997, Drew, 2003, Hill, Levy & Powell, 2005, Levis & Cockrill, 2002, Mehrtens, Craggs & Mills, 2001, O'Regan & Ghobadiah, 2004, Rothwell & Zegveld 1982, Sadowski, Maitland & Dongen, 2002). According to Chris MacKechnie (2007) information technology (IT) has become a vital and integral part of every small and medium business plan. So the computers can be used to process, analyze and store vast amounts of data to give the business more quality information. Although SMEs are small in size so these organization are highly dependent on computer technology in promoting the business (Lesjak, 1995). Businesses all over the world rely on computers to function and maintain high standards of efficiency and customer service (Miley, 2011). One of the main reasons that many businesses turned into IT world for their professional needs is the sheer speed at which computers and related technologies can process information. According to the Charlie S (2011) there are many businesses which are in need of the software packages for satisfying their operational as well as functional needs. Due to the development of the

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information technology sector, the SMEs are being able to keep themselves aware of the changes in the global markets. One of the first and largest applications of computers is keeping and managing business and financial records (Tiwari and Malviya, 2007). Chan (2000) explained that in business many manifestations, IT processes data, gather information, stores collected materials, accumulates knowledge and expedites communication. Garicano and Heaton (2009) cond-ucted a study to observe the relationship among information technology and productivity in business. Namani (2009) observed Information technology is changing the economy and traditional business become more dependent on new technologies. For that reason, it is very important to investigate that how much information technology effective for SMEs.

II. Research Hypothesis

In order to achieve the research objectives, following research hypotheses are proposed.

H1 - Relative advantage has a positive impact on SME performance

H2 - Acceptability has a positive impact on SME performance

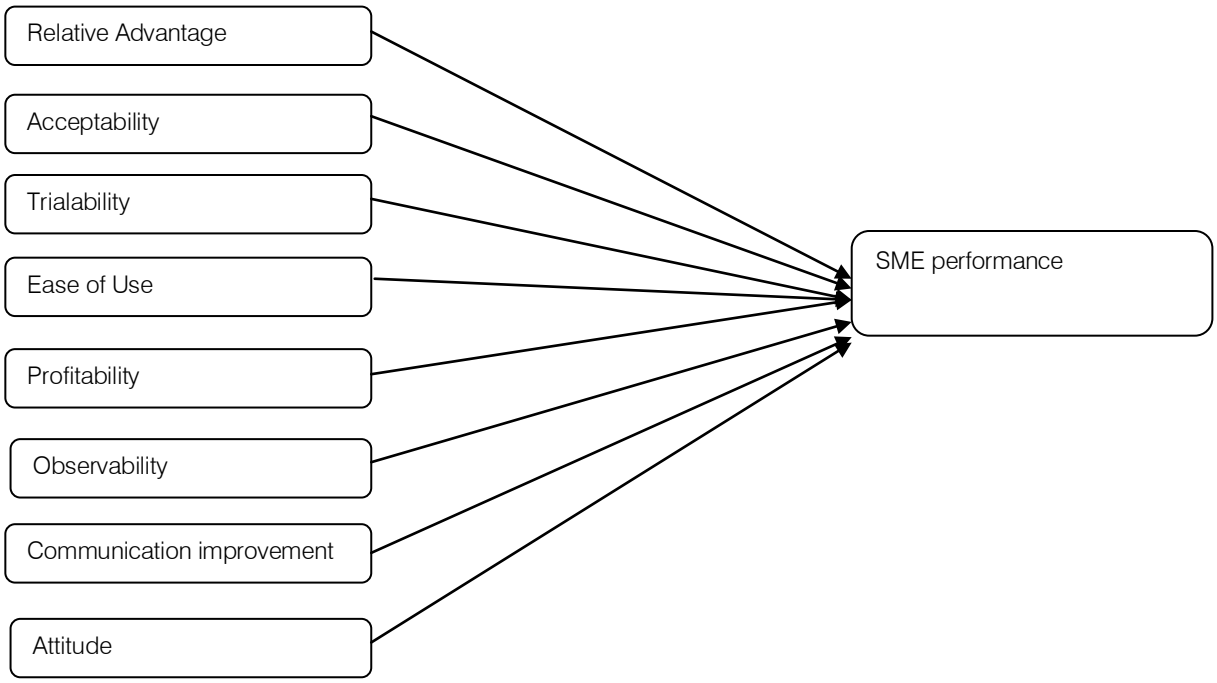

Figure 1 : Research Proposed Model

H3 - Trialability has a positive impact on SME performance

H4 - Ease of use has a positive impact on SME performance

H6 - Observability has a positive impact on SME performance

The SME, in particular the small industries of Pakistan and developing countries, are known to rely on low and obsolete technology. Association with SME and the increasing purchase of products makes it more valuable for the progress of country. Many researchers observed that the information technology has ultimately increased the efficiency of users in SMEs. Information technology involvement in the office helps speed up the movement of information and improves the analysis of information, also in SMEs communication is improved through the use of intranet and Internet. Workers can work away from the office using mobile technology such as phones, laptops and modems. SME performance leads to good communication on time with customer and also their attitude. According to Venkatesh et al (2003) some research has been done related to IT adoption by organization and its performance. This research will explore a set of variables that have influence on SME performance in developing countries. It will provide information as to which variable is more influential on performance of SMEs. More over the impact of SME performance on profitability has also measured, large quantity of SMEs selected and names are also mentioned. Based on the factors explored from literature, a research model is proposed. As in fig 1, in this research model relative advantage, acceptability, ease of use, trialability, observability, profitability,

communication improvement and attitude are the independent variables and which have their effect on SME performance (dependent variables)

H5 - Profitability has a positive impact on SME performance

H7 - Communication Improvement has a positive impact on SME performance

H8 - Attitude has also positive impact on performance of SME

III. Methods

a) Respondents

Lists of companies were searched from SMEDA website, so 22 companies were selected, 8 companies could not be answered. The remaining companies on the precompiled list were answered. Finally, 17 companies were agreed to fill up the questionnaire. Questionnaire was distributed among 240 respondents runs and working in SMEs located in Islamabad, Rawalpindi and related cities of Pakistan. In response, 162 questionnaires were returned. Data of 162 completely filled questionnaires were entered in Statistical Package for Social Sciences (SPSS) for analysis. Therefore, the response rate was 71.1%. The response shows that the sample represented from 17 selected companies, each company visit one by one and distributed questionnaire. At the time of questionnaire given to respondent, the respondents need a brief description of the study. For that reason, the simple and understandable statements were included in the questionnaire. A pilot test was conducted to verify the various dimensions of the questionnaire.

b) Measures

A five point Likert type scale questionnaire based on items adapted from Davis (1989), Taylor & Todd (1995), Venkatesh et al. (2003) and Thompson et.al (1991)

IV. Results and Analysis

a) Reliability Statistics

To confirm the reliability of the questionnaire, Cronbach's Alpha reliability statistics analysis was conducted. In statistics the Cronbach's Alpha value greater than .5 is considered to be a reliable scale.

Table 1 : Reliability Statistics

Cronbach's Alpha	No. of Items
.960	51

Table 1 shows the reliability statistics of questionnaire.The value .960 shows the scale used in questionnaire is highly reliable.

b) Descriptive Statistics

In order to explore IT adopted user responses with respect to gender. A frequency statistics was made.

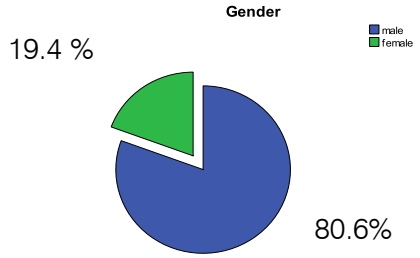

Figure 2 : Descriptive data of gender response

The figure 2 shows the frequency distribution of the respondents. Out of 162 responses, 80.6% were male and 19.4% were female.

Figure 3 shows the variation in age of the respondents. Out of 162 respondents, majority 43.8% lies in 31-43 age groups, while 22.7% respondents are in 44-56 age groups, 33.5% are in 18-30.

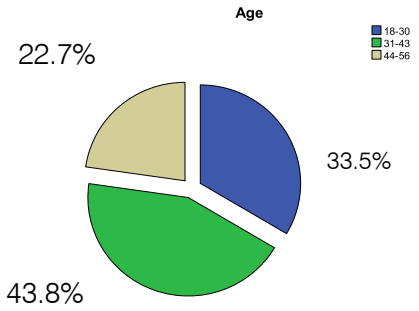

Figure 3 : Descriptive data of age response

Hypothesis Results & Analysis

In table 2 the R2 (.814) value shows that the independent variable explains the 81% variation in the IT adoption to use by SMEs. Here we can say that our model best fits and it explain significant variation in the performance.

Table 2 : Regression Analysis

Mode l	R	R Square	Adjusted R Square	Std.Error of the Estimate
1	.90(a)	.814	.812	.27620

Table 3 : Detailed Regression Analysis

Independent Variable	R^2	Independent Variables	Beta	t	Sig.
SME performance	.814	Relative Advantage	.192	7.110	.000*
		Trialability	.038	1.083	.279
		Ease of Use	.252	5.884	.000*
		Observability	.048	1.563	.118
		Profitability	-.080	-4.622	.000*
		Communication Improvement	.266	8.520	.000*
		Attitude	.236	9.178	.000*
		Acceptability	.995	268.265	.000*

Note. * Significant at .005 level

Table 3 shows the beta and significance value of each independent variable separated in regression model.

The significance value (p=.000) in table 3 shows that relative advantage is significant in measuring the performance of SME. The Beta value, B=.192 of relative advantage shows that relative advantage contribute to .192 variation the performance of SME. So we will accept H1.

Table 3 shows the regression analysis, the p value (p>.005) shows that trialability is not significant performance of SME. The Beta value, B=.080 of Profitability shows that Profitability contribute to .080 variable in measuring the performance of SME. Hence, we reject H3. The significance value (p=.000) in table 3 shows that Ease of Use is significant in measuring the performance of SME. The Beta value, B=.252 of Ease of Use shows that Ease of Use contribute to .252 variation the performance of SME. Here we will accept H4. Table 3 shows in regression analysis, the p value (p>.005) shows observability is not significant variable in measuring the performance of SME. Hence, we reject H6. The significance value (p=.000) in table 3 shows that profitability is significant in measuring the variation the performance of SME. The negative beta and t value indicate that this variable is not positively associated with the performance of SME. Here we will accept the H5.

Table 3 shows the regression analysis, the value (B =.266) shows that the variable Communication Improvement influence second strongest predictor in measuring the performance of SME. The p value (p=.000) also shows that Communication Improvement is a significant variable in measuring the performance of SME. Here we accept H7. In table3, Attitude having p value (p=.000) shows that attitude is a significant variable in measuring the performance of SME. Here we accept H8.The significance value (p=.000) in table 3 depicts that Acceptability is also a significant variable while predicting the performance of SME to Adopt IT. The table 3 also shows that the Beta value (B=.995) that identifies Acceptability is strongest predictor in measuring the performance of SME. Here we accept H2.

Table 4 : ANOVA

Statement	Mean								F	Sig.
Performance	RA	Acc	T	EU	O	P	CI	Att		
	4.30	4.29	4.29	4.62	4.12	4.51	4.35	3.50	422.870	.000*

In table 4 RA stands for Relative Advantage, Acc stands for Acceptability, T stands for Trialability, EU stands for Ease of Use, O for Observability, P for Profitability, CI stands for Communication Improvement and Att for Attitude. Here the significant value (p=.000) shows that majority variables are significant and these variables measure the performance of SME. As a whole, the model is significant and has a positive impact on SME performance.

V. Findings

The result of correlation analysis shows that acceptability, Communication improvement, attitude, and ease of use are strongly correlated with the performance of SME. While relative advantage, trialability, observability, profitability have medium level of correlation with performance of SME. The R square value (.814) shows that the overall independent variable explains 81% variation in the performance of SME. Here we can say that the model best fits and it explain significant variation in the performance. While exploring all variables individually, the variable performance is significant in measuring the SME performance. The Beta value, β=.995, show that acceptability is stronger predictor of the SME performance. Profitability is significant while explaining SME performance. The negative beta and t value indicate that this variable is not positively associated with the SME performance. The p value of trialability (p=.279) shows insignificant variable in measuring the SME performance. The p value (p=.118) in the regression analysis of the observability shows that is not a significant variable in measuring the performance of SME. The regression analysis shows that Acceptability is a strongest predictor in measuring the performance of SME while trialability and observability are not significant variables in measuring the performance of SME.

The ANOVA statistics shows that the overall independent variables have a significant relationship with performance of SME.

VI. Conclusion

This study was concerned on the IT adoption and SME performance. The aim of this study was to investigate IT adoption factors influencing SME. The first part of the study explores the literature related to IT adoption factors and IT usage in SMEs. Use of different standard models and theories of IT adoption in different sectors of SMEs have also been discussed. During the exploration of literature, many factors were identified for measuring the performance of SME. Based on the most common and influential factors a theoretical model was proposed. The population of this study was SMEs. The sample size of 240 respondents was selected, however, 162 out of 240 selected Participants responded. A questionnaire based survey was administered personally on 17 SMEs who were using IT system. In response to the survey, 162 valid responses were received. The response rate was 71%. Among the respondents, 80.6% were male while 19.4% were female. The findings of this study indicate that the proposed model over all explains 81% variation in the performance of SME. Except trialability and observability, all other variables having relationship to the performance of SME. Only two variables have no significant relationship with performance of SME. Majority of the respondents say that IT usage improves the work of an organization.

VII. Recommendations

Based on the findings of this study, the following recommendations are given to increase performance of SME.

- IT adoption is a need of the staff of SME that will help in reducing work load.
- The technical support should be provided to staff members to use computers.
- Basic learning of computer must be necessary for staff to work on computers.
- The teaching classes must be easy.
- The owner should encourage staff members to use IT/ computers.
- SME should provided necessary resources to the staff to use computer system.

VIII. Future Research

This research explains only 81% variation in the performance of SME. The remaining 19% portion of performance is unmeasured. There is a need of future research which explores the further variables to measures the leftover portion of performance which was not measured in this research.

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Integrating video Technology in Micro-Teaching Sessions for Teacher-Trainees' Self-Appraisal And Professional Growth

By Ekpo-Eloma, E. O, Arikpo, A. & Catherine N. Ebuta
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Abstract- The study examined the relationship between the use of video technology and teacher trainees' self-appraisal for progressive professional perfectibility. Two null hypotheses were formulated to guide the study. The quasi-experiment involved 100 third year students of the Faculty of Education, Cross River University of Technology engaged in microteaching. Data was obtained through a well validated ten-item Teacher Trainee Affective Response Questionnaire (TTARQ) developed on a four point Likert-scale by the researchers. The analysis of data was done using Pearson product moment correlation coefficient and independent t-test analysis for the first and second hypotheses respectively at 0.05 level of significance and 98 degree of freedom. The result of the study shows that there is a significant relationship between the use of video technology and teacher trainees' self-appraisal and evaluation, gender notwithstanding. The study therefore canvassed for the patronage of multi-media technology application in microteaching to enable teacher-trainees objectively assess their performance and also by their instructors and colleagues.

GJCST-G Classification: K.4.0

Integrating video Technology in Micro-Teaching Sessions for Teacher-Trainees' Self-Appraisal and Professional Growth

Ekpo-Eloma, E. O [α], Arikpo, A. [σ] & Catherine N. Ebuta [ρ]

Abstract- The study examined the relationship between the use of video technology and teacher trainees' self-appraisal for progressive professional perfectibility. Two null hypotheses were formulated to guide the study. The quasi-experiment involved 100 third year students of the Faculty of Education, Cross River University of Technology engaged in microteaching. Data was obtained through a well validated ten-item Teacher Trainee Affective Response Questionnaire (TTARQ) developed on a four point Likert-scale by the researchers. The analysis of data was done using Pearson product moment correlation coefficient and independent t-test analysis for the first and second hypotheses respectively at 0.05 level of significance and 98 degree of freedom. The result of the study shows that there is a significant relationship between the use of video technology and teacher trainees' self-appraisal and evaluation, gender notwithstanding. The study therefore canvassed for the patronage of multi-media technology application in microteaching to enable teacher-trainees objectively assess their performance and also by their instructors and colleagues.

I. Introduction

Classroom pedagogy is an alluring exercise especially for trained teachers. It is equally inundated with technicalities and procedures. It is only professional teachers who posses the skills and competencies, through training and re-training, to effect a positive change in behavior in those they teach. Obviously, professional teachers do not fall down from the blues like meteorites into the school system. They undergo vigorous and rigorous, prolonged or short term, theoretical and practical training, induction and internship to be sufficiently equipped with the where-withal of what, how, whom and when to teach. Therefore, a well-bred teacher-intellectually, psych-ologically, professionally and procedurally catalyses learning and propels the educational system to enviable heights.

On the other hand, untrained teachers (those bereft of appropriate teaching skills) merely gamble and ramble through the teaching-learning process each passing day at the peril of the learner and the entire educational system. They do not have the nitty gritty to cause big sparks at the sensory receptors of the learners (Ekpo-Eloma and Udosen, 2008). And, this of course, contributes substantially to the falling standard of education. This is so because, teachers tend to replicate their kind. Good teachers produce good students and bad teachers, bad learners.

Thus, teachers perform enormous functions in society. As catalysts of human resource development, teachers stand in between the lesson and the learner. According to Eddie (2001), what a teacher knows and what he does in the classroom setting can have far reaching consequences on both the learner and society. The Federal Ministry of Education (2004) equally admits that no nation can rise above the quality of its teachers. It follows logically that teacher preparation for optimum performance, enhanced professional growth and quality service delivery should be given utmost concern. Besides being enrolled in formal teacher training institutions, and exposed to courses like educational technology, psychology, philosophy, measurement and evaluation, principles and methods of teaching, one practical way of enhancing initial teacher preparation and resourcefulness is through microteaching.

According to Esiobu and Maduekwe (2008), microteaching is a melting point of theoretical knowledge of teaching and its actual practice under a simulated classroom environment. Obi (1991), maintains that microteaching is a simplified training system designed to enable trainee-teachers to practice and acquire teaching skills under a supervisor, in a short lesson of five to ten minutes with a small group of few students, employing colleagues or videotapes for feedback, focusing attention on only one teaching skill at a time. Furthermore, Abifarin (2004) and Adewoyin (2007) describe microteaching aptly as a scaled down teaching technique in terms of class size, tasks, time and skills. It is simply teaching in miniature, with the sole aim of exposing these category of students to the actual art of teaching in the classroom setting.

Microteaching is a critical component of teacher education as well as an empowerment technique which provides prospective teachers with opportunities to link theories of teaching with practice thereby stimulating acquisition of teaching skills and competencies (Abifarin, 2004). It thus represents a major paradigm shift from the traditional method of teacher trainee preparation to a more objective approach to training

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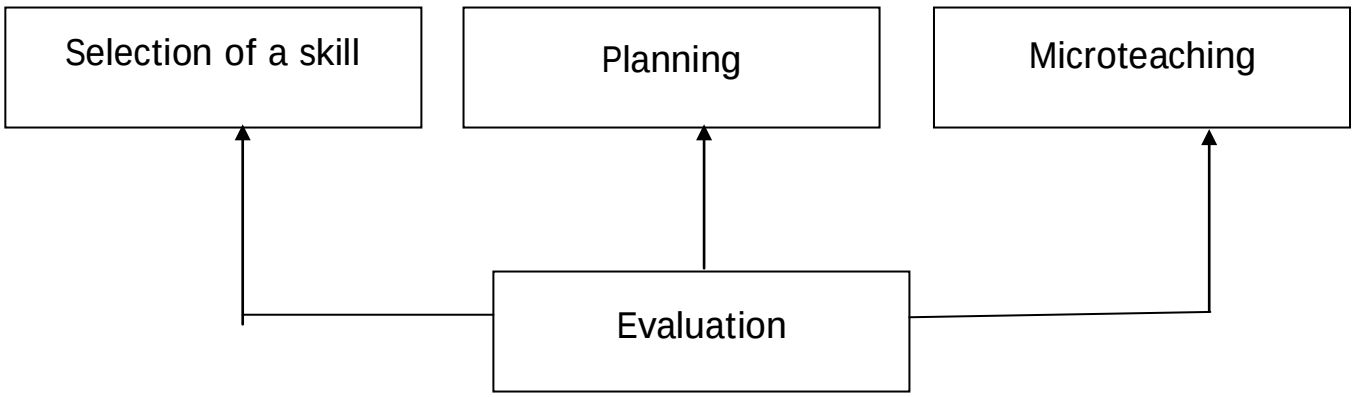
aimed at enhancing teachers' exposure and professional competence.

It was first developed in 1963 by Doright Allen, Frederick McDonald and Associates at Standford University, USA with the aim of improving the quality of teacher training and service delivery (Abifarin, 2004; Adewoyin, 2009 and Federal Ministry of Education, 2007). Microteaching is an invaluable clinical teaching experience that exposes teachers to the complexities of teaching by providing safe, interactive and fun environment they need to observe, interact, criticize and acquire skills of teaching (Al Methan, 2003; Karthagen, Loughrane and Rusell, 2006). The steps involved in microteaching include: selecting specific learning tasks, planning, teaching and evaluation as represented in the diagram below:



Microteaching cycle/process
(Source: Adewoyin, 2007:148)

The main essence of microteaching is to inculcate the values of reflective practice (Bento-Kuppa, 2001). And this enables trainees have an objective appraisal of themselves for the pupose of self-improvement and sustained professional growth (Adewoyin, 2007).

However, one thing that adds glamour to and makes the evaluation process more objective, highly reflective, realistic and more practical is the integration of video technology into microteaching. Heinich, Molenda, Russell and Smaldino (2002) describe video as any electronic media format that employs motion pictures to present a message. With the aid of a video machine, all the instructional activities/actions during the microteaching sessions are captured, highlighted and later displayed and replayed for observation, comments and criticisms by both the supervising teacher, the student and colleagues. It further aids the teacher-trainee to sit back, watch and assess his strengths and weaknesses after teaching using reliable guidelines such as the Standford Teachers' Competence Appraisal Guide (STCAG). This guide shows, in a nutshell, what should be assessed during microteaching and how.

In the final analysis the trainee notes his weaknesses, makes corrections in subsequent teaching sessions and these promote the acquisition of the requisite skills and competences for sustained professional enhancement.

Video technology can be effectively integrated into microteaching first of all by replaying similar recorded videotaped demonstrations of others. This is to enable the trainee teachers take a cue and acquaint themselves with the video skill(s) to watch and take a cue from it before the actual commencement of his teaching. While teaching, every bit of action or inaction is captured for playback and evaluation. Together with their peers and instructors, the trainees critically evaluate their teaching session.

This study, therefore, examines the potency of video recordings/ technology in the appraisal of teacher-trainees microteaching encounter for self-improvement, gradual acquisition and perfection of requisite teaching skills before going on teaching practice and the actual practice.

a) The problem

Teacher preparation for proficiency is gradually but systematically achieved through series of curricula activities in the school setting. This calls for harmonization of courses in educational theory and practice. The first practical step is subjecting teachers in training into microteaching after which they go out on 8-10 weeks teaching practice. The application of video technology in microteaching sessions captures every bit of the teacher-trainees presentation as well as minimizes the usual student-student and student-teacher arguments over performance. And, the knowledge of immediate feedback provides opportunity for improvement. The issue then is to what extent would the use of video technology enhance the objective appraisal of

teachers-in-making during this scaled down teaching encounter for sustained quality service delivery.

b) Purpose of study

The purpose of this study is to examine the effectiveness of video-technology in the appraisal of the performance of teacher-trainees for enhanced professional growth and development.

c) Research questions

The following research questions were generated to guide the study.

1. What is the relationship between the use of video technology and self-appraisal of teacher-trainees in microteaching?
2. Would the use of video technology have any significant difference between male and female teacher-trainees performance in microteaching?

d) Research hypotheses

This study is based on the following hypotheses.

1. There is no significant relationship between the use of video technology and pre-service teachers' self-appraisal.
2. There is no significant difference of the effect of use of video technology in microteaching for self-appraisal between male and female teacher trainees.

e) Methodology

Research design

The study is a quasi-experimental research using 100 students.

f) Population

The population of the study consisted of the 2007/2008 third year education students of Cross River University of Technology numbering 216. Who were engaged in teaching practice as a semester course requirement.

g) Sample/sampling technique

The researchers randomly selected 100 students, 50 each from the Departments of Primary Education (20 males and 30 females) and Educational Administration (27 males and 23 females). A toss of the Manchester United keyholder was used as the sampling technique in assigning the primary education students into the experimental class while those of Educational Administration as the control group.

h) Instrumentation

A ten-item Teacher-Trainee Affective Response Questionnaire (TARQ) was the only instrument used for data collection. It was developed on a four-point Likert-scale and administered to both the experimental and the control students. The contents of the questionnaire mostly covered issues like meaning of microteaching, microteaching skills and the use of video technology.

i) Validation of instrument

In order to ensure the face and content validity of the research instrument it was vetted by four experts (three in measurement and evaluation and one in curriculum and teaching) all of the University of Calabar.

j) Reliability of instrument

The Pearson product moment correlation coefficient was used in calculating the reliability index of the ten teacher-trainee affective response questionnaire and a reliability index of 0.80 was obtained.

k) Administration of instrument

The Teacher-Trainee Affective Response Questionnaire (TTARQ) was administered on the 100 teacher-trainees in both the experimental and control classes and analyzed using Pearson product moment correlational statistics and independent t-test respe-ctively for ho_1 and ho_2.

l) Results and discussion

The results of the study are presented hypothesis by hypothesis as follows:

Hypothesis one

This hypothesis states that there is no significant relationship between the use of video technology and pre-service teachers' self-appraisal. To test this hypothesis, data obtained from the questionnaire was analyzed using Pearson product moment correlation and the result as presented in the table below.

Table 1 : Analysis of the relationship between the use of video technology and pre-service teachers' self appraisal during microteaching (N=100)

	$\frac{\sum x}{\sum y}$	$\frac{\sum x^2}{\sum x^2}$	$\sum xy$	r-cal
Use of video technology	1221	257985	245956	0.99*
Pre-service teacher self-appraisal	1191	238283		

*Significant at .05; df=98; critical r=.195

From the result presented in Table 1 above, the data collected for hypothesis one were summed up under (X) and (Y) respectively. The calculated r-value of 0.99 compared to the critical r of .195 shows a significant high relationship between the use of video technology and self-appraisal for professional growth of teacher trainees. Hence the null hypothesis was rejected in favour of the alternate.

Hypothesis two

This hypothesis states that there is no significant difference of the effect of use of video

technology in microteaching for self-appraisal between male and female teacher trainees. The result is presented below in Table 2 below.

Table 2 : Independent t-test analysis of influence of video technology on male and female teacher-trainees' self-appraisal

Gender	N	$\bar{X}$	SD	t-cal	r-crit
Male	50	2.4	0.5	1	2.0
Female	50	2.39	0.5		

*Significant at .05 level; df=98; critical r=.195

From the analysis in the table above, the calculated t-value of 1 is lower than the critical t-value of 2.0, meaning that there is no significant difference between the effect of use of video technology on self-appraisal of male and female teacher trainees. Hence the null hypothesis is accepted.

As earlier noted, when video technology is integrated into microteaching sessions it will captivate the interest of teacher trainees. Besides, the use of this technology captures wholesale every action during microteaching for replay to enable the micro-teacher appraise and evaluate his/her performance. This agrees with the view of Eddie (2001), that videotape recordings of microteaching sessions is a necessary requirement for the stimulation of self-reflection for the student-teacher during microteaching. Esiobu and Maduekwe (2008) assertion further corroborates the findings of the study that the use of multi-media in the recording of microteaching performance is one of the most effective strategies that enhances the benefits of interaction and reflection, and provides student teachers and instructors the opportunity to review lessons taught, make observations as well as provide feedback and constructive criticisms.

The result of the second hypothesis also shows that there is no differential effect of the use of video technology during microteaching between male and female teacher trainees. This finding contradicts Abonyi and Eze (2007) who maintain that some instructional resources have been found to be gender sensitive. The use of this device to capture the activities of microteaching has a salutary effect in terms of promoting users' interest as well as enhancing their self-appraisal/evaluation, gender not withstanding. This means that both male and female teacher trainees benefit maximally from the use of video technology especially in assessing their performances for enhanced professional growth development.

II. Conclusion and Recommendations

Teacher grooming for his professional calling demands quality preparation. Teachers must be exposed to the nitty-gritty of their career by undergoing series of training and induction of which microteaching happens to be the first practical step towards teacher preparation. Incorporating video technology in microteaching session would heighten participants' interest and afford them ample opportunity to assess their performance exactly as it is without a modicum of doubt.

Therefore, institutions statutorily committed to the training of teachers should ensure that attention – compelling instruction devices like video machines, closed circuit television etc are procured and effectively utilized during micro-teaching to capture the actions and inactions of those involved and thus minimize, to the barest degree, unnecessary arguments among instructors, teacher trainees and peers.

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Investigation on the Sensitivity of Optical Fiber Sensors, for Pressure Sensing, Based on the OTDR Technique

By Lhaten & Rosly Adb Rahman
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Abstract- Most researches have been done for past few decades on distributed sensor and also fabricating the fibre optic to make sensor to detect vibration, cracks on the building and environmental factors. Due to the fact that fibre optic sensors are small, electrically isolated and immune to electromagnetic fields, they are an adequate choice to incorporate into the composite material designs. In this study, the transmission losses due to pressure on an optical fiber to determine the pressure sensitivity were investigated using a commercial optical time domain reflectometer (OTDR). A multimode optical fiber (50/125) was subjected to pressure using various mass in the range of 500 g to 2000 g at 25 m and 50 m from the end of the fiber. The mass was placed on the fiber using microbend test rigs.

Keywords: transmission loss, pressure sensitivity, optical fiber, micro bending, sensor, optical time domain reflectometer.

GJCST-G Classification: J.0

Investigation on the Sensitivity of Optical Fiber Sensors, for Pressure Sensing, Based on the OTDR Technique

Lhaten [α] & Rosly Adb Rahman [σ]

Abstract- Most researches have been done for past few decades on distributed sensor and also fabricating the fibre optic to make sensor to detect vibration, cracks on the building and environmental factors. Due to the fact that fibre optic sensors are small, electrically isolated and immune to electromagnetic fields, they are an adequate choice to incorporate into the composite material designs. In this study, the transmission losses due to pressure on an optical fiber to determine the pressure sensitivity were investigated using a commercial optical time domain reflectometer (OTDR). A multimode optical fiber (50/125) was subjected to pressure using various mass in the range of 500 g to 2000 g at 25 m and 50 m from the end of the fiber. The mass was placed on the fiber using microbend test rigs. The sensor with an area 910 x 10^{-6} m^2 with corrugation periodicity 2 mm for sensor I and 1.6 mm for sensor II was constructed. The Optical signal of 1300 nm from the OTDR was transmitted along a fiber of length of 1173.5 m. The optical output is analyzed using OTDR Trace Viewer 4.1 and the transmission losses were determined by two point loss and combination loss methods. The transmission loss increases with increase in pressure and increases with increase in sensor placement from the end of an optical fiber towards the transmitter. The sensor sensitivity remain constant at 25 m and 50 m determined by two point loss method with the value of 3 x10^{-4} dB/Pa for sensor I and 4 x 10^{-4} dB/Pa for sensor II. However the sensor sensitivity increases to 5 x 10^{-4} dB/Pa for sensor I and to 11 x 10^{-4} dB/Pa for sensor II when sensors were placed at 50 m. Therefore, the sensor II is more sensitive than I due to more microbendings.

Keywords: transmission loss, pressure sensitivity, optical fiber, micro bending, sensor, optical time domain reflectometer.

I. Introduction

An optical fibre sensing system is basically composed of a light source, optical fibre; a sensing element or transducer and a detector. The principle of operation of a fibre sensor is that the transducer or the microbender modulates some parameter of the optical system (intensity, wavelength, polarization, phase, etc.) which gives rise to a change in the characteristics of the optical signal received at the detector[1].Thus the output signal is characterize by OTDR.

OTDR is one of the versatile human built intelligence devices which operate to detect the fibre length, attenuation or loss through different events, so that easy location of the fault, installation, maintenance and restoration works can be done.

Basically when a light is sent through the glass fibre link, some of the light is reflected back to the transmitter and this reflected light is used to calculate the attenuation of the fibre, the characteristic of loss and the length of the fibre.

The optical fibre is a sensor to the surrounding environment like strain, pressure and temperature. The transmission loss due to microbend on an optical fiber as a result of pressure on it, gives the characteristic of sensor sensitivity. Sensor based on microbends loss in optical fiber were first demonstrated in 1980 and become indispensable factors in the field of optical research over 40 years and for the industrial and engineering applications [2 3 4] even though the studied was done as early as 1974 by Marus assuming the perturbation theory . The microbend is the mechanical perturbation of the multimode fibre waveguide causes a redistribution of light power among the many modes in the fibre. The more severe the mechanical perturbation or bending, the more light is coupled to radiation modes is loss [5]. The bending effect can be enhanced by squeezing the fiber between a set of corrugated plates or tooth blocks. The pressure that is exerted on the fibre through deformer, the mode coupling takes place, resulting in the formation of notches and thus loss in transmission there will be change in output signal due to change in light properties form the basis of fibre optic sensing.[2 6]. When the pressure on the fibre is released, mode coupling no longer occurs; the transmission of the fibre returns to its initial spectrum [7].

Depending on the application, fibre may be used because of its small size, or the fact that no electrical power is needed at the remote location, or because many sensors can be multiplexed along the length of a fibre by using different wavelengths of light for each sensor, or by sensing the time delay as light passes along the fibre through each sensor. Time delay can be determined using a device such as an optical time-domain reflectometer.

The microbends to the fibre can be created in many ways, like use of test rig, sand paper test and wounding the fibre around the cylindrical objects. These causes the deformation on the fibre and the losses can

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be calculated when the fibre is exposed to the action of a periodically repeated microbending [8]. Optical fibre, being a physical medium, is subjected to perturbation of one kind or the other at all times. Therefore, it experiences geometrical (size, shape) and optical (refractive index, mode conversion) changes to a larger or lesser extent depending upon the nature and the magnitude of the perturbation[9]

Pressure on the optical fibre introduces a bend at the point where it's applied which lead to signal degradation as a result of losing some power. Also external pressures push core and the cladding together, creating tiny bending in the fibre whereby the causes attenuation[10]. Therefore when the light pulse travel through the fibre the frequency, amplitude and the waves of light changes due to these perturbations. Thus the fibre optic sense, the response to external influences, where by resulting change in optical radiation can be used as a measure of the external perturbation. It serves as a transducer and converts measurements data like temperature, stress, strain, pressure, rotation or electric and magnetic currents into a corresponding change in the optical radiation.

Microbend losses are caused by small discontinuities or imperfections in the fibre too. Uneven coating applications and improper cabling procedures increase microbend loss. External forces are also a source of microbends. An external force deforms the cabled jacket surrounding the fibre but causes only a small bend in the fibre. Microbends change the path that propagating modes take,

The literature indicated that multimode fiber which was perturbated for 1 m along the fiber with varied tooth spacing (corrugation periodicity) and diameter of pin, the attenuation (dB) is increasing exponentially with regard to applied pressure[11] [12] and linear with length and linearly with applied pressure in single mode fiber [13] and the loss is greater when the sensor is far away rather at short distance.[11]. With the tooth spacing (Λ) of 1.5 mm and displacement of the deformer with 15 μm to 50 μm shows linear variation between the transmission and displacement with sensitivity of 0.15dB/μm. However the the sensitivity is maximum with corrugation periodicity 3.5 mm [14]

The transmission of the light is limited by 6 kg mass and it's below 0% for single mode step index fiber [12] and 7.7 kg[8]. The maximum pressure up to 1.6 MPa can be hold by the fiber where after that it breaks and with spatial periodicity Λ = 4.5 mm. The sensitivity in microbending can was defined as the slope of the curve between the output intensity and the pressure where there is decrease of output intensity with increase in pressure[15]. The slope was been calculated for different ranges of pressure and then the average has taken to calculate the average sensitivity and the average sensitivity of the sensor was 5.3/MPa on the arbitrary scale[5]. The sensitivity not only depends on the external pressure on the fiber by the microbends but also the tooth spacing.

II. Experimental

a) Construction of sensors

The test rig mainly refers to pressure transducer and can be called as pressure sensor which can be designed in different ways. Basically for this study, two sensors (as shown in the Figure 2.1 and 2.2) with different periodicity were designed. The ruler 35 mm by 24 mm were used and homogeneous metal wires were placed on both the plates with uniform corrugation periodicity. These will create uniform deformation over the fiber and can have uniform micro bending for certain length on fiber.

Specification of the sensor I

1. Material used: Al wire
2. Diameter of the wire: 1.03 mm
3. Area of the test rig: 35 mm x 26 mm= 910 mm^2 = 910x10^{-6} m^2
4. Corrugation periodicity Λ= 2.05 mm and x = 1.02 mm
5. Weight of test rig (upper plate) = 3.14 gm

Specification of the sensor II

1. Material used: nicrome wire
2. Diameter of the wire: 0.55 mm
3. Area of the test rig: 35 mm x 26 mm= 910 mm^2 = 9.10x10^{-6} m^2
4. Corrugation periodicity Λ= 1.6 mm and x = 0.80 mm
5. Weight of test rig (upper plate) = 2.09 gm

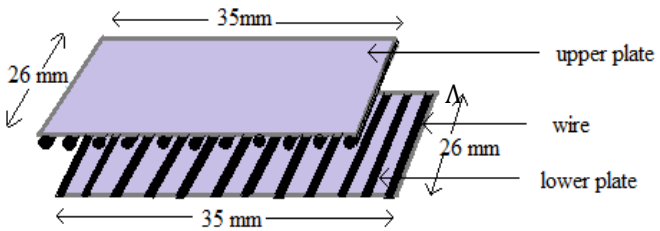

Figure 1 : Microbend pressure sensor.

b) Experimental set up

To do this research, a commercial OTDR, multimode fibre 50/125, sensor I with Λ = 2 mm and sensor II with Λ= 1.6 mm of same area 910 x10^{-6} m^2, some weight ranging from gram to kilogram were used to exert the pressure on the fibre. The test rig or sensors were placed on the fiber at distance (d) equals to 25 m and 50 m from the end of the fiber as shown in the Figure 2.

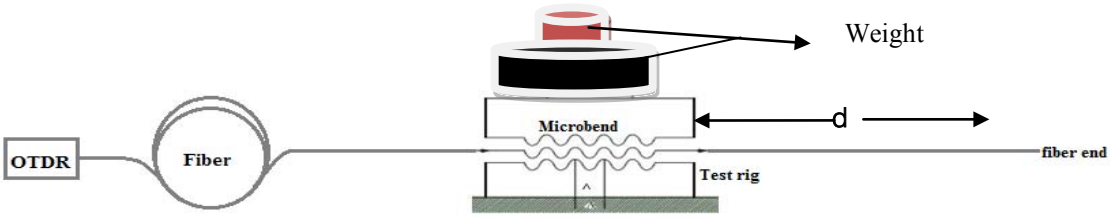

Figure 3 : Experimental set up

The experiment was carried out by placing the sensors at distance d m (25 m and 50 m) away from the end of the fiber. The weight ranging from 500 gm till 2000 gm was placed over the sensors in which the fiber was sandwiched between the corrugated plates causing the microbends.

c) Analysing Methods/Measurements

The trace displayed on the OTDR was used to measure transmission loss by two point loss and combination loss methods for both the sensors.

The two points refer to the the distance between marker A an B as indicated in the Figure 4 where the markers were placed on either end of the section of fiber to be studied. For this study the marker A was placed at the abrupt change in the graph where maximum loss occurs and marker B, 20 m away from marker A. The ODTR determines the loss between the two markers and record the distance. It will also read the difference between the lower levels of the two points where the markers cross the trace and calculated the losses between these two points the called two point loss.

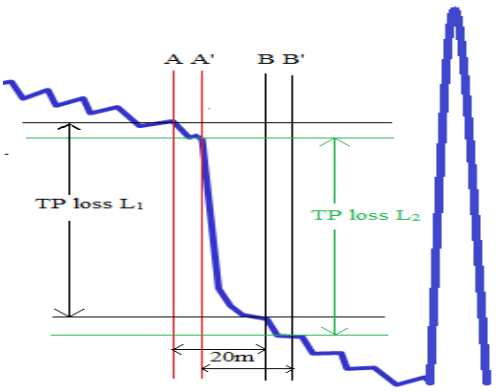

Figure 4 : Two point loss

The combination loss is the total loss of the microbend loss that happens due to sensor placed at certain distance from the end of an optical fiber, and the fiber loss here after the sensor. (Combination loss = Microbend loss + fiber Loss)

The combination loss is obtained by placing the marker A at the point where the sensor is placed and marker B at the end reflectance. The distance between marker A and B indicates the distance of sensor from end of the fiber.

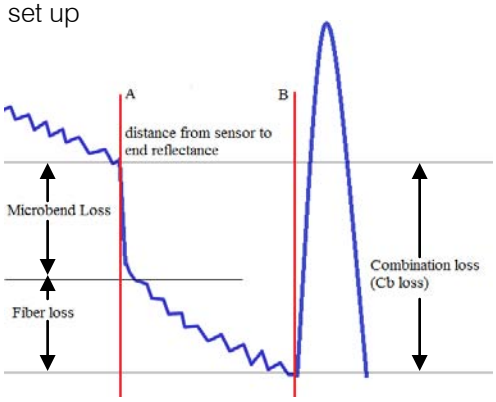

Figure 5 : Combination loss

III. Result and Discussion

The transmission loss determined by two point loss and combination loss methods when the sensors were placed at 25 and 50 m is presented in Table 1. The uncertainty in the position of markers to determine the transmission loss was ±0.05 m with an uncertainty in transmission loss of ± 0.46 dB was obtained when the pressure in order of 10^3 Pa was applied.

When the sensors were at 25 m, the transmission loss obtained by two methods increases abruptly from 16.18 x 10^3 Pa on wards for sensor I. Therefore, the greater loss is observed only at higher pressure. The similar observation was also noted for sensor II for TPL. However, the transmission loss determined by combination loss method for sensor II increases from 10.79 x 10^3 Pa. The greater loss was observed bit at lower pressure than loss observed at higher pressure. This is fact due to more number of microbendings and more mode couplings of propagating signals took place.

Table 1 : The transmission loss determined by the two point loss (TPL) and combination loss (CbL) methods.

Dist.	25 m				50 m			
	S (I) dB		S (II) dB		S (I) dB		S (II) dB	
P x 10^3 (Pa)	TPL	CbL	TPL	CbL	TPL	CbL	TPL	CbL
5.42	1.27	1.13	1.19	1.36	0.72	1.13	4.68	3.30
10.79	1.69	1.60	1.69	5.10	2.25	3.50	4.51	4.48
16.18	5.01	4.87	4.64	6.50	3.47	4.46	6.78	14.20
21.56	5.09	5.93	6.78	7.24	6.43	9.51	11.6	20.20

The average slope of transmission loss as a function of pressure determines the sensor sensitivity. The sensor sensitivity determined by two point loss and combination loss methods for sensor I and II at 25 m and 50 m are tabulated in Table 2 for further discussion.

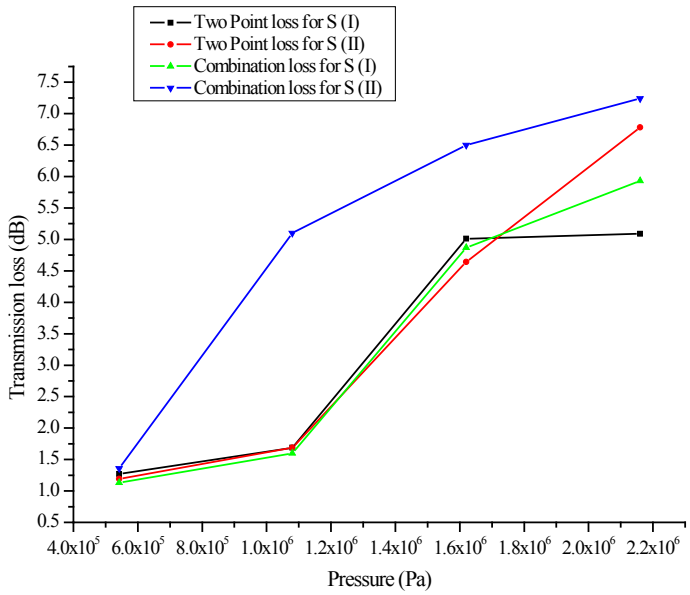

Figure 6 : Transmission loss as a function of pressure determined by TPL and CbL methods when the sensor was placed at 25 m

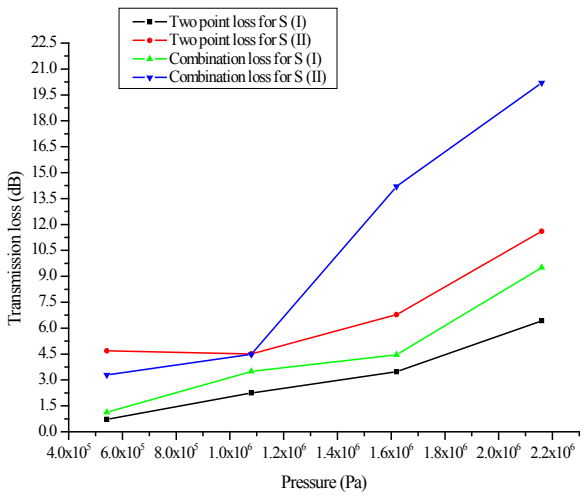

Figure 7 : Transmission loss as a function of pressure determined by TPL and CbL methods when the sensor was placed at 50 m

Table 2 : Sensor sensitivity for sensor I and II, determined as an average slope from Figure 6 and 7

Distance	25 m		50 m	
Method	S I db/Pa (10^{-4})	S II dB/Pa (10^{-4})	S Idb/Pa (10^{-4})	S II dB/Pa (10^{-4})
TPL	3	4	3	4
Cb L	3	4	5	11

Table 2 gives vivid information on variation of sensor sensitivity with regard to sensors location. The sensitivity determined by two point loss method remains constant despite of change in sensor location. However, the sensitivity determined by combination loss method increases with increase in sensor location.

IV. Conclusion

The transmission loss determined by two point, least square fit and combination methods are comparatively greater for the sensor II than sensor I.

This proved to be true since the sensor II has a low corrugation periodicity (1.6 mm) and can create 16 microbends much greater than sensor I which has 2 mm that creates 11 microbends. The microbend is one of the main factors that lead to transmission loss in light power. The losses also increase with increase in pressure and sensor location from the end of the fiber.

As shown in the Table 2, the sensor sensitivity for sensor II is a bit higher (11 x 10^{-4} dB/Pa) than sensor I (5 x 10^{-4} dB/Pa) and this basically prove that sensor II is more sensitive than sensor I. The sensitivity also increases with increase in length of sensor placement from the end of fiber for combination loss method.

Therefore, we can conclude that the sensor will be more effective if the sensor have fine and low corrugation periodicity to create microbends at the particular location. Although difficult to mathematically model, the study have shown that the concept of overlapping multimode fiber optical cables to create microbends can be used as weight sensor and that depending overlapping pattern once a threshold weight is suppressed that the rate of change $\Delta T/\Delta F$ is linear. After this study it is believe that the microbending concept has great potential to be utilized as a weight/pressure sensor in real world application.

V. Future Recommendation

The determination of pressure sensitivity of an optical fiber was carried out with two point loss, least square fit loss and combination loss methods, these methods need to be further confirmed through repeated research; the right way to determine the pressure sensitivity and the relation of increasing loss with increasing the distance of sensor placement from the end.

There are also, two point attenuation correlation, dB/km loss and dB/Km LSA loss method to determine the pressure sensitivity of an optical fiber and confirm the above findings. Further the designing of sensor too could be refined.

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Proofs must be returned to the dean at dean@globaljournals.org within three days of receipt.

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The Global Journals Inc. (US) are enclosed by our publishing's Early View service. Early View articles are complete full-text articles sent in advance of their publication. Early View articles are absolute and final. They have been completely reviewed, revised and edited for publication, and the authors' final corrections have been incorporated. Because they are in final form, no changes can be made after sending them. The nature of Early View articles means that they do not yet have volume, issue or page numbers, so Early View articles cannot be cited in the conventional way.

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

3. Think Like Evaluators: If you are in a confusion or getting demotivated that your paper will be accepted by evaluators or not, then think and try to evaluate your paper like an Evaluator. Try to understand that what an evaluator wants in your research paper and automatically you will have your answer.

4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

5. Ask your Guides: If you are having any difficulty in your research, then do not hesitate to share your difficulty to your guide (if you have any). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work then ask the supervisor to help you with the alternative. He might also provide you the list of essential readings.

6. Use of computer is recommended: As you are doing research in the field of Computer Science, then this point is quite obvious.

7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

8. Use the Internet for help: An excellent start for your paper can be by using the Google. It is an excellent search engine, where you can have your doubts resolved. You may also read some answers for the frequent question how to write my research paper or find model research paper. From the internet library you can download books. If you have all required books make important reading selecting and analyzing the specified information. Then put together research paper sketch out.

9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

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- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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