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KNOWLEDGE AND ATTITUDES AMONG SRI LANKAN PRE-INTERN DOCTORS ON NUTRITIONAL ASSESSMENT AND COUNSELING

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ABSTRACT

Nutritional assessment and counselling are core clinical skills of a doctor. Our objective was to describe the knowledge and attitudes on nutritional assessment and counselling among pre-intern doctors of Sri Lanka. A descriptive cross sectional study was conducted from August to October 2016. All the pre-intern doctors of Sri Lanka participating in the Good Intern Program 2016 were invited for the study. An online self-administered questionnaire was used. Knowledge and attitudes on nutrition were measured using a validated modified 17-item Nutrition in Patient Care Survey questionnaire. All analyses were conducted on SPSS version 22 with a priori alpha of .05. Of 616 respondents, 57.8% (n=356) were females. The mean age was 26.2±0.8 years. Forty four (7.1%) had participated in some kind of special projects in nutrition. A total of 317 (51.5%) had close friends/relatives with a medical condition which needed greater than normal attention to nutrition. Median knowledge score was 65% (IQR=58%–73%). Median positive attitudes score was 65% (IQR=60%–70%). Although 68.7% (n=423) agreed that nutritional assessment should be included in any routine consultation, 80.8% (n=498) agreed that most pre-intern doctors are not adequately trained to discuss nutrition issues with patients. Spearman's rank correlation coefficient test found a positive correlation between positive attitudes and self-reported knowledge (r_s=.204, n=616, p<.0001). Mann Whitney U tests did not show significant differences of knowledge or attitudes depending on sex (p>.05). Those who participated in some kind of special projects in nutrition had a higher knowledge (U=9499.5, p=.007, r=0.109) and attitudes (U=9267.0, p=.003, r=0.120) scores. Those who had a close friend/relative with a medical condition which needed greater than normal attention to nutrition had higher attitude scores (U=42099.0, p=.014, r=0.099), but there was no significant difference in the knowledge scores (U=43726.0, p=0.096, r=0.067). The internal consistency of the scale (Cronbach's alpha) was 0.82. In conclusion, perceived knowledge and positive attitudes on nutritional assessment and counselling are inadequate among pre-intern doctors.

KEYWORDS: *Nutrition, doctors, self-perceived, counselling, knowledge, attitudes*

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1 INTRODUCTION

Nutritional assessment and counselling are core clinical skills expected from a medical graduate. Preparing health care professionals to manage nutritional needs of a patient is an important objective in any undergraduate medical curriculum. However, there is relatively little information available on knowledge and attitudes on nutrition related issues among intern medical doctors who are the first contacts of the patients. Since there are regional variations among nutritional needs and practices, it is important to assess the knowledge in a National context based on National policies and guidelines. The purpose of this study was to describe the knowledge and attitudes on nutritional assessment and counselling among pre-intern doctors of Sri Lanka.

2 METHODOLOGY

A descriptive cross sectional study was conducted among Sri Lankan doctors who are awaiting internship in 2016. This was conducted in accordance with the guidelines set forth by the Declaration of Helsinky. All the pre-intern doctors were invited to participate in the study via electronic mails and social media. Data were collected from August to October 2016 using an online self-administered questionnaire. The questionnaire consisted of two sections. The section one was used to collect socio-demographic data. Whether the doctors had participated in special projects on nutrition during undergraduate years or after graduation and if they had close friends/family members with medical problems that need greater than average attention to nutrition were recorded since they were potential confounders of the study. Self-perceived knowledge and attitudes on nutrition were measured in the section two using a modified version of Nutrition in Patient Care Survey questionnaire (McGaghie et al., 2001). This consisted of 15-items (11 items for knowledge; 4 items for attitudes) measured on a five point Likert scale (1=strongly disagree to 5=strongly agree). Face validation of this scale was achieved by a panel of experts and a psychometrician. The instrument was pilot tested on 88 final year medical students who have completed their undergraduate curricula. The survey was revised based on the results of the original Principal Component Analysis and internal consistency (as measured by Cronbach's alpha). Standard descriptive statistics were used to describe the knowledge and attitudes of the population. Non-parametric tests were used to examine the relationships between knowledge, attitudes and their determinants. All statistical analyses were performed on SPSS version-22 with a priori alpha of .05.

3 RESULTS

Of 737 invited pre-intern doctors, 616 responded. The positive response rate was 83.6%. Of 616 respondents, 57.8% (n=356) were females and 42.2% (n=260) were males. The mean age was 26.2±0.8 years. The sample was comprised of 124 (20.1%) foreign graduates and the graduates from all nine state Universities: University of Colombo (19.6%, n=121), University of Sri Jayewardenepura (13.6%, n=84), University of Kelaniya (13.1%, n=81), University of Rajarata (11.5%, n=71), University of Ruhuna (8.1%, n=50), University of Peradeniya (6.2%, n=38), Kotelawala Defence University (3.6%, n=22), Eastern University (3.4%, n=21) and University of Jaffna (6.0%, n=4). Forty four (7.1%) had participated in some kind of special projects in nutrition. Majority (68.2%, n=30) of them were electives, of which all were regarding a specific component of nutrition (e.g. nutrition among patients with inflammatory bowel disease, nutrition among patients with diabetes mellitus, common misconceptions regarding breast feeding, perceptions among parents on complementary feeding). Four (9.1%) had completed online courses which had inputs on nutrition in specific diseases (e.g.: diabetes mellitus). Forty-three (47.8%) had close friends/relatives with a medical condition which needed greater than normal attention to nutrition. A total of 317 (51.5%) had close friends/relatives with a medical condition which needed greater than normal attention to nutrition. Of them, the majority (74.8%, n=237) had diabetes.

Median knowledge score was 65% (IQR = 58% – 73%). Median positive attitudes score was 65% (IQR

= 60% – 70%). Although 68.7% (n=423) agreed that nutritional assessment should be included in any routine consultation, 80.8% (n=498) agreed that most pre-intern doctors are not adequately trained to discuss nutrition issues with patients. There were substantial variations in knowledge among closely related topics. Pre-intern doctors perceived that there were deficiencies in their knowledge on areas such as the amount of calories in a tea-spoon of oil, providing examples of serving sizes of meat and vegetables according to Food based Dietary Guidelines, providing dietary advice to a patient who underwent total gastrectomy and prescribing a diet suitable to a patient with hepatic encephalopathy. Students' perceived self-efficacy was high in advising a mother regarding the correct technique of breast feeding and providing dietary advices to a newly diagnosed patient with diabetes.

The distributions of the knowledge and attitudes scores were examined for the normality. The knowledge score had a skewness of -0.372 (SE=0.098), kurtosis of -0.137 (SE=0.197) and the Shapiro Wilk test= .981 (df=616, $p<.0001$). The attitudes score had a skewness of 0.113 (SE=0.098), kurtosis of 1.068 (SE=0.197) and the Shapiro Wilk test= .950 (df=616, $p<.0001$).

The relationship between the knowledge and attitudes scores was investigated using the Spearman's rank correlation coefficient. There was a strong, positive correlation between the two variables, (r_s=.204, n=616, $p<.0001$), with high levels of knowledge on nutrition associated with positive attitudes on nutrition. Mann-Whitney U tests were conducted to examine if there were significant differences of knowledge and attitudes depending on sex, participating in some kind of special projects in nutrition, or having a close friend/relative with a medical condition which needed greater than normal attention to nutrition. There were no significant differences in the knowledge scores of males (median=63, n=260) and females (median=65, n=356), p=.984). No statistically significant differences in attitudes were found between males (median=66, n=260) and females (median=64, n=356), p=.725). Knowledge levels were not significantly different between those who had a close friend/relative with a medical condition which needed greater than normal attention to nutrition (median=65.5%, n=317) and to those who did not have (median=65.5%, n=299), (U=43726.0, p=0.096, r=0.067). But those who had such friend/relative showed more positive attitudes on nutrition (median=65.0%, n=317) when compared with those who did not have (median=65.0%, n=299), (U=42099.0, p=.014, r=0.099). Subjects with prior experience in special projects on nutrition had significantly higher knowledge scores (median=70.9%, n=572) compared to those who were not involved in such projects (median=65.5%, n=44), (U=9499.5, p=.007, r=0.109). Similarly those who had involved in special projects on nutrition had higher positive attitudes (median=70.0%, n=572) compared to those who had not had such experience (median=65.0%,n=44), (U=9267.0, p=.003, r=0.120). The internal consistency of the scale (as measured by Cronbach's alpha) was 0.82.

4 DISCUSSION

This descriptive cross-sectional study intended to assess the perceived self-efficacy and attitudes towards nutritional assessment in various disciplines of medicine among doctors awaiting internship. We found that a considerable proportion of doctors (35%) believe that they are not adequately knowledgeable and skilled in conducting a nutritional assessment and counselling on a routine patient encounter. A similar proportion (35%) has predominantly negative attitudes towards nutritional assessment and counselling.

A descriptive cross sectional study conducted among 528 senior medical students from nine Universities of Taiwan (Hu et al., 1997a) concluded that there is a necessity of improving knowledge and attitudes among medical students towards nutrition. They assessed the knowledge on general and clinical nutrition and the median scores were 59.9% and 51.5%. The positive attitude score of the study was 66.7% which is comparable to our study (65%). The same authors conducted a similar research to assess the knowledge, attitudes and practices related to nutrition among primary care physicians in Taiwan (Hu et al., 1997b). In comparison to the study

conducted among students, the doctors demonstrated a better knowledge (59.9%) and attitudes towards nutrition despite variations observed among each component of the nutrition assessed. The knowledge on general nutrition was better than on the clinical nutrition components. In contrast to the regional studies, the physicians in other countries showed an increased awareness and better attitudes regarding nutrition. An American study conducted among 292 physicians (Krause and Fox, 1977) showed a better knowledge score (65%) and favourable attitudes towards nutrition. A national survey among 3416 physicians in the United States (Levine et al., 1993) concluded that the study sample stated 82% positive attitude statements which exceed the positive attitude scores of regional studies. We found that there was a strong positive correlation between knowledge and attitudes scores (r_s=.204, n=616, p<.0001). This finding is consistent with the findings of a Taiwan study (Hu et al., 1997b) (r_s=.227, n=335, p<.0001). But there was no such correlation found between knowledge and attitudes in an American study (Krause and Fox, 1977).

A survey on nutrition in cancer conducted among medical students and physicians concluded that female physicians score better on nutritional knowledge questions (Cooper-Stephenson and Theologides, 1981). In contrast to that study, we found no differences in knowledge and attitudes between males and females. Knowledge and attitudes towards nutrition were significantly high among the doctors who participated in the special projects on nutrition. This cross sectional study could not assess the causal relationship whether this special nutrition related projects improve the knowledge and attitudes of the students or they score better because of their inherent enthusiasm towards medical nutrition.

The Cronbach's alpha of the scale we used in the present study was 0.82 demonstrating an excellent internal consistency. This exceeds the internal consistency values of the original Nutrition in Patient Care Survey (McGaghie et al., 2001) from which the present questionnaire is derived.

Self-perceived scores are influenced by non-test-relevant response determinants such as social desirability bias. This means some may respond in a favourable manner whereas some others may respond in a negative manner depending on their personality in a self-reported questionnaire. This overestimation or underestimation can be corrected by assessing social desirability using questionnaires and statistically controlling for the bias. A short version of the Malrowe-Crowne instrument (Reynolds, 1982) was used to assess the social desirability bias in the pilot study. The findings of the pilot study did not support the presence of social desirability bias (self-over-estimation) in students' reporting of knowledge and attitudes. Thus we did not include the social desirability scale in the present study.

5 CONCLUSIONS

Perceived self-efficacy and positive attitudes on nutritional assessment and counseling were inadequate among pre-intern doctors. Significantly high knowledge and attitudes were seen among the doctors who participated in the special projects on nutrition. Studies are necessary to find the strategies to enhance knowledge and attitudes among medical students on nutrition.

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REMOVAL OF MICROCYSTIN-LR USING CELLULAR EXTRACTS OF *Bacillus cereus*

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ABSTRACT

Microcystin –LR (MC-LR) is considered to be the most dominant type of cyanobacterial toxins present in water bodies. The present study focuses on using cellular extracts of Bacillus cereus in removal of MC-LR in water. Bacterial cell extracts were prepared using overnight grown fresh cultures of B. cereus which was previously recorded as a potent MC-LR degrading bacterium. Bacterial cell disruption was performed by bead beating on a micro-mini bead beater. Cell debris was removed by centrifugation at 13000 rpm, 20 min. Subsequently, a series of concentrations of cellular extract (100%, 75%, 50% and 25%) was prepared. These cell extracts were separately incubated at 280C with 100µg ml-1 of MC-LR for a period of 4 days. 1ml aliquots were removed at 24 hour intervals for four days and frozen at (-20) 0C. Then the frozen samples were freeze-dried and subjected to Photo diode array- High Performance Liquid Chromatography (PDA-HPLC) analysis to detect the remaining MC-LR concentrations of the samples. At the end of fourth day, 81.1 µgml-1 of MC-LR was removed when 100% of cell extract was used. When 75 % of cell extract was used, 77.6 µgml-1 of MC-LR removal was evident at the end of fourth day, whereas when 50 % and 25% of cell extract were used only 40.7 µgml-1 and 25.7 µgml-1 of MC-LR removal was detected respectively. The results of the present study indicate that bacterial cell extracts of B. cereus has the ability to remove MC-LR by an enzyme mediated mechanism.

KEYWORDS: *Microcystin-LR, Bacillus cereus, cellular extracts, PDA-HPLC*

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1 INTRODUCTION

Microcystins (MCs) are a family of monocyclic heptapeptide hepatotoxins produced by different genera of freshwater cyanobacteria including, *Microcystis, Anabaena, Oscillatoria (Planktothrix), Nostoc*, and *Anabaenopsis* (Sivonen and Jones, 1999, Chorus, 2001a). The molecular weight of MCs varies in the range of 909 to 1115 (Duy et al. 2000). The main structural variations in MCs are observed in the L-amino acid residues X and Y, which are indicated by a two-letter suffix in the name. There are more than 70 structural variants (congeners) of MCs identified so far (Codd et al. 2005a). Among, these variants Microcystin-LR (MC-LR) is considered as the most toxic variant (Fawell et al. 1993). Consumption of MC-LR contaminated water has resulted in hepatotoxic effects, renal damages, deformities in renal cell lines tumor promoting activities and DNA damage (Falconer *et al*. 1986., Ito *et al*. 1997, Dietrich and Hoeger, 2005). Therefore, the WHO has established a provisional guideline value for the concentration in drinking water of MC-LR as 1 µg l-1.

MCs are stable and recalcitrant to conventional water treatment (Lawton and Robertson, 1999). Ozonation, chlorination, reverse osmosis and photocatalytic degradation by TiO2 are used in many countries to treat MC-LR contaminated water. However, Jones and Orr (1994) recorded bioremediation of MC-LR by natural heterotrophic bacteria in environment by isolating a *Sphingomonas sp* which was capable of degrading MC-LR. To date over 30 bacterial strains are reported for efficient degradation of MCs and its variants (Idroos *et al* 2017, Manage *et al*. 2009a, 2009b) . Table 1 presents some of MC and Nodularin (NOD) degrading bacterial strains recorded in the world.

Table 1. Microcystin and nodularin degrading bacteria recorded in the world

Bacteria	Degradable analogous	Gene cluster	Gram Iden.	Reference
Sphingomonas sp. ACM-3962	MC-LR and –RR	*mlr*[a]	-ve	Bourne et al.(1996)
Novosphingobium sp. MD-1	MC-LR, -YR, and -RR	*mlrA*	-ve	Saitou et al. (2003)
Sphingosinicella microcystinivorans Y2	MC-LR, -RR, -YR, 6(Z)-Adda-LR	*mlrA*	-ve	Maruyama et al. (2003, 2006)
Sphingomonas sp. B9	MC-LR, -RR, dh-LR, LR-Cys, NOD	*mlrA*	-ve	Harada et al. (2004)
Sphingomonas sp. 7CY	MC-LR, -RR, -LY, -LW, -LF	NI	-ve	Ishii et al. (2004)
Paucibacter toxinivorans	MC-LR, MC-YR, NOD	NI	-ve	Rapala et al.(2005)
Sphingosinicella microcystinivorans B9	MC-LR, -RR	NI	-ve	Tsuji et al., (2006)
Sphingomonas sp. CBA4	MC-RR	NI	-ve	Valeria et al. (2006)
Sphingopyxis witflariensis LH21	MC-LA, MC-LR	*mlr*[a]	-ve	Ho et al. (2007)
Burkholderia sp.	MC-LR, [D-leu1]LR	*mlr*[a]	-ve	Lemes et al. (2008)
Sphingopyxis sp. C-1	MC-LR	*mlr*[a]	-ve	Okano et al. (2009)
Methylobacillus sp. J10	MC-LR, -RR	NI	-ve	Hu et al.(2009)
Arthrobacter sp. C6, F10,R1,R4,R9,R6,F7	MC-LR	NA	+ve	Manage et al. (2009b)
Brevibacterium sp. F3	MC-LR	NA	+ve	Manage et al. (2009b)
Rhodocoous sp. C1	MC-LR	NA	+ve	Manage et al. (2009b)
Stenotrophomonas sp. EMS	MC-LR, -RR	*mlrA*	-ve	Chen et al. (2010)
Sphingopyxris sp. USTB-05	MC-RR	NI	-ve	Zhang et al. (2010)
Bacillus sp. EMB	MC-LR, -RR	*mlrA*	+ve	Hu et al. (2012)
Bacillus sp.12GK	MC-LR,MC-RR,MC-LF,MC-LW,NOD	*mlr*[a]	+ve	Idroos et al. (2014)

Bacteria	Degradable analogous	Gene cluster	Gram Iden.	Reference
Stenotrphomonas maltophilia 4B4	MC-LR,MC-RR,MC-LF,MC-LW,NOD	*mlr*[a]	-ve	Idroos et al. (2014)
Rahnella aquatilis 13UL	MC-LR,MC-RR,MC-LF,MC-LW,NOD	*mlr*[a]	-ve	Idroos et al. (2014)

In the quest of exploring the potential of bacterial biodegradation of MCs, Bourne et al. (1996) identified and characterized a degradation pathway for MC-LR by Sphingomonas sp (Fig 1).

This bacterium was previously identified by Jones and Orr (1994) and shown to harbour specific MC degrading enzyme producing genes, namely, mlrA, mlrB and mlrC along with mlrD (oligopeptide transporter) in mlr gene cluster (Fig 2).

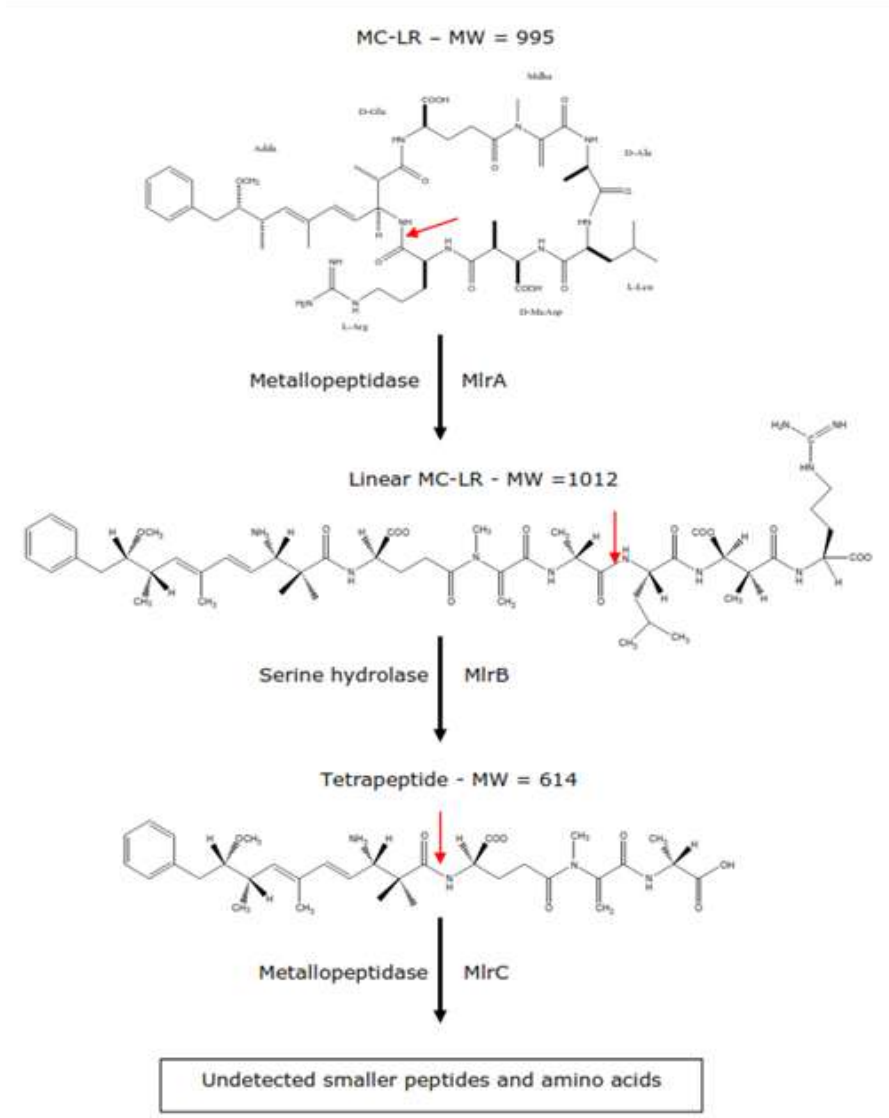


Figure 1: Proposed MC-LR degradation pathways by Bourne et al.1996

According to Bourne et al. (1996) MC degradation is carried out by four intracellular hydrolytic enzymes: Microcystinase- a putative metalloprotease (mlr A), a putative sereine peptidase 2 (*mlr* B), a putative metalloprotease 3 (*mlr* C) and a putative oligopeptide transporter which takes part in the uptake of MCs into the cell (*mlr* D).

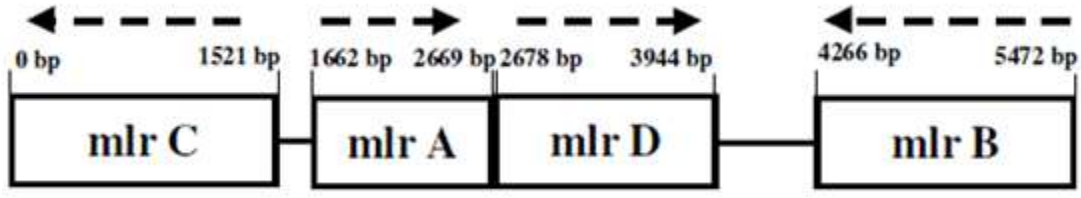


Figure 2: *mlr* gene clusters indicating the presence of *mlr*A, *mlr*B, *mlr*C and *mlr*D genes

Manage et al. (2010) and Nybome et al. (2012) suggested that if MCs are degraded enzymatically in the presence of probiotic bacteria, it is likely that proteolytic enzymes are involved in this process. Findings of Nybome et al. (2012) confirmed that extracellular proteinases of *Lactobacillus rhamnosus* are involved in the process of MC degradation. However, there is limited work done on utilizing of bacterial enzyme in degradation of MC-LR. Moreover, use of bacterial enzymes in bioremediation of MC-LR will help to overcome the inconvenience of maintaining bacterial biofilms in water treatment facilities.

KJ 954304 Bacillus cereus 12GK was isolated previously by authors from Girandurukotte reservoir, Sri Lanka as an efficient degrader of MC-LR (Idroos et al. 2014). However, there were no studies done on the MC-LR degrading mechanism of the bacterial strain. Therefore, the present study focuses elucidation of MC-LR removal mechanism of *B. cereus* and to utilize cellular extracts of the same strain in removing MC-LR in water.

2 MATERIALS AND METHODS

2.1 Chemicals

HPLC-grade Methanol, Milli-Q water, Acetonitrile (ACN), Trifluoroacetic acidacid (TFA) for HPLC analysis were purchased from Sigma, Aldrich. Microcystin-LR (MC-LR) standards were provided from Robert Gordon University, UK. Tryptone, Yeast extract, Sodium chloride, Bacteriological agar, phosphate buffer saline needed for bacteriological studies were purchased from Hardy diagnostics.

2.2 Extraction of MC-LR for studies

Surface scum samples collected from Beira Lake, Sri Lanka were filtered through 0.45 µm GF-C filters to retain cyanobacteria cells. The filter disk was extracted repeatedly (x2) in 80% HPLC grade methanol, rotary evaporated and the residue was reconstituted in 80% of HPLC grade methanol and transferred to HPLC vials.

2.3 Quantification of MC-LR and development of standard plots

Quantification of MC-LR was carried out using the PDA-HPLC system consisting of Agilent 1200 series. Sample volumes of 25 µL were injected into a 250 x 4.6 mm, C18 column at a flow rate of 1 mlmin-1. Two mobile phases were used for the gradient run (35% ACN/0.05% TFA and 65% Water/0.05% TFA). Concentrations of MC-LR were determined by calibration of the peak areas (at 238 nm) with that of an external standard. The HPLC method had a detection limit of 0.5 µgml-1. MC recoveries were greater than 95% with a relative precision of 10%.

A series of dilution ranging from 0.5-200 µg/ml of MC-LR was prepared using pure standards provided from the Cyano Solu lab in the Robert Gordon University, UK. These series were subjected to HPLC and peak areas were determined. Standard plots were developed by using the concentration of each toxin and the peak areas received (Fig 3).

2.4 Preparation of bacterial innocula

A loop of *B. cereus* pure culture was transferred into 5ml of liquid LB medium and incubated in a shaker (at 28 0C, 24 h, 150rpm). The exponentially growing bacterial culture was washed three times (x3) with an equal volume of 0.01 M Phosphate buffered Saline (PBS) by centrifugation at 3000 rpm for 15 min with re-suspension of the pellet in sterile 0.01 M PBS. The resulted pellet was re-suspended in 0.01M phosphate buffer saline solution (PBS) and kept overnight to let out residual carbon content. Then the suspension was centrifuged at 1000 rpm for 15 minutes and the pellet was washed three times using PBS. Optical density (OD) of bacterial suspension was equalized (A 590=0.35) using a spectrophotometer (SPECTRO UV-VIS double beam PC) by adding overnight grown bacterial cultures or by diluting with sterile 0.01 M PBS.

2.5 Elucidation of MC-LR degradation mechanism

Following equalizing the turbidities of bacterial strain at A 590=0.35, 0.5 µl of the bacterial suspension was inoculated into 100ml of filter sterile (0.2 µm) lake water (Beira lake) containing MC-LR at a final concentration of 5µg ml-1. Control sample was prepared without bacterial inoculation. All flasks were incubated at 28 °C and shaken at 100 rpm for 3 days.

Following three days of incubation 0.5ml sample aliquot was removed from both experimental and control flask and frozen at (-20 °C). Then 75ml of experimental sample was filtered under sterile conditions using 0.2 µm filter to remove bacterial cells. Then the filtrate was placed immediately in ice to prevent denature of enzymes.

10 ml of original sample was maintained as the positive control. A series of dilutions was prepared using the filtrate including:100%, 75%, 50% and 25% of MC-LR was spiked to positive control sample and each diluted medium at a final concentration of 5µgml-1and maintained at 28ºC, 100 rpm for 3 days. 1ml aliquot was removed from initial control sample and 100%, 75%, 50% and 25% of filtrate dilutions for 0-3 days of incubation. These samples were frozen and processed for HPLC analysis.

2.6 MC-LR removal by bacterial cellular extracts

Bacterial cell extracts were prepared using fresh cultures of *B. cereus*. Bacterial cell disruption was performed by bead beating on micro-mini bead beater (BIOSPEC, TP308, USA). Cell debris was removed by centrifugation (Biofuge A, 162816, Germany) at 13000 rpm, 20 min and the cell extract supernatant was diluted to prepare cell extracts of 100%, 75%, 50% and 25%.

These extracts were used for the MC-LR removal assays. MC-LR at a final concentration of 100 µgml-1 was introduced to 100%, 75%, 50% and 25% bacteria cell extracts. 1ml sample aliquots were removed continuously for four days and frozen at (-20) 0C. Then frozen samples were freeze-dried and subjected to High Performance Liquid Chromatography (HPLC) to detect the remaining MC-LR concentrations of the samples.

3 RESULTS AND DISCUSSION

MC-LR quantification was validated by the determination of the linearity of the calibration plot. Fig. 3 presents the calibration plots developed for MC-LR. Equation 1 was derived from the calibration plots and it was used in calculation of MC-LR concentrations in the degradation experiment. The regression value for calibration plot was 0.967.

MC-LR concentrations in samples were calculated using the following equation

$$C_{MC\text{-}LR} = (A - 51.12)/ 140.9 \quad (1)$$

Where,

A- Peak area (mAU)

$C_{MC\text{-}LR}$ - MC-LR concentration (ppm)

The UV chromatogram and spectrum of standard MC-LR is given below (Fig 4). The chromatograms and spectrums of experimented samples were compared with the standard given in fig. 4 to identify and quantify MC-LR.

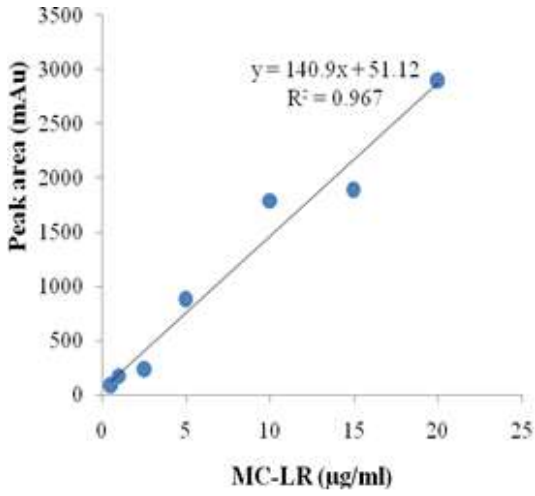
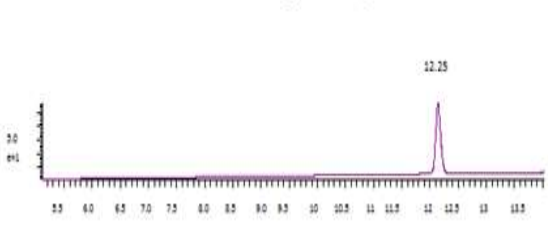
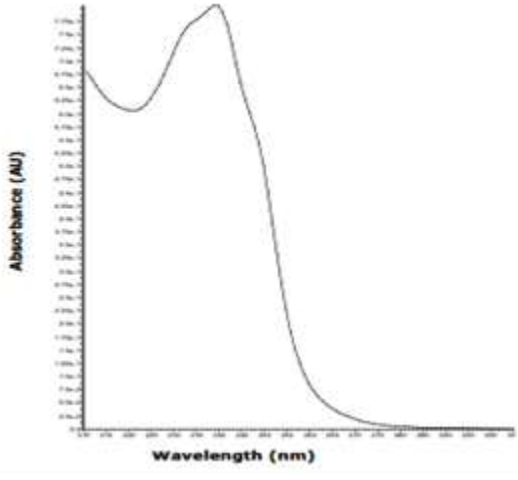


Figure 3: Standard calibration plot for MC-LR



(a)



(b)

Figure 4: (a) UV chromatogram at (200-300 nm), (b) UV spectrum 238 nm with relative purity > 95% of MC-LR.

Fig.5 represents the chromatogram for MC-LR detected in Beira Lake. The standard peak for MC-LR was received at 12.25 minutes and the area was 2896.35 mAu. Therefore, the MC-LR concentration was derived using the equation given in below.

Derivation : $C_{MC\text{-}LR}$ = (A- 51.12)/ 140.9

= (2896.35- 51.12)/140.9

MC-LR concentration in Beira lake =20.19 mg/l

Fig 6. indicates MC-LR removal by bacteria free filtrates. According to the results of the experiment the positive control which contained bacteria had reduced the MC-LR concentration from 5 µgml-1 to 1.8 µgml-1 following four days of incubation. However, bacteria free filtrate samples did not show considerable reduction of initial MC-LR concentration. Thus, the results convince that *B. cereus* degrades MC-LR as an intracellular metabolic activity. Thus, enzymes, which are, encoded by MC-LR degrading genes remain within the bacterial cell. The bacterium uptakes MC-LR through the cell membrane and proceeds with degradation.

Fig. 7. indicates MC-LR removal by cell extracts of *B. cereus*. At the end of fourth day, 81.1 µgml-1 of MC-LR was removed when 100% of cell extract was used. When 75 % of cell extract was used, 77.6 µgml-1 of MC-LR removal was evident at the end of the fourth day whereas when 50 % and 25% of cell extract were used only 40.7 µgml-1 and 25.7 µgml-1 of MC-LR removal was observed respectively. Thus, MC-LR removal by cell extracts of *B. cereus* strongly depends on concentration of cell extract.

Studies done by Wang et al. (2012) indicated that the intracellular extracts of M6 bacterial strain were able to degrade MC-LR. Wang et al. (2012) further confirmed that MC-LR degradation was optimum when 404.9 mgl-1 of intracellular extracts and 10 mgl-1 of the initial concentration of MC-LR were used. However, the present study has convinced that concentrated cell extracts of *B. cereus* can be used to remove high initial MC-LR concentrations like 100 µgml-1.

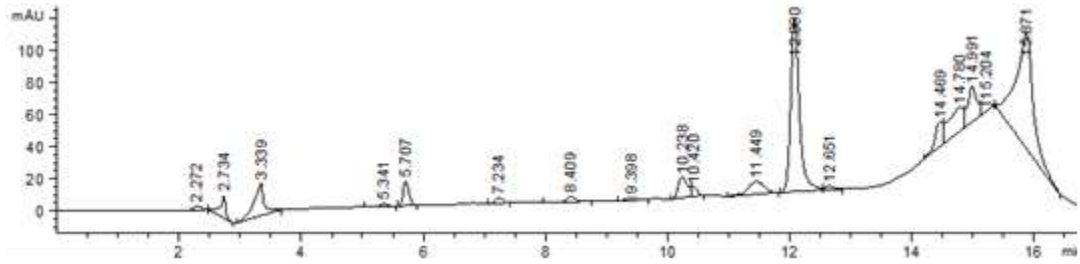


Figure 5: Chromatogram for MC-LR extraction from Beira Lake water

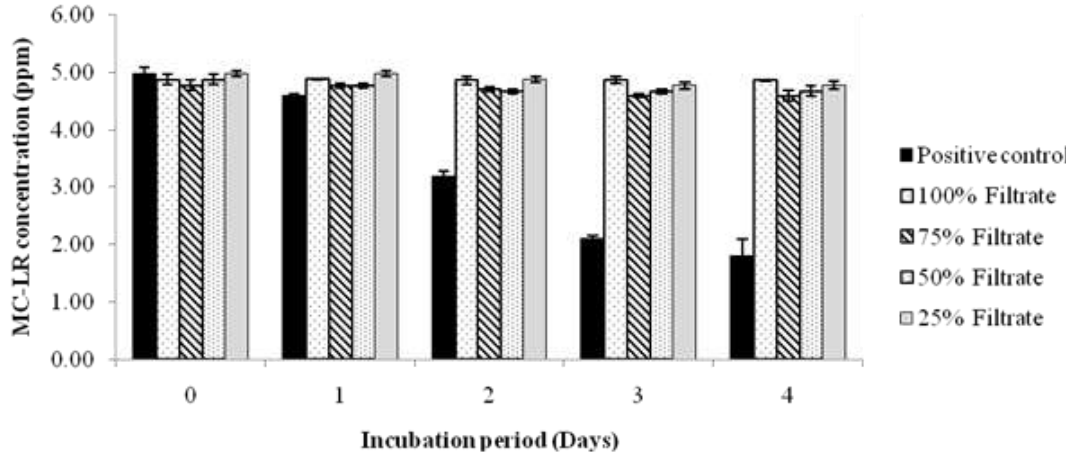


Figure 6: MC-LR removal by bacteria free filtrates . Error bars represent standard deviation.

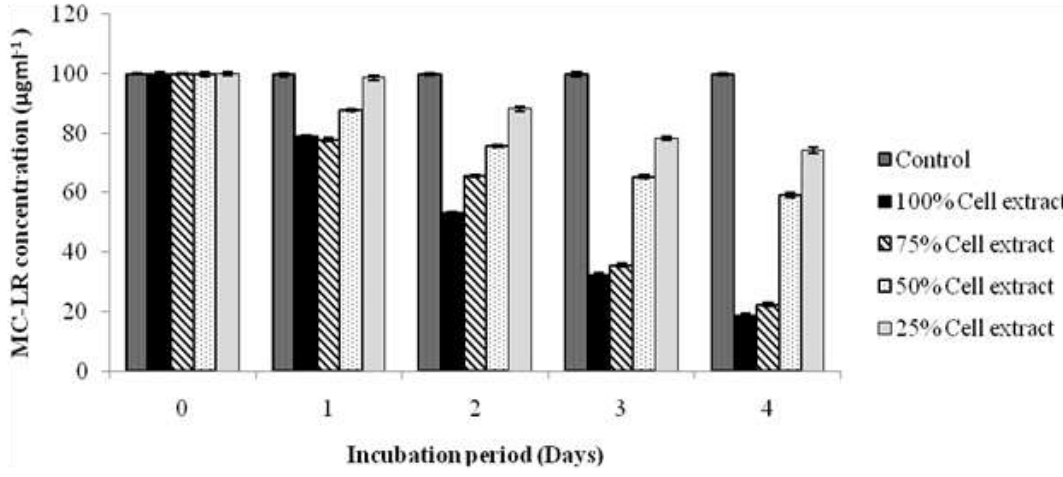


Figure 7. MC-LR removal by cell extracts of *B. cereus*.(Error bars represent standard deviation

4 CONCLUSION

The use of concentrated bacterial cell extracts is effective in removing MC-LR from water. Thus, this method has proposed a new perspective of using bacteria in bioremediation of MC-LR.

5 ACKNOWLEDGMENTS

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BIG DATA AND PREDICTIVE ANALYTICS: TIME SERIES FORECASTING FOR IMPROVED DECISION MAKING IN BUSINESS APPLICATIONS

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ABSTRACT

Predictive analytics is a significant aspect of big data analysis where large data sets are analyzed in order to give future predictions. Reliability and accuracy of the information generated through the use of predictive analysis models are crucial, particularly in the business environment. Many business organizations have progressed to integrate predictive analytics to their systems in order to get a competitive advantage in the business arena. Forecasting is critical to the successful execution of strategic as well as operational functions of an organization which further emphasizes the significance of the precision level of the forecasted information. Time series modeling and forecasting is a widely-used technique in monitoring and analyzing industrial processes to generate forecasted business data. This paper critically evaluates and analyses the moving average, exponential smoothing and linear regression predictive analytics models, which are widely used in time series forecasting, determining their reliability and accuracy with the use of business data. The accuracy of the time series forecasting models was further established through forecast error measurement statistics where it was determined that the linear regression model is a better fit for business data. The secular trend and the comparison of the actual data set with the forecasted data sets also helped determine the extent of accuracy of the predictive models.

KEY WORDS: *Big data, predictive analytics models, time series, business data, forecast error measurement statistics*

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1 INTRODUCTION

Predictive models are crucial in the business environment where their results can be employed in order to make critical business decisions that will provide organizations, particularly profit-oriented organizations, with a competitive advantage. Accurate forecasting is vital in making various management decisions for both strategic and tactical planning. Time Series is a forecasting technique where forecasts are made on a collection of data obtained sequentially over a particular period of time. Recent developments in technology along with Internet of Things applications have provided massive volumes of data, which can be analyzed in order to create information that is imperative to the success of business organizations. Big data has become a significant aspect in almost every organization and is vital in the process of analyzing data through Time Series Predictive Models in order to assist the organization in making better management decisions and performing strategic business moves, such as Finance and Risk Management, Operations Management etc., which will impact the growth of the organization in a positive manner. Advancements in data analysis and software capabilities have led to the development of sophisticated systems that offer effective forecasting to anticipate future demands, schedule productions and reduce inventories. Application of predictive analytics is crucial in the technological sector specifically in the development of strategic level business applications such as Executive Support Systems (ESS) that support the decision-making process of the strategic management. Thus, the accuracy and the reliability of the predictive models are vital in establishing the implementation aspect of the software development process, as the forecasted results provided by the application will directly affect the business decisions made by the strategic level management.

This paper critically evaluates and analyses the Time Series Predictive Models; Moving Average Method, Exponential Smoothing and Linear Regression, through the application of big data pertaining to the annual revenues of an organization. Univariate time series data of annual revenues of Walmart (an American Retailing Corporation), over a period of ten years (from year 2000 to 2009) were used as test data in order to get an in-depth understanding of the precision of the predictive models. The extent of accuracy and the reliability of the time series models were established by the comparison of the actual data and the forecasted values, by which the models which generate more accurate forecasts can be established.

2 RELATED WORK

Organizations have realized the importance of using big data in a business environment due to their confrontation with vast data volumes (Banica and Hagiu, 2015). Big data can be defined as high-volume, high- velocity and varying information assets that demand cost effective, innovative forms of information processing for enhanced insight and decision making (Kandalkar and Wadhe, 2014). Recent developments in Internet of Things (IoT) applications have further increased the scale of data to an unprecedented level (Tyagi et al., 2015). Careful synchronization and analyzation of big data, which has become the backbone of corporate performance and economic growth, has the ability to improve organizational performance while enabling better risk management (Chase, 2013). It is commonly sought after for building predictive models, where data forecasting is of major statistical significance (Hand, 2009).

A Time series dataset is a set of observations made in the chronological order, where the consequent values are within a predictable range from one another (Bhaskaran,2012). Prediction through the use of Time series data aims at explicit modeling of variable dependencies to forecast the next few values of the series (Esling and Agon, 2012). The ZETA model for bankruptcy classification developed by E.Altman(Altman et al, 1977), one of the earliest predictive analytics business models, and a Decision Support System for sales prediction developed by Kuo and Xue(1998) using fuzzy neural networks, provide the basis for the more advanced and accurate predictive models developed later. Time series data occur naturally in countless domains including medical analysis (Keogh et al., 2001) financial analysis (Zhu and Shasha, 2002) sensor network monitoring (Papadimitriou and Yu, 2006), gene expression analysis (Lin et al., 2008) etc. Time series models, which are grouped under Quantitative forecasting models, analyse the past observations of a time series to generate forecasts. Economic and Sales forecasting, Stock Market Analysis and Quality Control are some of the applications of time

series forecasting models (Gosasang V. et al., 2011) where general pattern or tendencies are taken into consideration. Research has been carried out in economics (Kang 1996, Timmermann and Granger 2004, Shin and Park 2009), in utility forecasting (Conejo et al. 2005, De Gooijer and Hyndman 2006) and in many other areas through the use of time series modeling. Forecasting Decision Support Systems (FDSS), developed specifically for business organizations, integrate managerial judgment, quantitative methods and databases to aid the forecaster in accessing, organizing and analyzing forecasting related data and judgments (Fildes et al., 2006). The reliability and the accuracy of the forecasting methodologies used in such systems are crucial as they directly influence the strategic and operational functions of an organization.

3 METHODOLOGY

Time series predictive models; Moving Average, Exponential Smoothing and Linear Regression, were used in order to obtain forecasted Walmart revenue values for a time period of five years. Forecasted results from the models were further ascertained through the use of forecasted error measurement statistics.

3.1 Moving average method

Moving average method averages the most recent values, where each observation receives the same weight, in a time series to obtain the forecast (y^*_{t+1}) for the next time period.

$$y^*_{t+1} = \frac{y_{t-n+1} + y_{t-n+2} + \cdots + y_t}{n}$$

(1)

Where,
t = time period for which data is collected
y_t = values (business data) in the time series
n = number of observations

The number of Time series values(n) included when executing this function may vary according to the relevance of the time series values, where a small value (preferably between 3-5) is used in situation where only the most recent time series values are considered relevant.

3.2 Exponential smoothing model

Exponential Smoothing is a Time series technique where forecasts can be calculated explicitly, using the weighted average of all the previous actual values of the time series. This technique employs a smoothing constant (W), specifically between 0 and 1, when applying to a set of business data. A set of smoothed values (E_i) are obtained initially, where the actual yearly values from past records are denoted by Y_i.

$$E_1 = Y_1$$
$$E_2 = WY_2 + (1 - W)E_1$$
$$\vdots$$
$$E_n = WY_n + (1 - W)E_{n-1}$$

(2)

The following equation (3) is used to obtain forecasted values, F_{n+1}.

$$F_{n+1} = WY_n + (1 - W)E_n$$

(3)

The Exponential smoothing method eliminates the drawback in the Moving average method where an equal weight is applied on all the data when computing the average.

3.3 Linear regression model

Linear Regression attempts to model the relationship between an explanatory variable and a dependant variable by fitting a linear equation to observed data. Values obtained from the following formulas are required in order to compute the forecasted values for subsequent years,

$$\bar{t} = \frac{\sum t_i}{n}$$

(4)

$$\bar{y} = \frac{\sum y_i}{n}$$

(5)

$$b = \frac{\sum_{i=1}^{n} y_i t_i - n\bar{y}\bar{t}}{\sum_{i=1}^{n} t_i^{\,2} - n\bar{t}^{\,2}}$$

(6)

$$a = \bar{y} - b\bar{t}$$

(7)

Where,
t_i = time period for which data is collected
y_i = values (business data) in the time series
n = number of observations

The forecasted value(y^*) is calculated using,

$$y^* = a + bt$$

(8)

Where a represents the intercept and b represents the slope of the linear trend line respectively.

3.4 Forecast error measurement statistics

Several error measurement statistics were taken into consideration when ascertaining the level of reliability and accuracy of the predictive models. The forecast error which is required when calculating the error measurement statistics is given by,

Forecast error (e_i) =Actual value (a_i) – Forecast
(10)

3.4.1 Mean absolute error(mae)

Mean Absolute Error(MAE) is calculated by averaging the absolute values of forecast errors.

$$MAE = \frac{\sum_{i=1}^{n} e_i}{n}$$

(11)

3.4.2 Mean squared error(mse)

Mean Squared Error is obtained by averaging the squared value of forecast errors.

$$MSE = \frac{\sum_{i=1}^{n} e_i^2}{n}$$

(12)

3.4.3 Mean absolute percentage error (mae)

Mean Absolute Percentage Error (MAPE) is calculated by averaging the absolute value of percentage forecast errors.

$$MAPE = \frac{\sum_{i=1}^{n} \left(\frac{e_i}{a_i} \times 100\right)}{n}$$

(13)

3.5 Application development and implementation

An application was developed through the Microsoft Visual Studio 2012 platform and Dev Express using the C# language in order to implement the three predictive models.

System Diagnostics was used in order to obtain the execution time of the respective predictive model to obtain a single forecast.

4 RESULTS

The above-mentioned time series predictive models were applied to the same set of data and the corresponding results for each model are shown below.

The forecasting error statistics (MAE, MSE and MAPE), which are critical in establishing the forecast accuracy for each model as well as execution time were also calculated.

4.1 Moving average

A three-point simple moving average method was employed, where n=3, in order to generate forecasted revenue data for Walmart from year 2010 to 2014. A comparative study of the actual and forecasted values is shown below (Table 1).

Table 1 Walmart Revenues: Forecasted values vs. Actual values (Year 2010 to 2014) using Moving Average method

Year	Actual Values ($ million)	Forecasted Values ($ million)
2010	421,395	393,347
2011	446,509	399,855
2012	468,651	399,445
2013	476,294	397,549
2014	485,651	398,950

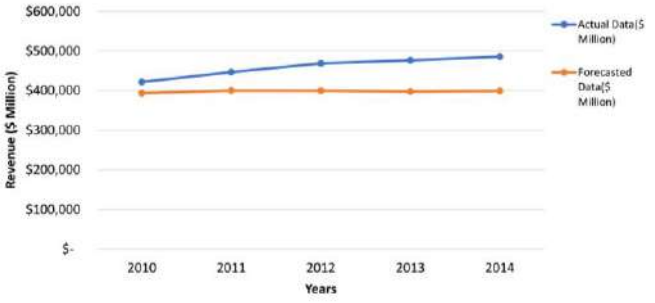

Figure 1 Walmart Revenues: Forecasted values vs. Actual values (Year 2010 to 2014)

According to the graph (Figure 1) there is a significant difference between the forecasted revenues and the actual revenues of Walmart. A slight deviation in the pattern of the forecasted revenue values can be seen for the years 2012 and 2013 whereas the actual revenue values have increased in a linear manner.

Table 2 Forecast Error Statistics for the Moving Average method

MAE	61,871
MSE	4,294,118,976
MAPE (%)	13.25141092

The error measurement statistics for the Moving average method are illustrated above (Table 2).

4.2 Exponential smoothing

A comparison of forecasted values and the actual Walmart revenue values for a time period of five years, from 2010 to 2014 are depicted below (Table 1). A smoothing constant (W) of 0.7 was used for the computation of the forecasting process.

Table 3 Walmart Revenues: Forecasted values vs. Actual values (Year 2010 to 2014) using Exponential Smoothing method

Year	Actual Values ($ million)	Forecasted Values ($ million)
2010	421,395	403,681
2011	446,509	403,377
2012	468,651	403,313
2013	476,294	403,299
2014	485,651	403,297

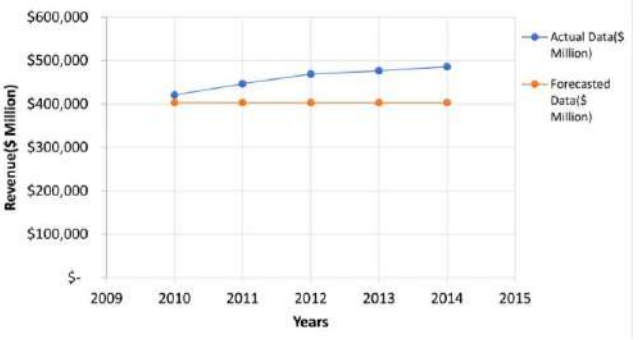

Figure 2 Walmart Revenues: Forecasted values vs. Actual values (Year 2010 to 2014)

The forecasted values seem to have the pattern of decreasing gradually whereas the actual revenues of Walmart have progressed steadily.

Table 4 Forecast Error Statistics for the Exponential Smoothing method

MAE	56,306.6
MSE	3,710,732,161
MAPE (%)	12.01765307

4.3 Linear regression

Forecasted values obtained using the Linear Regression method are shown below.

Table 5 Walmart Revenues: Forecasted values vs. Actual values (Year 2010 to 2014) using Linear Regression method

Year	Actual Values ($ million)	Forecasted Values ($ million)
2010	421,395	445,678
2011	446,509	472,420

Year	Actual Values ($ million)	Forecasted Values ($ million)
2012	468,651	499,162
2013	476,294	525,903
2014	485,651	552,645

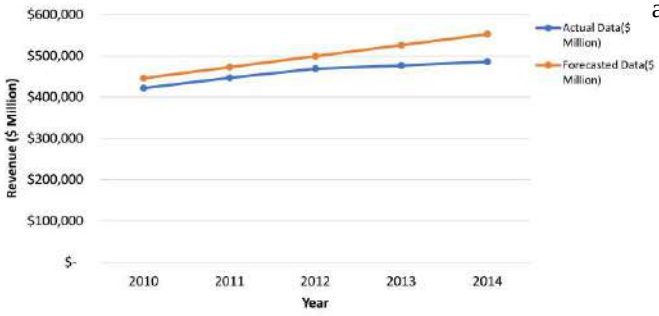

Figure 3 Walmart Revenues: Forecasted values vs. Actual values (Year 2010 to 2014)

The graph (Figure 3) indicates that the forecasted values follow a linear pattern, where the first three forecasted revenue values are very close to the actual revenue values.

Table 6 Forecast Error Statistics for the Exponential Smoothing method

MAE	39,461.6
MSE	1,828,242,810
MAPE (%)	7.72025459

4.4 Execution time analysis

The time taken for each predictive model to generate a single forecast value is mentioned below (Table 7).

Table 7 Time Elapsed for the Computation of one forecast value

Forecast Model	Time Elapsed (Milliseconds)
Moving Average	0.0003
Exponential Smoothing	0.0011
Linear Regression	0.0007

It has to be noted that the computational time for the execution of a single forecast is based on the complexity of the developed algorithm and the number of past observations considered (in this case 10 values from year 2000 to 2009), where CPU utilization speed and memory consumption also comes to play.

5 DISCUSSION

A considerable difference between the sets of forecasted values obtained from the three predictive models and the actual revenue values was observed.

Table 8 Walmart Revenues: Forecasted values vs. Actual values (Year 2010 to 2014)

Year	Actual Values ($ million)	Forecasted Values ($ million)		
		Moving Average	Exponential Smoothing	Regression
2010	421,395	393,347	403,681	445,678
2011	446,509	399,855	403,377	472,420
2012	468,651	399,455	403,313	499,162
2013	476,294	397,549	403,299	525,903
2014	485,651	398,950	403,297	552,645

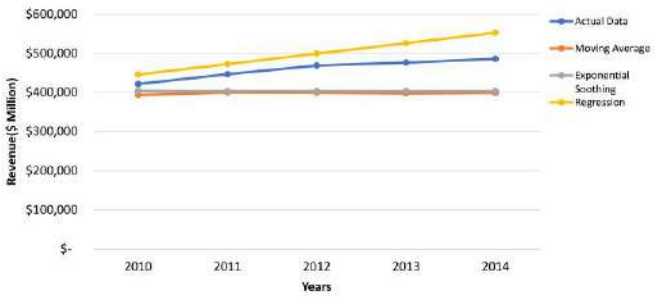

Figure 4 Walmart Revenues: Forecasted values vs. Actual values (Year 2010 to 2014)

As illustrated in figure 4, the forecasted values obtained using the Moving average method and the Exponential smoothing method show similarities in value range and pattern. Although the values forecasted using the Linear regression model are significantly higher than that those of the other models, the forecasted values are slightly higher and somewhat closer to the actual values the secular trend line of the Actual data and the data from the

Linear Regression model show a prominent similarity. Thus, it can be said that comparatively, the Linear regression model provides more accurate results.

Furthermore, the distribution of the set of actual values and the sets of forecasted values derived from the three predictive models, illustrated in the box plot shown below (Figure 5), was also taken into consideration when determining the model that is the better fit for business data.

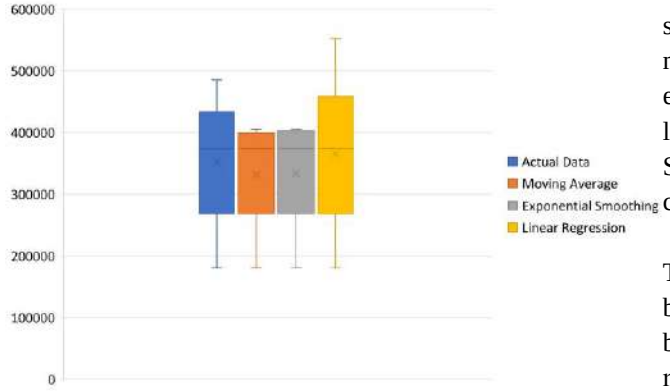

Figure 5 Distribution of Walmart Revenues: Forecasted values and Actual values (Year 2000 to 2014)

The median of all the data sets remain the same while the interquartile ranges of the Actual dataset and the Linear Regression Data set are closer than those of the other data. When considering the distribution of data, the spread of actual data and the data set with the Linear Regression results show similarities. This further elaborates the accuracy and the reliability of the Linear Regression method over the other two forecasting models discussed above.

The forecast error measurement statistics obtained for each predictive model is depicted below (Table 9).

Table 9 Forecast Error Statistics for the Moving Average, Exponential Smoothing and Linear Regression methods

Predictive Model	MAE	MSE	MAPE (%)
Moving Average	61,871	4,294,118,976	13.25141092
Exponential smoothing	56,306.6	3,710,732,161	12.01765307
Linear Regression	39,461.6	1,828,242,810	7.72025459

When considering the forecasted error measurement statistics (MAE, MSE and MAPE) for the predictive models, the statistics for the Moving Average method and the Exponential Smoothing method demonstrate very large values while the statistics for the Linear Regression model are comparatively low. This indicates that the Linear Regression model is a better fit for business data applications than the Moving average and Exponential smoothing methods.

When considering the execution time taken to compute a single forecast (Table 7), the Linear Regression model shows a moderate speed when compared to the other two models. Although the Moving Average shows more efficiency and consumption of less execution time, it has low reliability and accuracy levels, and the Exponential Smoothing model demonstrates low efficiency in comparison to the other models discussed.

The selection of the predictive model, which provides the best fit for business data, is vital in the development of a business application. High reliability and accuracy of the model is extremely crucial as the organization's business strategy is directly influenced by the forecasts provided by the application. The employment of an algorithm based on a predictive model which has a low level of reliability and accuracy, in the development of the business application, will in turn lead to inaccurate forecasts which will be used by the organization to make strategic business decisions yielding catastrophic results. Thus, the establishment of the level of reliability and accuracy of a predictive model is vital when developing business applications that directly influence and support the decision-making process of an organization.

6 CONCLUSION AND FURTHER WORKS

Massive volumes of data have been created and made available to organizations as a result of various business and Internet of Things applications. Time series modelling and forecasting that are crucial in various practical domains employ Big Data to generate various predictions. The extent of accuracy, reliability and efficiency of these predictive models are vital, particularly in the business sector in order to aid in the decision-making process. The selection of a suitable forecasting method that is highly accurate and reliable, to

be implemented in the development of strategic level business applications is significant as the forecasted values provided through the application will directly influence the decision-making process of the strategic level management. The secular trend, value differences and forecasted error measurement statistics for the time series predictive models; Moving average, Exponential Smoothing and Linear regression, were taken in to consideration when determining their extent of accuracy and reliability. Accordingly, the Linear regression model demonstrated a higher level of accuracy comparative to the Moving average model and the Exponential smoothing model, proving to be a better fit for business data. A low execution time was also demonstrated by the Linear Regression model which establishes its high efficiency level.

In the methodology followed, the results obtained were based on secular trend forecasting. The models can be further improved considering Cyclic and Seasonal Variations. The factor of White noise which helps in establishing correlations between variables will further improve the predictive models by determining the relevance of previous values when forecasting future values. Residual diagnostics can also be performed to further determine the reliability and the accuracy of time series forecasting methods. Performance measures, Root Mean Square Error(RMSE) and Theil's U-Statistics can be used to further evaluate and establish forecast accuracy.

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DERIVATIVES: ARE THEY WEAPONS OF MASS DESTRUCTION?

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ABSTRACT

The growth of the amount of financial derivatives during the last fifteen years has been phenomenal. With the total notional amounts outstanding on over-the-counter derivative contracts amounting to around nine times global GDP by the end of June 2012, they represent by far the largest financial transaction in the world. Even though, these instruments are used to deal with the inherent risk associated with finance, they can be the cause of destruction if not used cautiously. As once pointed out by Warren Buffet, "Derivatives are financial weapons of mass destruction". In this context, after an analysis of the nature and the types of derivatives, the article seeks to evaluate whether these financial instruments, derivatives, are in fact a cause of financial destruction than a cause which brings forth financial benefits, with reference to several controversial derivative disasters. This doctrinal research was conducted through the traditional black letter approach and the critical analysis method. Qualitative data were gathered through a review of primary sources, statutes and secondary sources, books with critical analysis, research journals, working papers, corporate and policy reports and web sources. In the light of the derivative disasters, 2008 global recession, it is concluded that Buffett's statement was correct to a great extent since derivatives are financially lethal in the absence of an effective risk control mechanism. However, it is stated that these derivative disasters could have been prevented with the presence of proper regulations, adequate corporate internal control systems and also with a sound understanding of the nature of the derivatives one deals with.

KEY WORDS: *Financial derivatives, mass destruction, derivative disasters*

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1 INTRODUCTION

The growth of the amount of financial derivatives during the last fifteen years was phenomenal. With the total notional amounts outstanding on over-the-counter (OTC) derivatives contracts amounting to around nine times global GDP by the end of June 2012, they represent by far the largest financial transaction in the world. Even though, these instruments are used to deal with the inherent risk associated with finance, they can be the cause of destruction if not used cautiously.

As Warren Buffet once pointed out in the annual report of Berkshire Hathaway Inc. (2002)

"Derivatives are financial weapons of mass destruction. Derivatives generate reported earnings that are often wildly overstated and based on estimates whose inaccuracy may not be exposed for many years. Large amounts of risk have become concentrated in the hands of relatively few derivatives dealers...which can trigger serious systemic problems".

In this context, the article seeks to examine, with reference to several controversial derivative disasters, whether these financial instruments, derivatives, are in fact a cause of financial destruction or whether they are a cause of financial benefits,.

2 METHODOLOGY

Following the legal research methodology this doctrinal research was conducted using the traditional black letter approach and the critical analysis method. Qualitative data for the research was gathered through a review of primary sources; statutes and secondary sources; books with critical analysis, research journals, working papers, corporate and policy reports. Further reference was made to web based sources for the purpose of gaining current awareness. Initial part of this research, which sets up the background for the analytical discussion, is expository as it discusses about the nature and types of derivatives. In the latter part of the research, the data gathered regarding several key derivative disasters around the world were analysed through the critical analysis method to address the research problem whether derivatives, in fact are a cause of financial destruction than a cause which brings forth financial benefits.

3 DISCUSSION

Nature of financial derivatives

Derivatives are financial products that have no intrinsic value but derive its value from another financial asset such as interest rates, securities or currencies. Any change in the value of the underlying asset leads to price change of the derivative.

Hull (2009) defines a derivative as "a financial instrument whose value depends on or is derived from the performance of a secondary source such as an underlying bond, currency, or commodity, or "a financial instrument whose value depends on (or derives from) the value of other, more basic, underlying variables" and this definition is largely used in legal and policy discourses (Lynch, 2011).

Hedging and speculation operate as the commercial rationale for financial derivatives. Standard forms of financial derivatives are the option, the forward and the swap. 'The futures' and credit derivatives are important as well. The characteristic common to these derivatives is that the price of the underlying asset exceeds the capital invested.

Different types of financial derivatives

'Forward' contracts are bilateral customized contracts to buy or sell a financial asset in the future at a certain time and a price. The 'Futures' are based on the same principle and are standardized agreements to sell or buy a specified quantity of a financial asset between two parties at a specified price, time and a place. However, while the 'futures' are traded on exchanges, 'forwards' are said to be OTC and this difference in trading venues result in noteworthy distinctions in the two types.

The most popular form of derivatives, the 'options' are contracts between two parties to buy or sell a specified quantity of asset at a specified price. The buyer possesses a right but bears no obligation to perform the contract and the performance can be made on or before the date specified in the contract.

An option contract exists between a party which gains the right to perform the contract known as the option buyer/ option holder and an option writer/ option seller who charges a fee called 'option premium' from the former, in exchange for the given right (Rohilla, 2011). The options are further categorized as American option and European option. The former refers to a contract that can be exercised at any time before it matures and when an option can be exercised only at the maturity, it is called European option.

A swap contract refers to an agreement between a party with a fixed rate security and a party with a variable rate security to exchange two different streams of cash flows in future. Credit derivatives can be divided as credit default swaps and collateralized debt obligations (Partnoy, 2007).

Are derivatives financial weapons of mass destruction?

Warren Buffet once in 2002 described derivatives as "time bombs" for all parties involved and also emphasized the difficulty of tracking the values and liabilities of derivatives even for their holders (Berkshire Hathaway Inc, 2002). However, he also pointed out that this generalization might not always be judicious since the range of derivatives is so great.

Derivatives create a vehicle for corporations to hedge some of their unwanted risks (Aboy, 2010). However, they are also capable of being used for the purpose of speculating, concealing and keeping the dealings off balance sheets. They can heighten leverage and arbitrage regulatory and tax-rules.

In the annual report of Berkshire Hathaway Inc. (2002) Buffets States that "parties to derivatives have enormous incentives to cheat in accounting for them". Traders on derivatives are paid on earnings calculated by mark-to-market accounting and according to Buffet, utilizing mark-to-model in substitution of mark-to market model leads to large scale mischief (Berkshire Hathaway Inc, 2002).

Analysis of the statement by Buffet in the annual report of Berkshire Hathaway Inc. (2002) makes it clear that he directed his criticism at OTC derivatives which are not collateralized, guaranteed or transparent as forwards. Risks associated with these derivatives can be categorized as counter party risks, marking errors and linkage and 100% leverage. The counter party risk refers to the risk that the other party may fail to perform its delivery obligation. As for the second type, the lack of an exchange coupled with incentive by inducement by CEOs etc. to overestimate profit can result in marking errors, departing from market-to-market accounting to market-to-hypothetical value. Further, some OTC contracts that facilitate 100% leverage can cause systematic problems (Aboy, 2010).

In case of credit derivatives their payoffs are linked in some way to a change in credit quality of an issuer or issuers. When a company faces a state of difficulty, banks become involved in saving the company, and in the event of bankruptcy, the banks can intervene in liquidation since their loan is often secured with preferential right to get their loan settled. Accordingly, credit derivatives reduce the incentive for banks to monitor and adequately control credit risks neglecting the "know your customer rule" completely (Partnoy, 2007).

The case of Enron bank provides an illustration. In this case, JP Morgan Chase, Citigroup and some other banks had lent money to it using massive amounts of credit derivatives. Banks failed to monitor the Enron, and as a result, Enron was tottering on the brink of closure and so were the banks (Economist, 2002).

Another problem is the non-transparency of the credit default market. All swaps are structured as over-the-counter (OTC) derivatives, and mostly they are unregulated which makes it possible for the detail of a swap contract to be kept undisclosed. This results in uncertainty for the stakeholders and sometimes it proves to be a big loss (Tijoe, 2007).

Further, it is noteworthy that derivative instruments like total-return swaps have no regard to margin requirements. Analysing the financial status of organizations that are majorly involved with derivative contracts is problematic even for experienced analysts and investors. Derivatives are not always regulated, yet they can cause extreme

swings in value. High fluctuation of value of these securities can create dangers to the economy as a whole as one could see from the 2008-2009 credit crisis.

However, despite often being considered as high risk, the derivatives market in the U.S. has grown up to $516 trillion opposed to an estimate of $100 trillion (by Bank of International Settlements) in 2008 (Rohilla, 2011) .

Derivatives disasters

Bank frauds via derivatives trades have not been a rare scenario during the last few decades. Disasters associated with derivatives trade have resulted in derivatives having a bad public image.

Most disasters are caused by single rogue traders who attempt to cover up losses they incur in derivative trade as a result of risks they assume, which are not known to the senior management. Some aggressive traders choose high risk doubling strategy which is usually used in gambling, to recover such losses (Verma, 2008).

Banks and institutions usually have rules regarding the limits of risks any trade can assume and thereby attempt to prevent imprudent strategies like doubling which can lead to bankruptcy when luck disfavours. Nevertheless, smart traders circumvent such regulations by hiding trades or misinterpreting the risks.

The chain of events which led to the collapse of Barings in 1995, Britain's oldest merchant bank, is a demonstration to the high risk associated with the derivatives trade. From 1992, Nick Leeson, the major trader of Barings Bank, made unauthorized speculative trades which initially made large profits. However, Leeson lost his touch as his speculative range enhanced. Having an obligation to report to superiors, Leeson used one of Barings' error accounts to hide his losses and managed to deceive the bank's auditors (Caproasia Online, 2015).

Leeson guessing that the exchange rate will continue to stay static overnight, placed a short straddle on the Nikkei. Due to the Kobe earthquake, a sudden and a sharp drop in the Nikkei and other Asian markets was caused. Leeson attempted to offset this heavy loss with short term risky new trades betting that Nikkei stock average would make a speedy retrieval. However, due to the severity of the earthquake, the recovery failed to materialize and having lost more than twice its available capital, the bank went bankrupt (Bhugaloo).

Afterwards more regretful disasters took place. In 2004, National Australia Bank (NAB) incurred a huge loss amounting to $ 360 million as a result of its greater reliance on speculation and high-risk investment activity to maintain profitability. The company tolerated the breaches of risk limits by traders like David Bullen and even ignored warning from rival banks since important profits had been made by these traders in the past (Skeers, 2004). As depicted by the bank's annual reports the increasingly risky trading was a conscious policy.

Along with other incidents like 'Metallgesselschaft' and 'Proctor and Gamble', NAB incident provides an illustration to a kind of situation where the derivative disasters stem from imprudent and inappropriate derivative strategies implemented with the full knowledge of the top management.

Furthermore, in 2008, Jerome Kerviel an employee of Société Générale, lost over $7 billion having purchased futures contracts for which the underlying assets were stock indices (Canac and Dykman, 2011). The total value at purchase was about 50 billion while the delivery date for the contracts has been one to three months in the future. This constituted one of the largest bank frauds in the world history via derivatives trading.

In the light of aforementioned situations, it can be stated that the statement made by Buffett was correct to a great extent since it is evident that the financial derivatives are financially lethal in the absence of an effective risk control mechanism. These financial weapons had an impact on the sub-prime crisis of 2008 in the U.S. as well.

In the U.S. many banks gave highly lucrative sub-prime loans and they were expected to yield a very high return in view of the increasing home prices. Owing to the high risk associated with this kind of

loans the interest rate was kept 2% higher than the prime loans and therefore appeared to be excellent investment options. As stock markets flourished, many big fund investors were attracted to sub-prime loan, and they bought such portfolios from the original lenders making the sub-prime loan market a fast booming segment.

Nevertheless, these sub-prime loans became speculative as well as unprofitable when the home prices started declining. Sub -prime borrowers were in an extremely difficult situation as they could not afford to pay their higher interest rates. With the rapid decline of the home prices, the lending companies, that were expecting to sell them and recover the loans, found them in a scenario where loan amount surpassed the total cost of the house. The only option that remained in these circumstances was to write off losses on these loans. With the Mortgage Backed Securities (MBS) losing their value the problem got aggravated.

Warren Buffet's reference to derivatives as financial weapons of mass destruction became true in 2008 and paved the way to the financial crisis referred to as Global Recession. At the end of 2002 as shown by their annual report, Insurance giant American International Group's (AIG) Financial Products unit had $14.9 billion in risk related to credit derivatives and a notional amount in its credit-derivative portfolio of $126 billion. Bank of America held an average of $25.3 billion in derivative assets and $17.3 billion in derivative liabilities in 2002.

Underlying reasons and prevention of the disasters

When considering the role of the derivatives in these financial calamities, it is the immense liquidity of the derivatives which attract rogue traders. High liquidity makes it possible for such traders to adopt doubling policies (Partnoy, 2007). Secondly, derivatives provide enormous amount of leverage. Traders are enabled to multiply their rate or return (or loss) on the underlying asset owing to the fact that capital invested in the derivative is significantly less than the underlying asset. Furthermore, due to the complex nature of derivatives most members of senior management of companies and banks possess low levels of awareness regarding trade and it affords an opportunity for smart traders to circumvent rules and mislead the senior management.

However, with the right regulations, the above discussed kinds of financial disasters could have been prevented. In my opinion, failure of corporate internal controls can be considered as the main cause of these disasters. Lack of involvement, lack of awareness and the absence of accountability of the management for important activities of the company make it possible for rogue traders to hide their illegal transactions and losses.

In cases like the Baring Bank's, a proper system of internal controls, mainly an increased supervision, a regulatory system to prevent imprudent policies like oubling, a strategy and a system of checks and balances could have prevented the entire debacle. The duties performed by Nick Leeson should have been segregated among several individuals. In addition, unannounced spot audits are a great way to deal with this kind of problems

In the case of credit derivatives, standardized derivatives lead to fewer problems and companies tend to adhere to the relevant regulatory laws. However, there are costs related to standardizing derivatives and the terms and conditions cannot be modified. In order to keep clear of these costs, sometimes the companies go for OTC derivatives where there are lesser costs and tailor-made terms and conditions. These self-regulations can lead to violation of laws. These OTC derivatives play a central role within contemporary capitalism. In case of OTC derivatives in particular, due to lack of transparency and inadequate regulation, identifying where the dangers lie is a very difficult task.

In the United Kingdom, for regulatory purposes, the necessary limitations are brought in by the Financial Services and Markets Act 2000 (Regulated Activities) Order 2001 (SI2001/544). Section 19 of the Act requires firms to be authorized to conduct regulated activities. Breach of this section is considered a criminal offence punishable on indictment by a maximum term of a two year imprisonment with or without a fine. Additionally,

under section 22, an activity to be recognized as a regulated activity, it must be carried on 'By way of business'. While Section 118 of FSMA concerns market abuse, Section 397 makes it a criminal offence to mislead a market or investors.

However, it should be noted that under section 412, Gaming and wagering legislation does not apply to transactions regulated by the FSMA with certain provisos (Perera, 2007).

Some positive characteristics of derivatives

Derivatives, contrary to the popular belief can be used to help allocating and taking the price risk out of everything from corn to cattle to stock. According to Richard Sandors, who has been called "the father of financial futures, Buffett was wrong since he made no distinction between regulated and unregulated derivatives which are "opaque, have no price discovery and done with bilateral deals that could cause systemic credit risk" (Task, 2013). According to Sandors derivatives promote efficiency, yet Buffet view this positive perspective as a micro-picture of the scenario (Task, 2013).

New research, co-authored by an assistant professor of finance at Stanford GSB, Francisco Pérez-González, demonstrated that hedging has collateral benefits that can enhance a firm's overall value. Further, he states that "allowing firms to focus on the risks they are in business to take, while hedging against risks that they are not in business to take, can add value," (Andrew, 2013).

4 CONCLUSION

Extreme fluctuation of value based on contingent events is what makes derivatives dangerous. As Randall Dodd, director of the Derivatives Study Centre, Washington, pointed out that derivatives are double-edged swords that are extremely useful for risk management, but they also can create a host of potential new risks (Dodd, 2001).

In fact, derivatives are not necessarily dangerous. Yet, deficiency of information and knowledge are the dangerous things. Shareholders and the management should be well informed to control the use, and concomitant abuse of derivatives (Hudson, 1998).

The losses caused by derivatives are often due to self-regulatory methods and a public regulator can do much better in this regard (Rohilla, 2011). In terms of hedging not only the banks but also other participants too should come within the domain with expertise.

Although, some consider derivatives as a form of legitimate gambling that enable users to place bets on the market these financial instruments provide gains that extend beyond those of gambling by causing markets to be more efficient, aiding to successfully manage risk and providing investors with assistance to discover asset prices. Despite the negative comments made by many on the financial derivatives, the world of finance is kept fascinated by the capabilities and powers of the financial derivatives.

The fundamental factor here is that the derivatives come within different categories and all the derivatives are not destructive to the same degree. Hence, it is extremely important to understand the nature of what one is dealing with before an intelligent assessment can be made and handling of derivatives should be done with care to prevent disasters.

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RECENT CHANGES IN POPULATION AND ITS IMPACT ON USAGE OF DRINKING WATER SOURCES IN HOUSEHOLDS: A CASE STUDY OF KALUTARA DISTRICT, SRI LANKA

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ABSTRACT

The major problem that arises with the rapid growth of population is whether it is possible to fulfil basic requirements of human beings such as food, water, shelter and air (De Silva, 2007). Especially, drinking water is a basic need of human life and in fact an essential component in primary healthcare and poverty alleviation (Amponsah, Aidam and Senadza, 2009). However, the growing intensity of population and development activities create tremendous pressure on available water resources. Therefore, it is essential to understand the relationships among a full range of population characteristics such as the size, growth, distribution, and density of population, total households and the usage of water sources. With this brief background, the aim of this paper is to identify the recent changes in population and its impact on the usage of drinking water sources in households in Kalutara district during the period of 2001-2012. Towards achieving this aim, population and households data on sources of drinking water was obtained from the reports of Census of Population and Housing in 2001 and 2012. The data were analyzed using thematic maps and correlation analyses. Accordingly, the highest population and population density were recorded in the west coast while the lowest were in rural areas and there was an increase both spatially and temporally. The study also revealed that there was a similar distribution pattern in total households and the high total households was in Panadura and Kalutara DSDs in both the years. The high annual growth rates were recorded in Bandaragama and Horana DSDs. It was found that the majority of the households used improved sources of drinking water, especially from shallow ground water wells (including protected and unprotected dug wells). There was an increase in the use of improved sources of drinking water and a decrease in use of unimproved sources of drinking water. In the coastal side, there was a considerable increase in the use of pipe-borne water as the major source of water. It was evident that the highest proportion of unimproved sources of drinking water was used by the households in Palindanuwara DSD. The t-test results showed that there was a significant difference ($p<0.05$) between those who used all classified unimproved sources of drinking water in 2001 and 2012. Further, the study revealed that there was a strongly significant ($p<0.05$) relationship between the increase in population size, population density and total households while it led to a chain effect on the use of all the classified improved sources of drinking water in both the years. However, all the unimproved sources of drinking water, except two sources which use tanker-truck and bottled water, have shown negative correlation values. It was also evident that the increase in population density had a significant ($p<0.05$) influence on the use of surface water. The study, therefore recommends that the source of drinking water should be managed sustainably in order to ensure continuous availability in the long-term.

KEY WORDS: *population, drinking water sources, household, improved sources, unimproved sources, significant*

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1 INTRODUCTION

Of all natural resources, water is the most essential. It is fundamental to all vital processes of value to mankind (FAO, 1994). Further, water is the most important natural resource for sustainable development and quality of life, yet it is unevenly distributed; almost one-fifth of the world's population live in regions where water is scarce and one-quarter suffer from a severe water shortage (Fan et all., 2013). Especially, water used in households for drinking, bathing and cooking becomes contaminated by various chemicals and other constituents introduced during its use. However, drinking water is a basic need of human life and in fact an essential component of primary healthcare and in poverty alleviation (Amponsah, Aidam and Senadza, 2009).

The type of water source or the technology specified by the household is used as an indicator of whether the drinking water is of suitable quality. The Millennium Development Goals (MDGs) on drinking water were met globally in 2010; the water sources likely to be of suitable quality or *improved* are: piped water supply into the dwelling; piped water to a yard/plot; public tap/standpipe; tube well/borehole; protected dug well; protected spring; and rainwater. Water sources that are *unimproved* are: unprotected dug well; unprotected spring; cart with a small tank/drum; water tanker-truck; surface water and bottled water.

In general, population size, growth and distribution mainly influence on the natural resources (De Silva, 2007). Among those impacts, population growth and distribution have always been linked to the availability of freshwater and the sustainability of renewable water resources. Especially, population growth is a direct determinant of increases in water demand for domestic uses. According to the Population Reference Bureau (PRB), 2016, the demand for water has grown significantly over the last 50 years not only because of population growth, but also because of an increase in the use of water for households, agriculture and industrial production. Another key demographic factor is the change in the geographic distribution of population, which modifies the spatial pattern of demand for domestic water uses. Especially, over population density affects the use of drinking water sources. The reason is that an increase in population causes to increase water consumption. The problem regarding this condition is the limitation of water resources when compared with the increasing population. Furthermore, not only the population but also human settlements are heavily pressured on the availability of water sources, for example, increase in the number of households that use the sources of drinking water is indicated in the increase of the yearly drinking water requirement in the area.

Thus, the rapid growth of population constitutes the key factor when studying the relationship of natural resources in the geographical space because water is one of the most compelling needs for human life and socio-economic development. Many studies have been conducted to investigate the relationship between population growth and water availability in terms of both quantity and quality. These studies have underlined that the relationship between population growth and environmental problems are closely linked. It is important to establish in each household whether sufficient safe drinking water is available for drinking and cooking for all household members. In addition, identifying the factors that affect domestic water demand and consumption is very important in the management of available regional water resources. With this brief background, the purpose of the present study is to identify the recent changes in population and its impact on usage of drinking water sources in households with special reference to Kalutara district in Sri Lanka.

The specific objectives of the study are mainly three folds: Firstly, it was aimed to identify the spatial and temporal changes of population in Kalutara district during the period of 2001-2012. Secondly, to identify the spatial and temporal

changes of usage of drinking water sources in households in Kalutara district during the same period. Finally, to analyze the population changes and their impact on the usage of drinking water sources in households.

2 METHODOLOGY

Description of study area

The study area of this study is Kalutara district, located in the western province of Sri Lanka and on the southern coastal belt. Kalutara district is located at the coordinates between northern latitudes 6^0 $25^/$ & 6^0 $45^/$ and eastern longitudes 79^0 $50^/$ & 80^0 $20^/$. The elevation of the district is between the lowest of 61 m and the highest of 660.5 m above Mean Sea Level (MSL). Kalutara district is located in the low country wet zone of Sri Lanka, which receives an average annual rainfall of 3233.6 mm. It receives heavy rainfall during the Southwestern monsoonal period of May to September and second inter-monsoonal period of October to November.

The average annual temperature of the district is around 30.6 ^{0}C and there are high humidity levels. According to the Köppen Climate classification, Kalutara District features a tropical rainforest climate abbreviated "Af". Kalutara district has a total area of 1606.4 Sq. km. It has 14 Divisional Secretariat (DS) divisions and 762 Grama Niladhari (GN) divisions for administrative purposes (Kalutara District Secretariat, 2017). Especially, the current study is based on fourteen Divisional Secretariat Divisions (DSDs), i.e. Panadura, Bandaragama, Horana, Ingiriya, Millaniya, Kaluthara, Dodangoda, Madurawala, Bulathsinghala, Beruwala, Mathugama, Agalawatta, Palindanuwara and Walallawita. Kalutara district is a multi-ethnic, multi-cultural district, and it is one of the most populated districts in the country. According to the Population and Housing Census of 2012, the total population of Kalutara district was 1,221,948 persons and the population density was 765 persons per square km. The total number of households was 305,737 in 2012.

Data collection

The study was based on divisional secretariats of the district. Data used for the study was based on secondary sources, population data and number of households by sources of drinking water for each divisional secretariats of the district obtained from the reports of Census of Population and Housing during the years 2001 and 2012 (DCS, 2001 & 2012).

Figure 1: Divisional Secretariat Divisions of Kalutara district

Data analysis

This study was a comparison of data of two census years. The variables of size, growth and distribution of population were used to study the changes in population in the study area. Population density and average annual population growth rates were calculated to identify the changes in population distribution and growth for the period of study respectively. The average annual population growth rate was calculated based on the following

formula:

$$r = \frac{1}{n}\left(\frac{pt}{po} - 1\right) \times 100$$

(De Silva, 2007)

Where *r* is the average annual population growth rate, *n* is the number of years between two census years, *pt* is the population in last censes year and *po* is the population in the previous censes year.

Further, analysis based on spatial and temporal changes of usage of drinking water sources in households are displayed using thematic maps. Spatial patterns of population are also displayed using thematic maps; especially those maps are used to compare the patterns between two years of 2001 and 2012. Thematic maps are portrayed using Arc GIS 10.0 version and equal interval classification method was used for presenting the population data in thematic maps. Microsoft Excel was employed for the data analysis. Standard statistical techniques such as percentage analysis and correlation analyses were used wherever applicable. T-test was used to identify the statistically significant differences between two censes years.

3 RESULTS AND DISCUSSION

Identifying spatial and temporal changes of population

In order to identify the spatial and temporal changes of population in Kalutara district, the study was concentrated mainly on the characteristics of population, i.e. the distribution, growth and the density of the population and the total number of households.

Spatial and temporal changes of population distribution

Based on equal interval method the highest population is in Panadura, Kalutara and Beruwala Divisional Secretariat Divisions in both the years of 2001 and 2012. Figure 2 presents the spatial distribution of population in DS divisions of Kalutara district in 2001. These three DS divisions account for 42% and 41% of the total population in 2001 and 2012 respectively. Especially, it is clear that all the highest populated DS divisions in Kalutara district are located in the west coast. The lowest population is recorded from rural areas in the study, i.e. Ingiriya, Madurawala, Agalawatta, Palindanuwara, Walallawita, Dodangoda and Millaniya DSDs. These seven DSDs account for more than one quarter (29%) of the total population, while Bandaragama and Horana DSDs record a moderate population in both years. Therefore, based on the thematic maps it can be concluded that the spatial distribution pattern of population is similar in both the years. However, the t- test results showed that there is no significant temporal changes ($p>0.05$) of the spatial distribution in the population of the study area.

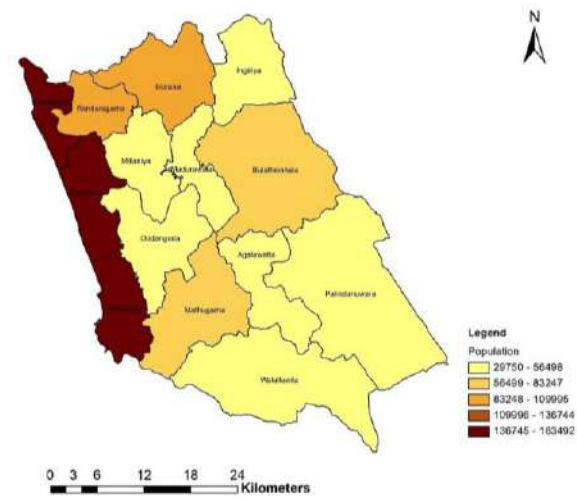

Figure 2: Distribution of population by DS divisions in 2001

Similarly, when considering the records of total population in DSDs level wise, it can be identified that the highest population is recorded in Panadura DS division while the lowest population is recorded in Madurawala DS division in both the years of 2001 and 2012 with a significant increase (Table 1). In addition, the records in the Table 1 revealed that the all DSDs have shown a continuous increase in the population distribution both spatially and temporally.

Spatial and temporal changes of population density

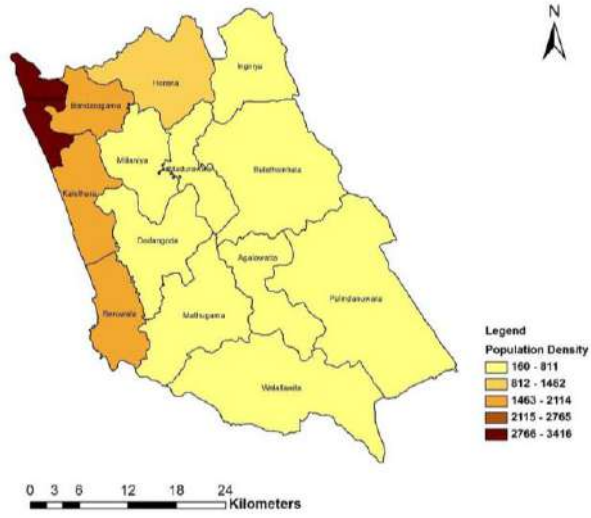

Figure 3: Population Densities of DS divisions in 2001

In general, the population density or number of persons per square km in a country increases corresponding to the increase in the total population (Table 1). The population density in Kalutara district was 677 persons per square km in 2001 census, and it has increased to 775 by the 2012 census. In comparison to the census of 2001, the population density has increased by 98 persons.

Similarly, when focussing on the population density on DS division basis, it could be seen that the DS division of Panadura (according to the census data, the highest population is recorded in Panadura) has the highest densities of population in both years. Numerically it is 3416 and 3809 in 2001 and 2012 respectively.

Figure 3 illustrates the Population Densities of DS divisions in 2001. This result is line with Nandaseela (2015) that recorded the highest density in Panadura DSD. Moreover, the population density of Panadura DSD has increased by 393 persons between 2001 and 2012.

Table 1: Summary of the population distribution in the study area

DS Division	2001	2012	Population Increases
Madurawala	29750	34381	4631
Agalawatta	33962	36669	2707
Millaniya	44476	52176	7700
Ingiriya	45726	53896	8170
Palindanuwara	45911	50801	4890
Walallawita	50676	54628	3952
Dodangoda	55052	63960	8908
Bulathsinhala	59787	64600	4813
Mathugama	73269	81286	8017
Bandaragama	86886	109236	22350
Horana	90690	113364	22674
Kaluthara	141829	159697	17868
Beruwala	144733	164969	20236
Panadura	163492	182285	18793

Note: Data have been arranged in ascending order based on the population

Source: Census of population and housing – 2001, 2012

Numerically it is 3416 and 3809 in 2001 and 2012 respectively. Figure 3 illustrates the Population Densities of DS divisions in 2001. This result is in line with Nandaseela (2015) that recorded the highest density in Panadura DSD. Moreover, the population density of Panadura DSD has increased by 393 persons between 2001 and 2012. According to Nandaseela (2015), the reason for the highest density in Panadura DSD is the location of the city and its infrastructure.

The road network with Panadura as a centre connecting Rathnapura, Colombo and Galle makes the city more connected with people who travel from different areas. Specially, the DSDs along the A2 road (Galle Road), i. e. Beruwala and Kalutara also indicate high population densities in both years. In addition to Beruwala and Kalutara, adjoining Bandaragama DS division also indicates a comparatively high population density.

Numerically, it is 1526 and 1919 in 2001 and 2012 respectively. The population density has increased by 393 persons. Population density in Ingiriya,, Bulathsinhala, Palindanuwara, Madurawala, Agalawatta, Walallawita, Mathugama, Dodangoda and Millaniya DSDs in both the years of 2001 and 2012 were low.

Specially, population density maps clearly show that population is congested along the low land areas within the district and a high density can be observed beyond the coastal sides.

Therefore, based on the thematic maps it can be concluded that the spatial distribution pattern of population density is similar in both years. The t-test results showed that there is no significant temporal changes ($p>0.05$) of the spatial distribution in the population density.

However, according to the table 2, it can be identified that all the DSDs have shown a continuous increase in the population density both spatially and temporally.

Table 2: Population Density in the study area, 2001 and 2012

DS Division	2001	2012	Population Density change (2001-2012)
Palindanuwara	160	177	17
Walallawita	241	260	19
Bulathsinhala	288	311	23
Agalawatta	453	489	36
Madurawala	474	548	74
Ingiriya	497	586	89
Dodangoda	515	598	83
Mathugama	546	606	60
Millaniya	585	686	101
Horana	847	1058	211
Bandaragama	1526	1919	393
Kaluthara	1978	2227	249
Beruwala	1983	2260	277
Panadura	3416	3809	393

Note: Data have been arranged in ascending order based on the population density

Source: Census of population and housing – 2001, 2012.

Spatial and temporal changes of population growth

When considering the annual growth of population, Bandaragama and Horana DS divisions have the highest average annual growth rates in 2001 - 2012 with 2.34% and 2.27% respectively. In fact, according to the results of the study area, Bandaragama and Horana DSDs recorded a moderate population in both the years of 2001 and 2012. In addition, Ingiriya (1.62%), Madurawala (1.42%), Millaniya (1.57%) and Dodangoda (1.47%) DS divisions also indicate comparatively high average annual growth rates. However, the low average annual growth rates are reported in Bulathsinhala (0.73%), Palindanuwara (0.97%), Agalawatta (0.72%), Mathugama (0.99%) and Walallawita (0.71%) DSDs. This could be explained as being due to the migrating of estate population for employment prospects. Moreover, the high-populated DSDs namely Panadura, Kalutara and Beruwala are recorded as second low average annual growth rates with 1.04%, 1.15% and 1.27% respectively.

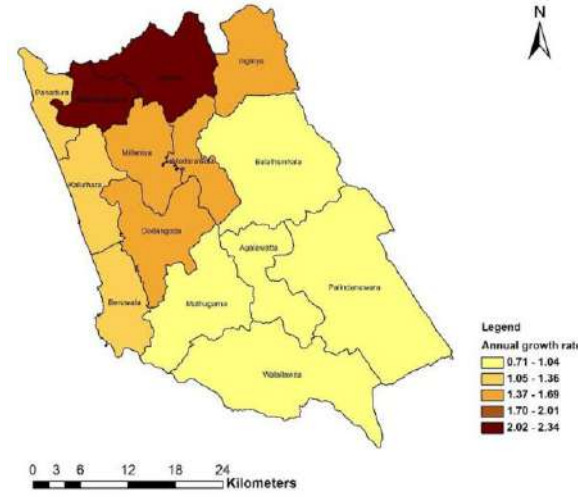

Figure 4: Average annual growth rates by DS divisions between 2001 and 2012

However, according to the average annual growth rates, it can be identified that Bandaragama DSD has recorded the highest population growth rate while Walallawita DSD has recorded the lowest population growth rate.

Spatial and temporal changes of total households

Figure 5 presents the spatial distribution of total households by DS divisions in Kalutara district in 2001. According to the figure, high values of the total households are in Panadura and Kalutara Divisional Secretariat Divisions in 2001. The same pattern could also be identified in 2012.

The low numbers are recorded from rural areas in the study area, i.e. Ingiriya, Madurawala, Agalawatta, Palindanuwara, Walallawita and Millaniya DSDs, while Bandaragama and Horana DSDs recorded moderate total households in both the years.

Therefore, based on the thematic maps it can be concluded that the spatial distribution pattern of total households is similar in both the years. However, the t- test results showed that there is no significant temporal changes ($p>0.05$) of the spatial distribution in the total households of the study area.

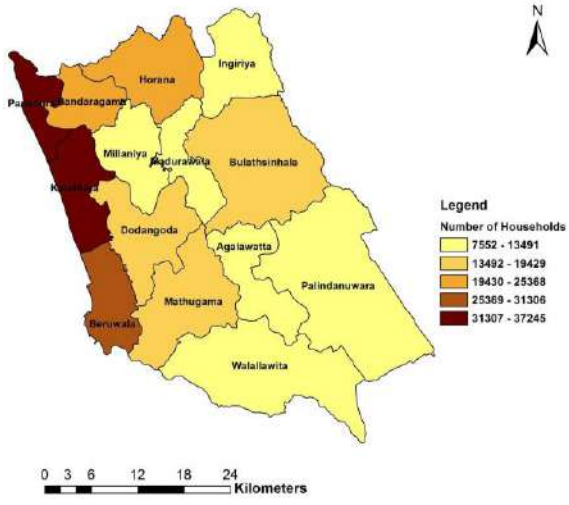

Figure 5: Total households by DS divisions in 2001

Identifying the spatial and temporal changes in the usage of drinking water sources in households

In particular, the Millennium Development Goals (MDGs) on drinking water were met globally in 2010; water target is measured by the proxy indicator of use of 'improved' or 'unimproved' drinking-water sources. As already mentioned, the "improved" water sources are piped water supply into the dwelling; piped water to yard or plot; public tap or standpipe; tube well or borehole; protected dug well; protected spring; and rainwater. Water sources that are "unimproved" are unprotected dug well; unprotected spring; cart with small tank or drum; water tanker-truck; surface water; and bottled water. However, according to the census data in Sri Lanka, the data can be categorized in nine sources according to the MDGs standard. The nine classified sources of drinking water which are included in "improved" water sources are piped water supply into the dwelling; piped water to yard or plot; tube well or borehole; protected dug well; and rainwater while "unimproved" are unprotected dug well; water tanker-truck; surface water; and bottled water. Therefore, in this study, the data of the main sources of drinking water by households were analysed by using the nine classified sources of drinking water categories. Particularly spatial analysis tools in Arc GIS were used as the main analytical tool for identifying the spatial changes of the usage of drinking water sources. Especially, equal interval classification method was used for presenting household data in thematic maps.

Spatial and temporal changes in the usage of the improved sources of drinking water

According to the data as well as the percentage share of major drinking water sources in both censuses, the results indicated that in Kalutara district, majority (86% and 94%) of the households used "improved" sources of drinking water while 14% and 6% used "unimproved" sources of drinking water in 2001 and 2012 respectively. Therefore, it can be identified that there is an

increase in the use of improved sources of drinking water by 8%. In addition, it is important to note that the majority of the current population in the study area has access to safe drinking water. Specially, availability and access to improved source of drinking water is a basic indicator for human development. It bears direct relevance to health and well-being and is thus symbolically linked to the achievement of Millennium Development Goals.

Among the nine classified sources of drinking water, the study also showed that the majority (63% and 59%) of the households used protected dug well as the main source of drinking water in 2001 and 2012 respectively. Therefore, it can be identified that most of the households (about 74% and 63% in 2001 and 2012 respectively) in the study area obtained their drinking water from shallow ground water using wells (including protected and unprotected dug wells).

However, the absolute figures reveal a decrease in the use of protected dug well (4%) as a major drinking water source, indicating a fall in ground water tables. Moreover, the results of the study showed that there was a significant increase (18%) in the use of piped water into the dwellings (12% and 30%) in 2001 and 2012 respectively

When considering the spatial distribution of usage of improved sources of drinking water, it is revealed that the highest proportion of usage of improved sources of drinking water was reported in Panadura DSD (figure 6) in 2001. Kalutara and Beruwala DSDs rank in second position in 2001.

Moreover, Horana and Bandaragama DSDs depend moderately on improved sources of drinking water, whereas Ingiriya, Bulathsinhala, Palindanuwara, Walallawita, Agalawatta, Madurawala, Millaniya and Dodangoda DSDs depend the least on improved sources of drinking water. However, when comparing the figures 6 & 7, it is revealed that the high proportion of improved sources of drinking water is used by the households in Panadura and Kalutara DSDs, while Beruwala DSD ranks in the second position in 2012, although, the same position of use of improved source is recorded in other DSDs in both the years in 2001 and 2012. However, the t- test results showed that there is no significant difference ($p>0.05$) between those who used improved sources of drinking water in 2001 and 2012.

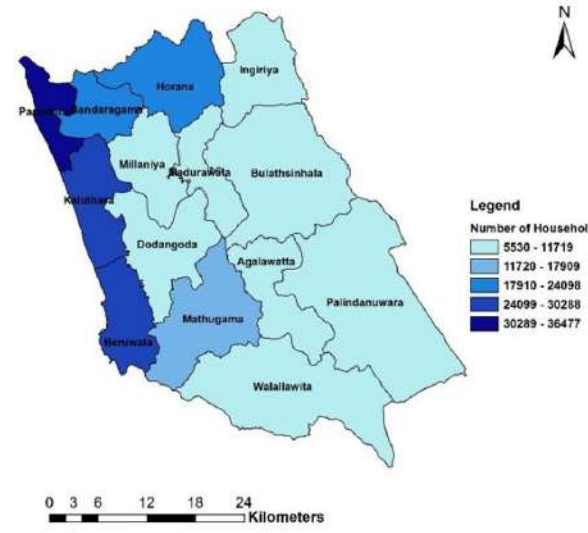

Figure 6: Distribution of usage of improved sources of drinking water, 2001

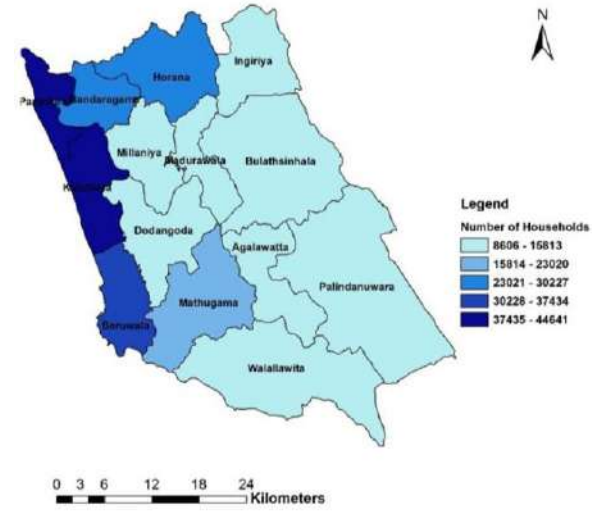

Figure 7: Distribution of usage of improved sources of drinking water, 2012

According to the classified sources of "improved" water sources, at the DSDs level, Panadura and

Beruwala DSDs depend the most on piped water supply into the dwelling while Kalutara DSD ranks in the second position in 2001.

However, there is a decrease in the use of piped water supply into the dwelling as the main source of drinking water in Beruwala DSD in 2012. The thematic maps also indicate that Ingiriya, Bulathsinhala, Palindanuwara, Walallawita, Agalawatta, Madurawala, Horana, Bandaragama, Millaniya, Dodangoda and Mathugama DSDs depend the least on piped water supply into the dwelling in both the years of 2001 and 2012.

However, the t- test results showed that there is no significant difference ($p>0.05$) between those who used piped water supply into the dwelling in 2001 and those who did so in 2012.

When thematic maps on the sources of drinking water is compared between census 2001 and 2012, the use of piped water to a yard or plot has recorded an appreciable decrease in Kalutara DSD. Of the users of piped water to a yard or plot, 20% of the users have recorded in 2001 while in 2012 only 14.7% of the households have used that facility in Kalutara DSD. Further, the high numbers of households which use piped water to a yard or plot is reported from the DSDs of Panadura and Beruwala, and the low numbers of households which use piped water to a yard or plot is reported from the DSDs of Ingiriya, Bulathsinhala, Palindanuwara, Walallawita, Agalawatta, Madurawala, Horana, Bandaragama, Millaniya, Dodangoda and Mathugama in both the years. Moreover, it is revealed that most of the users of piped borne water (including the piped water supply into the dwelling) were in the coastal side of the study area. However, the t- test results showed that there is no significant difference ($p>0.05$) between those who used piped water to a yard or plot in 2001 and those who did so in 2012.

When considering the use of protected dug well as the main sources of drinking water, it is revealed that the high numbers of households is reported in Bandaragama, Panadura and Kalutara DSDs in 2001, while only Bandaragama DSD ranks as the highest in 2012. Panadura and Kalutara DSDs rank third and second position in 2012 respectively. However, a significant increse in use of protected dug well as the main sources of drinking water can be identified in Horana DSD in 2012.

Therefore, it can be noticed that the decrease in the use of protected dug well in the coastal side DSDs is indicating fall in ground water tables. Moreover, the use of protected dug well has increased in Ingiriya and Walallawita DSDs in 2012 as the main source of drinking water. However, the t- test results showed that there is no significant difference ($p>0.05$) between those who used of protected dug well in 2001 and 2012.

At the DSDs level, Kalutara DSD have the maximum number of households with use of rainwater while other DSDs depend the least on rainwater in both the years of 2001 and 2012. However, the t- test results showed that there is no significant difference ($p>0.05$) between those who used rainwater in 2001 and 2012.

Spatial and temporal changes of the usage in the "unimproved" sources of drinking water

As already mentioned, there is a decrease in the use of "unimproved" sources of drinking water as their main source of drinking water in the study area between the year 2001 and 2012. When considering the spatial changes of the use of unimproved sources of drinking water, figure 8 reveals that the highest proportion of unimproved sources of drinking water was used by the households in Palindanuwara DSD, while Bulathsinhala and Walallawita DSDs ranks in the second position in both years. Moreover, Beruwala and Mathugama DSDs depend moderately on unimproved sources of drinking water in 2001. However, in 2012, only the Mathugama DSD depend moderately on unimproved sources of drinking water and Beruwala has decreased the use of unimproved sources. Furthermore, Ingiriya, Madurawala, Millaniya, Bandaragama, Panadura and Kalutara DSDs depend the least on unimproved sources of drinking water in 2001.

However, Horana and Agalawatta DSDs have decreased the use of unimproved sources of drinking water and those DSDs are considered as the DSDs which used the least unimproved water by 2012. Although, Dodangoda DSD in the same position in both years. Thus, the t-test results showed that there is significant difference ($p<0.05$) between those who used unimproved sources of drinking water in 2001 and those who did so in 2012.

When considering the spatial changes of the classified sources of "unimproved" water sources, at the DSDs level, Beruwala, Walallawita, Palindanuwara and Bulathsinhala DSDs depend the most on unprotected dug well while Mathugama DSD ranks in second position in 2001.

However, in Beruwala and Bulathsinhala DSDs a decrease in the use of unprotected dug wells can be identified by 2012. In addition, in Ingiriya, Kalutara, Dodangoda and Agalawatta DSDs a decrease in the use of unprotected dug wells can be identified by 2012. Therefore, by 2012 it can be identified that there are five DSDs as the lowest in use of unprotected dug well. Thus, the t-test results showed that there is significant difference ($p<0.05$) between those who used unprotected dug well in 2001 and those who did so in 2012 in the study area.

It is also indicated that Beruwala DSD depends the most on tanker-truck while Horana and Kalutara DSDs rank in the second position in 2001. The thematic maps also indicate that Panadura, Bandaragama, Ingiriya, Bulathsinhala, Madurawala, Millaniya, Dodangoda, Mathugama, Agalawatta, Palindanuwara and Walallawita DSDs depend the least on tanker-truck in 2001. Although, by 2012 Dodangoda DSD depends the most on tanker-truck and other DSDs depend the least.

However, the t-test results showed that there is significant difference ($p>0.05$) between those who used water from tanker-truck in 2001 and those who did in 2012.

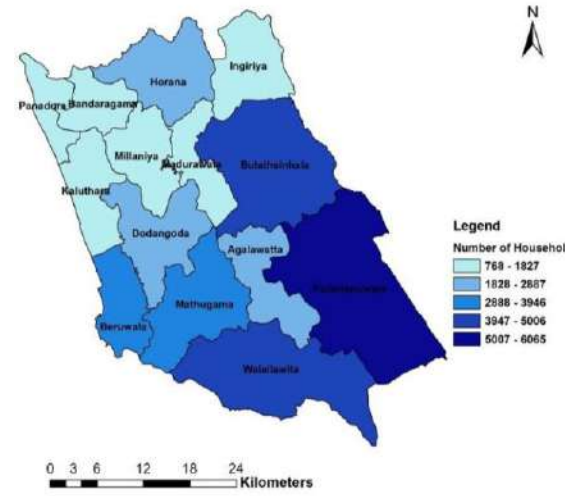

Figure 8: Distribution of usage of unimproved sources of drinking water, 2001

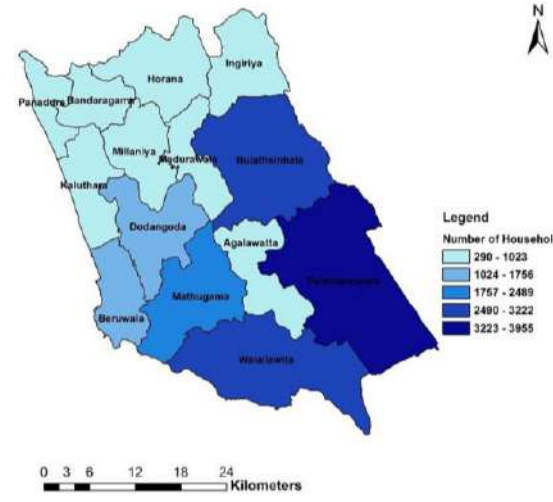

Figure 9: Distribution of usage of unimproved sources of drinking water, 2012

The thematic maps also indicate that the highest number of households used water from the surface water, which is considered an unsafe source of water for drinking purposes in Palindanuwara DSD in both the years. Further, it is revealed that there is an increase in the use of surface water in Bulathsinhala DSD and a decrease in Agalawatta DSD by the year 2012. However, the t-test results showed that there is a significant difference ($p>0.05$) between those who used surface water in 2001 and those who did so in 2012.

According to the mapping analysis, it is revealed that Panadura and Beruwala DSDs depend the most on bottled water while Kalutara DSD ranks in the second position in 2012. Further, Bandaragama, Horana, Ingiriya, Bulathsinhala, Madurawala, Millaniya, Dodangoda, Mathugama, Agalawatta, Palindanuwara and Walallawita DSDs depend the least on bottled water as the main source of drinking water.

Analyze the population changes and their impact on usage of drinking water sources in households

Correlation analysis was used to establish the type of relationship between population and usage of drinking water sources in households in the study area. T-test was also used to identify the statistically significant relationship between two censes years. Null hypothesis and Alternative Hypothesis are presented below.

Null Hypothesis (H_0): There is no significant relationship between the population increase and use of drinking water sources in households.

Alternative Hypothesis (H_1): There is a significant relationship between the population increase and use of drinking water sources in households.

Relationship between population size and usage of drinking water sources

According to the results of correlation analysis, the correlation values of 0.98 and 0.99 indicate a strong relationship between the increase in population size and the usage of improved sources of drinking water in 2001 and 2012 respectively. It is also significant ($p<0.05$) change in both the years. Furthermore, the positive correlation among the correlated factors has increased by 2012. On the other hand, it means that the relationship between population size and the use of improved sources of drinking water in the study area is really a strong one, in the sense that any significant increase in the population of the district leads to a chain effect on the use of improved sources of drinking water of the district. This also really means that safety water is affected at a rate of 98% and 99% by the continuous increase in the population size of the district in 2001 and 2012 respectively.When considering the classified sources of "improved" water sources, there is a strong positive relationship between the increase in population size and the uses of all the classified improved sources of drinking water in the Kalutara district. It is significant ($p<0.05$) in both the years. These values are also really high, and it shows that the population factor is highly dependent on water use.

However, according to the correlation analysis, the correlation values of -0.29 and -0.36 indicate a weak relationship among the correlated factors in 2001 and 2012 respectively. It has a negative correlation and is not significant ($p > 0.05$). Therefore, it can be concluded that the relationship between population size and use of unimproved sources of drinking water in the study area is really a weak one, in the sense that significant increases in the population has no significant influence on the use of unimproved sources of drinking water. There is a strong positive relationship between the increase in population size and the use of tanker-truck as the main source of drinking water in 2001 and is significant ($p<0.05$). It can also be identified in the use of bottled water in 2012.

Relationship between population density and usage of drinking water sources

There is a significant ($p<0.05$) strong positive relationship between the increase in population density and the usage of improved sources of drinking water in both the years of 2001 and 2012 with $r = 0.93$ and $r = 0.92$ respectively. Further, all the classified improved sources of drinking water show a significant ($p<0.05$) positive correlation values. Therefore, it can be concluded that improved sources of drinking water are affected at high rates by the continuous increase in the

population density of the district in 2001 and 2012 respectively.

When considering the unimproved sources, there is a moderate negative relationship (r = - 0.41 in 2001 and r = - 0.52 in 2012) between the increase in population density and the usage of unimproved sources of drinking water in the Kalutara district. There is no significant relationship ($p>0.05$) in 2001 whereas there is a significant relationship ($p<0.05$) in 2012. In addition, it is evident that all the unimproved sources of drinking water, except two sources, show a negative correlation values. Use of tanker-truck in 2001 and use of bottled water in 2012 are the only sources that have shown a significant positive correlation ($p<0.05$). Moreover, the use of surface water is indicated significant ($p<0.05$) and a moderate negative relationship. Therefore, it can be concluded that increases in the population density has significant influence on the use of surface water and when there is an increase in population density the use of surface water has decreased.

Relationship between total households and usage of drinking water sources

According to the results, the correlation values of 0.99 and 1.00 indicate a strong relationship among the correlated factors in 2001 and 2012 respectively. Accordingly, it can be said that there is a strong relationship between the increase in total households and the usage of improved sources of drinking water in the study area. Moreover, it is a significant relationship ($p<0.05$). Furthermore, the positive correlation among the correlated factors has increased by 2012. This also really means that improved sources of drinking water is affected at a rate of 99% and 100% by the continuous increase in the number of households in the district in 2001 and 2012 respectively. It is also identified that any significant increase in the number of households leads to a chain effect on the use of improved sources of drinking water of the district. Moreover, according to the results of correlation analysis it is evident that all the improved sources of drinking water show a strong positive relationship among the correlated factors and are significant ($p<0.05$) in both the years.

When considering the usage of unimproved sources of drinking water, the correlation values of -0.29 and -0.35 indicate a weak relationship among the correlated factors in 2001 and 2012 respectively. It has a negative correlation and is no significantly different ($p>0.05$).

Therefore, it can be concluded that the relationship between total households and use of unimproved sources of drinking water in the study area is really a weak one, in the sense that increases in the population has no significant influence on use of unimproved sources of drinking water in the study area is really a weak one, in the sense that increases in the population has no significant influence on the use of unimproved sources of drinking water. However, there is a strong positive relationship between the increase in total households and the use of tanker-truck as the main source of drinking water in 2001 and it is significant ($p<0.05$). It can also be identified in use of bottled water in 2012.

4 CONCLUSIONS

The study was carried out to identify the spatial and temporal changes of population and usage of drinking water sources in Kalutara district. Similarly, the study aimed at establishing a relationship that exists between the population increase and the use of drinking water sources in Kalutara district. The study has revealed that all the DS divisions with the highest population and population density are located in the west coast while the lowest are recorded from rural areas in the study area. It is also revealed that there was an increase in the population size and population density both spatially and temporally. The study has also shown that there was a similar distribution pattern in total households and the highest total households were in Panadura and Kalutara DSDs in both the years. Further, the study has revealed that the highest annual growth rate of population is recorded in Bandaragama and Horana DS divisions. However, the t- test results showed that

there is no significant temporal changes ($p>0.05$) of the spatial distribution in the population size, population density and total households of the study area.

This study showed that the majority of the households used improved or safe sources of drinking water. It could be identified that there was an increase in the use of improved sources of drinking water while there was a decrease in the use of unimproved sources of drinking water. The results also showed that most of the households in the study area obtained their drinking water from shallow ground water using wells (including protected and unprotected dug wells). However, in terms of absolute figures it revealed a decrease in the use of protected dug wells as their major source of water in the coastal side indicating a fall in ground water tables in the area. Moreover, the results showed that there was a significant increase in the use of piped water into dwelling in both the years. According to the thematic maps, it was revealed that most of the households use pipe borne water as their major source of water in the coastal side of the study area. However, the t- test results showed that there was no significant difference ($p>0.05$) between those who used all classified improved sources of drinking water in 2001 and those who used them in 2012. It was evident that the highest proportion of unimproved sources of drinking water was used by the households in Palindanuwara DSD. The t-test results showed that there was a significant difference ($p<0.05$) between those who used all classified unimproved sources of drinking water in 2001 and those who used them in 2012.

Further the present study revealed that there was a strong relationship between the increase in population size, population density and total households, and it led to a chain effect on the use of all the classified improved sources of drinking water in Kalutara district and was significant ($p<0.05$) in both the years.

However, the study indicated that the relationship between population size and use of unimproved sources of drinking water as well as total households and use of unimproved sources of drinking water in the study area is really a weak one, in the sense that significant increases in the population size and total households had no significant influence on the use of unimproved sources of drinking water. Although, there was a strong positive relationship between the increase in population size and the use of tanker-truck as well as total households and the use of tanker-truck as their main source of drinking water in 2001 and was significant ($p<0.05$). It could also be identified in the use of bottled water in 2012.

There was a moderate negative relationship between the increase in population density and the uses of unimproved sources of drinking water in Kalutara district. In addition, it was evident that all the unimproved sources of drinking water, except two sources which use tanker-truck and bottled water, show negative correlation values. It was also evident that the increase in population density had significant influence on the use of surface water. The study therefore recommend that the source of drinking water should be managed sustainably in order to ensure continuous availability in the long-term.

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INTERNALLY GENERATED REVENUE AND SCHOOL PLANT MAINTENANCE IN KWARA STATE PUBIC SECONDARY SCHOOLS, NIGERIA

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ABSTRACT

This study investigated the internally generated revenue and school plant maintenance in Kwara State public secondary schools, Nigeria. The research adopted descriptive research design of survey type. The population of the study was made up of 7273 teachers and principals from the existing 334 public secondary schools in Kwara State. Random sampling technique was used to select 40 public secondary schools representing 12% of the schools and 415 respondents made up of 375 teachers and 40 principals representing six percent of the total number of teachers and principals used in the study. The researchers used two self-developed instruments tagged "Internally Generated Revenue Checklist" (IGRC) and "School Plant Maintenance Questionnaire" (SPMQ). IGRC comprises of items on IGR and SPMQ comprised of items on five identified school plant maintenance practices. These include corrective, preventive, shut down, running and breakdown maintenance. The instruments were validated by three experts in the Department of Educational Management. Only one hypothesis was formulated and four research questions were raised for the study. Descriptive statistics of Mean, Standard Deviation, Rank Ordering and Percentage Average were used to answer the research questions, while inferential statistic of Pearson(r) was used to test the hypothesis at 0.05 level of significance. The hypothesis tested revealed that there was a significant relationship between internally generated revenue (IGR) and school plant maintenance in Kwara State public secondary schools, Nigeria. The amount ₦15,274,556 devoted for school maintenance in 2014/15 had the highest percentage average of 66.9% and finally, preventive maintenance is the common type of school plant maintenance in public secondary schools in Kwara State. Based on the findings, it was recommended among others that principals should engage in other sources of internally generated revenue for school plant maintenance.

KEYWORDS: *Internally Generated Revenue, School Plant Maintenance*
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1 INTRODUCTION

The quality of education delivered by teachers and the academic achievement of students of any school are dependent on several factors. School plants are material resources that enhance teaching and learning as they help make the process of teaching and learning meaningful and purposeful. School facilities can be referred to as school plant. School facilities can be defined as the entire school plant which school administrators, teachers and students harness, allocate and utilize for the smooth and efficient management of any educational institution, with the objective of bringing about effective and purposeful teaching and learning experience. Adeboyeje (2000) and Emetarom (2004) described school plants as the physical and spatial enablers of teaching and learning, which will increase the production of results. School plants serve as pillars and support for effective teaching and learning. A quality or standard school largely depends on the provision, adequacy, utilization and management of educational facilities.

Akinsolu (2004) asserted that educational curriculum cannot be adequately operated with poor and badly managed school plants. From all indication, school plants are physical resources that facilitate effective teaching and learning. They include blocks of classrooms, laboratories, workshops, libraries, equipment, consumables, electricity, water, visual and audio-visual aids, tables, desks, chairs, playground, storage space and toilets. In Nigeria, public school enrolment has continued to increase without a corresponding increase in facilities for effective teaching and learning, perhaps because of underfunding of education in Nigeria (Omosidi, 2008). However, the government in recent time has been encouraging proper maintenance of available school facilities.

School plants maintenance entails ensuring that the facilities are kept near their original state as possible. This involves keeping the school sports and football field clean, periodic renovation of the buildings, prompt servicing of school bus and generator sets, repair of furniture, etc. For the purpose of restoring and maintaining the school plants to optimum working condition, there is a need for school principals to device other means of generating funds. The only other means that is legally available to the school principal is the money generated within the operations of the school system, which is referred to as the Internally Generated Revenue (IGR) (Omosidi, 2008).

IGR is the creation of either tangible or intangible results within the confines of one entity. The term implies an organization's source of funds through its effort or operations, that is, such funds are not borrowed or realized through any other means outside the operations of the organization.

Omosidi (2008) defines IGR as the revenue or income generated within the school system through internal operational activities, and such income includes tuition fees, examination fees, sales of forms, rents, consultancy services, farm products, sports, and internet services.

According to Salamat (2007), internally generated revenue controls and regulates the spending of money in educational system, and it thereby helps to reveal losses, waste and inefficiency, thus making it possible for corrections to be made promptly. Internally generated revenue forms an integral part of school administration. Hence, one of the administrative functions of a school principal is to appropriately manage school funds. Therefore, if the objectives of the school must be achieved, generated funds must be prudently managed. Lack of prudence and management of school funds by the principals could give rise to poor students' performance as it might slow down the acquisition of essential materials for teaching and learning (Yusuf, 2011). It is observed that most of the secondary schools in Nigeria, especially in Kwara State are dilapidated due to inadequate funding and poor maintenance culture. Such situation hinders effective teaching

and learning, making the process rigorous and uninteresting to students and teachers (Owuamanam, 2005). It is against this background that the study examined the relationship between internally generated revenue and school plant maintenance in Kwara State public secondary schools, Nigeria.

Statement of the Problem

In some schools, the buildings are dirty and they have no lighting, while some have blown off roofs. The roads leading to the sports field in some schools are weedy. It appears there are no adequate management and maintenance culture of school plants. Asiyai (2012) noticed the same during several visits to some schools for supervision, that most school compounds were bushy, and that they had dilapidated buildings with leaking roofs, broken chairs and desks, and rough floors and windows without louvers. Therefore, In view of this unfortunate development, school principals should be encouraged to device other means of generating revenue for the maintenance of the available school plants with a view to restoring the school plants to its optimum working condition.

Many related studies have been carried out in various areas on fund management and school plants management in schools, such as: financial administration practices in public secondary schools in the Accra metropolis (Samuel, 2007), the role of head teachers in improvisation and maintenance of school plants (Yusuf & Adigun, 2012). Omosidi, Oyedeji and Ojo (2015) conducted a study on school plants management and students' academic performance in Kwara State public secondary school, Nigeria. Durosaro (1998) examined school plants planning in relation to administrative effectiveness of secondary schools in Oyo State of Nigeria. Bruno (2009) examined the challenges heads of senior high schools face in the management of internally generated revenue in a case study of selected schools in Sunyai Municipality.

It is however noted that most of the research studies cited have been carried out in the area of school plant maintenance in relation to students' academic performance, administrative effectiveness and role of head teachers in the improvisation of school plant maintenance, thus, none of these studies have been carried out to examine IGR and school plant maintenance. Hence, this study covers some of these missing gaps.

Purpose of the Study

The main purpose of this study was to determine the relationship between internally generated revenue and school plant maintenance in Kwara State public secondary schools.

The specific purposes of this study were to:

1. Identify the various sources of generating revenue internally in Kwara State public secondary schools.
2. Determine the amount of internally generated revenue in Kwara State public secondary schools.
3. Find out the percentage of internally generated revenue devoted for school plant maintenance in Kwara State public secondary schools.
4. Identify the types of school plant maintenance in Kwara State public secondary schools

Research Hypothesis

There is no significant relationship between internally generated revenue and school plant maintenance in Kwara State pubic secondary schools, Nigeria.

Research Questions

The following research questions were raised to guide the study:

1. What are the various sources of generating revenue internally in Kwara State public secondary schools?

2. What are the amounts of internally generated revenue in Kwara State public secondary schools?
3. What percentage of internally generated revenue is devoted for school plant maintenance in Kwara State public secondary schools?
4. What are the types of school plant maintenance in Kwara State public secondary schools?

Literature Review

Samuel (2007) carried out a study on financial practices in public secondary schools in Accra metropolis. The findings of the study revealed that the schools were not able to generate sufficient funds internally through their own initiatives. The study recommended that, since the funds from the central government are not sufficient to fund secondary schools, heads of schools should adopt proactive measures to collect much of the school fees from the students before the academic year ends. The steps include frequent calling of Parent-Teacher Association (PTA) meetings to educate parents on the need for prompt payment of their wards' fees and publishing lists of debtors on the notice boards, at least once every term. It is hoped that this would inform students who owe fees to remind their parents to pay on time. Also, the government and educational institutions should encourage chiefs, individuals, churches and businessmen in their area to set up foundations and endowment funds to support education.

In the same vein, Asiyai (2012) in his study on assessing school facilities in public secondary schools in Delta State, Nigeria lamented that the maintenance activities carried out on school facilities in Delta State public secondary schools are inadequate. Thus, cracks on buildings, ceiling, roofs and electric fixtures are not easily detected and repaired. Broken chairs and tables are not quickly repaired. Damaged louvers, doors and windows are not replaced immediately and buildings are not regularly renovated due to insufficient government funds and internally generated revenue. The study then recommended that the school principals should find alternative methods of generating revenue internally to complement the efforts of the government. It was also recommended that for effective management and maintenance of school facilities, preventive maintenance procedures should be established and implemented by school managers.

Yusuf and Adigun (2012) investigated the role of head teachers in improvisation and maintenance of school plants. The study recommended that Head teachers should not only take proper care of the available school plants but they should also strive hard to create, design and generate alternative materials and resources from their immediate environment to facilitate proper teaching and learning processes in the primary schools.

Olagboye (1998) saw school plant maintenance as work carried out on any component of the plants with a view to keeping it in good condition. Having identified the economic rationale of modernization, a relevant programme of maintenance and physical plants renewal is imperative. A priority for maintenance is essential because unattended deterioration and neglect of school buildings could lead to higher outlays, in the form of replacement cost which schools cannot afford at this period of economic hardship; hence a maintenance culture should be adopted wherever school premises are occupied. Besides, maintenance enables us to pay less now, instead of waiting to pay more at a delayed point in time in the future (Enawhwo, 1990). Hence, there is an absolute need for the few available ones to be properly maintained for effective teaching and learning.

Omosidi, Oyedeji and Ojo (2015) examined the existing relationship between school plant management and students' academic performance in

Kwara State secondary schools, Nigeria. The result of the study shows that school plant management had a positive significant relationship with students'

academic performance in Kwara State public secondary schools, Nigeria.

However, all the previous researches reviewed on internally generated revenue and school plant maintenance used different locale. This study is different because it covered Kwara State and internally generated revenue was discussed along with funding from parents, students, community groups, foundations and charitable organisations considering the issue of school plant maintenance.

2 METHODOLOGY

The researchers adopted descriptive survey design for the study. It was used because the researcher aimed at finding out the effect of internally generated revenue (independent variable) on the school plants maintenance (dependent variable).

The population of the study was made up of 7273 teachers and principals from the existing 334 public secondary schools in Kwara State. Random sampling technique was used to select a sample of 40 public secondary schools representing 12% of the schools and 415 respondents made up of 375 teachers and 40 principals representing six percent of the total number of teachers and principals used in the study.

The researchers used two self-developed instruments tagged "Internally Generated Revenue Checklist" (IGRC) and "School Plant Maintenance Questionnaire" (SPMQ). IGRC comprises of items on IGR and SPMQ comprised of items on five identified school plant maintenance practices. These include corrective, preventive, shut down, running and breakdown maintenance.

The drafted copies of the instruments were presented to four experts in the field of Educational Management and Educational Measurement and Evaluation, Faculty of Education, University of Ilorin, Ilorin for the purpose of validating its content. Test re-test method was used to ascertain the reliability of SPMQ.

The data gathered were analysed using Pearson product moment correlation statistics and reliability Coefficient of 0.68 was obtained. This indicated that the instrument was reliable.

Descriptive statistics of mean, standard deviation, percentage average and rank ordering were used to analyse the research questions, while Pearson product-moment correlation statistic was used for testing the hypothesis at .05 level of significance.

Analysis, Findings and Discussion Hypothesis

There is no significant relationship between internally generated revenue and school plant maintenance in Kwara State public secondary schools, Nigeria.

Table 1 revealed the result of Pearson product-moment correlation Calculated r-value =0.65 > Critical r-value =0.196 at .05 level of significance. Hence, the null hypothesis is rejected. This shows that there is a significant relationship between internally generated revenue and school plant maintenance in Kwara State pubic secondary schools, Nigeria.

This shows that IGR collected were judiciously utilized to maintain the school plants. Although the amount generated may not be adequate to cover all the maintenance costs of school plants.

This implies that the little amount generated need to be properly managed and utilized effectively towards achieving stated educational goals in public secondary schools of Kwara State, Nigeria.

The finding is in consonant with Earthman (2002) who found that there is a significant relationship between school facility conditions and students' academic achievement.

Table 1: Correlational Analysis of Internally Generated Revenue and School Plant Maintenance. in Kwara State Public Secondary Schools

Variables	N	Mean	S.D	Df	Cal. r-value	Cri. r-value	Decision
IGR	415	27.52	6.65	414	0.65	0.196	Ho:Rejected
School Plant Maintenance	415	23.56	5.52				

Source: School Finance Record Book (2015)

Table 2: Sources of Internally Generated Revenue

Items	Mean	Standard Deviation	Rank Order
School Improvement Programme (SIP)	1.26	.441	11th
Sales of Services	1.50	.501	4th
Parent-Teacher Association (PTA)	1.96	.198	1st
Extension Programme	1.37	.483	9th
Development Levies	1.77	.421	2nd
Internal and External Examinations	1.48	.500	5th
Sales of Agricultural Products	1.24	.425	12th
Social Activities	1.44	.497	7th
Retention Fees	1.41	.492	8th
Donation	1.71	.454	3rd
Cumulative File Charges	1.19	.391	13th
Facilities Rentage	1.45	.498	6th
Boarding House System	1.16	.364	14th
Medical Charges	1.28	.448	10th

The school plants are fairly adequate and the available facilities were fairly well maintained when matched with students' population. The availability and maintenance of school facilities will enhance teaching and learning and hence the academic performance of students.

Owoeye (2000) have long identified the importance of school plants in teaching and learning while the inadequacy, deterioration and lack of maintenance of these facilities will spell doom for the teachers and students in the teaching and learning activities. Negligence in the maintenance of school plants has many negative consequences. When school plants are not well managed and maintained, they constitute health hazards to pupils and teachers who use the facilities. For instance Akinsolu (2004) reported the killing of pupils and teachers of a primary school in Nigeria when the school walls and roofs collapsed.

Research Question 1: What are the various sources of generating revenue internally in Kwara State public secondary schools?

Even large amounts of money invested on school plants are wasted when school buildings and equipment are left to deteriorate without maintenance. It has been observed that school plants are not been maintained by school administrators and hence depreciating. The principals' sometime appears to spend much time on instructional planning, curriculum development, personnel development and community relations claiming that the management and maintenance of school plants is the sole preserves of the government.

Table 2 indicates that Parents-Teachers Association, development levies, donations, sales of services and internal and external examinations constitute the most popular and recognised sources of the internally generated revenue in the public secondary schools in Kwara State. The responses to the items are well above 90%, it is evident that these sources were well known and recognised by both the teachers and principals in most of the schools. This is because money from these sources was directly collected by the teachers before remitting them to the central purse, which is the principal.

It is therefore, evident that both the teachers and principals were aware that a substantial amount of revenue is generated.

Table 2, also indicates the popularity of other sources like facilities rentage, social activities, retention fees, extension programme, students' improvement programme and medical charges in IGR generation. Both the teachers and principals were also aware that substantial amount of revenues are generated through them.

The internally generated revenue through boarding house system, sales of agricultural products and cumulative files have the lowest mean responses in the items. This is not to say that substantial amount of revenue were not generated through them but because of the fact that is not of common practice in most of the public secondary school in Kwara State.

Research Question 2: What are the amounts of internally generated revenue in Kwara State public secondary schools between 2012/2013 and 2014/2015.

Table 3: Amount of IGR in Kwara State Public Secondary Schools between 2012/2013 and 2014/2015

Items	**2012/13** ₦	**2013/14** ₦	**2014/15** ₦
School Improvement Programme (SIP)	4,186,800	4,728,300	2,299,020
Sales of Services	1,076.340	815,560	758,450
Parents-Teachers Association.	2,145,840	1,664,490	9,190,080
Extension Programme	672,380	880,450	422,660
Development Levies	2,216,090	2,085,710	1,480,920
Examinations	2,527,120	3,045,080	6,568,105
Sales of Agricultural Products	31,901	25,885	17,620
Social Activities	130,540	159,730	100,360
Retention Fees	1,663,540	2,115,890	1,554,700
Donation	825,000	689,350	350,000
Cumulative File Charges	159,230	142,340	145,160
Facilities Rentage	123,600	851,500	91,900
Boarding House System	167,600	212,500	132,070
Medical Charges	743,445	968,680	757,830
Total	**16,669,426**	**18,385,465**	**23, 868,875**
Source: School Finance Record Book (2015)			

Table 3 indicates that several millions of revenue are generated internally every session by public secondary schools in Kwara State. The revenues were generated internally through various sources and these revenues accumulate together to become a substantial amount of money, which, if effectively utilised by the principals, is enough to initiate school plant maintenance in public secondary schools. Table 3 shows that a total sum of sixteen million six hundred and sixty-nine thousand four hundred and twenty six naira (₦16,669,426) was generated in 2012/13 session, the amount generated represents an average of ₦416,736 per school. The internally generated represents an average of ₦416,736 per school.The internally generated revenue rose to 18 million, 385,000,465 Naira in 2013/2014 (₦18,385,465).

This represents an increase of 12.5% when compared the revenues generated in 2012/213 session. The amount also increased to 23 million, 868000, 875 Naira (₦23,868,875) in 2014/2015 session at an average of ₦1,638,774 per school. The total revenue generated in that session had an increase of 18% compared to the amount of 2012/2013 and %% to the revenue generated in 2014/2015 session.

Table 4: Percentage of Internally Generated Revenue Devoted for School Plant Maintenance in Kwara State Public Secondary Schools

Items	**Amount devoted 2012/13 ₦**	**Percentage on amount devoted**	**Amount devoted 2013/14 ₦**	**Percentage on amount devoted**	**Amount devoted 2014/15 ₦**	**Percentage on amount devoted**
School buildings	5,123,673	48.74	5,543,867	45.26	6,032,162	39.59
Furniture	509,856	4.84	628,346	5.13	1,800,345	11.82
Vehicles	124,576	1.18	220,126	1.80	300,213	1.97
Workshop	218,645	2.08	202,543	1.65	276,236	1.81
Equipment	164,567	1.57	187,759	1.53	200,000	1.31
Electrical infrastructure	170,945	1.62	195,643	1.60	242,456	1.59
Books	1,005,489	9.56	1,999,723	16.33	1,879,934	12.34
Machinery	1,097,002	10.43	1,342,673	10.10	1,987,654	13.05
School site	132,645	1.26	200,348	1.64	259,567	1.70
Accessories	1,845,231	17.55	1,570,456	12.82	2,045,389	13.42
Water supply infrastructure	120,458	1.15	156,876	1.28	250,600	1.64
General Total Devoted	**10,513,087**		**12,248,360**		**15,274,556**	
Percentage Average		**63.07**		**64.0**		**66.9**

Source: School Finance Record Book (2015)

Research Question 3: What percentage of internally generated revenue is devoted for school plant maintenance in Kwara State public secondary schools?

Table 4 presents the percentage of internally generated revenue devoted for the maintenance of school plant in Kwara State Public Secondary Schools. It was shown that a different amount of money was allocated for the maintenance of various school plants.

The Table 4 shows that ₦10,513,087 was devoted for school maintenance in 2012/13, ₦12,248,360 was devoted in 2013/14 while ₦15,274,556 was devoted in 2014/15.

As a result of this, it was indicated that the amount of ₦15,274,556 devoted for maintaining school maintenance in 2014/15 had the highest percentage average of 66.9%, followed by a percentage averages of 64.0% in 2013/14 and 63.07% in 2012/13 for the maintenance of the school plant.

However the huge amount of revenue is still left as surpluses after all the spending had been made. It should be noted that, surplus can be used to initiate more school plant maintenance which has not been the practice in the past. Therefore, complaints over inadequate funds to maintain school plant may not be necessary.

It should also be noted from Table 4 that area of the principals focus in the use of internally generated revenue is recurrent expenditure and yet they often complain of inadequate school plant maintenance in the school.

Most of the surpluses from the internally generated revenues are unaccounted for or in some cases misappropriated. The principals are supposed to make use of these surpluses for the school plant development and maintenance (Yusuf, 2010).

Research Question 4: What are the types of school plant maintenance in Kwara State public s3econdary schools?

Table 5: Analysis of Mean Score of School Plant Maintenance

Items	Mean	Standard Deviation	Rank Order
Corrective Maintenance	1.69	.461	2nd
Preventive Maintenance	1.90	.305	1st
Shut Down Maintenance	1.06	.238	5th
Running Maintenance	1.27	.442	4th
Breakdown Maintenance	1.45	.498	3rd

Table 5 reveals that the type of school plant maintenance that is common to public secondary schools in Kwara State is preventive maintenance, which has the highest mean of 1.90, followed by corrective maintenance with mean 1.69, breakdown maintenance with mean 1.45, while shut down maintenance and running maintenance have the least mean value of 1.06 and 1.27 respectively.

It should be noted from Table 5 that preventive and corrective maintenance are peculiar to most of the public secondary schools in Kwara State, and that other types of school plant maintenance are at times being used as the condition dictates.

3 CONCLUSION

Based on the findings of this study, the researchers conclude that, IGR has a significant relationship with school plant maintenance in Kwara State public secondary schools, Nigeria. This implies that substantial amount of money was generated internally by public secondary schools in Kwara State between 2012/13 and 2014/15 session.

The Parent-Teacher Association (PTA) levies form a large proportion of IGR in all the schools. The amount devoted for maintenance from IGR in 2013 (₦10,513,087), 2014 (₦12,248,360) and in 2015 (₦15,274,556) were 63.07%, 64.0% and 66.9% respectively which were deemed adequate for effective school plant maintenance.

The amount ₦15,274,556 devoted for school maintenance in 2014/15 had the highest percentage average of 66.9% and finally, preventive maintenance is the common type of school plant maintenance in public secondary schools in Kwara State.

4 RECOMMENDATIONS

Sequel to the findings of this study, the researcher made the following recommendations:

1. The IGR collected presently are fairly adequate for the maintenance of the school plant, and there is therefore the need for the monitoring of the IGR collected so as to ensure that the left over revenue be properly accounted for.

2. The principals should ensure that all other sources of internally generated revenue are incorporated towards school plant maintenance.

3. The principals should keep proper record of internally generated revenue in school for proper auditing by the government.

4. The principals should make wise use of the percentage devoted from internally generated revenue for the school plant maintenance judiciously through establishment of finance management committees.

5. The school IGR needs to be shared along a priority list of the school. It is hoped that it would help determine the actual amount allocated for school plant maintenance. IGR should be religiously spent for the stated purposes.

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EXPLORATORY SURVEY OF HUMAN FACTORS ON OFFSHORE PATROL VESSELS

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ABSTRACT

Spending up to six months or more aboard a ship, occasionally subject to harsh weather, the life of a seafarer is heavily dependent on the design of the ship. A good ship design, thus, has to take account of socio-technical requirements to fulfil the fundamental needs of safety, efficiency, and usability of the entire ship and its systems by keeping Human Factors (HF) in mind. This paper presents findings of an exploratory survey conducted on two Offshore Patrol Vessels (OPVs) with an aim to identifying the application of HF within the current designs. The study was conducted using quantitative and qualitative approaches such as questionnaires, observations, and discussions with the OPV crews. Results of this study were helpful to recognise the areas where design improvements are necessary in HF perspective including inadequate comfort in ship accommodation, low level of privacy and facilities for both individual and social relaxation, noise disturbance, ergonomics issues, layout limitations, and limited spaces for crews. As a result, different levels of compliance in various HF dimensions were also recognized, and out of them habitability and maintainability were the major concerns. Finally, significant improvements that are necessary for the upcoming naval designs in terms of physical, psychosocial and organisational aspects on-board ships were identified.

KEY WORDS: *Human Factors, Human Centred Design, Usability, Marine Design, Offshore Patrol Vessels*
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1 INTRODUCTION

Spending up to six months or more aboard a ship, occasionally subject to harsh weather, the life of the seafarer is thus heavily dependent on the ship's design dimensions such as equipment accessibility, habitability, workability, maintainability, operability, usability, and survivability (LR, 2008). To ensure a design is appropriate for the intended purpose and to the context in which it will be used, the design process should consider these aspects as an integral part to consider the users' capabilities and limitations (Lützhöft, 2004, Lützhöft et al., 2017, Earthy and Sherwood Jones, 2010, Petersen, 2012, Abeysiriwardhane et al., 2016b). Furthermore, a good design always has to ensure the fundamental requirements of the safety and efficiency of the ship or its systems, and the health, safety and wellbeing of the crew, by keeping the Human Factors (HF) in mind (Squire, 2014). The International Ergonomics Association (IEA) defines Human Factors as:

> "The scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance." (IEA, 2016)

HF and user involvement can be applied to the ship design process through a Human Centred Design (HCD) approach. HCD is an approach, which focuses on making systems usable by applying HF, ergonomics, and usability knowledge and techniques during design (ISO, 2010). According to the ISO 9241-210 standard, this approach enhances effectiveness and efficiency, improves human well-being and user satisfaction. In addition, it is noted that the HCD process is designed to maintain the consideration on user needs, through direct and continuous involvement of the users, throughout the entire product life-cycle (Nielsen, 1993). Unfortunately, the maritime design practice today does not show explicit consideration of the end user, and thus does not apply HCD approach (Petersen, 2012, Earthy and Sherwood Jones, 2006, Sherwood Jones, 2005). Specially within naval ship designs, limited research has been carried out with respect to the application of HF and HCD to improve the users' quality of life (Wilcove and Schwerin, 2008, Ross, 2009).

Strong (2000) performed a survey to investigate habitability and accommodation facilities on naval ships. Based on a literature review, initial interviews, and a pilot survey, he reported on the crew's evaluation of the existing ships and their preferences for the design of future warships. Adequate levels of privacy and facilities for both individual and social relaxation are considered important aspects in the ship's accommodations (Ellis, 2009). A North Atlantic Treaty Organisation (NATO) human performance assessment was developed in the form of a questionnaire, and it was used on seven frigates and destroyers in the NATO Standing Naval Forces Atlantic fleet for two weeks, involving 1026 participants and 16,000 completions (Colwell, 2000). A method for calculating motion sickness with habituation for a changing motion environment was proposed.

Hardwick (2000) carried out a comparative study on accommodations in the Royal Navy and merchant naval fleets by visiting ships and submarines and interviewing their crews. They suggested factors based on their study that include a drive toward cabin-based accommodations for all cabin crew, increased space for sleeping and personal storage, improved ambient conditions (noise and temperature), and provision of other facilities to create user friendly designs. Dalpiaz et al. (2005) used a 3-D computer model to review a new US Navy ship design. They reported incorrect height/orientations for equipment, machinery, and other manually operated technology as the most common mistakes. Stair, ladder, step, and walkway designs were also found to be inadequate. Other deficiencies in inaccessibility to valves, hand wheels, and hand pumps, incorrect control panel, console, control, and display designs, and problems with personnel access and movement were found.

Wilcove and Schwerin (2008) analysed data of the 2002 Navy Quality of Life (QOL) survey to reveal the facets of shipboard habitability viewed as most and least satisfying. They used the data to create

habitability subscales, and to apply those subscales in a multiple regression to better understand satisfaction with shipboard life. The findings indicated that despite the amount of time seafarers spend at sea in their careers, the variety of ship platforms, and the complexity of the shipboard experience, little research has been conducted on shipboard life. As a result, further research is necessary and opportunities for such research are plentiful.

As discussed above, though at least a few studies have been conducted around the world with respect to HF consideration of ship designs, it is still a field of research that has not yet been sufficiently discussed in the Asian context. In addition, it is difficult to find such studies conducted within the naval and defence domain in this region. Thus, this research study focusses on identifying and analysing the current HF related design concerns on Offshore Patrol Vessels (OPVs) operating under the custody of Sri Lanka Navy (SLN) as its case study. The findings of this study are beneficial for naval ship designers to understand the areas where they should improve on their future naval designs.

2 METHODOLOGY

Two different OPVs were selected for this study. However, due to the classified nature of the data gathered, their identities are not revealed. Therefore, these OPVs are named as OPV-A (Length > 100m), and OPV-B (100m >Length > 50m).

Data were collected through a survey questionnaire. Open-ended questions, closed-ended questions and scaled questions were included in this questionnaire. It consisted of three parts, firstly, general questions about their on-board life, secondly questions about their particular working areas (engine room, bridge, mess and galley), and finally the questions related to the accommodation and recreational facilities available on-board. Moreover, it included a place for the crew to provide their suggestions to improve the usability of the OPVs.

Prior to distributing the questionnaire, everybody was briefed on the purpose of this study. Furthermore, they were informed that it was totally up to them to decide whether they wanted to participate in this survey. The questionnaire was then distributed to the focus groups including sailors and officers working on-board these two OPVs during two field visits while they were in the Port of Colombo, Sri Lanka.

The participants were informed to write their honest answers since information provided were considered anonymous and treated strictly confidential. Furthermore, they were advised that submitting this questionnaire implied their consent to participate in the study. However, some persons found it difficult to express their responses to the questions. Therefore, for such participants, structured interviews using the questions given in the questionnaire were carried out and the researchers wrote their answers on the questionnaire. The answers were verified by reading them back to the particular participant (Lapan et al., 2011, Brinkman and Kvale, 2015).

The answers to the questionnaire were collected on the same day and 45 responses from OPV-A and 55 responses from OPV-B were received making up a a total of 100 responses. None of the responses were rejected since all the necessary information was given by the participants. All the answer scripts were then collected and separated according to the departments within the OPVs for easy analysis of the collected data. The content analysis method was used to analyse answer scripts (Harwood and Garry, 2003). The significant findings were presented in a quantitative manner in accordance with the three main focused areas namely working, accommodation, and recreation.

3 RESULTS AND DISCUSSION

In order to improve the clarity of the discussions, the results are discussed based on three main sections including working area, accommodation area, recreational facilities and general feedback.

3.1 Working area

Upon analysis, the findings under four main working areas are summarised and discussed below.

Engine room (ER):
The results from both vessels mainly show many deficiencies in ER that did not comply with

ergonomics principles or even with the on-board health and safety requirements. The disappointments voiced by marine engineers regarding the space within the engine room and the accessibility to frequently operated valves and other equipment are critical (see few quotes below). These quotes are only a few of them extracted from the answers.

> "there should be more space between the machinery for maintenance (OPV-A)"
> "there are two pumps in engine room that are not using, these have to be removed to improve workflow obstructions (OPV-B)"
> "there are valves we have to operate daily, but because of the low space it was difficult, and they are not reachable (OPV-A) (see Figure 1)"
> "a ventilation duct is there to obstruct access to the oil distribution box and turning gear of the main engine and RGB (OPV-B)"

During the analysis of data from the exploratory survey, it was discovered that there were many criticisms highlighting the design of the engine room and working environment. According to the participants, the nature of their job is different from those of the other departments. They deal more with problems and troubleshooting alongside routine maintenance activities. Therefore, uncertainty and the unknowns are dominant in their work, yet they do not get enough support from the design to ease their job.

> In addition to the limited space and inadequate accessibility issues, the sailors of both vessels highlighted many other concerns such as inadequate headroom clearance, noise, vibration, lighting, ventilation, steep stairs and ladders, insufficient landing spaces, unused and malfunctioned machines in the engine room, and visibility of the engine room from the engine control room. Furthermore, the location and storage capacity of engine room stores was a common complaint from 56% of the engine room crew of OPV-A. The engine room store is located at the forecastle of the vessel, far from the engine room location, affecting the level of mental and physical stress on the crew (Ellis, 2009, Houtman et al., 2005, IMO, 2001). However, 100% engine crew of OPV-B was satisfied with their workshop, which is located close to the engine room.

Figure 1: Bad valve placement in OPV-A

With regard to the control room design, it was 50% of the OPV-A engine room crew who stressed the need of a good design that can aid them to quickly identify the unusual incidents in the engine room while they are in the control room. In addition to that, the crew of OPV-B stressed the need of proper access without obstructions between these two places for them to move rapidly.

Bridge:

Contrary to the engine room layout, all the participants from the bridge departments of both vessels were satisfied with the bridge layout design. Participants from OPV-A wrote that "all the equipment have been located correctly", "all bridge equipment are properly arranged", "bridge is good, no disturbances for daily tasks". Similarly, a participant from OPV-B mentioned that "this ship bridge has enough space and open bridge area, which is good". However, some of the crew from OPV-B suggest that, it is more user-friendly for them if there is an access from the equipment room to the chart room.

Among the participants from the bridge departments, 45% from OPV-A and 31% OPV-B highlighted that it is good to improve the bridge visibility due to some

obstructions they see in the current design. When they were asked about a reassignment on the same OPV, 64% of bridge crew from OPV-A and 63% from OPV-B said that if they get another chance to work on-board these OPVs, they will be happy to take the opportunity.

Mess and Galley:

Based on the answers given by the crew from the mess department, it can be seen that 75% of them from OPV-A and 80% of them from OPV-B were somewhat satisfied with the current mess and galley layouts. However, the responses highlighted the concerns in order to take into account for future improvements of the design (see below quotes).

> "it is good to have extra racks near the hot steam ovens and to place kitchen towels etc. (OPV-A)"
> "it is difficult to clean some equipment due to inadequate accessibility (OPV-A)"
> "It is good to have anti slip prevention to avoid slips and falls in wet areas (OPV-B)"
> "when supply takes to galley, we have to walk too many times per day due to the long distance between stores and the galley. The walkways are narrow. (OPV-A) (see Figure 2)"

In addition, findings showed that the users of the mess (87% of OPV-A and 80% of OPV-B crew) are satisfied with the current mess location. It was easy for them to move food and cutlery even during rough weather since mess and galley are located next to each other on both OPVs. However, in both OPVs the users of the galley and mess do not have sanitary facilities nearby.

Figure 2: Walkway in OPV-A

3.2 Accommodation area

Among 100 participants of this survey, only two officers of OPV-A and three officers of OPV-B use private cabins, which was only 5%. As illustrated in Figure 3, more than 65% respondents from OPV-A and 75% from OPV-B share their cabins at least with 8 other members.

Within these shared cabins, 70% of them use triple bunk beds (see Figure 4) on OPV-A, and it was 63% for OPV-B (see few quotes below).

> "no enough space between beds, we have small lockers attached to our beds (OPV-A)"
> "need space to hang our clothes, keep our shoes and good lockers (OPV-B)"
> "need to have single bunk beds instead of triple bunk beds" "hard to sleep on bunk beds (OPV-A)"
> "my cabin is not suitable for 5 people (OPV-B)"
> "due to compactness and hardness (live inside the cabin), our stress level increases and there is no relaxed mind (OPV-A)"
> "no privacy, no freedom, no happiness, no one feels like home in here (OPV-A)"

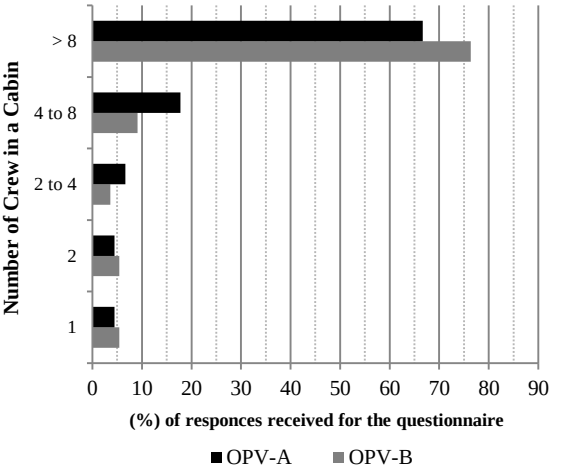

Figure 3: Percentage of crew in different type of cabins

Another major finding of this survey was that, except 3 crew members on-board these OPVs, remaining 97 participants were using shared toilet and bathroom facilities. In addition, natural ventilation inside the cabins was found as one of the major concerns these crews were facing. The participants wrote that

"though there are openings (for ventilation), quality of the fresh air circulation inside the cabins is poor", "there is no fresh air at all in the cabin, after a day overwhelmed by tough work, it is important to get fresh air inside the cabin".

Figure 4: Triple bunk bed in OPV-A

In addition to that, 57% respondents from OPV-B and 75% from OPV-A face difficulties in having a good sleep due to excessive vibration inside their cabins. The interesting fact was that 95% of the participants from both the vessels wanted to change their accommodation if possible. These responses are a good example to understand how these design features affect the crews' ability to sleep and to be free from mental and physical stress (Ellis, 2009, Houtman et al., 2005), which in turn will directly reduce the crews' safety, effectiveness, efficiency, and satisfaction (IMO, 2001).

3.3 Recreational facilities

Regarding the recreational facilities, 69% on OPV-A and 67% of OPV-B agreed that they have some sort of facilities to use on-board at the time of the survey. However, respectively 76% and 53% of them identified the need for improvements in the existing facilities. Following thoughts are extracted from their answers: "we have a gym, but ventilation is poor", "need a good sound system and a TV in mess", "junior sailors need a place to relax", "for junior sailors it is good to have a place for a small gathering".

Among the respondents 71% on-board OPV-A and 73% on-board OPV-B did not have a common office area for reading or studying. The following are some of their thoughts on the study area: "need a study area similar to mess", "I do not have an office space to do my work", "it is good to have a place to do some studies", "we want a place to study", "no place to do any documentation work", "if we have a place to read a book, it is good", "we have only one office for engineering department, officers have to share it or do their work in the cabin, separate are for officers' office work is beneficial".

When the participants were asked to give their suggestions about the facilities that they would like to see on-board these OPVs soon, most of them highlighted the need of internet connection. In addition, regarding the future designs, they commented as follows: "our living area should be re-designed to satisfy sailors, medical facilities should be accessible from the engine room and need office spaces", "recreational facilities should be well equipped and modern, adequate washrooms and designs should be upgraded to current day standards", "it is good to allocate proper recreational facilities for junior sailors and there should be a maximum limit for the number of crew", "since the officers and crew are on-board for a long period on-board a OPV, it is good to discuss with crew during re-design".

3.4 General feedback

There was a question that requested their feedback about the survey and some of their thoughts are given below.

> "this is a good work; however, it would be great if you can improve these issues in future designs"
> "if our voice is being heard and improve future designs, we can work happily and effectively"
> "this is really a good activity and we really hope next new build ships of SLN will be user friendly"

"expecting to see our suggestions in the next OPV"

"even if you consider our needs, there is no point in designing a ship that is not suitable for its intended work, therefore the design should be specific for its context and that is one of the major issues we are facing right now".

3.5 Discussion

As an overall summary, this research study indicated similar issues previously raised by other researches (Table 1). These findings ultimately reveal that the current OPV design features cause mental and physical stress for the crew (Ellis, 2009, Houtman et al., 2005), which will directly reduce the on-board safety, effectiveness, efficiency, and satisfaction (IMO, 2001).

As a consequence, the sailors' dissatisfaction with shipboard life will significantly affect their retention plan and actual retention behaviours as previous studies of Wilcove and Schwerin (2008) identified. One can argue that these design inadequacies are there because these ships were designed many years back and just for naval operations – OPV-A is approximately 30 years and OPV-B is approximately 50 years old. However, the fact is that these OPVs are still operational today when the world is prioritising human needs and their values. Thus, this study suggests to seriously consider these design issues to mitigate similar failures in future OPV designs. Otherwise, a design made in 2017 too would cause an enormous physical and mental effect on its crew, continuously throughout the next five decades, until it will be decommissioned.

Table 1: Findings of current surveys and issues that arose in previous studies

Previous studies and publications	**Claims**	**Comments based on OPVs surveys**
Meister (1971)	Design engineer does not consider HF in his design.	Findings of both surveys confirmed these claims.
Reason (1990)	Poor design of ship layouts.	
Squire (2007)	Ship is designed without input from the crew.	
Strong (2000), Wilcove and Schwerin (2008)	Adequate levels of privacy needed. Facilities for social relaxation are expected.	
Hardwick (2000), Wilcove and Schwerin (2008)	Cabin-based accommodations are suggested. Room in the berthing area, space in the racks and personal stowage is expected. Improved ambient conditions are expected (temperature, lighting, and Noise). On-board social needs, recreation, office space, and computers are expected.	
Grundevik et al. (2009)	Visibility problems.	
Dalpiaz et al. (2005)	Incorrect height/orientation. Stairs, ladders, steps, and walkways. Inaccessibility to valves, hand wheels, and hand pumps. Problems with access and personnel movement.	

Furthermore, the findings indicate that the design process of these OPVs had not adequately considered the end users, and thus, had not applied HF concepts to their full extent. This appears to be the case in mainstream maritime design today (Petersen, 2012, Petersen et al., 2010, Lützhöft et al., 2017). Recent research studies stressed that this is mainly due to maritime designers' unawareness about HF, HCD and the operational issues which the ships' crews face during their sea time (The Nautical Institute, 1998, Walker, 2011). Furthermore, the designers' limited understanding of HF and HCD is likely due to the combined effect of poor maritime HCD education (Abeysiriwardhane et al., 2014) in maritime design courses and poor post-design contact with those who work on-board the ships (Kuo and Houison-Craufurd, 2000, Walker, 2011). To change this situation several efforts have been made to

intervene at ship design and education level (Abeysiriwardhane et al., 2017, Abeysiriwardhane et al., 2016a, Abeysiriwardhane et al., 2015b, Abeysiriwardhane et al., 2015a, CyClaDes, 2014, NI, 2015).

Furthermore, Maritime Labour Convention (MLC) was formally established and enforced on 20 August 2013 to emphasise the rights of every seafarer to a safe and secure workplace that complies with safety standards; to fair terms of employment; to decent working and living conditions on-board a ship; and to health protection, medical care, welfare measures and other forms of social protection (MLC, 2006). In addition, International Maritime Organisation (IMO) has published a number of codes and guidelines within the area, such as the code on noise levels, guidelines for engine-room layout, design, and arrangement and guidelines on ergonomic criteria for bridge equipment and layout. Furthermore, a number of new ergonomic notations (ABS, 2014) were developed to promote an ergonomically-focused design and construction on vessels, specifically with respect to enclosed spaces (ERGO ES) and maintenance (ERGO MAINT), as well as topsides (ERGO TOP) and valves (ERGO VALVE). However, these regulations and recommendations do not in themselves solve the problem (Rasmussen, 2005). The professional knowledge and skill of the designers and builders of ships is of paramount importance in order for us to get ships that are really 'usable'. Therefore, the findings of this study could be used as a valuable guidance to make future OPV designers aware of HF issues within the current designs and to motivate them to mitigate those concerns in their upcoming designs.

4 CONCLUSION

Despite the amount of time seafarers spend at sea in their careers, the variety of ship platforms, and the complexity of the shipboard experience, little research has been conducted on shipboard life within naval and defence domain in the Asian context. This study was conducted as exploratory surveys on OPVs to explore HF concerns within the current designs. Two different OPVs were selected for this study as mentioned in the section 2.

It can be concluded that very less emphasis has been made on HF in the design stages of the current OPVs. Major concerns that were recognized including inadequate comfort in ship accommodation, low level of privacy and facilities for both individual and social relaxation, noise disturbance, ergonomics issues, layout limitations, and limited space. As a result, different levels of compliances in various HF dimensions were recognized, and out of them, habitability and maintainability were the least satisfactory. Ultimately, significant improvements that are necessary for the upcoming naval designs in terms of physical, psychosocial and organisational aspects on-board ships were identified.

According to the operators' voice, what they were stressing was that 'Designers, please consider HCD concept in your designs. We are the people who work on-board your designs, therefore please leave a space for our voice too in your design spiral'. Therefore, future ship designs should include consultation with users – who will actually spend significant proportion of their lifetime on board – during the design stage, and by this the authors do not only mean the master of the ship!.

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EXPERIENCE AS A FACTOR INFLUENCING UPPER BASIC SCHOOL TEACHERS' PERCEPTION OF SOCIAL STUDIES ORIENTATIONS IN SOUTH-WEST, NIGERIA

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ABSTRACT

This study investigated the Upper Basic School Teachers' perception of three social studies orientations in South –West of Nigeria. Survey type of research design using questionnaire was adopted for the study. The population consisted of all social studies teachers in South-West, Nigeria. The sample comprised of 646 Upper Basic School Social Studies teachers selected using multi-stage sampling techniques. The two main research questions were analyzed using percentage, while one-way ANOVA was used to test all the hypothesis generated. The study revealed among others that social studies teachers have a diverse perception of all the orientations, but they were more favourably predisposed to citizenship transmission orientation. Less experienced, moderately experienced and highly experienced teachers are significantly different in their perception of all the orientations. Based on the findings, it was recommended among others that social studies teachers should be inclusive in the teaching of all these orientations as entrenched in the social studies curriculum without giving much priority to one orientation over the others.

KEY WORDS: *Orientation, Citizenship, experience, eclectic, curriculum, and inclusive*

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1 INTRODUCTION

One of the paramount aims of education in our school system is to produce citizens who will solve immediate and future problems of their community and not citizens who will learn, imbibe and acquire knowledge, values, behaviours and dispositions that are not relevant to the survival and continuous growth of their society. Social studies as one of the core subjects in our schools are to help students acquire the necessary knowledge, skills, dispositions, and viable understandings that will make them as citizens to contribute meaningfully to the nation building process using their abilities to make informed and reasoned decisions for the public good.

However, in spite of the lofty responsibility to create and produce effective citizens for the perpetuation of our society being saddled on the shoulder of social studies education, since 1916 when the Committee on the Reorganization of Secondary Schools Association introduced the subject for the first time in American Schools, unending polemics have trailed it existence up to the present moment (Kochha, 2006). This has made scholars and experts in the field over the years to express their views about this conflicting nature of the subject. Barth, Barr, and Shermis (1977) described social studies as a garden variety curriculum that confuses both teachers and students alike. Barth (1990) in his own view, described the subject as a mystery to most people and particularly perplexing to college students who sometimes wondered why a preparation in elementary education or social science and humanities would end with certification to teach social studies.

Irrespective of different opinions and positions being canvassed by different experts in the field on the nature of the subject, Trump and Miller (1976) during the tense years of 1960's and 1970's of the great debate and polemics over the nature, purpose and scope of the field saw the necessity of defining social studies, otherwise it will continue to be amorphous, as this can make people ascribe anything to the subject. In their landmark expositions in unravelling the nature of social studies education, Barth et al., (1977) crafted three historical orientations to serve as a basis to understand the subject. They classified them as citizenship transmission, social science, and reflective inquiry. Over the years, these three orientations have been regarded and accepted as the basic epistemological foundation of curriculum development in social studies education.

Citizenship transmission orientation is the transmission of knowledge of cultural heritage of the people; their values, norms, beliefs, attitudes and disposition to students to learn so as to perpetuate the existence of society from generation to generation. Social science orientation is the integration and interdisciplinary teaching of various social science disciplines in terms of their concepts, themes, and generalisations and constructs to address crucial issues in social studies education. Reflective inquiry orientation deals with the students identifying problems or issues of concern in their society and developing processes and methods to unravel these problems and also to resolve value-laden issues through the process of value analysis and value clarification.

Adewuya (2002) in his reflection on pedagogical issues in social studies over the years observed that the response of teachers to use the new methods has taken various forms: ranging from a half hearted compliance and defiance to outright condemnation. This is very paramount because there is the need for a conceptual clarification of the nature and purpose of the subject is highly crucial to its successful teaching. In addition, because teachers are not sufficiently involved in curriculum planning, such teachers with limited conceptions of the purpose of the subject attacked or misinterpreted the intention of the programme and substituted their own philosophy which may run counter to the writers' philosophy.

This might perhaps have influenced the opinion of Okam (2008) which suggested that curriculum processes and practices like methodology of inquiry, employment of decision making processes and principles, including the use of critical thinking and problem-solving procedures which are inbuilt into the interactions in the teaching of the subject were relegated to the background in many classrooms today by teachers.

Teachers' experience is probably the key factor in personnel policies that affect employees. The underlying assumption is that experience promotes effectiveness (Rice, 2010). Findings from studies have shown that the impact of the teacher is felt during the first few years of teaching, after that, marginal returns diminish (Harris & Sass, 2007; Rockoff & Staiger, 2006). This is in line with the study of Rivkin, Hanushek, and Kain (2005) who concluded that there is little evidence that

improvement continues after the first three years. In addition, Sass, Hannaway, XU and Figlio (2010) concluded that research has shown that less experienced teachers are more effective than teachers with more experience. However, these findings are in contrast with the findings of Adeyemi (2007) who stated that teachers with five years and above teaching experience achieve better results than teachers with less than five years teaching experience.

Furthermore, findings from previous studies on social studies orientations appear to be conflicting. Firstly, some of the studies were conducted in Nigeria, for instance like the studies of Jekayinfa (1996); Okunloye (2001) and Udoukpong and Okon (2012) while others were conducted outside the shore of Nigeria, like the studies of Adeyemi (1992); Griffith (2003); Park (2008); Acikalm (2011) and Kaymacki and Ata (2012). This difference in locale with its own socio-cultural milieu influenced the outcome of these various studies. These previous studies conducted outside the country were more recent and larger in number than those conducted within the shore of Nigeria. In addition, the criteria used by previous researchers in determining years of teaching experience are not uniform and similar. Okunloye (2001) and Kaymacki and Ata (2012) used the number of years teachers spent teaching as a criteria for determining different categories of years of teaching experience, while Griffith (2003) used chronological age of respondents (teachers) as the determinant to measure different strata of years of teaching experience. All these factors have contributed to the inconclusiveness of previous studies, and therefore in this present study, different criteria will be used to determine years of teaching experience as thus – 0-5yrs (less experienced), 6-10yrs (moderately experienced) and 10yrs and above (highly experienced).

Research Questions

The research questions for this study are stated below:

1. What are the hierarchical levels of teacher perception of social studies orientation?

2. Do less experienced, moderately experienced, and highly experienced social studies teachers differ in their perception of social studies orientations?

Research Hypotheses

The following research hypotheses were tested in this study:

H01: Less experienced, moderately and highly experienced social studies teachers are not significantly different in their perception of citizenship transmission orientation.

H02: Less experienced, moderately experienced and highly experienced social studies teachers are not significantly different in their perception of social science orientation.

H03: Less experienced, moderately experienced and highly experienced social studies teachers are not significantly different in their perception of reflective inquiry orientation.

2 METHODOLOGY

The study used a survey research design. A target population of all of the Upper Basic School social studies teachers in three states namely Ekiti, Ondo and Osun State was chosen for the study. The sample for the study consisted of 646 Upper Basic School social studies teachers selected from 323 Upper Basic Schools from the 1,744 secondary schools with the three states selected. The sole method used for data collection was a questionnaire adopted from DuBey & Barth (1980) Social Studies Traditions Checklist. The questionnaire contained 27 items involving three social studies orientations of citizenship transmission, social science and reflective inquiry but modified to suit the purpose of this present study. It also sought biodata information on respondents' years of teaching experience as thus – 0-5yrs (Less experienced teacher), 6-10yrs (moderately experienced teacher) and 10yrs and above (highly experienced teacher).

The content validity was ascertained by experts in social studies Education. A test-re-test method was used to determine the reliability of the instrument. A reliability coefficient of 0.74 was obtained and this was considered adequate for the study. To analyse the data obtained both descriptive and inferential statistics were employed. The percentage was used for the demographic analysis of the data and one-way ANOVA was used to test all the hypotheses. The 0.05 level of significance was assumed in testing the entire hypothesis.

3 RESULTS

1. What are the hierarchical levels of teachers perception of social studies orientations?

Table 1: Teachers perception in hierarchical

Orientations	Agree (%)	Disagree (%)	Undecided (%)
Citizenship Transmission	5076 (87.31%)	573 (9.86%)	165 (2.84%)
Social Science	4938 (84.93%)	627 (10.87%)	249 (4.28%)
Reflective Inquiry	4476 (76.99%)	996 (17.13%)	342 (5.88%)

Table 1 showed that the perception scores for citizenship transmission orientations is 5076 (87.31%), while 573(9.86%) respondents disagreed, 165 (2.84%) remain undecided. For social science orientation, the perception scores is 4938(84.93%), 627 (10.87%) disagreed and 249 (4.28%) remain undecided. Thirdly, the perception scores for reflective inquiry orientation is 4476(76.99%), 996 (17.13%) disagreed, while 342 (5.88%) remain undecided.

It is obvious from the result that social studies teachers have diverse perception of the three orientations, but nevertheless, were more favourably predisposed to citizenship transmission orientation than to any other orientations.

2. Do less experienced, moderately experienced and highly experienced social studies teachers differ in their perception of social studies orientations?

Table2: Differences in the perception of Teachers.

Social studies Orientations	Less Experienced Teachers Perception Score or Ratings	Moderately Experienced Teachers Perception Score or Ratings	Highly Experienced Teachers Perception Score or Ratings
Orientation of Citizenship Transmission	1060 (83.53 %)	2417 (82.51%)	1561 (89.87%)
Social Sciences	1045 (82.35%)	2016 (71.79%)	1415 (81.46%)
Reflective Inquiry	1060 (83.53%)	2416 (86.04%)	1600 (92.11%)

Result on table 2 showed that for citizenship transmission orientation, the less experienced teachers have perception scores of 1060 (83.53%), moderately experienced teachers have 2416 (86.04%) and highly experienced teachers have 1600 (92.11%). Secondly, less experienced teachers moderately experienced teachers and highly experienced teachers have perception scores of 1060 (83.53%), 2317 (82.51%) and 1561 (89.87%) respectively for social science orientation. For reflective inquiry orientation, the perception scores of less experienced teachers is 1045 (82.35%), that of moderately experienced teachers is 2016 (71.79%) and that of highly experienced teachers is 1415 (81.46%).

It was revealed from the finding of this study that highly experienced teachers have a higher perception of the three orientations than the less and moderately experienced teachers. Also, all the respondents in this category were more favourably predisposed to citizenship transmission orientation.

Testing of hypotheses

Hypothesis 1: Less experienced, moderately experienced and highly experienced teachers are not significantly different in their perception of citizenship transmission orientation.

Table 3: One-way ANOVA of less experienced and citizenship transmission orientation

Group	SS	df	MS	F	p-value
Between Groups	73.519	2	36.760	8.737	0.000
Within Groups	2705.238	643	4.207		
Total	2778.757	645			

P<0.05

Table 3 shows that less experienced, moderately experienced, and highly experienced teachers are significantly different in their perception of citizenship transmission orientation (p-value 0.000

<0.05). Therefore, the null hypothesis is not accepted.

In order to determine the source of pairwise significance difference, Scheffe Post hoc test was used. The result is presented in table 4.

Table 4: Scheffe Post hoc test of teachers perception of citizenship transmission orientation by years of teaching experience.

Group	Less Experienced Teachers	Moderately Experienced Teachers	Highly Experienced Teachers	Mean	N
Less Experienced Teachers	*			25.18	141
Moderately Experienced Teachers		*		25.50	312
Highly Experienced Teachers			*	26.08	193

* Mean difference significant at 0.05 alpha level

Table 4 showed that highly experienced teachers are significant different from less experienced and moderately experienced teachers in their perception of citizenship transmission orientation.

Hypothesis 2: Less experienced, moderately experienced, and highly experienced teachers are not significantly different in their perception of social science orientation.

Table 5: One-way ANOVA less teachers and teaching experience

Group	SS	df	MS	F	p-value
Between Groups	98.662	2	49.311	6.089	0.002
Within Groups	5207.206	643	8.089		
Total	305.828	645			

P<0.05

Table 5 shows that less experienced, moderately experienced, and highly experienced teachers are significantly different in their perception of social studies orientation (p-value = 0.002 < 0.05). Therefore, the null hypothesis is not accepted.

In order to determined the sources of pairwise significant difference, Scheffe Post hoc test was used. The result is presented in table 6.

Table 6: Scheffe post hoc test of teachers perception of social science orientation by years of teaching experience.

Group	Less Experienced Teachers	Moderately Experienced Teachers	Highly Experienced Teachers	Mean	N
Less Experienced Teachers	*			25.06	141
Moderately Experienced Teachers		*		24.98	312
Highly Experienced Teachers			*	25.85	193

* Mean difference significant at 0.05 alpha level

Table 6 showed that highly experienced teachers are significantly different from less experienced and moderately experienced teachers in their perception of social science orientation.

Hypothesis 3: Less experienced, moderately experienced, and Highly experienced teachers are not significantly different in their perception of reflective inquiry orientation.

Table 7: One-way ANOVA of teachers perception of reflective inquiry orientation

Group	SS	df	MS	F	p-value
Between Groups	162.1462	81.073	6.238	12.997	0.000
Within Groups	4010.814	643	8.089		
Total	4172.960	645			

P<0.05

Table 7 showed that less experienced, moderately experienced and Highly experienced teachers are significantly different in their perception of reflective inquiry orientation ((p-value =0.000<0.05). therefore, the null hypothesis is rejected.

In order to determine the source of pair-wise significant difference, scheffe Post hoc test was used. The result is presented in table 8.

Table 8: Scheffe Post hoc test of teachers perception of reflective inquiry orientation by years of teaching experience.

Group	Less Experienced Teachers	Moderately Experienced Teachers	Highly Experienced Teachers	Mean	N
Less Experienced Teachers	*			24.91	141
Moderately Experienced Teachers		*		23.88	312
Highly Experienced Teachers			*	24.86	193

* Mean difference significant at 0.05 alpha level

Table 8 showed that less experienced teachers are significantly different from moderately experienced teachers and while moderately experienced teachers are significantly different from highly experienced teachers in their perception of reflective inquiry orientation.

4. DISCUSSION

Results obtained from this study have shown that though social studies teachers have a diverse perception of social studies orientations, they were observed to be more favourably predisposed to citizenship transmission orientation than to any other orientations. Previous studies of Jekayinfa (1996), Okunloye (2001), and Udoukpong and Okon (2012) conducted within the shore of Nigeria all found that citizenship transmission orientation is the most perceived orientation. This is in congruence with the findings of this study. However, this is at variance within the findings of Adeyemi (1992) and Kaymacki and Ata (2012) whose most perceived orientation was social science which were conducted in Botswana and North Western Turkey respectively, while that of Griffith (2003) and Park (2008) was reflective inquiry and which were also conducted in Caribbean Island, South Korea and Australia respectively. These present findings might be justified in the sense that the society and the school value the inculcation of right values, beliefs, traditions and knowledge that will preserve and sustain the social fabric of society especially in Nigeria and Africa at large into the students from generation to generation.

One of the findings also showed that reflective inquiry orientation seem to be the least favourably predisposed orientation by all categories of respondents. This has confirmed the conclusions made by Okam (2008) that curriculum processes and practices like methodology of inquiry, employment of decision making process and principles including use of critical thinking and problem solving procedures which are inbuilt into the interactions in the teaching of the subject were relegated to the background in many classrooms today by teachers. The justification for this might be that some of the social studies teachers in today's classroom are not solely the specialists in the field. As it has been shown, teachers from other disciplines teach the subject, and these teachers bring their different prejudiced views and opinions from their various disciplines into the teaching of the subject, thereby confusing its nature, processes and principles.

In one of the findings, highly experienced social studies teachers appear to have a higher perception of all the orientations than the other two categories of experienced teachers. These findings tend to contradict the studies of Hariss and Sass (2007); Kane, Rockoff and Staiger (2006) and Rivkin, Hanushek and Kain (2005) who observed that impact of experience is stronger during the first few years of teaching, after that marginal returns diminish and there is little evidence that improvement continues after the first three years. However, Adeyemi (2007) concluded that teachers with five years and above teaching experience achieve better results than teachers with less than five years teaching experience. The reason why this happened might be that as the teacher garners experience over the time they become adept in the handling of the subject. Even the hypotheses tested in this regard lent credence to these differences. Also, the justification could be attributed to the different climes in which studies were conducted as evident in the previous studies reviewed.

Results from this study further showed that all the three categories of experienced teachers were more favourably predisposed to citizenship transmission orientation. This is in contrast to the findings of Griffith (2003) who observed that younger teachers were favourably predisposed to reflective inquiry orientation, while older teachers tend towards a didactic method of citizenship transmission orientation. The reason might be that the locale where these two studies were conducted might be a contributing factor as the social milleu and culture of a place influence people's world view, which

includes how they employ different methodologies of instruction in teaching in their various schools.

5. CONCLUSION AND RECOMMENDATION

Based on the findings in this study and the discussion that followed, some conclusions were drawn. First, social studies teachers were more favourably predisposed to citizenship transmission than to any other orientations. Secondly, reflective inquiry has been relegated to the background in the perception of the three orientations by the teachers. And lastly, highly experienced teachers have a higher perception of the three orientations than the other two categories of experienced teachers, and they are significantly different in their perception of all the three orientations.

Social studies teachers should be diverse and inclusive in the teaching of these orientations so that one orientation will not be given priority over the others, in order to achieve the aims and objectives of social studies education. Also, mechanisms and measures should be put in place to ensure that differences in the perception among different categories of experienced teachers does not affect teaching of different components of social studies curriculum in the classroom.

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PERCEIVED LEVEL OF CLINICAL COMPETENCY AMONG GRADUATE NURSING STUDENTS IN EASTERN UNIVERSITY, SRI LANKA: A COMPARATIVE STUDY BETWEEN MALE AND FEMALE STUDENTS

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ABSTRACT

Background: The contemporary health professional education greatly emphasizes on competency based education. Clinical skill is an essential competency of Bachelor of Science (BSc) in Nursing programme. Clinical competencies of nursing students should be assessed before graduation, and it is important to shorten their length of orientation to work. Eastern University, Sri Lanka (EUSL) is one of the national higher educational institutes that provides graduate nursing education in Sri Lanka. At present, four batches have graduated from EUSL. However, the nursing students' clinical competencies have not been assessed yet.

Aim: to assess the nursing students' clinical competency and its gender difference at EUSL.

Methodology: This descriptive study was conducted in 2017 with the use of clinical competency questionnaire (CCQ). The CCQ incorporated nursing clinical competencies are in three forms as General Nursing Skill, Core Nursing Skill and Advanced Nursing Skills. Final year nursing students (fifth batch) participated in this study. The scores of CCQ statements were converted into continuous variables and summarized as means. The t-test was used to compare the students' clinical competency with the gender.

Result: The overall CCQ score was 4.10. It indicated that the students are having a positive level of confidence in their clinical competency. Meanwhile, the advance nursing skill is identified as the weakest area. Furthermore, the male nursing students perceived high competency in Advanced & Core Nursing Skill. Anyhow, the overall mean CCQ score is not statistically varied with gender. In future, research studies are needed to assess the nursing students' clinical competency by the feedback of mentors, clinical instructors, colleague and supervisors.

KEY WORDS: *competency based education, clinical competency questionnaire, nursing education, eastern university, Sri Lanka.*

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1 INTRODUCTION

The contemporary health professional education greatly emphasizes on competency based education (Zieber et al., 2014). Competencies are the indicators of successful performance in particular situations, and also it is an intricate mixture of attributes such as knowledge, skill and attitudes (Gonczi, 1994). Clinical competency is an essential outcome of Bachelor of Science (BSc) in Nursing programme. There are several descriptions made by different organizations for nursing clinical competency.

The National Council of State Boards of Nursing defined the nursing clinical competency as capable application of knowledge, interpersonal decision-making and psychomotor skills expected for the practice role (Kenward & Zhong, 2006). Meantime, The Board of Nurse Examiners for the State of Texas (2017) described competency as an effective demonstration of the knowledge, judgment, skills and professional values derived from nursing education by the time of graduation. The Institute of Medicine (2004) stated that, the nurses' clinical competency plays a significant role in providing patients with safe care. Therefore, nurses should have competencies in performing clinical skills, using resources, applying theoretical knowledge to patient care and managing workload.

Nurse is an essential member of the collaborative health-care team. Bedsides care is mostly delivered by nurses in a curative setting. Nursing malpractice is a threat to the patient life. A survey in 2003 revealed that, 49% of newly recruited nurses were involved in patient care error and 75% of them were involved in medication error (Smith & Crawford, 2003). Fero et al. (2009) revealed that the level of clinical competency of a new graduate nurse is comparably less than that of an experienced nurse.

Shortage of nurses is a global issue in the world of healthcare. Fresh graduates are hired to solve this critical situation. The healthcare employers expect competent clinical skill from nursing graduates at the entry time of their jobs (Burns & Poster, 2008). Therefore, the nursing educational institutes are facing the challenge of producing graduates with adequate clinical competency to meet the healthcare needs of the world.

Furthermore, nursing education experts have suggested that clinical competency assessment among nursing students should take place before graduation to shorten the length of clinical orientations for new graduate nurses after they enter the workplace (Liou & Cheng, 2013).

The modern nursing education is highly focused on standardising the students' hands on skill in professional practice. Nursing education has evolved from traditional diploma programme to university based graduate education. In Sri Lanka, the first nursing degree programme was commenced by the Open University of Sri Lanka in 1994 (Jayasekara & McCutcheon, 2006).

At present there are seven state universities conducting nursing degree programmes in Sri Lanka, namely; University of Sri Jayewardenepura, University of Peradeniya, University of Jaffna, University of Ruhuna, Eastern University, Open University of Sri Lanka and Sir John Kotelawala Defence University.

Eastern University, Sri Lanka (EUSL) is one of the national higher educational institutes that provides nursing education in Sri Lanka. The BSc in Nursing programme at EUSL commenced in 2008. At present, four batches of students have graduated from EUSL. However, the nursing students' clinical competencies have not been assessed immediately prior to their graduation. Thus, the study is aimed to assess the nursing students' clinical competency at EUSL.

1 2 METHODOLOGY

It was a descriptive cross-sectional study conducted in the Faculty of Health-Care Sciences (FHCS), EUSL during the academic year of 2017. Final year BSc nursing students (5th Batch) of EUSL were selected as the study population. Non-probability sampling method was used to collect convenience samples from the study population.

Self-administered clinical competency questionnaire (CCQ) was used to collect competencies data from students. Liou & Cheng (2013) developed and validated the CCQ to measure the perceived clinical competence of upcoming baccalaureate nursing graduates. The CCQ was developed based on Patricia Benner's "From Novice to Expert" model (Benner, 2001).

The CCQ consists of three subscales, namely: General Nursing Skills, Core Nursing Skills and Advanced Nursing Skills. The CCQ inventory consists of 31

questions, each scoring 5. The following is an approximate guide to interpreting the score: 1-Do not have a clue, 2-Know in theory, but not confident at all in practice, 3-Know in theory, can perform some parts in practice independently, and needs supervision to be readily available, 4-Know in theory, competent in practice, need contactable sources of supervision, 5-Know in theory, competent in practice without supervision (Liou & Cheng, 2013).

The general nursing skill incorporates basic nursing clinical competencies such as patient admission, assessment and monitoring. The core nursing skill consists of vital nursing clinical competencies such as drug administration and sterile nursing procedures. High order clinical competencies include advanced nursing skills such as intravenous fluid administration, venipuncture, blood transfusion and chest tube care.

All questionnaires were coded and entered into an electronic database. Data analysis was carried out using SPSS version 22. The t-test was used to compare students' clinical competency score with gender. The pilot study was conducted on eight students (out of study population) two weeks before the commencement of the main research study. Ethical clearance was obtained from the ethics review committee of FHCS, EUSL.

3 RESULTS

The final year nursing students (N=22) participated in this study. There were 15 females in the study group. The students' mean age was 25.18. The overall CCQ score was 4.10 (Table-1).

This indicates that the BSc Nursing student clinical competency can be described as "known in theory, competent in practice, need contactable sources of supervision". Anyhow, the overall CCQ score is not statistically varied with gender.

However, the advanced and core nursing skills are statistically varied with gender. The male nursing students had high confidence in advanced and core nursing skills than females nursing students (Table-1). There were totally 12 CCQ statements significantly different among gender (Table-2 & 3).

Table 1: **Nursing Students' self-evaluation of clinical competency and its subscales**

Clinical Competency Subscale	Mean CCQ Score			p-Value
	Female	Male	Overall	
General Performance	4.16	4.27	4.22	0.608
Core Nursing Skills	4.22	4.77	4.49*	0.001
Advanced Nursing Skills	3.37	4.17	3.77*	0.032
Overall	3.84	4.35	4.10	0.079

The items in * had significant p value

Thirteen General Nursing Skills were assessed in the study (Table-2). Overall CCQ mean score for most of the general performance statements (11) were between 4 to 5. Meanwhile, the lowest rating (3.79) is given for performing shift. Furthermore, providing emotional and psychosocial support is significantly varied with gender. The female nursing students have perceived high confidence in providing emotional and psychosocial support (Table-2).

Core nursing skills and advanced nursing skills were assessed in the study. In both, male nursing students perceived to have higher confidence than females (Table-1). Twelve core nursing skills and six advanced nursing skill activities were assessed. Most of the core skill activities (10) scored between 4 to 5. The two core skills, performing enema and performing tracheotomy care received ratings below 4 (Table-3).

The items in * had significant p value

Also, the mean CCQ of nine core nursing skills were significantly varied with gender, i.e. changing intravenous fluid bottle or bag, administering intravenous medications, administering intramuscular medications, performing subcutaneous injection, performing urinary catheter insertion, performing enema, performing tracheotomy care, performing nasogastric tube feeding and performing wound dressing care. Interestingly, male nursing students perceived high confidence in the above mentioned nine core nursing skills.

Table 2: **Nursing Students' self-evaluation of clinical competency in General Nursing Skill**

Clinical Competency in General Nursing Skill	Mean CCQ Score		
	Female	**Male**	**Overall**
Taking a history for new admissions	4.60	4.57	4.59
Performing and documenting patient health assessment	4.27	4.43	4.35
Answering questions for patients or families	3.87	4.57	4.22
Preventing patients from problem occurrence	3.60	4.29	3.94
Educating patients or families with disease-related care knowledge	4.40	4.29	4.34
Charting and documentation	4.00	4.00	4.00
Developing care plan for patients	4.47	4.43	4.45
Performing shift report	3.87	3.71	3.79
Performing hygiene and daily care routines	4.27	4.29	4.28
Assessing nutrition and fluid balance	4.07	4.14	4.10
Assessing elimination	4.00	4.29	4.14
Assisting activities and mobility, and changing position	4.27	4.43	4.35
Providing emotional and psychosocial support	4.47	4.14	4.30*

Meanwhile, most of the advanced skill activities (04) scored between 3 to 4. Anyhow, more than four was scored for performing venipuncture and starting intravenous injections. Also, performing venipuncture mean CCQ was significantly different among gender. The male nursing students were perceived to have high confidence in performing venipuncture (Table-3).

4 DISCUSSION

The mean CCQ score was 4.10. It indicated that the students have perceived a positive level of confidence in their clinical competency. These results are similar to the findings of a study conducted in Taiwan, in which graduate nursing students generally perceived themselves as competent (Liou & Cheng, 2013). A Finland study also revealed that nursing students self-assessed their clinical competence as good (Kajander-Unkuri et al., 2014). Brown et al. (2003) stated that the overrating may be given by some students in self-evaluation. Anyhow, the graduate nursing students are normally rating themselves as confident in clinical skill during their graduation time. But, their confidence level is gradually declining, once they enter to clinical practice (Casey et al., 2004 and Heslop, McIntyre & Ives, 2001). Overall CCQ score was high among male students. But it is not a significant difference ($p>0.05$). However, the results are based on the students' self-assessment. Therefore, future researches are needed from the viewpoint of mentors, clinical instructors, colleague and supervisors to enhance the accuracy of the hypothesis.

The basic patient care skill is incorporated into the general performance subscale. It includes skills in assessment, monitoring of patient activity & hygiene, patient & family counselling, charting & documentation and technical skills. The nursing students have perceived positive confidence in carrying out general nursing performance skill (Table-1). But, a group of Taiwan students did not have high level of confidence in performing general nursing skills. Fink et al. (2008) revealed that graduate nursing students are facing challenges in assessment and charting/documentation. In our study, lowest score was given for the general performance activity of performing shift report because, in our institution, academic activity is scheduled as morning clinical practice and evening class room activities. So, the student were not be able to complete the entire shift. Therefore, the students felt less confident in

handing over / taking over reporting. Interestingly, the female nursing students perceived high confidence in providing emotional and psychosocial support.

Core nursing skill has been assessed in this study. It included the nursing activities in drug administration and sterile procedures. The confidence level of male nursing students in performing urinary catheter insertion & care, tracheotomy care, nasogastric tube feeding & care, wound dressing care, performing enema, changing intravenous fluid bottle or bag, administering intravenous medications, administering intramuscular medications and performing subcutaneous injections are significantly higher than that of female students (Table-3).

Table 3: Nursing students' self -evaluation of clinical competency in Core and Advance Nursing Skill

Clinical Competency	Mean CCQ Score		
	Female	Male	Overall
Core Nursing Skills			
Changing intravenous fluid bottle or bag	4.67	5.00	4.83*
Administering intravenous medications (or into intravenous bags)	4.47	5.00	4.73*
Administering intramuscular medications	4.73	5.00	4.87*
Performing subcutaneous injection	4.67	5.00	4.83*
Administering oral medications	4.87	5.00	4.93
Performing urinary catheter insertion and care	3.60	4.86	4.23*
Performing sterile techniques	4.07	4.43	4.25
Performing enema	3.13	4.14	3.64*
Performing upper airway suction	3.87	4.43	4.15
Performing tracheotomy care	3.47	4.43	3.95*
Performing nasogastric tube feeding and care	4.53	5.00	4.77*
Performing wound dressing care	4.60	5.00	4.80*
Advanced Nursing Skills			
Performing venipuncture	3.87	4.57	4.22*
Starting intravenous injections	4.33	4.29	4.31
Administering blood transfusion	3.13	4.29	3.71
Performing postural drainage and percussion, and oxygen therapy	2.87	4.14	3.50
Performing preoperation / post operation care	3.40	4.29	3.84
Performing chest tube care with underwater seal management	2.60	3.43	3.01

The items in * had significant p value

In our study, specific items in the advanced nursing skills' (ANS) subscales included skills in intravenous fluid administration, venipuncture, blood transfusion and chest tube care. The mean ANS score (3.77) is the lowest score among four subscales of CCQ (Table-1). A group of Taiwan nursing students also perceived the advance nursing skill as their weakest technical skills (Liou & Cheng, 2013). Similarly, earlier studies found that new graduate nurses consider these same advanced skills as some of the most challenging procedures to perform in clinical practice (Fink et al., 2008).

The limitations of the study are the limited number of participants (Less number of students in the final year) and the study's incorporation of student's self-evaluations only.

5 CONCLUSION

The present study revealed that the BSc Nursing students in FHCS, EUSL had a positive level of confidence in their clinical competencies. However, the advance nursing procedures is identified as the weakest area, which needs further improvement. Meanwhile, the male nursing students perceived high competency in advanced & core nursing skills. Anyhow, the overall mean CCQ score is not statistically varied with according to gender.

In future, research studies are needed to assess the nursing students' clinical competency by the feedbacks of mentors, clinical instructors, colleague and supervisors.

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PRIMARY SCHOOL TEACHERS' KNOWLEDGE OF LEARNING DISABILITIES IN ILORIN-WEST LOCAL GOVERNMENT, KWARA STATE

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ABSTRACT

*This study examined the primary school teachers' knowledge of learning disabilities in Ilorin West Local Government, Kwara State. The study was a descriptive design of survey, and a sample of 150 primary school teachers were selected using simple random procedure out of a total population of 1,837 primary school teachers in Ilorin West Local Government Area. A 10 item researcher-designed questionnaire with psychometric properties of content validity and 0.65 reliability index was used to elicit the needed data from the respondents. Frequency counts and percentages were used for answering the research questions. The findings of the study showed that the majority (*62.67%*) of the teachers did not know that head injuries, nutritional deprivation and exposure to toxic substances can contribute to learning disabilities. Also a considerable percentage (*51.3%*) of the teachers did not know that children with learning disabilities do have a problem in understanding body language and facial expressions. Based on the findings, it was among others recommended that the school authorities should employ professionally qualified educational psychologists to teach the teachers about class management with a view to decreasing distraction for pupils with learning disabilities*

KEY WORDS: Teachers' Knowledge, Learning Disabilities, Facial Expression and Nutrition

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1 INTRODUCTION

According to Nigeria Demographic and Health Survey (NDHS;2013), Nigeria now has a population of 173.6 million out of whom 12 million are living with learning disabilities, and out of that number, 6 million are children (Vanguardngr,2014). Learning disability is a condition that gives rise to learning difficulties, especially when not associated with physical disability. It is otherwise called learning disorder. Learning disability is recognized by health professionals as a cognitive neurobiological disorder and/or language processing disorder caused by atypical brain functioning. They are manifested by significant difficulties for listening, speaking, reading and writing, reasoning or mathematic abilities (Silver *et al.*, 2008).

According to Encyclopaedia of Children's Health (2014), how learning is being influenced by disorders may not be easily observable. Nevertheless, successful learning of an individual is a function of the condition of the brain. Effective learning activities are fostered when the brain is in perfect order. What does learning then connote? Learning is said to be taking place when the behaviour of an individual member of a society is transformed in an acceptable manner to the society in which the individual lives. If this change is actually observed and demonstrated then learning is said to have taken place. For instance, a child who is unable to successfully complete a given arithmetic task is now able to do that at ease after some experience and practice. Also, if a child who disobeys parents' order now comes to discover that such habit is bad and imbibe the culture of obedience, he has learnt that disobedience to parents is bad. Learning Disabilities or Disorders refer to any impediment in a child's ability to read, comprehend, write and organize his or her thoughts, and present such learnt materials or thoughts in a sequential manner and when it is required by him or her to do so. A child with learning disorders experience difficulty in such academic activities or tasks such as reading, performing mathematics tasks or making written expressions. This is not to say that the intelligence of children with learning disorders is below normal as learning disorders have little or nothing to do with intelligence of a child. Children and adults like of average to above average intelligence do experience difficulties in academic work as a result of learning disorders. Learning disorders of children are not mere difficulties in reading, writing, Mathematics, listening, speaking and reading because these difficulties resulting from disorders significantly interfere with academic achievements and daily living.

The current UBE programme in Nigeria is a re-emergence of the Universal Primary Education (UPE) programme of the late 1970's. This current UBE was officially launched on 30th September 1999 in Sokoto by the then President of Nigeria, Chief Olusegun Obasanjo (Tahir, 2001). For the goals of the UBE to be achieved, learning difficulties among children can serve as a cog in the wheel of progress capable of truncating the achievement of the desired results. It therefore becomes imperative on parents, teachers and other stakeholders in the programme to put in place some workable modalities to address issue of children's learning difficulties. Learning disorders are synonymous to learning difficulties or learning disabilities. Whichever term is used, the classification includes several disorders in which an individual has difficulty in a typical manner, resulting from an unknown factor or factors (Tahir, 2001).

Statement of the Problem

Often, teachers categorize many students as "dull", "unintelligent", "slow-learning", etc. Others are even labelled as "truants", "extroverts", "introverts", "bullies", etc., and evidences are now abound to show that many of the students so categorized and labelled do simply manifest signs or symptoms of learning disabilities. It is a condition that gives rise to learning difficulties especially when not associated with physical disability. A lot of learners face difficulties in their education and are not able to study courses of their choice because of a disability in one area of learning which could have easily been remediated if detected early. In a study by Kessel, Ningenbach and Lawver (2009) on student teachers' knowledge of the individual with disabilities

education act, the authors found that overall, 74.5% felt they were prepared to teach special needs students in agricultural education classrooms and laboratories. In Nigeria, 50% of people with learning disabilities are children, and therefore, the researchers found it imperative to find out the primary school teachers' knowledge of learning disabilities in Ilorin West Local Government Area of Kwara State, Nigeria. The general purpose of this study was to critically examine primary school teachers' knowledge of learning disabilities. Specifically, the study investigated;

1. Teachers' knowledge of the causes of learning disabilities among primary school pupils.
2. The level of teachers' knowledge based on the signs and symptoms of learning disability among primary school pupils.

Research Questions

The following questions were formulated in order to find solutions to the problems identified.

1. What is the level of teachers' knowledge about the causes of learning disabilities among the pupils?
2. What is the level of teachers' knowledge about the signs and symptoms of learning disabilities among the primary school pupils?

2 METHODOLOGY

The research design adopted for gathering information for this research work was survey design. This method was the most appropriate for this research work as it enables the researcher to describe through the collection and analysis of data, and arriving at conclusions and making recommendations based on the data collected from the respondents through the use of a questionnaire. Osuala, (2001) remarked that survey method uncovers data, interprets synthesis, integrate these data and point to implications and interrelationship between the variables. A sample of 150 primary schools teachers was selected using simple random procedure out of a total population of 1,837 primary school teachers in Ilorin West Local Government Area. A 10 items researcher-designed questionnaire with psychometric properties of content validity, and 0.65 reliability index was used to elicit the needed data from the respondents. Frequency counts and percentages were used for answering the research questions.

3 RESULTS

Research Question One: Are the primary school teachers knowledgeable about the causes of learning disability?

Table 1: Primary School Teachers' Knowledge about the Causes of Learning Disability

Knowledge on Causes of LD	YES (%)	NO (%)	Total
Learning disabilities can be caused by illness or injury during, before or after birth.	142 (94.67)	8 (5.33)	150 (100)
Head injuries, nutritional deprivation and exposure to toxic substances cannot contribute to learning disabilities.	94 (62.67)	56 (37.33)	150 (100)
Environmental factors such as poor parental healthcare and malnutrition may constitute learning disabilities.	136 (90.67)	14 (9.33)	150 (100)
It is uncommon to find that people with learning disabilities have parents or relatives with similar difficulties.	95 (63.33)	55 (36.67)	150 (100)
German measles contracted during the first three months of pregnancy may cause learning disabilities.	76 (50.67)	74 (49.33)	150 (100)

Table 1 shows that 142 (94.67%) of the teachers knew that learning disabilities can be caused by illness or injury during, before or after birth. This was followed by 136 (90.67%) of the teachers who knew that environmental factors such as poor parental healthcare and malnutrition may cause learning disabilities. The next item had 76 (50.67%) of the teachers knew that German measles contracted during the first three months of pregnancy may cause learning disabilities. Unfortunately, 95 (63.33%) of the teachers did not know that it is uncommon to find that people with learning disabilities have parents or relatives with similar difficulties. Lastly, 94 (62.67%) of the teachers did not know that head injuries, nutritional deprivations and exposure to toxic substances can contribute to learning disabilities.

Research Question Two: Are the primary school teachers knowledgeable about the signs and symptoms of learning disabilities among primary school pupils?

Table 2: The Level of Teachers' Knowledge about the Signs and Symptoms of Learning Disabilities among Primary School pupils

Knowledge on Sign and Symptoms of LD	**YES %**	**NO %**	**Total %**
Children with learning disabilities usually have normal intelligence, but they have trouble expressing their knowledge.	137 (91.3)	13 (8.6)	150 (100)
Pupils with learning disabilities do not struggle with writing in several areas.	71 (47.3)	79 (52,6)	150 (100)
Pupils with learning disabilities may have trouble acquiring new skills and depend on memorization.	138 (92)	12 (8.0)	150 (100)
Children with learning disabilities do not have problem understanding body language and facial expression.	77 (51.3)	73 (48.6)	150 (100)
Some learning disabled children are known to be hyperactive that is restless, impatient, intolerant etc.	104 (69.3)	46 (30.6)	150 (100)

Table 2 shows that 138 (92%) of the teachers knew that pupils with learning disabilities may have trouble acquiring new skills and depend on memorization. Also, 137 (91.33%) of the teachers knew that children with learning disabilities usually have normal intelligence, but they have trouble expressing their knowledge. On the other hand, 104 (69.33%) of the teachers who knew that some learning disabled children are known to be hyperactive that is restless, impatient and intolerant. Lastly, 79 (52.67%) of the teachers knew that pupils with learning disabilities do struggle with writing in several areas. However, 77 (51.33%) of the teachers did not know that children with learning disabilities do have problems in understanding body language and facial expressions.

4 DISCUSSION

The first research question sought to know the level of primary school teachers' knowledge about the causes of learning disability, which according to the result of the findings, highest proportion of the teachers did not know that learning disabilities can be caused by illness or head injury during, before or after birth; Environmental factors such as poor parental healthcare and malnutrition; and German measles contacted during the first three months of pregnancy which may also cause learning disabilities. This finding agrees with Simos, Fletcher, Sarkari, Billingsley, Castillo, Pataraia, Francis, Denton, andPapanicolauo, (2005), position that learning disability is as a result of one or combination of the following: heredity, problem during pregnancy, incidents after birth, and environmental factors.

The second research question was formulated to look into the level of teachers' knowledge about the signs and symptoms of learning disabilities among primary school pupils. Based on the findings, many of the teachers knew that pupils with learning disabilities may have trouble acquiring new skills and depend on memorization; that pupils with learning disabilities do struggle with writing in several areas; that children with learning disabilities usually have normal intelligence, but they have trouble expressing their knowledge; and that some

learning disabled children are known to be hyperactive that is restless, impatient and intolerance which is in compliance with Kenyans and Lynch (2007), who opined that pupils with learning disabilities have normal or better intelligence, but they also have severe "information-processing deficits". Also, children with learning disorders according to Vanguardngr (2014) usually experience difficulties in certain tasks such as reading, writing, Mathematics, listening, speaking and reading and these tend to significantly interfere with academic achievements or daily living. However, few of the teachers did not know that children with learning disabilities do have problem understanding body language and facial expression.

5 CONCLUSIONS

From the ongoing, it could be concluded that knowledge of learning disabilities among the primary school teachers was not convincingly adequate. As revealed in the findings, majority of the teachers did not know that head injuries, nutritional deprivation and exposure to toxic substances can contribute to learning disabilities. Also, a good percentage of the teachers did not know that children with learning disabilities do have problem understanding body language and facial expression as well. Also, teachers did not know that distractions should be decreased in the classroom for children with learning disabilities and in as much as every child with a learning disability is different and will exhibit different signs; the first step toward improving their academic life is recognizing that a student might have a learning disability.

6 RECOMMENDATIONS

In view of the empirical findings concerning the primary school teachers' knowledge of learning disabilities in Ilorin West Local Government, the following recommendations are proposed;

1. The Federal Ministry of Education should orientate the teachers on knowledge of causes of learning disabilities.
2. The school authority should employ guidance counsellors and psychologists to train the teachers on how to understand the body language and facial expression of pupils with learning disabilities.

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