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Editorial

Dear authors, reviewers, and readers

It has been a month since I was given the privilege to serve as the Chief Editor of the International Journal for Innovation Education and Research (IJIER). It is a great pleasure for me to shoulder this duty and to welcome you to ***THE VOL-6, ISSUE-4 of IJIER*** which is scheduled to be published on **30th April 2018.**

International Journal for Innovation Education and Research (IJIER) is an open access, peer-reviewed and refereed multidisciplinary journal which is published by the International Educative Research Foundation and Publisher (IERFP). IJIER aims to promote academic interchange and attempts to sustain a closer cooperation among academics, researchers, policy makers and practitioners from a wide range of disciplines, which contribute to state of the art in science, education, and humanities. It provides a forum for the exchange of information in the fields mentioned above by welcoming original research papers, survey papers, and work-in-progress reports on promising developments, case studies, and best practice papers. The journal will continue to publish high-quality papers and will also ensure that the published papers achieve broad international credibility.

The Chief Editor, appointed by the Associate Editors and the Editorial Board, is in charge for every task for publication and other editorial issues related to the Journal. All submitted manuscripts are first screensed by the editorial board. Those papers judged by the editors to be of insufficient general interest or otherwise inappropriate are rejected promptly without external review. Those papers that seem most likely to meet our editorial criteria are sent to experts for formal review, typically to one reviewer, but sometimes more if special advice is needed. The chief editor and the editors then make a decision based on the reviewers' advice.

We wish to encourage more contributions from the scientific community to ensure a continued success of the journal. We also welcome comments and suggestions that could improve the quality of the journal.

I would like to express my gratitude to all members of the editorial board for their courageous attempt, to authors and readers who have supported the journal and to those who are going to be with us on our journey to the journal to the higher level.

Thanks,

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Table of content

Influence of Microfinance Training Content on Women's Acquisition of Financial Skills: A Case of Women's Self-Help Groups in Kiambu County, Kenya

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Abstract

Microfinance institutions have had their fair share of challenges, especially the ability of the women entrepreneurs to manage loans secured from the institutions. Thus, the study intended to examine the effectiveness of microfinance training content on women's acquisition of financial skills in Kiambu County, Kenya. The study was guided by Pearson's Theory of Gender Relations, The Endogenous Growth and Knowledge-Based Theories. It adopted mixed methods approach and thus applied exploratory research design. The target population comprised of 8 Credit Officers, 25 staff members, 1900 women in SHGs, 700 spouses and 100 Key Informants (Training Officers) all totaling to 2733. Using the Central Limit Theorem to obtain a sample of MFIs, that is, 25.0% of 8 MFIs and 295 respondents, that is, 10.9% of 2708, were selected. Purposive sampling was used to select two Credit Officers and 20 key informants (Training Officers). 190 women in SHGs and 83 spouses were selected using simple random sampling. Focus group discussions were used to collect data from women in SHGs and their spouses, interview schedules for women in SHGs, Credit Officers and spouses whereas questionnaires were used to gather information from Training Officers. Qualitative data was analyzed thematically along the study objectives and presented in narrative forms while the quantitative data was analyzed descriptively using frequencies and percentages with the help of Statistical Packages for Social Science (SPSS 23) and were presented using tables and charts. The study established that microfinance training content influence women's acquisition of financial skills. Thus, the study recommends that training materials should be specifically designed to suit the content of training programmes in order to enhance faster understanding of concepts to be learnt.

Keywords: Microfinance, Training Content, Women's Financial Skills, Self-Help Groups

Introduction

Financial skills are important for the success of any business venture. However, while the need for financial literacy may be largely acknowledged, the importance of gender dimension remains a subject for debate. There are three key aspects of a general rationale for considering women's needs. In a study conducted in

the Netherlands, Carr (2010) posits that, where gender differences in financial literacy exist, there are both philosophical and pragmatic reasons for addressing them.

While it is important to refrain from *ex-ante* assuming the direction of a gender gap, Carr (2010) suggests that women tend to have lower levels of financial knowledge and are relatively less financially skilled than men. This calls for the need to empower them through financial training. Such gaps represent fundamental problems for social equity, with several important follow-on implications.

There may be unrealized potential for gains in economic efficiency among one-half of the population, particularly in societies where a relatively large share of production takes place in informal home-based enterprises run by women. Low levels of female financial literacy and confidence may impede their more active

participation in the economy. In his journal about women's financial acumen in Italy, Abromovitz (2012) notes that financial literacy differences may affect relative economic power within the household. This has implications for well-being if men and women allocate household resources according to different preferences. Abramowitz (2012) suggests that spouses in different households do not act as single unitary decision makers. Instead, he asserts that household resources in women's hands have been observed to be more likely spent on improving family's well-being, particularly that of the children.

To address these challenges, microfinance training content cannot be overlooked. Providing program continuity through developmentally appropriate curricula for training of women entrepreneurs has been proposed as one of the keys to successful management of microfinances (Clark, Dobbins and Ladd, 2013). Baldwin, Magjuka and Loher (2010) propose that women's ability to claim the new skills as their own and to benefit educationally from it, may be reflected in the degree to which their trainers have collaborated in a shared conceptual framework of women's learning. In practice, however there are discontinuities associated with curricula in the two settings. Generally, these involve the move from a developmental approach to a cognitive curricula approach. Armstrong (2012) emphasizes the value of goal consensus between microsystems for successful management of microfinances to be made. A national study undertaken by Armstrong (2012) amongst MFIs in Bangladesh looking at trainers' practices related to the financial management found that 85% of trainers felt that coordinated curricula materials with appropriate content could be a positive step.

Microfinance institutions' training materials such as posters, flash cards, videos, films, models and other audio-visual aids, can effectively communicate ideas and information to trainees. Carefully chosen or prepared drawings or diagrams can communicate concepts and ideas better than words. People remember pictures they see better than words they hear. If people hear words and see pictures at the same time, they will remember even better.

Training materials on microfinance are often available locally and sometimes can be prepared from resources that are close at hand. Materials must be selected carefully to ensure that they are appropriate for the training group and they contain aspects of financial skills such as planning, pricing and costing, record-keeping, control, investment and expenditure, budgeting and working capital management. Implementation

should create more coherence across the various training opportunities available to staff in public institutions, while also acknowledging the diversity of settings.

However, there is some concern that linking training curricula with those of formal education might result in a more formal curriculum for the training settings (Daffron & North, 2010). On the same breath, women's training depends on the content of curriculum materials.

A study conducted by Schwoerer, May, Elaine and Mencl (2011) amongst 123 respondents to establish the efficacy of training tool kit on women's management of microfinances reveals that training materials with enough content register cases of improved performance. The study further asserts that these resources when well applied can lead to prudent management of microfinances by women.

A similar study conducted in Morocco by Swanson and Holton (2010) indicated that availability of curriculum materials with enough content during training enables trainees to acquire pre-requisite skills to achieve their potential at their workplaces and register positive results.

In Kiambu County, the effective use of curriculum and content materials on microfinance during training has been found to contribute to women's acquisition of financial skills. However, aspects such as planning, record-keeping, financial analysis, pricing and costing still pose challenges. Schwoerer et al (2011) and Swanson and Holton (2010) have not indicated whether such curriculum materials on microfinance enhance training and women's acquisition of finance skills without qualified trainers. The research studies have not indicated whether such content is suitable for specific skills the women enterprises demand; a research gap which the study sought to fill.

Statement of the problem

Microfinance institutions have been successful in providing legal frameworks upon which women get financial loans or subsidies to uplift their small and medium income generating enterprises. However, in Kiambu County, despite the highest number of MFIs, failure rate of women-based enterprises was on the rise. This situation has elicited concerns amongst stakeholders. It was also noted that efforts to mitigate these challenges have not yielded much and have failed to register remarkable progress in ensuring growth of women-based enterprises through prudent financial management. This brings into question the effectiveness of microfinance training programmes with specific focus on their quality and relevance to women's specific needs and concerns. As noted earlier, microfinance training has not been conceptualized to examine microfinance training contents, yet these have been considered important training targeted women.

Theoretical Framework

This study was guided by Pearson's Gender Relations Framework (2005) and the Endogenous Growth and the Knowledge-Based Theories. According to Pearson's theory, society views all activities that are carried out to be based on social roles and interactions of men and women. In this context, the framework views the notion of gender roles and activities as having a strong ideological content. Policies often reflect a prescribed version of men and women's roles rather than the actual activities they engage in. Based on such

ideologies, the society seems to have ultimate authority on nature of what men actually do and their contribution which turns out to be biased against women (Pearson, 2005). This theory was used to interrogate how women's prescribed roles and biased perceptions influenced their financial performance and how these informed MFI training, education and financial skills. The Pearson (2005)'s gender relations theory identifies the social differences between men and women that are learned, are changeable over time, and have wide variations between and within cultures. Endogenous Growth and the Knowledge-Based Theories underline the role of knowledge in increasing productivity within different enterprises and the economy. Enterprises and economies, which have highly educated and financially trained human resource, are likely to be high performers compared to those that lack these key resources.

In relation to MFIs, it was presumed that women entrepreneurs, who are trained on financial skills, are proactive and quick at applying new skills to improve efficiency, productivity, risk taking and innovativeness of their enterprises (Penrose, 1959). Therefore, the rationale of using this theory is; it underscored the vitality of the level of women's financial training which positively impact on their finance skills such as record-keeping, pricing and costing projections, investment plans, budgeting plans and e-financing.

Scope and Limitations of the Study

This study was carried out in microfinance institutions and registered self-help groups in Kiambu County. It covered the period between 2009 and 2016 since this is the period when so many MFIs such as Faulu, K-REP, Rafiki, Uwezo, SMEP, CBA and KWFT were conceptualized and registered in Kiambu County. Some of the respondents withheld information due to its sensitive nature. In this case, the researcher explained to the respondents that the aim of the study was to provide knowledge that could improve training programmes. The study may not be applicable to all women in SHGs since there could be other dynamics which influence their ability to adopt financial prudence other than training.

Research Methodology

The study applied exploratory sequential design. This is a double-phase design in which qualitative data helps explain or builds upon initial quantitative results (Creswell, 2009). This design was useful since it provided significant insight on how microfinance training programmes have impacted on women's acquisition of financial skills. The target population comprised of women and their spouses in 250 registered Self-Help Groups. Only those who had accessed microfinance services in the study area between 2009 to 2014 were included in the study. Key informants also included Credit Officers from the registered MFIs providing training services to women in the study area and the training officers commissioned by MFIs. This is because they had information on women beneficiaries of microfinance training. Using the Central Limit Theorem, the study sampled two MFIs out of the eight operating in Kiambu County and 295 respondents, that is, 10.9% of 2708. Purposive sampling was applied to select two Credit Officers and 20 Key informants (Training Officers). This was because they held responsibility of implementation of the MFI training programmes.

On the other hand, simple random sampling was applied to select 83 spouses of women in Self Help Groups (SHGs) and 190 women selected from SHGs that benefited from microfinance training and loans from MFIs. Data analysis began by identifying common themes from the respondents' description of their experiences. The relevant information was broken into phrases or sentences, which reflect a single, specific thought. Qualitative data was analyzed thematically along the study objectives and presented in narrative forms. Quantitative data was analyzed using descriptive statistics such as frequencies, percentages, mean and standard deviation with the help of Statistical Packages for Social Science (SPSS Version 23) and presented in frequency distribution tables.

Results and Discussions

The study sought to evaluate the influence of microfinance training content on women's acquisition of financial skills in Kiambu County, Kenya.

Respondents' Background Information

In this study, 20 questionnaires were administered to the training officers. In return, 17 were filled and returned. The researcher also conducted interviews and focus group discussions among 156 women in SHGs, interviewed one Credit Officer and 80 spouses. This yielded response rates as shown in Table 1;

Table 1: Response Rate

Respondents	Sampled Respondents	Those Who Participated	Response Rate (%)
Training Officers	20	17	85.0
Credit Officers	2	1	50.0
Women in SHGs	190	156	82.1
Women's Spouses	83	80	96.4
Total	**295**	**254**	**86.1**

Source: Researcher (2017)

From Table 1, training officers, credit officers, women in SHGs and spouses registered a response rate of 86.1%. This confirmed the findings of Creswell (2009) that a response rate above 75.0% is adequate and of suitable levels to allow for generalization of the outcomes to the target population.

Levels of Women's Involvement with Microfinance Institutions

The study sought to establish if women in SHGs have been involved with MFIs, duration and the amount of money they have received as shown in Table 2;

Table 2: Findings of Women's Involvement in MFIs

Aspects of Involvement		Women in SHGs		Training Officers		Credit Officers		Spouses	
Have Been		f	%	f	%	f	%	f	%
Involved	Yes	102	65.4	13	76.5	1	100	56	70.0
	No	54	34.6	4	23.5	0	0.0	24	30.0
Duration of	Less Than 1	15	9.6	2	11.8	0	0.0	4	5.0
Involvement	1-3 years	47	30.1	4	23.5	0	0.0	32	40.0
	More than 3 years	94	60.3	11	64.7	1	100.0	44	55.0
Amount	>50,000	10	6.4	1	5.9	0	0.0	10	12.5
Received	50,000-100,000	31	19.9	3	17.6	0	0.0	25	31.2
	100,000-150,000	109	69.9	12	70.6	1	100.0	40	50.0
	<150,000	6	3.8	1	5.9	0	0.0	5	6.3

Source: Researcher (2017)

When asked if they have been involved in microfinance institutions, 65.4% of the women in SHGs reported to have been involved in accessing funds for their businesses from such institutions with only 34.6% indicating that they have never been involved with MFIs. To support this, most women, who were interviewed, indicated that their economic situations cannot allow them to depend on their own individual finances to start business enterprises. On further probing, a woman respondent noted,

> "Most of us come from humble backgrounds and thus, find it difficult to even raise little capital to start business. In coming together, we find strength in each other and thus able to pool together to access findings from MFIs" (Monday, 24/08/2016).

The study also established that majority of women in SHGs which have not accessed any funding from MFIs find it difficult to carry out their activities. When asked why they have not been involved with MFIs as a source of funding, they cited longer bureaucracy and tedious procedures of filing forms and longer periods of waiting. Further, a woman discussant admitted,

> "It is sometimes very difficult to access loans from these institutions. For example, last year, our SHG applied for the same, but up to today, we have not received despite meeting the necessary requirements and terms. When you receive the loan, their interest rates are very high to a point where it sometimes becomes difficult to pay back"

This was evidenced by the inability of the majority of women in SHGs to state the basic requirements and procedures for an individual to access loans. Fear of repossession of members' private property in case one defaults was another concrete reason for their non-involvement with MFIs. In the same vein, 76.5% of the

training officers who filled questionnaires also corroborated the view that majority of women SHGs are involved in accessing funding from MFIs as did the Credit Officer and 70.0% of the spouses. Further, one spouse remarked,

> "My spouse has been doing business with MFIs as a source of funding for her *mitumba* business since 2010 when it was started" (Tuesday, 25/08/2016).

From these findings, it is evident that microfinance institutions are regarded as the most reliable and main source of funding of businesses amongst women in SHGs.

These findings lend credence to the assertions of Mboguah and Musinga (2014) that the emergence of micro-finance as an industry is a relatively old phenomenon in Kenya, with a number starting about 20 or so years ago, but the sector gaining the status of an industry about 10 years ago.

These findings point to the fact that many women's SHGs regard MFIs as their source of capital to boost and expand their business ventures. Most women groups start their businesses with small amounts of money but later get support from MFIs.

On duration of involvement, Table 2 shows that majority (60.3%) of the women respondents admitted that they have been involved with MFIs for a period of more than 3 years, 30.1% indicated that they have done business with MFIs for 1-3 years whereas a small proportion of 9.6% indicated that they have done business with MFIs for a period less than a year. A woman discussant noted,

> "Our Self-Help Group has been involved with MFIs since it was formed three years ago. We have accessed finances from MFIs at least twice since it was started" (Monday, 24/8/2016).

The study further established that most business enterprises owned by women in SHGs have been in existence for the last five years with MFIs as their main source of funding. This implies that any business enterprise owned by women in SHGs at their start-up stages or growth largely partner with MFIs.

Microfinance institutions form the basis of success of many businesses owned by women in SHGs. These views were echoed by training officers in their questionnaires with a majority (64.7%) indicating that women's SHGs have been doing business with MFIs for more than 3 years. Similar views were expressed by the Credit Officer and the spouses. In affirming this view, one spouse reported,

> "My spouse started her saloon business four years and has depended on funding from Rafiki Microfinance Institutions".

These findings lend credence to the assertions of Streppel et al (2011) that government policy or philosophy of microfinancing was to promote the small-scale and enterprise sector as a means of accelerating economic growth and generating employment opportunities. These findings attest to the fact that MFIs play a pivotal role as a tool for empowerment of women and other socially and economically vulnerable members of society.

When asked to state the amount of money they have received from MFIs and how they have spent it, 69.9% of the women respondents admitted to have received a loan between Kshs. 100,000-150,000 from MFIs. 19.9% of the women respondents indicated that they have received amount between Kshs. 50,000-100,000,

6.4% received less than Kshs. 50,000 whereas 3.8% admitted to have received more than Kshs. 150,000 from MFIs. This shows that most enterprises belonging to women in SHGs get most of their funding from MFIs. This was evidenced by a smaller portion of women in SHGs which could not could access any funding from such institutions. Their business had serious financial challenges. However, expenditure of these loans was also a challenge to many with much of the funding being channeled to vote heads for which the loan was not intended. A woman discussant confessed,

> "I have had the opportunity to secure Kshs. 150, 0000 from Uwezo MFI to boost my detergent manufacture business. However, it has not been channeled wholly to my business enterprises. Sometimes, I had to allocate part of the money to help my spouse pay our children's school fees and even purchase some iron sheets to set up our family house" (Wednesday, 26/08/2016).

This was evidenced by many women who could not account for the expenditure of the loans they acquired from MFIs. Some had disjointed accounts records which could not add up. Women respondents admitted that they had mismanaged their loans and could not meet the requirements of the budget plans which enabled them to secure the loans. To corroborate this, a woman interviewee confessed,

> "I always find it difficult to balance my records in a manner to reflect the loan I borrowed, invested and the expected profit margins. This is because some of the money I get from the proceeds of the business find its way in taking care of family responsibilities. To this point, repaying the loans becomes a major problem" (Wednesday, 26/08/2016).

This implies that majority of women in SHGs lack the basic financial management skills to enable them do proper analysis of their priorities. Most women respondents admitted that they face the challenge of inadequate financial skills such as book keeping, investment, pricing and projections, and budgeting besides inability to prioritize between business and domestic needs.

Training officers also echoed similar views with 70.6% reporting that most women in SHGs receive between Kshs. 100,000-150,000 for their business activities, but lands in different priorities. The Credit Officer also corroborated these views as did half (50.0%) of the spouses. To affirm this, one spouse confessed,

> "My spouse has received Kshs. 130,000 from KWFT, but due financial constraints at home, part of it has often been used to cater for domestic needs such as buying food, paying fees, medical bills and domestic expenses which leave little money for investment in business for which it was intended" (Thursday, 27/08/2016).

These findings corroborate the assertions of Abramowitz (2012), in his journal about women's financial acumen in Italy which revealed that financial literacy differences may affect relative economic power within the household. This has implications for well-being if men and women allocate household resources according to different preferences. Abramowitz (2012) suggests that spouses in different households do not act as single unitary decision makers. Instead, he asserts that household resources in women's hands have been observed to be more likely spent on improving family's well-being, particularly that of the children.

Influence of Microfinance Training Content on Women's Finance Skills

The study sought to find out how microfinance training content and materials impact on women's finance skills and the results are shown in Table 3:

Table 3: Findings on the Influence of Microfinance Training Materials on Women's Acquisition of Financial Skills

Test Items	Women in SHGs		Spouses		Training Officers	
	f	%	f	%	f	%
Content of microfinance training materials are not suitable to enhance women's acquisition of financial skills	88	56.4	44	55.0	4	23.5
Microfinance training materials only have content on loaning processes and interests thus irrelevant to promote women's acquisition of financial skills	98	62.8	48	60.0	13	76.5
Most MFIs do not provide women trainees with adequate training materials	102	65.4	40	50	3	17.6
Training materials provided by MFIs barely have content on financial skills	125	80.1	48	60.0	5	29.4
Language used in most microfinance training materials is complex for women to understand	117	75.0	44	50.0	9	52.9

Source: Researcher (2017)

Table 3 shows that 56.4% of the women respondents stated that content of microfinance training materials is not suitable to enhance their acquisition of financial skills.

Women respondents stated that materials for training provided by MFIs contain information which are not suitable for enhancing financial skills. At the same time, 62.8% of women also noted that microfinance training materials only have content on loaning processes and interests thus irrelevant to promote women's acquisition of financial skills. Majority (65.4%) of the women respondents also reported that most MFIs do not provide women trainees with adequate training materials. During the interviews, a woman respondent noted,

> "The training materials are rarely relevant nor are they sufficient. They only contain information on procedures of accessing loans, amounts and duration of loan repayment. They do not bare any information on training of women on financial skills" (Tuesday, 28/8/2016).

These views were also supported by 60.0% of the spouses who reported that training materials at their disposal contain information on loaning process and the amount of interests charged on different categories of money borrowed. However, credit officer and 23.5% of the training officers refuted the claims that training materials provided by the MFIs are not suitable, not relevant nor ar they adequate. This indicates that the nature of the training materials provided by MFIs determine the kind of information women get as far as financial skills are concerned.

Majority (76.5%) of training officers, however, concurred with the women respondents that microfinance training materials only have content on loaning processes and interests thus irrelevant to promote women's acquisition of financial skills. These findings affirm the fact that training materials are vital for the success of any training of women in SHGs on financial skills such as investments, book keeping, pricing and projections and budgeting and e-financing. This is indicative of the fact that having the materials available to teach women in SHGs what they need to know on financial skills makes the difference in the performance of their business ventures.

These findings corroborate the assertions of Daffron and North (2010) that training materials must be selected carefully to ensure that they are appropriate for the training group and that they contain aspects of financial skills such as planning, pricing and costing, record-keeping, control, investment and expenditure, budgeting and working capital management.

These views support the views expressed in Austria in which Schwoerer et al (2011) noted that training materials with enough content register cases of improved performance. The author further asserts that training materials, when well applied, can lead to prudent management of microfinances by women.

These data further lend credence to the views expressed in Morocco by Swanson and Holton (2010) that availability of curriculum materials with enough content during training enable trainees to acquire pre-requisite skills to achieve their potential at their workplaces and register positive results. When asked about the effectiveness of language used in the training materials, 75.0% of women respondents noted that language used in most microfinance training materials is complex for women to understand. During the FGD, a woman respondent reported,

> "I always find it difficult to understand the contents of training materials provided by MFIs since the language used in very technical and subjective. That is, the individual who is able to understand must have basic knowledge in accounts and interpretations confusing" (Tuesday, 12/10/2016).

This implies that, to understand the meaning of any information contained in the training materials, language used determines the outcome of any training session. Language allows women in SHGs to understand different concepts contained in the training materials. This implies that training materials developed in simple and clear language make it easy for women to understand and therefore acquire financial skills. Spouses (50.0%) also noted that language used in developing most of training materials is quite complex and technical for women to understand. On further probing, a spouse remarked,

> "So far, the microfinance training materials I have come across are not simple in expression and requires a person with higher knowledge in financial management. For example, concepts like

> principals, time, rates, interests and durations of loan repayment are sometimes expressed in a manner that is not possible to interpret" (Friday, 12/10/2016).

These views were also supported by credit officer and 52.9% of training officers who indicated that sometimes women in the SHGs require serious explanations for them to make meaning of the language used while developing the training materials. These findings support the assertions of a study conducted in Bangladesh by Armstrong (2012) which revealed that training materials, which are carefully chosen or prepared can communicate concepts and ideas better than words.

SUMMARY OF FINDINGS

From the study findings, it is evident that microfinance training content influence women's finance skills. Suitability of training materials enhances women's record-keeping, investment, pricing and costing and budgeting skills. This affirms the fact that training materials must be selected carefully to ensure that they are appropriate for the training group and that they contain aspects of financial skills such as planning, pricing and costing, record-keeping, control, investment and expenditure, budgeting and working capital management. Relevance and sufficiency of training curriculum content enhance women's record-keeping, investment, pricing and costing and budgeting skills. These findings attest to the fact that training materials with enough content register cases of improved performance. That is, such resources, when well applied, can lead to prudent management of microfinances by women. Quality is also important in designing training materials. Likewise, it is evident that quality of training materials enhances women's record-keeping, investment, pricing and costing and budgeting skills as do the guidance and counseling skills. This is indicative of the fact that effective use of curriculum and content materials on microfinance during training have been found to contribute to women's acquisition of finance skills.

CONCLUSIONS AND RECOMMENDATIONS

From the study findings, it is evident that microfinance training content influence women's finance skills. Suitability, relevance and quality of training materials enhances women's record-keeping, investment, pricing and costing and budgeting skills. The study thus recommends that training materials need to be specifically designed to suit the content of training programmes in order to enhance faster understanding of concepts to be learnt. In other words, the training material should be redesigned to also focus on acquisition of financial skills for effective investment and business management.

REFERENCES

Abromovitz, M. (2012). The feminization of austerity', *New Labor Forum*, vol. 21, no. 1, pp. 32–41.

Armstrong, H. (2012). *Principles of Best Value.* London, HMSO

Baldwin, T. T., Magjuka, R. J. & Loher, B. T. (2010). The perils of participation: Effect of choice of training on trainee motivation and learning. *Personal Psychology*.

Carr, E. S. (2010). Rethinking empowerment theory using a feminist lens: the importance of process', *Affilia,* vol. 18, no. 8, pp. 8–20.

Clark, C. S., Dobbins, G. H., & Ladd, R. T. (2013). Exploratory field study of training motivation. *Group & Organization Management*, 18 (3), 292-307.

Creswell, J. W. (2009). *Research design: qualitative, quantitative and mixed methods approaches.* Thousand Oaks, California: Sage Publications.

Daffron, S. R., & North, M. W. (2010). Learning transfer: Lesson learned from software company professionals. *Journal of Lifelong Learning*, 15, 51-67.

Mboguah, Ch. and Musinga, M. (2014). *Profiles of Kenyan Micro-Finance Agencies as Supported* by Dutch CFAs (working document).

Pearson, R. (2005). *Theory of Gender Relations*. Zed Books, pp.157-179.

Schwoerer, C. E., May D. R., Elaine, H. C. and Mencl, J. (2011). General and specific self-efficacy in the context of a training intervention to enhance performance expectancy. *Human Resource Quarterly,* 16 (1), 111-129.

Streppel, F., Gommans, C. and Duursma, M. (2011). *Microfinance Policy Kenya*. Nairobi, Kenya.

Swanson, R. A., & Holton E. F. III (2010). *Foundations of human resource development*. San Francisco: Berrett-Koehler.

Influence of Microfinance Trainers' Characteristics on Women's Acquisition of Financial Skills: A Case of Women's Self-Help Groups in Kiambu County, Kenya

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Abstract
Microfinance institutions have had their fair share of challenges, especially the ability of the women entrepreneurs to manage loans secured from the institutions. Thus, the study intended to examine the effectiveness of microfinance trainers' characteristics on women's acquisition of financial skills in Kiambu County, Kenya. The study was guided by Pearson's Theory of Gender Relations, The Endogenous Growth and Knowledge-Based Theories. It adopted mixed methods approach and thus applied exploratory research design. The target population comprised of 8 Credit Officers, 25 staff members, 1900 women in SHGs, 700 spouses and 100 Key Informants (Training Officers) all totaling to 2733. Using the Central Limit Theorem to obtain a sample of MFIs, that is, 25.0% of 8 MFIs and 295 respondents, that is, 10.9% of 2708, were selected. Purposive sampling was used to select two Credit Officers and 20 key informants (Training Officers). 190 women in SHGs and 83 spouses were selected using simple random sampling. Focus group discussions were used to collect data from women in SHGs and their spouses, interview schedules for women in SHGs, Credit Officers and spouses whereas questionnaires were used to gather information from Training Officers. Qualitative data was analyzed thematically along the study objectives and presented in narrative forms while the quantitative data was analyzed descriptively using frequencies and percentages with the help of Statistical Packages for Social Science (SPSS 23) and were presented using tables and charts. The study established that microfinance trainers' characteristics influence women's acquisition of financial skills. Thus, the study recommends that microfinance trainers' need to update their skills to match the changing times such as adopting use of ICT and attitude change towards women empowerment. The trainers need to plan for quarterly and semi-annual evaluation of training programmes since they are effective in ascertaining of the efficacy of such programmes.

Keywords: Microfinance, Trainers' characteristics, Women's Financial Skills, Self-Help Groups

Introduction

Financial skills are important for the success of any business venture. However, while the need for financial literacy may be largely acknowledged, the importance of gender dimension remains a subject for debate.

There are three key aspects of a general rationale for considering women's needs. In a study conducted in the Netherlands, Carr (2010) posits that, where gender differences in financial literacy exist, there are both philosophical and pragmatic reasons for addressing them.

While it is important to refrain from *ex-ante* assuming the direction of a gender gap, Carr (2010) suggests that women tend to have lower levels of financial knowledge and are relatively less financially skilled than men. This calls for the need to empower them through financial training. Such gaps represent fundamental problems for social equity, with several important follow-on implications.

There may be unrealized potential for gains in economic efficiency among one-half of the population, particularly in societies where a relatively large share of production takes place in informal home-based enterprises run by women. Low levels of female financial literacy and confidence may impede their more active

participation in the economy. In his journal about women's financial acumen in Italy, Abromovitz (2012) notes that financial literacy differences may affect relative economic power within the household. This has implications for well-being if men and women allocate household resources according to different preferences. Abramowitz (2012) suggests that spouses in different households do not act as single unitary decision makers. Instead, he asserts that household resources in women's hands have been observed to be more likely spent on improving family's well-being, particularly that of the children.

Trainers-of-Trainers and other stakeholders have been identified as a principal factor which contributes to women's acquisition of pre-requisite skills to manage their enterprises. Toby, Yang and Bartlett (2014) have articulated the need to focus on MFIs and trainer practices that are responsive to context when examining the performance of an individual woman rather than to over focus on strategies to teach women specific skills.

Public institutions have a responsibility to provide suitable training to its staff (Toby et al, 2014).

This mandate is often met by MFI through offering opportunities intended to train all women regardless of their status in society. Support is provided by trainers, management of MFIs and other stakeholders. In a study conducted in Nicaragua amongst 211 respondents to establish the efficacy of professionals on women training and financial management, Michael and Dwivedi (2013) have shown that the most important variable in such success is a well-prepared and capable trainer or facilitator.

The study further indicated that beliefs held by professionals have about women's ability to manage finances and their understanding of the challenges which women face after borrowing finance from MFIs, hold key to the success of such training. Michael and Dwivedi (2013) asserts that the exosystem and macrosystem also influence the trainer, in terms of the curriculum he or she has to work with, and the cultural expectations and views of trainers and their roles in society.

Similar findings were reported in Nigeria by Nwoye (2011) in which they suggested that trainers have images of knowledge custodians and the role they should play during women training to enhance their ability to do record-keeping, financial control, planning, budgeting, pricing, costing and working capital management. Nwoye (2011) further asserts that the best practice for trainers is that they should become well versed and trained in evidence-based instruction and behavioral techniques in order to help the women

obtain his or her therapeutic and training goals (Nwoye, 2011). Thus, with the majority of women spending large portions of their working days in general education or training settings, trainers must be knowledgeable.

Such knowledge should include the women's core characteristics and relevant evidence based training strategies for women in different cadres or levels of education to ensure that women succeed in realizing their full entrepreneurial potential. This study acknowledges considerable benefits of training while understanding the research based need for women to receive multiple hours of specific trainings depending on job demands.

The current researchers sought to understand how prepared general trainers are to implement training curriculum content for employees in different job groups. However, the findings contradict the assertions of a study by Kehrhahn (2012) which indicated that even when general trainers do report receiving academic instruction and/or professional development training related to the demands of different women, they still do not feel completely prepared to instruct women whose projects demand specific attention. In Kiambu County, the ability to manage microfinances amongst women is still wanting despite the importance of identifying observable aspects of professionals and trainers' preparedness as aspects of training which enhance women's ability to manage microfinances obtained from MFIs.

This is attributed to the fact that that studies by Nwoye (2011) and Kehrhahn (2012) have had difficulty identifying specific training and counseling skills or approaches of training which professionals should adopt to improve their effectiveness in enhancing women's acquisition of important skills to undertake microfinance management. There is little evidence that professional training of trainers and stakeholders predicts management of microfinances amongst women trainees. These were research gaps which this study sought to fill.

Statement of the problem

Microfinance institutions have been successful in providing legal frameworks upon which women get financial loans or subsidies to uplift their small and medium income generating enterprises. However, in Kiambu County, despite the highest number of MFIs, failure rate of women-based enterprises was on the rise. This situation has elicited concerns amongst stakeholders. It was also noted that efforts to mitigate these challenges have not yielded much and have failed to register remarkable progress in ensuring growth of women-based enterprises through prudent financial management. This brings into question the effectiveness of microfinance trainers' characteristics on women's specific needs and concerns.

As noted earlier, microfinance training has not been conceptualized to examine trainers' characteristics, yet these have been considered important training targeted women. Consequently, this study sought to assess the influence of microfinance trainers' characteristics on women's acquisition of financial skills in Kiambu County, Kenya.

Theoretical Framework

This study was guided by Pearson's Gender Relations Framework (2005) and the Endogenous Growth and the Knowledge-Based Theories. According to Pearson's theory, society views all activities that are carried

out to be based on social roles and interactions of men and women. In this context, the framework views the notion of gender roles and activities as having a strong ideological content. Policies often reflect a prescribed version of men and women's roles rather than the actual activities they engage in. Based on such ideologies, the society seems to have ultimate authority on nature of what men actually do and their contribution which turns out to be biased against women (Pearson, 2005). This theory was used to interrogate how women's prescribed roles and biased perceptions influenced their financial performance and how these informed MFI training, education and financial skills.

The Pearson (2005)'s gender relations theory identifies the social differences between men and women that are learned, are changeable over time, and have wide variations between and within cultures. Endogenous Growth and the Knowledge-Based Theories underline the role of knowledge in increasing productivity within different enterprises and the economy.

Enterprises and economies, which have highly educated and financially trained human resource, are likely to be high performers compared to those that lack these key resources. In relation to MFIs, it was presumed that women entrepreneurs, who are trained on financial skills, are proactive and quick at applying new skills to improve efficiency, productivity, risk taking and innovativeness of their enterprises (Penrose, 1959). Therefore, the rationale of using this theory is; it underscored the vitality of the level of women's financial training which positively impact on their finance skills such as record-keeping, pricing and costing projections, investment plans, budgeting plans and e-financing.

Scope and Limitations of the Study

This study was carried out in microfinance institutions and registered self-help groups in Kiambu County. It covered the period between 2009 and 2016 since this is the period when so many MFIs such as Faulu, K-REP, Rafiki, Uwezo, SMEP, CBA and KWFT were conceptualized and registered in Kiambu County.

Some of the respondents withheld information due to its sensitive nature. In this case, the researcher explained to the respondents that the aim of the study was to provide knowledge that could improve training programmes. The study may not be applicable to all women in SHGs since there could be other dynamics which influence their ability to adopt financial prudence other than training.

Research Methodology

The study applied exploratory sequential design. This is a double-phase design in which qualitative data helps explain or builds upon initial quantitative results (Creswell, 2009). This design was useful since it provided significant insight on how microfinance training programmes have impacted on women's acquisition of financial skills.

The target population comprised of women and their spouses in 250 registered Self-Help Groups. Only those who had accessed microfinance services in the study area between 2009 to 2014 were included in the study. Key informants also included Credit Officers from the registered MFIs providing training services to women in the study area and the training officers commissioned by MFIs. This is because they had information on women beneficiaries of microfinance training.

Using the Central Limit Theorem, the study sampled two MFIs out of the eight operating in Kiambu County and 295 respondents, that is, 10.9% of 2708. Purposive sampling was applied to select two Credit Officers and 20 Key informants (Training Officers). This was because they held responsibility of implementation of the MFI training programmes.

On the other hand, simple random sampling was applied to select 83 spouses of women in Self Help Groups (SHGs) and 190 women selected from SHGs that benefited from microfinance training and loans from MFIs. Data analysis began by identifying common themes from the respondents' description of their experiences. The relevant information was broken into phrases or sentences, which reflect a single, specific thought.

Qualitative data was analyzed thematically along the study objectives and presented in narrative forms. Quantitative data was analyzed using descriptive statistics such as frequencies, percentages, mean and standard deviation with the help of Statistical Packages for Social Science (SPSS Version 23) and presented in frequency distribution tables.

Results and Discussions

The study sought to evaluate the influence of microfinance trainers' characteristics on women's acquisition of financial skills in Kiambu County, Kenya.

Respondents' Background Information

In this study, 20 questionnaires were administered to the training officers. In return, 17 were filled and returned. The researcher also conducted interviews and focus group discussions among 156 women in SHGs, interviewed one Credit Officer and 80 spouses. This yielded response rates as shown in Table 1;

Table 1: Response Rate

Respondents	Sampled Respondents	Those Who Participated	Response Rate (%)
Training Officers	20	17	85.0
Credit Officers	2	1	50.0
Women in SHGs	190	156	82.1
Women's Spouses	83	80	96.4
Total	**295**	**254**	**86.1**

Source: Researcher (2017)

From Table 1, training officers, credit officers, women in SHGs and spouses registered a response rate of 86.1%. This confirmed the findings of Creswell (2009) that a response rate above 75.0% is adequate and of suitable levels to allow for generalization of the outcomes to the target population.

Levels of Women's Involvement with Microfinance Institutions

The study sought to establish if women in SHGs have been involved with MFIs, duration and the amount of money they have received as shown in Table 2;

Table 2: Findings of Women's Involvement in MFIs

Aspects of Involvement		Women in SHGs		Training Officers		Credit Officers		Spouses	
Have Been		f	%	f	%	f	%	f	%
Involved	Yes	102	65.4	13	76.5	1	100	56	70.0
	No	54	34.6	4	23.5	0	0.0	24	30.0
Duration of	Less Than 1	15	9.6	2	11.8	0	0.0	4	5.0
Involvement	1-3 years	47	30.1	4	23.5	0	0.0	32	40.0
	More than 3 years	94	60.3	11	64.7	1	100.0	44	55.0
Amount	>50,000	10	6.4	1	5.9	0	0.0	10	12.5
Received	50,000-100,000	31	19.9	3	17.6	0	0.0	25	31.2
	100,000-150,000	109	69.9	12	70.6	1	100.0	40	50.0
	<150,000	6	3.8	1	5.9	0	0.0	5	6.3

Source: Researcher (2017)

When asked if they have been involved in microfinance institutions, 65.4% of the women in SHGs reported to have been involved in accessing funds for their businesses from such institutions with only 34.6% indicating that they have never been involved with MFIs. To support this, most women, who were interviewed, indicated that their economic situations cannot allow them to depend on their own individual finances to start business enterprises. On further probing, a woman respondent noted,

> "Most of us come from humble backgrounds and thus, find it difficult to even raise little capital to start business. In coming together, we find strength in each other and thus able to pool together to access findings from MFIs" (Monday, 24/08/2016).

The study also established that majority of women in SHGs which have not accessed any funding from MFIs find it difficult to carry out their activities. When asked why they have not been involved with MFIs as a source of funding, they cited longer bureaucracy and tedious procedures of filing forms and longer periods of waiting. Further, a woman discussant admitted,

> "It is sometimes very difficult to access loans from these institutions. For example, last year, our SHG applied for the same, but up to today, we have not received despite meeting the necessary requirements and terms. When you receive the loan, their interest rates are very high to a point where it sometimes becomes difficult to pay back"

This was evidenced by the inability of the majority of women in SHGs to state the basic requirements and procedures for an individual to access loans. Fear of repossession of members' private property in case one defaults was another concrete reason for their non-involvement with MFIs. In the same vein, 76.5% of the training officers who filled questionnaires also corroborated the view that majority of women SHGs are involved in accessing funding from MFIs as did the Credit Officer and 70.0% of the spouses. Further, one spouse remarked,

> "My spouse has been doing business with MFIs as a source of funding for her *mitumba* business since 2010 when it was started" (Tuesday, 25/08/2016).

From these findings, it is evident that microfinance institutions are regarded as the most reliable and main source of funding of businesses amongst women in SHGs.

These findings lend credence to the assertions of Mboguah and Musinga (2014) that the emergence of micro-finance as an industry is a relatively old phenomenon in Kenya, with a number starting about 20 or so years ago, but the sector gaining the status of an industry about 10 years ago.

These findings point to the fact that many women's SHGs regard MFIs as their source of capital to boost and expand their business ventures. Most women groups start their businesses with small amounts of money but later get support from MFIs.

On duration of involvement, Table 4.2 shows that majority (60.3%) of the women respondents admitted that they have been involved with MFIs for a period of more than 3 years, 30.1% indicated that they have done business with MFIs for 1-3 years whereas a small proportion of 9.6% indicated that they have done business with MFIs for a period less than a year. A woman discussant noted,

> "Our Self-Help Group has been involved with MFIs since it was formed three years ago. We have accessed finances from MFIs at least twice since it was started" (Monday, 24/8/2016).

The study further established that most business enterprises owned by women in SHGs have been in existence for the last five years with MFIs as their main source of funding. This implies that any business enterprise owned by women in SHGs at their start-up stages or growth largely partner with MFIs.

Microfinance institutions form the basis of success of many businesses owned by women in SHGs. These views were echoed by training officers in their questionnaires with a majority (64.7%) indicating that women's SHGs have been doing business with MFIs for more than 3 years. Similar views were expressed by the Credit Officer and the spouses. In affirming this view, one spouse reported,

> "My spouse started her saloon business four years and has depended on funding from Rafiki Microfinance Institutions".

These findings lend credence to the assertions of Streppel et al (2011) that government policy or philosophy of microfinancing was to promote the small-scale and enterprise sector as a means of accelerating economic growth and generating employment opportunities. These findings attest to the fact that MFIs play a pivotal role as a tool for empowerment of women and other socially and economically vulnerable members of society.

When asked to state the amount of money they have received from MFIs and how they have spent it, 69.9% of the women respondents admitted to have received a loan between Kshs. 100,000-150,000 from MFIs. 19.9% of the women respondents indicated that they have received amount between Kshs. 50,000-100,000, 6.4% received less than Kshs. 50,000 whereas 3.8% admitted to have received more than Kshs. 150,000 from MFIs. This shows that most enterprises belonging to women in SHGs get most of their funding from MFIs. This was evidenced by a smaller portion of women in SHGs which could not could access any funding from such institutions. Their business had serious financial challenges. However, expenditure of these loans was also a challenge to many with much of the funding being channeled to vote heads for which the loan was not intended. A woman discussant confessed,

> "I have had the opportunity to secure Kshs. 150, 0000 from Uwezo MFI to boost my detergent manufacture business. However, it has not been channeled wholly to my business enterprises. Sometimes, I had to allocate part of the money to help my spouse pay our children's school fees and even purchase some iron sheets to set up our family house" (Wednesday, 26/08/2016).

This was evidenced by many women who could not account for the expenditure of the loans they acquired from MFIs. Some had disjointed accounts records which could not add up. Women respondents admitted that they had mismanaged their loans and could not meet the requirements of the budget plans which enabled them to secure the loans. To corroborate this, a woman interviewee confessed,

> "I always find it difficult to balance my records in a manner to reflect the loan I borrowed, invested and the expected profit margins. This is because some of the money I get from the proceeds of the business find its way in taking care of family responsibilities. To this point, repaying the loans becomes a major problem" (Wednesday, 26/08/2016).

This implies that majority of women in SHGs lack the basic financial management skills to enable them do proper analysis of their priorities. Most women respondents admitted that they face the challenge of inadequate financial skills such as book keeping, investment, pricing and projections, and budgeting besides inability to prioritize between business and domestic needs.

Training officers also echoed similar views with 70.6% reporting that most women in SHGs receive between Kshs. 100,000-150,000 for their business activities, but lands in different priorities. The Credit Officer also corroborated these views as did half (50.0%) of the spouses. To affirm this, one spouse confessed,

> "My spouse has received Kshs. 130,000 from KWFT, but due financial constraints at home, part of it has often been used to cater for domestic needs such as buying food, paying fees, medical bills and domestic expenses which leave little money for investment in business for which it was intended" (Thursday, 27/08/2016).

These findings corroborate the assertions of Abramowitz (2012), in his journal about women's financial acumen in Italy which revealed that financial literacy differences may affect relative economic power within the household. This has implications for well-being if men and women allocate household resources

according to different preferences. Abramowitz (2012) suggests that spouses in different households do not act as single unitary decision makers. Instead, he asserts that household resources in women's hands have been observed to be more likely spent on improving family's well-being, particularly that of the children.

Microfinance Trainers' Characteristics and Women's Financial Skills

The study also sought to establish how microfinance trainers' characteristics influence women's finance skills and results are shown in Table 3:

Table 3: Findings on the Influence of Microfinance Trainers' Characteristics on Women's Acquisition of Financial Skills

Test Items	Women in SHGs		Spouses		Training Officers	
	f	%	f	%	f	%
Education of microfinance trainers does not determine the ability of women in SHGs to acquire financial skills	92	59.0	36	45.0	12	70.5
MFIs usually hire experienced trainers, though, has not improved financial skills amongst women in SHGs	93	59.6	32	40.0	13	76.5
Most microfinance trainers view women as people who can't learn financial skills	109	69.9	52	65.0	3	17.6
Microfinance trainers rarely possess guidance skills to enhance their ability to impart financial skills to women	82	52.6	40	50.0	11	64.7

Source: Researcher (2017)

When asked about their trainers' levels of education, 59.0% of the women respondents stated that education of microfinance trainers does not determine the ability of women in SHGs to acquire financial skills. During the interview, a woman respondent observed,

> "I may not know the level of education of my trainers, but I am only concerned with the ability of the trainer to make me understand different concepts in financial skills" (Monday, 14/10/2016).

This implies that, despite the importance of levels of education of microfinance trainers, their ability to transfer financial knowledge to women in SHGs is vital. In other words, their mastery of content, effective communication and ability to make women understand financial concepts are critical to women's acquisition of financial skills. This further indicates that trainers' educational level enables them to have an understanding of the implications of women's lack of financial skills. However, only 45.0% of the

spouses responded in favor of the view that trainers' educational level does not determine women's acquisition of financial skills. During the interview, a spouse remarked,

> "For effective delivery of training content, the trainer must have good educational background. Education enables the trainer have a grasp of the concepts being taught" (Friday, 12/10/2016).

These views were supported by the credit officer and 70.5% of the training officers. These findings lend credence to the assertions of a study conducted in the Nicaragua amongst 211 respondents to establish the efficacy of professionals on women training and financial management in which Michael and Dwivedi (2013) have shown that the most important variable in such success is a well-prepared and capable trainer or facilitator.

Likewise, these views attest to the fact that trained professionals such as trainers and other stakeholders have been identified as a principal factor which contributes to women's acquisition of pre-requisite skills to manage their enterprises. When asked whether MFIs hire experienced trainers, 59.6% of the women respondents reported that MFIs usually hire experienced trainers, though has not improved financial skills amongst women in SHGs. During the FGD, a woman participant observed,

> "Trainers hired by MFIs often have a wealth of experience in training clients for the MFIs. Despite this, I still have challenges with my record-keeping, investment plans, pricing and costing projections, budgeting plans and e-Financing skills" (Thursday, 28/08/2016).

This indicates that for women to effectively acquire financial skills, experience which trainers have is paramount. This is indicative of the fact that microfinance trainers should be well-versed and trained in evidence-based instruction and behavioral techniques in order to help the women obtain their therapeutic and training goals for women.

Despite trainers' experience, women stated that they still manifest inadequate financial skills which brings into question trainers' area of specialization and experience. However, 40.0% of the spouses indicated that trainers' experience is important in enhancing women's financial skills as did credit officer and 76.5% of the training officers.

These findings lend credence to the assertions of Nwoye (2011) who noted that, with the majority of women spending large portions of their working days in general education or training settings, trainers must be knowledgeable of the women's core characteristics, relevant evidence based training strategies as well as general strategies for training women in different cadres or levels of education to ensure that women succeed in realizing their full entrepreneurial potential.

These views further affirm the fact that acknowledging considerable benefits of training while understanding the research based need for women to receive multiple hours of specific trainings depending on job demands, the current researchers sought to understand how prepared general trainers are to implement training curriculum content for employees in different job groups.

On trainers' attitudes, 69.9% of the women respondents noted that most microfinance trainers view women as people who cannot acquire financial skills. Women noted the society views their inability to manifest any for financial skills as appropriate. During the interviews, a woman participant noted,

> "My ability to acquire financial skills has been made difficult by people's attitude. For example, our trainers view us as people with little understanding of financial concepts, lazy, not hardworking and that only men have the capability of undergoing complex financial training" (Monday, 15/10/2016).

These views point to the fact that attitude and biases which trainers hold against women is a hindrance to the women's ability to master financial skills. Besides, this points to the fact that gender stereotyping developed by trainers has a way of preventing women in SHGs from actively taking part in microfinance training. These views were echoed by 65.0% of the spouses who indicated that any trainer who manifests any form of gender bias towards women is an obstacle to the women's acquisition of financial skills.

However, the credit officer and 17.6% of the training officers disagreed with the view that most of the trainers consider women as people who cannot acquire financial skills. This indicates that, for effective acquisition of financial skills, microfinance trainers should develop positive attitudes, beliefs and interests towards women's training and believe that women have the ability to understand every concept they are trained. These further corroborate the views expressed by Michael and Dwivedi (2013) that beliefs the professionals have about women's ability to manage finances and their understanding of the challenges bedeviling women after borrowing finance from MFIs, hold key to the success of such training. These findings also lend credence to the Gender Relations theory by Pearson (2005) which asserts that society seems to have ultimate authority on the nature of what men actually do and their contribution which turns out to be biased against women. Pearson (2005) further posits that women's prescribed roles and biased perceptions influence their financial performance and how microfinance training influence their acquisition of financial skills.

Slightly more than half (52.6%) of the women respondents also reported that microfinance trainers rarely possess guidance skills to enhance their ability to impart financial skills to women in SHGs. Women stated that trainers do not show any care and concern for the financial challenges. A woman respondent reported,

> "When I share a challenge with my trainer, he does not appear to care about seeking for a solution. Sometimes, it is even difficult to ask the trainer any question about a topic learnt since he answers rudely and never provides any convincing answer. He often blames me for inattentiveness during training sessions" (Monday, 23/10/2016).

These findings affirm the fact that guidance and counseling skills play an important role in training and any trainer should have such skills. Any trainer with guidance and counseling skills have their trainees manifest impressive acquisition of financial skills. This further implies that trainer with effective counseling skill shave the ability to understand group dynamic which might be a hindrance to the women's acquisition of financial skills.

Besides, these skills enable trainers to create a conducive environment for training where very woman is considered equal and able to develop a sense of belonging which are very necessary for acquisition of financial skills during training. Spouses also echoed similar sentiments with 50.0% indicating that any trainer with effective guidance and counseling skills have the ability to help women to manage challenges

of self-rejection, low self-esteem and faulty self-concepts. Credit officer and 64.7% of the training officers also concurred.

These findings thus lend credence to the views expressed by Nwoye (2011) and Kehrhahn (2012) that have had difficulty identifying specific training and counseling skills or approaches of training which professionals should adopt to improve their effectiveness in enhancing women's acquisition of important skills to undertake microfinance management. That is, even when general trainers do report receiving academic instruction and professional development training related to the demands of different women, they still do not feel completely prepared to instruct women whose projects demand specific attention. Thus, these views also attest to the fact that professional training of trainers and stakeholders predicts management of microfinances among women.

SUMMARY OF FINDINGS

From the study findings, it is evident that trainers' level of education rarely enhances women's record-keeping, investment plans, pricing and costing projections, budgeting plans and e-Financing skills. These findings thus affirm the fact that most important variable in such success is a well-prepared and capable trainer or facilitator. From the study findings, it is also evident that trainers' experience enhances women's record-keeping, investment plans, pricing and costing projections, budgeting plans and e-Financing skills. This points to the fact that the best practice for trainers suggests that trainers should become well versed and trained in evidence-based instruction and behavioral techniques in order to help the women obtain his or her therapeutic and training goals. This is further indicative of the fact that with the majority of women spending large portions of their working days in general education or training settings, trainers must be knowledgeable of the women's core characteristics, relevant evidence based training strategies as well as general strategies for training women in different cadres or levels of education to ensure that women succeed in realizing their full entrepreneurial potential.

It is also evident that trainers' attitude and cultural orientation, trainers' counseling skills and trainers' ability to integrate ICT enhance women's record-keeping, investment plans, pricing and costing projections, budgeting plans and e-Financing skills. That is, beliefs the professionals have about women's ability to manage finances and their understanding of the challenges bedeviling women after borrowing finance from MFIs, hold key to the success of such training.

CONCLUSIONS AND RECOMMENDATIONS

From the study findings, it is also evident that trainers' experience enhances women's record-keeping, investment plans, pricing and costing projections, budgeting plans and e-Financing skills. Evaluation of relevance of the training curriculum enhances women's acquisition of record-keeping, investment, pricing and costing and budgeting skills. Assessing the progress of women trainees is one of the most important responsibilities of a microfinance training officers and in training projects, all operations and issues that contribute to planning and implementation of a project can be evaluated. This includes many items such as the effectiveness of the training methods and materials used; the relevance of the training content to the

backgrounds of the women trainees; the knowledge, attitudes and skills gained by the trainees and the types of services delivered by the trainers. The study thus recommends that trainers' need to update their skills to match the changing times such as adopting use of ICT and attitude change towards women empowerment. This will go a long way in helping train on concepts based on modern market demands and provide skills to match the changing times.

REFERENCES

Abromovitz, M. (2012). The feminization of austerity', *New Labor Forum*, vol. 21, no. 1, pp. 32–41.

Carr, E. S. (2010). Rethinking empowerment theory using a feminist lens: the importance of process', *Affilia,* vol. 18, no. 8, pp. 8–20.

Creswell, J. W. (2009). *Research design: qualitative, quantitative and mixed methods approaches.* Thousand Oaks, California: Sage Publications.

Kehrhahn, M. T. (2012). *Transfer of customer service training: Individual perceptions of organizational support, social support, and motivation to transfer*. Dissertation Abstract International, 56 (10).

Mboguah, Ch. and Musinga, M. (2014). *Profiles of Kenyan Micro-Finance Agencies as Supported* by Dutch CFAs (working document).

Michael, B. R. & Dwivedi, P. O. (2013). *An inquiry into balanced scorecards within Best Value implementation in UK local government.* Public Administration

Nwoye, O. K. (2011). *Instructors' Attitudes and Job Proficiency*. Western Publishers, Nigeria.

Pearson, R. (2005). *Theory of Gender Relations*. Zed Books, pp.157-179.

Streppel, F., Gommans, C. and Duursma, M. (2011). *Microfinance Policy Kenya*. Nairobi, Kenya.

Toby, E. M., Yang B., & Bartlett, B. R. (2014). The effect of organizational learning culture and job satisfaction on motivation to transfer learning and turnover intention. *Human Resource Development Quarterly*, 15 (3), 279-301.

Transformational School principals: the missing piece of puzzle in ICT integration in teaching and learning

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ABSTRACT

ICT is a critical tool for expanding human skills and rests largely on a system of producing, distributing and utilising information and knowledge that in turn plays a great role in driving productivity and economic prosperity. Kenya as a developing country realizes this importance and has a ministry specifically dealing with ICT. The vision statement of the ministry of information and Technology as stated in its strategic plan 2013-2018 is to make Kenya a globally competitive knowledge-based economy. This vision aims at shifting the current industrial development path towards innovation where creation, adoption, adaptation and use of knowledge remain the key source of economic growth. Research has shown that countries which have invested a lot in their human capital are far ahead of others in development. This development is likely to be an illusion unless Kenya is able to achieve its educational goals. Education and training has been isolated in the vision 2030 as the only mechanism that will translate Kenya into a middle-income economy. This is because education is fundamental to development of human resource capacities for sustainable economic growth and development.

Through impartation of new skills and knowledge in people, education is able to improve human capabilities and labour productivity. It is in this regard that the Kenyan government has invested a lot of funds in ICT infrastructure including digitization of educational materials through Kenya Institute of curriculum Development. Kenya's vision of education service provision is to have a globally competitive quality education, training and research for Kenya's sustainable development. This study focused on the influence of secondary school managers on integration of ICT in teaching and learning in Githunguri subcounty, Kiambu County in Kenya. The study targeted 40 schools with a total population of 245 male

teachers and 282 female teachers. teachers. A researcher developed questionnaire was issued to all the 40 school managers and to 100 teachers for triangulation purposes. Data analysis was done using statistical package for social sciences (SPSS).The study sort to establish if there is a relationship between management support and ICT integration in teaching and learning. Pearson correlation coefficient was used in the analysis. A positive correlation coefficient of 0.560 was obtained between the level of school management support and the use of ICT in teaching and learning. The findings indicated that school managers influenced integration of ICT in teaching and learning. The study therefore suggested that effort should be made by all stakeholders to ensure that school managers come up with policies on ICT integration in their schools which should be in line with the National ICT policy.

Keyword: ICT integration, Teaching and learning, school managers, transformational leadership, challenging the process, secondary schools

1.0 Introduction

The UNDP Human Development Index Report (2015) ranked Kenya 146 out of 188 countries and territories. Kenya's HDI value for 2015 is 0.555 which put the country in the medium human development category. This figure is however below the average of 0.631 for countries in the medium human development and slightly above the average of 0.523 for countries in Sub-saharan Africa. For Kenya to improve in this performance it is important to invest more in its human capital. Technology has also been correlated with enhanced human development and a major driving force of national growth. Tuviera-Lecaroz (2002) asserts that no development is possible without the help of science and technology. To bring about the necessary positive changes towards development, there is need for countries to include ICT education and training in their strategic plans so that people attain skills and expertise in the spheres of ICT The importance of ICT in human development cannot be over emphasized. This emphasis should especially be done in ensuring that there is quality education and training. Various reasons for integration of ICT in teaching and learning have been fronted. For example, Organization for Economic Co-operation and Development (OECD) says that countries need to adopt ICT in education because of the following reasons: the perceived needs of the economy and the fact that most companies require personnel with ICT skills making ICT an important employability criterion of the 21st century (Al Mofarreh 2016). This is hinged to the fact that countries wishing to become more productive must invest more heavily in equipping their personnel in ICT (Newby et al. 2013). Another reason that ICT should be embraced in education is the fact that ICT has the ability to transform pedagogical practices and increase the breadth and the richness of teaching and learning (Alharbi, 2014). For technological advancement to take place, it requires a well advanced manpower to match it. This calls for a manpower well versed in ICT.

Integration of ICT in teaching and learning has also been associated with improvement in delivery of knowledge. This is because modern technology offers many tools that can improve teaching and learning quality (Hussain et al. 2011). Research has shown that ICT has the potential in preparing students for life in the 21st Century. Students will also be able to face future challenges based on proper understanding when they learn ICT skills. These skills are also needed for the current globalization (Ghavifekr 2017). ICT

does not just boost the learners' motivation but also broaden their knowledge and information (Hussain et al. 2011). Nations said to be competitive are said to also to have embraced ICT skills to a great extent. This is because they become creative in other spheres of development. Ghavifekr et al (2008) also assert that information and communication Technologies (ICTs) could be referred currently as the most basic building block of modern industrial society in a very short time. Without it countries would not be able to take developmental strides to match those countries that are ahead in ICT knowledge. This is the reason why many countries regard mastering information technology and understanding basic skills and concepts of ICT seriously (Rampersad, 2011). The best place to prepare the society in this is in schools where all learning starts.

It is worth noting that even with the recognition of the importance of ICT, the integration of ICT in teaching and learning remains minimal especially in developing countries. This has led to many countries investing a lot of money in ICT infrastructure in the hope that the country can reap the advantages of integrating ICT in teaching and learning (Kenyan situation 2017). Kenya just like other countries has invested a lot of money and effort in ICT as evidenced in its strategic plan. The pace of adoption of ICT in teaching however remains low. This study sought to establish whether this low pace has anything to do with school leadership. It sought to establish the extent to which school managers influence the integration of ICT in teaching and learning in public secondary schools in Githunguri Sub-County. The study was guided by the following hypothesis:

H0:1 there is no significant relationship between school leadership and integration of ICT in teaching and learning.

2.0. Literature review

Role of leadership in ICT integration

Various studies have related transformational leadership to effectiveness. For example, Berends, Bodilly, and Nattaraj (2002) found that effective and supportive principal leaders were most likely to increase and deepen the implementation of school improvement initiatives. This leadership style has also been found to create a positive school culture because teachers become interested and are involved in the daily interactions at their schools (Darling-Hammond, 2003, Kanter, 2003).

Kouzes and Posner (2002) identified challenging the process as another practice of exemplary leaders. Leaders who challenge the process are continuously searching for opportunities to improve and innovate, with little fear of experimenting and taking risks. Leaders are the problem

identifiers. They look for difficult situations and try to find new ways of doing things. Exercise courage and take risks and know that incremental change is challenging (Knab, 2009). Such leaders are proactive and unwilling to settle for the status quo (Starcher, 2006). Effective leaders are open to new ideas and innovations, yearning to "make something happen" (Kouzes & Posner, 2002). As people inevitably make mistakes, leaders help pick them up and move forward. Effective leaders help people learn from their mistakes, continuing towards success. As leaders and their constituents stumble along the path to excellence, they must not blame themselves but examine the initiative and determine if it needs modified in order to accomplish the ultimate goal. Ultimately, leaders must build a commitment to the challenge of

reaching new heights, supporting constituents along the way (Kouzes & Posner, 2002). Effective leaders create opportunities for various interactions so that individuals can network with one another, sharing their experiences and expertise as well as celebrating their accomplishments (Kouzes & Posner, 2002).

The principal of a school plays an essential role in ICT integration. As a decisional maker, the principal has to coordinate, regulate and ensure that the educational goals are achieved. As Dutercq (2001) asserted, the principals are the only ones who are able to transform the school towards a desired end. Many studies have shown that school leadership plays an increasingly important role in leading change, providing vision and objectives, as well as professional development initiatives in using ICT to bring about pedagogical change; (Schiller, 2002). While technology infrastructure is important ICT leadership is even more necessary for effective ICT implementation. While effective leadership is one of the key variables that determine the success of an educational institution, strategic leadership is needed for long term sustainability of school improvements (Davis, 2005)

School management plays an important role in establishing and maintaining learning environments compatible with student –centered approaches to teaching and learning with ICT (Afshari et.al 2008). This was also confirmed by Kidombo, Gakuu and Ndiritu (2012). They saw school leaders as curriculum and pedagogy leaders who are central figures in leading processes in the use of ICT in teaching and learning. In their research in ICT integration in teaching and learning in Nairobi and Kiambu counties, they reported that it was necessary for the school managers to have ICT competencies if their institutions were to be well versed with ICT

According to Brannigan (2010) leadership is one of the several critical components in the successful integration of ICT's in education. The locus of leadership influences the degree to which ICT integration can become embedded in educational institutions as well as the role of leadership in championing ICT. The failure by educational institutions to integrate in education and imprint it on the minds of the teachers has been attributed to lack of leadership capacity (Moyle, 2006). As a result, today's school principals must not only manage the day to day routine activities in the school but also focus on how students learn, performance standards, evidence based decision making and continuous improvement efforts. Ability to plan, implement and sustain changes, including ICT in a school, therefore, depends on the leadership qualities of the school manager.

Gichovi (2013) asserts that school leaders should demonstrate leadership in their day to day activity by using ICT in their activities. This is likely to make teachers to embrace ICT in their teaching. School managers have also the mandate of ensuring that the schools are well equipped with ICT infrastructure. This infrastructure also acts as a motivation to teachers who have no skills in ICT to seek opportunities to acquire the skills so as to be able to use the infrastructure.

School management plays a coordination role in learning institutions. Studies show that the role of ICT coordinator is paramount to the implementation of the ideas and vision on how staff interactions should unfound during ICT Integration (Vanderlinde et.al 2012). They also asserted that shared meanings for ICT among shareholders are greatly enhanced through coordination.

Administrators should understand the element and characteristics of long- range planning for the use of current emerging technology; use technology to communicate efficiently with staff, parents and community, understand how current and available technologies can be integrated effectively into all aspects of teaching and learning process; understand the legal and ethical issues related to technology licensing and usage; and use technology appropriately in leading and communicating about school programs and activities (Fullan 2003) .

The role of school leadership is vital in ICT integration as it can hinder or facilitate schools adoption of ICT (Fullan, 2003; Elmore, 2010). As transformational leaders, school managers should show that they also live the values they advocate. This consistency between words and deeds is believed by transformational leaders to build their credibility. (Starcher, 2006). The principal as a learning leader, specifically, can impact multiple areas of the school setting such as ICT integration (Elmore, 2000). Nataraj-kirby et al (2001) findings suggested that effective and supportive leaders were most likely to both increase and deepen ICT implementation in a school. Principals are therefore, likely to make the dream of ICT integration in teaching and learning possible leading through modeling and taking an active role towards this effort. Other studies that reveal the importance of leadership include one carried out in Tondeur et al. (2008) asserted that school principals are in a position to create the conditions to develop a shared ICT Policy. This is echoed by Becta (2002) that supportive, enthusiastic and visionary leadership has a positive impact on teacher's attitude and behavior in the use of ICT

A study conducted by Keiyoro et al (2010) associated lack of ICT integration to school principals. Teachers felt that the integration of ICT in teaching and learning was slow among the principals themselves evident in their failure to use internet. Other reasons given include administrative ignorance of the role of ICT in teaching and learning, lack of resources and principals' negative attitude towards ICT usage in teaching and learning science curriculum. A study conducted by Manduku et al, (2012) concluded that the experiences and perceptions of school leaders and teachers played an important role in the implementation and integration of ICT in Kenyan schools.

3.0 Theoretical framework

This study is based on transformational leadership theory by Kouzes & Posner (1993). Studies have linked transformational with efficiency in running of organizations. It is further agreed that although there are many factors that help make schools successful such as good curriculum, quality teaching, and a strong professional culture, all these are shaped and developed by leadership characteristics of school principals (Ndiritu 2012) Principals serve as key factors in the health of the school and the success of its students (Cotton, 2003). A recent topic of interest has been transformational leadership (Murphy, 2002).

More intensive research on transformational leadership by Kouzes and Posner (2002) have shown consistent practices associated with transformational leaders. These are: model the way; inspire a shared vision; challenge the process; enable others to act; and encourage the heart. The notable characteristic of a transformational leader to enhance the use of ICT in school is the characteristic of challenging the process. Ndiritu (2012) reports that transformational leaders seek out challenging opportunities that test their skills and abilities and look for innovative ways to improve their organizations. These leaders are able to

transform teaching by making bold decisions that transform the working of the followers (teachers). These leaders show willingness to challenge the system in order to turn these ideas into actions and to get new products, processes and services adopted. Transformational leaders experiment and take risks with mistakes because every one mistake opens the door to a new opportunity (Kouzes & Posner, 2002). Leaders who challenge the process are continuously searching for opportunities to improve and innovate, with little fear of experimenting and taking risks. Such leaders are proactive and unwilling to settle for the status quo. Effective leaders are open to new ideas and innovations, yearning to "make something happen" (Kouzes & Posner, 2002). Effective leaders help people learn from their mistakes, continuing towards success. As leaders and their constituents stumble along the path to excellence, they must not blame themselves but examine the initiative and determine if it needs modified in order to accomplish the ultimate goal (Kouzes & Posner, 2002). ICT integration in teaching and learning is one of these innovative ways improving education delivery

Transformational leaders who challenge the process are open to new ideas and realize that a key to success is the ability to recognize good ideas from others or external sources. Taking risks means that leaders must be able to deal with failure (Kouzes & Posner, 2002). Such leaders are able to encourage teachers and learners who view technology as a challenge.

4.0 Research Methodology

This study entailed both quantitative and qualitative techniques with the use of a questionnaire and focus group discussions to investigate the influence of school leadership on integration of ICT in teaching and learning in public secondary schools in Githunguri Sub-County. The responses from the questionnaires were measured using likert scales. The interviews entailed the school Principals' role in ensuring that ICT was used in teaching and learning. The study was also done on the teachers for triangulation purposes.

The target population for this study was school principals and teachers in the selected secondary schools in Githunguri sub-County. The study target 40 Secondary schools out of which 5 were boys' boarding secondary schools, 5 girls' boarding secondary schools and the rest 30 were mixed secondary schools. Out of these 40 schools, 6 were county schools, 3 were sub-County boarding schools, while the rest were sub-county secondary day schools. The teachers' population in these schools was 527.Out of this population, 245 were male teachers while 282 were female teachers.

5.0 Research findings

The researcher sought to establish the extent to which school management influences the integration of ICT in teaching and learning in secondary schools. The research findings indicated that most of the respondents (40.2%) felt the support of school managers was average, 20.7% rated them as below average while 18.3% and 13.4% rated them as above average and good respectively. A fair positive correlation coefficient of 0.560 was obtained between the level of school management support and the use of ICT in teaching and learning. This information is summarized in Table 5.1

Table 5.1: Correlation between Level of support from school managers and ICT use in Teaching and Learning

		USE OF ICT IN TEACHING	LEVEL OF SUPPORT ON ICT INTEGRATION FROM SCHOOL MANAGERS
USE OF ICT IN TEACHING	Pearson Correlation	1	.560**
	Sig. (2-tailed)		.001
	N	82	82
LEVEL OF SUPPORT ON ICT INTEGRATION FROM SCHOOL MANAGERS	Pearson Correlation	.560**	1
	Sig. (2-tailed)	.001	
	N	82	82

There was also a need to ask the respondents on what they thought the management would do in order to support *integration in teaching and learning. The respondents reported* Support that school managers should give to enhance ICT integration in teaching and learning. The findings are as represented in Table 5.2

Table 5.2: Suggestions on the support that school managers should provide to enhance ICT integration in teaching and learning

Suggestion	**Percent**
ICT training to teachers in the field of ICT	29.3
Provide adequate ICT hardware and software to teachers	34.2
Have an integrated ICT policy based on the school level	21.9
Purchasing the digital content to be used for teaching	14.6
Total	**100.0**

6.0 Recommendations

The findings indicated that school managers influenced integration of ICT in teaching and learning. Policy makers should ensure that all school managers are trained on the use of ICT in their daily activities so as to set pace on use of ICT in the school. The ministry of education should ensure that school managers come up with policies on ICT integration in their schools which should be in line with the National ICT policy.

References

Afshari, M., Kamariah, A. B., Luan, W. S., Samah, A., & Fooi, F. S. (2008). School principal as a change facilitator in ICT integration.

Alghamdi, I. A., Goodwin, R., & Rampersad, G. (2011). E-government readiness assessment for government organizations in developing countries. Computer and Information Science, 4(3), 3.

Alharbi, S., & Drew, S. (2014). Using the technology acceptance model in understanding academics' behavioural intention to use learning management systems. International Journal of Advanced Computer Science and Applications, 5(1), 143-155.

Berends, M., Bodilly, S. J., & Nataraj-Kirby, S. (2002). Facing the Challenges of Whole-
Brannigan, N. (2010). Enhancing Leadership Capacity in ICTs in Education through technology enabled collaboration. Pedagogy for Technology Enhanced Learning, The Turkish Online Journal of Educational Technology–TOJET ISSN, 1303-6521.
CA: Jossey-Bass.

Cotton, K. (2003). Principals and student achievement: What the research says. ASCD.

Darling-Hammond, L. (2003). "Keeping good teachers: Why it matters, what leaders can

Davis, N. E., & Roblyer, M. D. (2005). Preparing teachers for the "Schools that technology built" Evaluation of a program to Train teachers for virtual schooling. Journal of Research on Technology in Education, 37(4), 399-409.
Do". Educational Leadership, 60(8), 6-13.

Dutercq, Y. (2001). Educational Administration: A New Context and New Perspectives. European Education, 33(2), 74-106.

Elmore, R. F. (2000). Building a new structure for school leadership. Albert Shanker Institute.
forum Stone, A.G., Russell, R.F., & Patterson, K. (2003). Transformational versus servant leadership – a difference in leader focus. Servant Leadership Roundtable – October 2003. Retrieved August 3, 2006 from http://www.regent.edu/acad/cls/2003servantleadershiproundtable/stone.pdf

Fullan, M. (Ed.). (2003). The moral imperative of school leadership. Corwin press.

Ghavifekr, S., Afshari, M., Siraj, S., & Razak, A. Z. A. (2017). Managing change in educational organization: a conceptual overview. *MOJEM: Malaysian Online Journal of Educational Management*, *1*(1), 1-13.

Gichovi, G. M. (2013). Factors Influencing Integration Of Information And Commmunication Technology In Teaching And Learning In Public Secondary Schools In Kenya: The Case Of Kirinyaga East District, Kirinyaga County.

Hussain, A. J., Morgan, S., & Al-Jumeily, D. (2011, December). How Does ICT Affect
ICT Integration In Education: Incorporation for Teaching & Learning Improvement
Simin Ghavifekr, Kanter, R. M. (2003). Leadership and the psychology of turnarounds. Harvard Business

Keiyoro, P. N. (2010). Factors influencing the effective use of ICT in teaching and learning science curriculum in Kenyan secondary schools: The case of Cyber and NEPAD eschools. An Unpublished PhD Thesis of the University of Nairobi.

Kirriemuir, J. (2002). A survey of the use of computer and video games in classrooms. British Educational Communications and Technology Agency (Becta).

Knab. D (2009). A Comparison of the Leadership Practices of Principals of Making Middle Grades

Kouzes, J., & Posner, B. (2002). The leadership challenge (3rd ed.). San Francisco,

Manduku, J. Kosgey, A. & Sang, H. (2012) Adoption and use of ICT in enhancing management of public secondary
Mofarreh, A., & Ibrahim, Y. (2016). Implementation of ICT policy in secondary schools in Saudi Arabia.

Moyle, K. (2006). Leadership and learning with ICT. Voices from the profession. Teaching Australia. Australia: Australian Institute for Teaching and School Leadership LTD.

Nataraj-Kirby, S., Berends, M., Naftel, S., McKelvey, C., Bodilly, S. J. &Chun, J.(2001). Implementation of NAS designs during the scale-up phase. In Facing the challenges of whole-school reform: New American schools after a decade. (p. 71-

Ndiritu, A. W. (2012). Effects of principals' transformational leadership characteristics on students' academic performance in secondary schools in Nairobi County, Kenya. Kenya (PHD thesis, University of Nairobi, Kenya).

Ndiritu, A. W., Kidombo, H., & Gakuu, C. (2012). Institutional Management and Integration of ICT InTeaching and Learning in Selected Kenyan Schools. Journal of Open, Continuing and Distance Education., 2(1).

Newby, L. S., Hite, J. M., Hite, S. J., & Mugimu, C. B. (2013). Technology and education: ICT in Ugandan secondary schools. Education and information technologies, 18(3), 515-530.
Review, 81(6), 58-67.

Schiller, J. (2002). Developing appropriate ICT competencies in trainee teachers: An Australian example. In Society for Information Technology & Teacher Education International Conference (pp. 1445-1446). Association for the Advancement of Computing in Education (AACE).
School Reform (No. MR-1498-EDU). Santa Monica, CA: Rand Corporation.
schools: A survey of Kesses zone secondary schools in Wareng District of Wasin Gishu County, Kenya

Starcher, G. (2006). Towards a new paradigm of management. European Bahai Business
Teachings and Learning within School Education. In Developments in E-systems Engineering (DeSE), 2011 (pp. 250-254). IEEE. Islee

Tondeur, J., Van Keer, H., van Braak, J., & Valcke, M. (2008). ICT integration in the classroom: Challenging the potential of a school policy. Computers & education, 51(1), 212-223.

Tuviera-lecaroz, S. (2001). Teachers Using ICT for Networking and Professional Growth. In 7^< th> UNESCO-ACEID International Conference on Education. Bangkok, Thailand.

Vanderlinde, R., & van Braak, J. (2011). A New ICT Curriculum for Primary Education in Flanders: Defining and Predicting Teachers' Perceptions of Innovation Attributes. Educational Technology & Society, 14(2), 124-135.

Attitudes of A Staff Before and After Educational Action for The Implementation of Safe Surgery Checklist

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ABSTRACT

Aim: *To evaluate attitudes about the safety atmosphere of a surgery staff before and after an educational action for the implementation of the safe surgery checklist.* ***Method****: Quantitative research of experimental type in the period of December 2016 to November 2017. A questionnaire of Safety Attitudes was applied, Surgical Center version for 101 professionals that work in the surgical center of a general hospital before and after na educational action for the implementation of the safe surgery checklist. The data analysis was done with the use of descriptive statistics.* ***Results****: Most of the items belonging to the SAQ/CC obtained increase in averages after the educational action. "Communication in the Surgical Atmosphere" was the most approached domain highlighted in the educational action and presented an increase of the averages in all itens; the item that didn´t obtain a satisfactory score in this domain was "The equipments of the surgical center are adequate". The most pontuated descriptive measure after the educational action was "The transmission of information among professionals of the surgical center before the realization of a surgical procedure is important for the security of the patient", with a lower deviant pattern.* ***Conclusion:*** *The educational action developed aiming at the implementation of the safe surgery checklist is importante to qualify the assistance to the patient in the surgical period with safety.*

Descriptors: Safety of the Patient; Organizational Culture; Education; Perisurgical Nursery; Surgical Center.

INTRODUCTION

The safety culture is defined as a product of values, attitudes, perceptions and competences, in groups and individually, that determine a behavior pattern and an engagement with the safety of the institution and aims to substitute the blame and the punishment for the opportunity of learning through the mistakes (SAMMER et al., 2010). In Brazil, with the creation of the National Program of the Patient Safety (NPPS), the culture turned out to be considered a principle of risks' management directed to the quality and safety of the patient.

The evaluation of the safety culture occurs through the use of psychometrics tools of the safety atmosphere perceived by the health staff (LEE et al., 2010). The expression. "Safety Environment" has

been widely discussed in literature and used as a synonym of 'culture'. Safety environment can be defined as the timing measure of the state of culture of the institution's safety and can be measured by the individual perceptions about the organization attitudes. To recognize its importance and impact in the health organizations the base is to develop any type of safety programm with emphasis on the learning and organizational improvement.

The studies demonstrate that positive perceptions about safety security are associated to the adoption of safe behaviors, improvement on communication, educational actions, reduction of adverse events, attitude changes, group work, investigation and strategic planning, which contribute to a safe and qualified assistance (LEE et al., 2010; EL-JARDALI et al., 2011).

Several advances were evidenced about the patient's safety, however, it becomes necessary to identify perceptions of professionals about safety with the focus on the patient, to evaluate how it is managed in diferente contexts, to develop strategic visions and enlarged practices to improve the safety culture (VICENTIN; ALMABERTI, 2016), especially in a complex environment like the surgical center. We highlight that the implementation of the List of Verification of Safe Surgery (LVSS) is an intervention that reduces avoidable complications.

In this sense, an international multicentric study showed a reduction of 36% of complications and 47% of mortality in surgical patients after the *checklis*t implementation (HAYNES et al., 2009). Another research in 2010 (WHO, 2011) evidenced a breakdown in the mortality rate by mistakes in surgeries and reduction of complications of 35,2% to 24,3%. Investigation in 14 hospitals of South Carolina (USA) showed a reduction of 22% of the post-surgical deaths and characterized itself as one of the first studies that presented the true impact of the LVSS in large scale (HAYNES et al., 2017). This list aims to reinforce daily practices, to improve communication, work group and to accomplish critical phases of safety and, in this way, reducing avoidable risk.

Even with proven eficiency of the aims and of the *checklist*, hospital institutions still fight to implement and/or enlarge the adhesion of the LVSS by the surgical staff. Freitas et al. (2014) point out that the biggest challenge is convincing people of the importance of this practice, to ensure its applicability and to modify perceptions of the staff about the patient's safety. The authors report themselves to the LVSS as the greatest cause of resistance of surgical staff, for the fact of considering it a bureaucratic process added to the lack of knowledge of its relevance.

The nurse as a leader, coordinator and educator in health plays an important role concerning the educational actions in the implementation, awareness, integration and dissemination of different attitudes of the patient's safety among the surgical staff. It is the professional with abilities in the approach of subjective aspects intending to reduce the resistance to changes, adaptation to the needs of the environment, among others. (TOSTES; HARACEMIW; MAI, 2016).

In Brazil, there are few studies that analyse professionals perceptions concerning the safety environment linked to the educational actions aiming at the implementation of the *checklist.* The understanding of this process can contribute to the change of paradigms and to the promotion of safety culture. This involves and values attitudes, perceptions and professional behaviors, determinant to the engagement to the surgical patient safety. Taking into account these considerations, the present research

has as an objective to evaluate perceptions about safety atmosphere of a surgical staff, before and after an educational action for the implementation of the safe surgery *checklist*.

METHOD

Research of quantitative approach of experimental type carried out in the surgical center of a philanthropic hospital size IV of the Northeast region of the state of the Rio Grande do Sul. This state presents part of the results that integrate the dissertation: "Evaluation of a multiprofessional staff about safety environment before and after the implementation of the *checklist* safe surgery".

The surgical center is composed of six surgical rooms and carries out approximately 232 elective surgeries and 234 emergency surgeries of different complexities. In relation to the type of health staff that act on it, there are approximately 60 surgeons of diverse specialities six Medicine, resident surgeons, 10 anesthetists, six pediatrician plantonists, six nurses, 42 nurse technicians.

The following inclusion criteria were listed: to work for at least a month in the surgical center and to accept to sign the Term of Free and Clarified Consent (TFCC); and of exclusion criteria: to be off work on health license or not having participated of the first stage of the research.

The research period was from December 2016 to November 2017. It occured in five stages. At first, we talked to the nurses and the surgical center administrator about the activities to be carried out, and right after that, the Questionnaire of Safety Attitudes was applied on the Surgical Center version (LORENÇÃO; TRONCHINI, 2016) for 107 health professionals that worked at the mentioned Unit in the month of December 2016 and January 2017.This stage was characterized by the adaptation and pilot test with its application during 15 days from the Safety Surgery Verification List of the WHO (World |Health |Organization) to the location's reality.

On the fourth moment, which happened in the months of February and March 2017, an educational action was carried out with a nursery staff in the four shifts, morning, afternoon and two nights. That took place in a staff meeting that counted with approximately 35 professionals, among technicals and nurses that work in the scheduling, surgical room and Recuperation Post Anesthesic |Unit. For the night shift, the action was carried out *in loco* at the surgical center and included all participants of the nursery staff. The meetings counted with the expressive participation of these professionals who could suggest, dialogue and expose their previous knowledge and doubts about the thematic.

For the medical staff, the educational action took place in a residence classroom, counted with six residentes and two preceptors and in four distinct moments, *in loco* at the surgical center with the doctors who waited for the beginning or the end of the surgery in a waiting room. With the medical staff, the scheduling and the participation for the action were challenging. The activity started with the coordinators of the surgery service and anesthesia, subsequently with preceptors, residents, other anesthesists and with greater difficulty, the surgeons, as in this period there were not any meetings of the clinical body, usually suffering with overload of procedures and unavailable schedules to participate of the action. The doctors' contributions were directed to the quantity of material, professionals, time for checklist application, term of surgical consent, antibiotic therapy and data to be added or excluded from the *checklist* of the adapted safe surgery.

The approached contents in the educational action were standardized to favor the awareness about the importance of the surgical patient safety, effective communication and implementation of the LVSS with a subsequent presentation and explanation of the way of using the *checklist* adapted to the local reality.

Subsequently, after the educational action the LVSS was implemented fot the nursery and medical staff. After 60 days of educational action and implementation of the checklist, the same data collection instrument was applied again, SAQ/CC for 101 professionals, due to the fact that six of them didn´t participate of the second stage, three nursing technicians left the institution, one of them was on maternity leave and two doctors were not working at the surgical center any longer.

The SAQ/CC owns six domains (LOURENÇÃO; TRONCHIN, 2016) according information explicited in Table 1. Concerning the denominations of each domain, the authors who adapted and validated the instrument followed the domains of the original questionnaire (SEXTON et al., 2006) and the ones of the short translated and adapted version by Carvalho (2011).

Table 1 – Domains of the Questionnaire of Safety Attitudes on the Surgical Center Version (LOURENÇÃO; TRONCHIN, 2016)

Domains	Description	Example of items
Safety Environment Seven items: 28, 29, 30, 32, 34, 35 e 38	Evaluates the perception of the professionals in what concerns their organizational engagement for the security of the patient.	The patient's safety is constantly reinforced as a priority here at the Surgical Center.
Perception of the Management Four items: 5, 6, 7, 11 e 14.	Refers to the approval of the professionals concerning the management actions referring to safety.	The administration of this hospital is doing a good job.
Perception of Stress Four items: 31, 33, 36 e37.	Concerns the recognition of how much the stressors values influence the execution of the work.	I feel frustrated with my work.
Work Conditions Six items: 16, 17, 18, 22, 26 e 23.	Refers to the perception of the quality of the work environment.	I am encouraged by my workmates to inform any concern that I might have with the patient´s safety.
Communication in the surgical environment Four items: 9, 10, 15 e 19	Perceptions about the transmission of communication in the surgical environment.	The transmission of information is common at the surgical center.
Perceptions of the professional performance Four items: 12, 21, 24 e 25	Perception of professionals concerning to tiredness and overload of work in the professional performance.	I am less efficient at work when I'm tired.

Source: Adapted by the researcher

The SAQ\CC is composed by three parts. The first one contais 15 items refering to the quality of communication and colaboration between the professionals that work at the surgical environment, in which

the research's participant answered about its relationship with each one of the professional categories. The second part is composed by 40 assertives that include the patient's safety through six domains identified in Table 1. The third part is composed by demographic information: age, sex, race/ethnic group, professional category, time and acting (LOURENÇÃO; TRONCHIN, 2016).

Each item of the SAQ/CC follows a scale of five points of *Likert,* ordenated and scored in the following way: disagrees totally (0 point), disagrees partially (25 points), neutral (50 points), agree partially (75 points) and agrees totally (100 points); the option "doesn´t apply" was not scored. In the final score, 0 corresponds to the worst perception of the safety environment and 100 to the best perception. They are considered positive values when the total score is equal to 75. The calculation is carried out adding up the answers of the items of each domain and dividing the result by the number of items of each domain, after the inversion of the reverse items. The average time used by each participant for the filling of the questionnaire was from 10 to 20 minutes, in consonance to other studies (CARVALHO et al., 2011; CAUDURO et al., 2015).

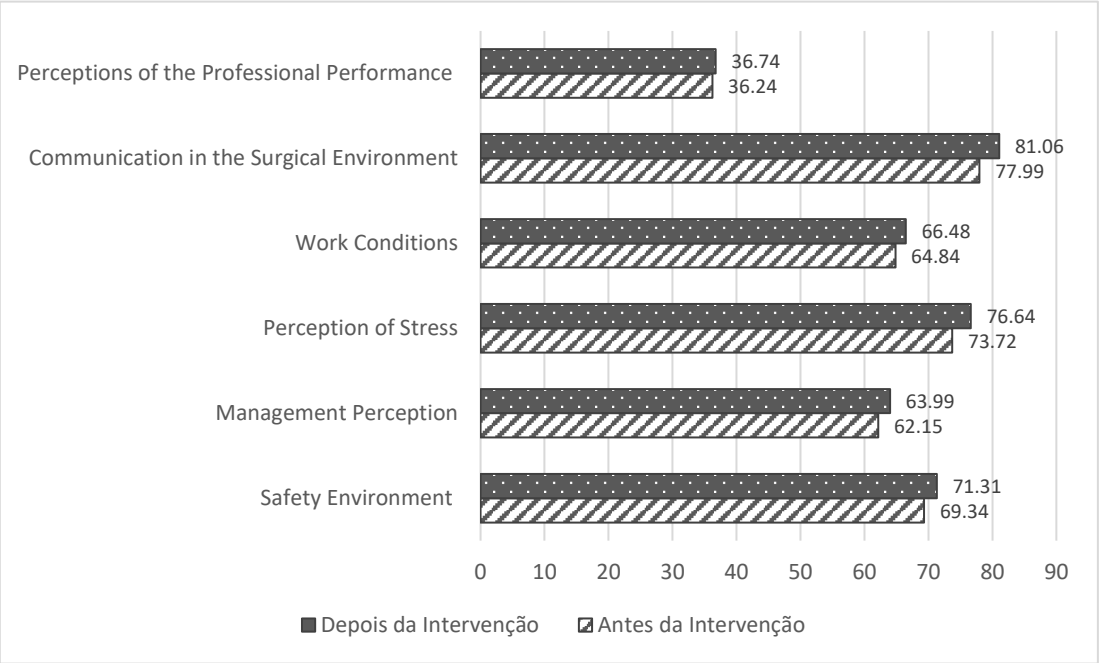
The participants of the study were divided in a nursery staff (nurses, technicians and nursery assistants) and a medical staff (anesthesiologists, surgeons, pediatricians and residents). We highlight that the educational action was developed by the researcher. Before the educational action the invitation and clarifications related to the research were done for each participant in the work environment. To those who accepted to participate in both of them, an envelope with the TFCC and SAQ/CC was delivered printed in paper. The SAQ/CC was made available to the professionals to be filled in the researcher's presence or through the deposit in a sealed box available in the unit, according to what was previously arranged, before and after the implementation of the *checklist* of hte safe surgery.

For the analysis of the variables descriptive statistics was used including absolute values and percentages, averages and standard deviations and tables to better visualize the results. The research followed all the ethical norms predicted in the Resolution 466/12 of the National Health Committee that involves human beings. The Project was approved by the Ethical Committee Norm number 1.834.908 e CAAE 60803516.9.0000.5350.

RESULTS

A hundred and one instruments that corresponded to the number of professionals who participated in the two stages of the data collection were analysed, before and after the educational action. Firstly, in the figure 1, the averages of the participants of the research perceptions were explicited before and after the educational action according to the domains SAQ.

Figure 1 - Perceptions of professionals of the surgical center, before and after the educational action, according to the domains SAQ/CC Ijuí /RS – December 2016 to July 2017.



Still concerning the data contained in the Figure 1, we verify that the domains "Communication in the Surgical Environment" and "Perception of Stress" showed satisfactory scores, equal ou above 75, after the educational action. Sequentially, the ones that equally obtained increasem but didn't reach satisfactory scores were "Safety Environment", "Work Conditions", "Management Perception" and with a smaller pontuation "Perceptions of the Professional Performance".

On Table 01 the distribution of the descriptive answers are presented for domain scores "Safety Environment", "Perceptions of Management" and "Perception of Stress" of SAQ/CC, before and after the educational action. On the first domain we verify that the questions with a satisfactory score after the educational action were "*The medical staff of this Surgical Center makes a good job*", followed by the question "*All staff of the surgical center takes responsibility for safety*" and "*The patient's security is constantly reinforced as a priority here in hte Surgical Center*". The question that obtained greater increase of average, after the educational action was "*The information obtained through the reports of the adverse events are used to make the assistance safer in this Surgical Center*", but it didn´t reach a satisfactory score

Table 1 – Descriptive measures of the domains scores "Safety Environment", "Perceptions of Management" and "Perceptions of Stress" of SAQ/CC, before and after the educational action. Ijuí /RS– December 2016 to July 2017

Questionings	Before Intervention	After Intervention
Domain 1 – Safety Environment	69,4±24,1	69,9±23,7
28. The moral in this surgical center is high	79,5±20,7	82,4±19,2
29. The medical staff in this surgical surgery makes a good job	75,7±26,6	77,0±26,0
30. All the personnel of the Surgical Center takes responsibility for safety	73,8±28,6	76,0±28,9
32. The patient's ssafety is constantly reinforced as a priority here at the Surgical Center	68,2±23,9	61,7±29,9
34. Very important issues are communicated in the shift changes	61,3±25,0	63,9±28,4
35. Here there is wide adhesion to the clinical principles and criteria based in evidences related to the patient´s safety	59,6±28,2	67,0±26,4
38. The information obtained through the reports of the adverse events are used to make the assistance safer in this Surgical Center		
Domain 3 - Perceptions of Stress*		
31. I feel tired when I wake up in the morning and I have to face another day of work	71,5±32,5	76,8±28,1
33. I feel exhausted with my work	75,3±30,7	78,3±26,8
36. I feel frustrated with my work	88,3±21,7	90,2±19,6
	60,3±34,3	62,0±33,3

*Reverse Scor

In relation to the domain "Safety Environment" that didn't obtain increase of the average after the action was the item "*Very important issues are communicated in the shift changes*". We highlight that this showed smaller average and greater standard deviation what denotes disparity in the participants' answers.

Still concerning the data contained in Table 01 we verify that in the domain "Perception of Management" the only question that obtained a satisfactory score was "*This hospital is a good place to work".* The answers that showed increase of average after action were respectively: "*The administration of this hospital is making a good job*", followed by "*I receive an adequate feedback about my performance*" and "*The administration of this hospital supports my daily effort".* The question that obtained reduction after the educational action "*In this surgical center the number of professionals is enough to attend the number of patients".*

Concerning the domain "Perception of Stress" reverse score, we verify the increase of averages after the educational action in all the questions. We have to point out that only an alternative didn't reach the satisfactory score after the action: "*I feel that I am working too much*". The question that obtained the greatest increase was "*I feel tired when I Wake up in the morning and I have to face another day of work*", followed by "*I feel exhausted with my work".*

Sequentially, in Table 2, the descriptive measures of the domains' are explicited as follows "*Work*

Condiitions", "Communication in the Surgical Environment" and "*Perception of Professional Performance*". On the domain "*Work Conditions*" the questions that obtained satisfactory scores after the educational action were: "*I am encouraged by my workmates to inform any concern that I might have with the safety of the patient*" and the item 26 with the answer "It *is easy for the professionals that work in this surgical center to make questions when there is something they don't understand*", this last one presented a satisfactory score, but presented reduction after the educational action. The question that almost maintained itself unchanged was "*The hospital deals in a constructive way with the problematic professionals*" with a lower average, compared to the other items that make part of this domain.

Table 2 – Descriptive measures of the domains scores "Work Conditions", "Communication in the surgical environment" and "Perceptions of professional performance" of SAQ/CC, before and after the educational action

Ijuí/RS – December 2016 to July 2017

Questionings	Before the educational action	After the educational action
Domain 4 -Work Conditions		
16. I am encouraged by my workmates to inform any concern that I might have with the patient´s safety	77,3±27,8	81,8±23,4
17. The safety culture in this surgical center makes it easy to learn with others	58,4±26,9	63,3±27,9
18. The hospital deals in a constructive manner with the problematic professionals	51,5±29,0	51,0±28,2
22. I get adequate and convenient information about occurrences in hospital that might affect my work	51,8±26,3	52,5±24,6
23. I know the adequate means to direct questions related to the patient's safety in this surgical center	69,8±28,3	71,8±27,8
26. It is easy for the professionals that work in this surgical center to make questions when there is something they don´t understand	78,7±24,8	77,5±24,1
Domain 5 – Communication in the surgical environment		
9. The transmission of informationamong the surgical center professionals before the surgical procedure is important for the patient´s safety	93,5±15,3	98,8±6,5
10. The transmission of information is common in the surgical center	78,2±21,7	79,2 ±20,9
15. The decision taking in the surgical center uses information of the involved professionals	73,0±24,9	76,5±23,8
19. The equipment of the surgical center is adequate	67,3±23,4	70,0±25,3
Domain 6 – Perceptions of the professional performance*		
12. The tiredness affects my performance during emergency		

situations	40,1±34,5	40,4±32,9
21. When my working load becomes excessive my performance might go down	28,7±30,7	32,8±30,7
24. I am less efficient at work when I am tired	35,6±32,3	34,3±35,1
25. I am more probable to commit mistakes in tense and hostil situations	39,6±34,3	38,4±34,3

*Reverse score.

Concerning the data contained in Table 2, in relation to the domain "Communication in the Surgical Environment" widely approached in the educational action presented an increase in all averages. We point out the question "*The equipment of the surgical center are adequate*" which was the only one in this domain that didn´t reach the satisfactory score. The most scored item after the educational action was "*The transmission of information among the professionals of the surgical center before the accomplishment of a surgical procedure is important for the patient´s safety*", this one with a lower deviation standard.

On the other hand, in the domain "Perceptions of the Professional Performance", an item that was equally calculated with a reverse score, in none of the questions a satisfactory score was evidenced.

The descriptive measure that obtained an increase after the educational action was the question "*When my working load is excessive my performance is damaged"*. The other item "*The tiredness damages my performance during emergency situations*", almost kept unchanged, and the other questions, *"I am less efficient at work when I am tired*" and "I have greater probability to commit mistakes in tense and hostil situations", were reduced after the educational action.

DISCUSSION

The fact of using the SAQ/CC before and after the educational action with the nursing and medical staff showed that it was effective, evidenced by the increase in the averages of the participants's perceptions. However, we verify the need of giving a continuation to the moments like this one, that allow changes and widening of knowledge, clarification of doubts, aiming at improving the professionals' perceptions concerning the environment safety in the surgical environment.

We evaluate that the fact that the domains "Communication at the Surgical Environment" e "Perceptions of Stress" presente satisfactory results shows that the educational action was effective, that is, communication and stress were widely approached and target of several questionings, more especifically, by the nursing staff. The other domains didn´t presente satisfactory results, in other words, punctuation over 75.

Studies tha in the same way used the SAQ, in diferente environments ambientes, also indicated unsatisfactory scores and the participants questioned about the need of developing organizational strategies to promote actions and atitudes aiming at widening the perceptions about culture safety (CARVALHO et al., 2015; CAUDURO et al., 2015; LUIZ et al., 2015; CORREGGIO et al., 2014; MARINHO; RADÜNZ; BARBOSA, 2014).

Among the descriptive measures of the domain "Safety Environment" the ones that obtained satisfactory scores concerning the perceptions of the professionals about the good performance of the medical staff, responsibility and priority of the staff about the patient's safety. These results meet the research that used the SAQ/OR in eight hospitals of Harvard, before and after the implementation of the *checklist* (HAYNER et al., 2011). The authors detected improvement in the perceptions of professionals concerning staff work and the safety environment and state that this result is due to to implementation of the *checklist* of the safe surgery. Another investigation with nurses in Taiwan showed strong association between the group work and of safety attitudes between them (LEE et al., 2010).

The group work improves the culture of the patient´s safety, spreads the acception and adhesion of the LVSS (SINGER et al., 2016). A systematic revision of literature (RUSS et al., 2013) showed a good relationship between groupwork, use of LVSS and pointed out two main functions of the *checklist*: to composse a set of verifications of basic safety that qualify the adhesion to the clinical practices, to improve the interdisciplinary and the communication among the professionals. In this context, Carvalho et al. (2015) state that the group work characterize itself as one of the main challenges in the surgical environment and that the harmonic relation, interaction and cooperation are fundamental aspects.

In relation to the domain "Safety Environment", the item that didn´t obtain improvement was the communication of important issues in the changes of shifts. In this sense, the communication constitutes itself in a weakened actionin inumerous institutions of health assistance. Casey e Wallis (2011) report themselves to the adequate communication between the members of the staff as a basic principle of the nursing practice, however it needs to be standardized. The authors point out that sharing information and reports of incidents are formal aspects of communication. In thi sense, Almeida et al. (2012) point out that the information of the patient in shift changes and in the transferences of units needs to be precise, clear, and correct as when ommited or misinterpreted it can contribute for the assistance fails.

In the research here analysed it was evidenced a disparity in the participants' perceptions concerning the descriptive measures about the information of adverse events (AEs). The average in the question that inquired about information through the AEs reports had an increase after the educational action, however unsatisfactory score. A result that equally happened concerning the questions of adequate and convenient information about occurences in the hospital that can affect professional's work and knowledge in what concerns the adequate means to put forward questions related to the patient´s safety, with an average, after educational action of 52,5 e 71,8, respectively.

We evaluate that giving correct information about incidents that involve safety or concerns related to them needs to be encouraged. In this sense, there are evidences of subnotifications of mistakes, in some institutions, in which the professionals are blamed or punished for informing abou their occurence (OLIVEIRA et al., 2014). The authors report themselves to this evaluation as a moral question and it doesn´t fail in the process of work.

In what concerns the satisfactory scores refering to the descriptive measures that integrate the domain "Communication in the Surgical Environment", denotes improvement in the participants' perceptions refering to the transmission of information among professionals, if compared before the realization of a surgical procedure, a relevant aspect to the implementation and adhesion of the LVSS.

Other items that, equally presente positive scores, above 75, were the use of the information of professionals involved in decision taking and their value about information transmission in this environment. These results also demonstrated advances in the process of communication in this environment.

The item that presented greater average in the domain "Communication in the Surgical Environment" (84,5) was the hospital to be a good place to work. We think that this perception is important and comes to meet Cauduro et al (2015) e Carvalho et al. (2105), when stating that to be satisfied with the institution in which we work influences directly in the assistance quality and in the staff productivity. Another investigation that compared the satisfaction of Brazilian with those who work in the USA and Ireland showed that the Brazilian nos felt more satisfied with their work than the others (TAYLOR et al., 2012; RELIHAN et al., 2009).

Concerning the domain "Work Conditions", the items less scored were "*The hospital deals with the problematic professionals in a constructive manner*" and "*I get adequate and convenient information about ocurrences in the hospital that can affect my work*", with unsatisfactory scores, that is, below 75. These results come to meet two researches with professionals of surgical centers, one in the South region and the other in the Federal District (CARVALHO et al. 2015; CORREGGIO et al., 2015). The last one identified that assistential professionals have difficulty in perceiving the commitment of the management with the dormant factors of the safety culture. The authors report themselves to the educational action as na alternative to mobilize the staff to express their opinions in relation to the culture of patient's safety. In this contexto, Nie et al. (2013) state that to know and to evaluate this institutional culture makes it possible to identify weaknesses, potentialities in the process and to sensitize the professionals about the thematic.

In the domains "Perception of Stress" and "Perception of Professional Performance", we verify that the item "*I feel that I am working too much*" didn´t obtain a satisfactory score and the second "*When my working load becomes excessive my performance is damaged*", the less scored. These results denote weaknesses refering to the professionals' perceptions in what concerns the identification of the influence of the working load in the patient's safety. Allied to the working load, the item "*the number of professionals is not suficiente to attend the number of patients*", reduced from 56,8 to 53,5 after the educational action. Cho et al. (2003), in a study in North-American hospitals with 10.000 nurses and more than 230.000 patients, showed that a high proportion of surgical patients per nurse led to a greater risk of death, after 30 days of hospitalization and death for complications potentially avoidable. Novaretti et al. (2014) report themselves to the overworking load as related to the desproportion between the number of nursing professionals and of patients as a risk fator to the incidence of hospital infections in critical patients. The authors state that the overworking load is obstacle to develop frequent educational actions, with damage to the availability and efficiency of participation.

Still in relation to the item "insufficiency of professionals to attend the patients", we consider that the adequate dimensioning of staff is an important indicator of the patient's security and this statement comes to meet Chakravarty (2013), who developed a study in \india, with 175 doctors and 60 nurses. The author concluded that from the point of view of 76% interviewees, the overworking load was na importante reason for the occurence of AE and there is a need of adequate dimensioning of health professionals. He reports himself to attitutes directed to standartization of procedures, implementation of techniques, routines

of assistance, awareness and commitment of the staff in the safe assistance.

Concerning the domains “Work Conditions”, “Perceptions of Management” and “Perception of Professional Performance” that obtaines low scores of the items that integrate them, indicate changes to improve the environment of the patient´s safety among the professionals. These items were also identified, in national studies, as challenges to be upgraded in the surgical environment (CARVALHO et al., 2015; CAUDURO et al., 2015; CORREGGIO et al., 2015; MARINHO; RADÜNZ; BARBOSA, 2014). Actions that aim at widening knowledge, improving conditions of work, availability of materials, adequate equipment and professional dimensioning, allied to the hospital’s management are some atitudes that modify the culture scenery of safety among professionals (MARINHO; RADÜNZ; BARBOSA, 2014).

The educational action in the patient´s safety aims at producing, systematizing and spreading knowledge (BRAZIL, 2013). It implies in learning experiences that give the opportunity to the professional of using the scientific evidence and to be able to describe the components of care centered in the patient, to identify deviations in their practice and to determine actions for their corrections (KIERSMA; PLAKE; DARBISHIRE, 2011).

We evidence the mismatch between what should be done and what in fact happens in the educational and assistential practices, a challenge for professionals that work in patient’s safety (NATIONAL PATIENT SAFETY FOUNDATION, 2016). The curricular guide of patient’s safety of the WHO presentes wide upgrading od diferente asoects that envolve the teaching of patient’s safety, guides strategies and makes lectures available , reading material, online activities, training of abilities, videos, games, besides discussions based in case studies and sceneries that picture the practice (WHO, 2011).

Marinho, Radünz e Barbosa (2014) report themselves to the nurse as a representative of the category of the health staff, for acting during all teh time with the patient and establishing a bond with the other professionals. The nurse supervises in a continuous and systematic manner the nursing staff and develops educational actions to widen the assistance quality. A study that evaluated perceptions of the nursing staff of a surgical center in São Paulo, about trainings of assistential activities, reinforces the need of the nurse to consider the technical dimension and the routine of work, in the elaboration of the annual program of capacitations (FERNANDES; PENICHE, 2015).

The evaluation of the perceptions of the medical and nursing staff about the safety environment, before and after the educational action, aiming at the implementation of the *checklist* of the safe surgery, provided us with important subsidies that guided the implementation of *checklist*, more especifically in what concerns the changes in the professionals’ perceptions that join the two staff, the nursing and the medical one. This statement can be done based on the averages of the scores of each domain that join the instrument allied to the process of implementation of the *checklist*. As a limitation we verify that the evaluation of the educational action can be done at regular braks, in special after the implementation of the *checklist.*

CONCLUSION

To evaluate perceptions of the medical and nursing staff that work in a surgical center about the safety environment was important for providing subsidies for the implementation of the *checklist* of the

safe surgery in the refered unit. It provided us important information that guided the implementation of the checklist, more especifically in what concerns the changes in the perceptiosn of the professionals that join the two work groups. We think that the use of a validated instrument can contribute much with the nurse that works in a surgical center in the sense of obtaining a precise diagnosis about the safety environment of the two work groups and which is fundamental to qualify the assistance to the patient in the perisurgical stage with safety.

We consider that the results of this research equally can be used by managers, teachers, nurses, and other professionals that work in surgical centers, researchers and students, in the sense of encouraging them for the construction of more investigations about this thematic, including in otehr surgical centers, in a way to make it possible to make inferences and also other researchs with different methodological approaches.

REFERENCES

ALMEIDA, Ana Carolina Goulardins de et al. Intra-hospital transport of critically ill adult patients: complications related to the team, equipment and physiological factors. Acta Paul. Enferm., São Paulo, v. 25, n. 3, p. 471-476, 2012. Available from <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103- 21002012000300024 & lng = en & nrm = iso> .access on 01 Dec. 2017. http://dx.doi.org/10.1590/S0103 -21002012000300024.

BRAZIL. Ministry of Health. Cabinet of the Minister. Ordinance No. 529, of April 1, 2013. **Establishes the National Patient Safety Program.** Brasília. Available at: <http://www.saude.pr.gov.br/arquivos/File/0SEGURANCA_DO_PACIENTE/Porta ria5292013_1.pdf> Accessed on 05 nov. 2016.

CARVALHO, R. E. F. L. Cross-cultural adaptation of the Safety Attitudes Questionnaire for Brazil - Security Attitudes Questionnaire. 2011. 158 f. Thesis (Doctorate). University of São Paulo, Ribeirão Preto, 2011. Available at: <http://scholar.google.com/citations?view_op=view_citation&hl=en BR & user = 1Q7Yn2wAAAAJ & citation_for_view = 1Q7Yn2wAAAAJ: 3fE2CSJIrl8C>. Accessed on Oct 02. 2017.

CARVALHO, P.A. et al. Safety culture in the surgical center of a public hospital, in the perception of health professionals. Rev. Latino-Am. Nursing, Nov.-Dec. 2015. [Access. March 27, 2017] 23 (6): 1041-8. Available at: http://www.scielo.br/pdf/rlae/v23n6/en_0104-1169-rlae-23-06-01041.pdf.

CASEY, Anne; WALLIS, Alison. Effective communication: Principle of Nursing Practice E. **Nursing Standard,** [s.l.], v. 25, n. 32, p. 35-37, 13 abr. 2011. RCN Publishing Ltd. http://dx.doi.org/10.7748/ns2011.04.25.32.35.c8450

CAUDURO, Fernanda Letícia et al. Safety culture among surgical center professionals. Cogitare Nursing, [s.l.], v. 20, n. 1, p.129-138, 31 March. 2015. Federal University of Paraná.

http://dx.doi.org/10.5380/ce.v20i1.36645.

CHAKRAVARTY, Abhijit. A survey of attitude of frontline clinicians and nurses towards adverse events. **Medical Journal Armed Forces India,** [s.l.], v. 69, n. 4, p. 335-340, out. 2013. Elsevier BV. http://dx.doi.org/10.1016/j.mjafi.2013.01.009.

CHO, S. H. et al. The effects of nurse staffing on adverse events, morbidity, mortality, and medical costs.**Nurs Res**. 2003; 52 (2): 71-9. https://www.ncbi.nlm.nih.gov/pubmed/12657982

CORREGGIO, Thâmy Canova da; LOVER, Lucia Nazareth; BARBOSA, Sayonara de Fátima. Evaluation of patient safety culture in Surgical Center. Revista SOBECC, São Paulo, v. 19, n. 2, p. 67-73, Jun. 2014. ISSN 2358-2871. Available in: <https://revista.sobecc.org.br/sobecc/article/view/60>. Accessed on: 02 Dec. 2017

EL-JARDALI, Fadi et al. Predictors and outcomes of patient safety culture in hospitals. **BMC Health Services Research,** [s.l.], v. 11, n. 1, p.1-12, 24 fev. 2011. Springer Nature. http://dx.doi.org/10.1186/1472-6963-11-45.

FERNANDES, Hellen Maria de Lima Graf; PENICHE, Aparecida de Cássia Giani. Percepção da equipe de enfermagem do Centro Cirúrgico acerca da Acreditação Hospitalar em um Hospital Universitário. **Revista da Escola de Enfermagem da USP,** [s.l.], v. 49, n., p. 22-28, dez. 2015. Fap. UNIFESP (SciELO).
http://dx.doi.org/10.1590/s0080-623420150000700004.

FREITAS, Marise Reis de et al. Avaliação da adesão ao *checklist* de cirurgia segura da OMS em cirurgias urológicas e ginecológicas, em dois hospitais de ensino de Natal, Rio Grande do Norte, Brasil. **Cadernos de Saúde Pública,** [s.l.], v. 30, n. 1, p.137-148, jan. 2014. FapUNIFESP (SciELO).
http://dx.doi.org/10.1590/0102-311x00184612.

HAYNES, Alex B. et al. A Surgical Safety Checklist to Reduce Morbidity and Mortality in a Global Population. **New England Journal of Medicine**, [s.l.], v. 360, n. 5, p.491-499, 29 jan. 2009. New England Journal of Medicine (NEJM/MMS). http://dx.doi.org/10.1056/nejmsa0810119.

HAYNES, A. B. et al. Changes in safety attitude and relationship to decreased postoperative morbidity and mortality following implementation of a checklist-based surgical safety intervention. **BMJ Quality & Safety**, [s.l.], v. 20, n. 1, p.102-107, 1 jan. 2011. BMJ. http://dx.doi.org/10.1136/bmjqs.2009.040022.

HAYNES, Alex B. et al. Mortality Trends After a Voluntary Checklist-based Surgical Safety Collaborative. **Annals of Surgery,** [s.l.], v. 266, n. 6, p. 923-929, dez. 2017.
Ovid Technologies (Wolters Kluwer Health). http://dx.doi.org/10.1097/sla.0000000000002249.

KIERSMA, Mary E.; PLAKE, Kimberly S.; DARBISHIRE, Patricia L. Patient Safety Instruction in US Health Professions Education. **American Journal of Pharmaceutical Education,** [s.l.], v. 75, n. 8, p.162-173, out. 2011. American Journal of Pharmaceutical Education. http://dx.doi.org/10.5688/ajpe758162.

LEE, Wui-chiang et al. Hospital Safety Culture in Taiwan: A Nationwide Survey Using Chinese Version Safety Attitude Questionnaire. **BMC Health Services Research,** [s.l.], v. 10, n. 1, p. 1-8, 10 ago. 2010. Springer Nature. http://dx.doi.org/10.1186/1472-6963-10-234.

LOURENÇÃO, Daniela Campos de Andrade; TRONCHIN, Daisy Maria Rizatto. Patient safety in the surgical environment: translation and cultural adaptation of a validated instrument. Acta Paul. Enferm., São Paulo, v. 29, n. 1, p. 1-8, Feb. 2016. Available from <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103- 21002016000100002 & lng = en & nrm = iso> .Access on 11 Nov. 2017. http: // dx .doi.org / 10.1590 / 1982-0194201600002.

MARINHO, Monique Mendes; RADÜNZ, Vera; BARBOSA, Sayonara de Fátima Faria. Assessment of safety culture by surgical unit nursing teams. **Texto & Contexto - Enfermagem,** [s.l.], v. 23, n. 3, p.581-590, set. 2014. FapUNIFESP (SciELO). http://dx.doi.org/10.1590/0104-07072014002640012.

NATIONAL PATIENT SAFETY FOUNDATION. Accelerate improvement of patient safety fifteen years after To Err is Human. 2016 [access: 2017 nov. 23]. Available at: https://proqualis.net/ article / free-of-damage-accelerate-improvement-of-safety-patient-fifteen-years-later-of-err-human

NIE, Yanli et al. Hospital survey on patient safety culture in China. **BMC Health Services Research,** [s.l.], v. 13, n. 1, p.1-11, 24 jun. 2013.Springer Nature. http://dx.doi.org/10.1186/1472-6963-13-228.

NOVARETTI, Marcia Cristina Zago et al. Nursing work overload and incidents and adverse events in ICU patients. Rev. Bras. Enferm., Brasília, v. 67, n. 5, p. 692-699, Oct. 2014. Available from<http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0034- 71672014000500692 & lng = en & nrm = iso> .access on 02 Dec. 2017. http://dx.doi.org/10.1590/0034-7167.2014670504 .
OLIVEIRA, Roberta Meneses et al. Strategies for promoting patient safety: from the identification of the risks to the evidence-based practices. **Escola Anna Nery - Revista de Enfermagem,** [s.l.], v. 18, n. 1, p.1-8, 2014. GN1 Genesis Network. http://dx.doi.org/10.5935/1414-8145.20140018

RELIHAN E et al. Measuring and benchmarking safety culture: application of the safety attitudes questionnaire to an acute medical admissions unit. **Ir. J. Med. Sci**. [Internet]. 2009 [Access Ago 17, 2017];178(4):433-9. Available from: https:// www.ncbi.nlm.nih.gov/pubmed/19437091.

RUSS, Stephanie et al. Do Safety Checklists Improve Teamwork and Communication in the Operating Room? A Systematic Review. **Annals of Surgery,** [s.l.], v. 258, n. 6, p.856-871, dez. 2013. Ovid Technologies (Wolters Kluwer Health). http://dx.doi.org/10.1097/sla.0000000000000206

SAMMER, Christine E. et al. What is Patient Safety Culture? A Review of the Literature. **Journal of Nursing Scholarship,** [s.l.], v. 42, n. 2, p.156-165, 21 jan. 2010. Wiley-Blackwell. http://dx.doi.org/10.1111/j.1547-5069.2009.01330.x.

SEXTON, John B. et al. The Safety Attitudes Questionnaire: psychometric properties, benchmarking data, and emerging research. **BMC Health Services Research**, [s.l.], v. 6, n. 1, p.6-44, 3 abr. 2006.Springer Nature.http://dx.doi.org/10.1186/1472-6963-6-44

SINGER, Sara J. et al. Relationship Between Operating Room Teamwork, Contextual Factors, and Safety Checklist Performance. **Journal of The American College Of Surgeons**, [s.l.], v. 223, n. 4, p. 1-44, out. 2016. Elsevier BV. http://dx.doi.org/10.1016/j.jamcollsurg.2016.07.006

VICENT,Charles e AMALBERTI, Rene. Cuidado de Saúde mais Seguro: estratégias para o cotidiano do cuidado– Rio de Janeiro, 2016.

TAYLOR, Jennifer et al. Do nurse and patient injuries share common antecedents? An analysis of associations with safety climate and working conditions. **BMJ Quality & Safety,** [s.l.], v. 21, n. 2, p. 101-111, 19 out. 2011. BMJ. http://dx.doi.org/10.1136/bmjqs-2011-000082.

TOSTES, Maria Fernanda do Prado; HARACEMIW, Annelise; MAI, Lilian Denise. Surgical safety checklist: Considerations from the institutional micropolitics. **Esc. Anna Nery**, Rio de Janeiro, v. 20, n. 1, p. 203-209, March. 2016. Available in <http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1414-81452016000100203-&lng=en&nrm=iso>. Accessed on 10 Jul. 2017. http://dx.doi.org/10.5935/1414-8145.20160027.

WORLD HEALTH ORGANIZATION.**World Alliance for Patient Safety.** WHO patient safety curriculum guide: multi-professional edition. Geneva: WHO, 2011.

Extent of Counselors Effectiveness in Post Primary Institutions in Enugu State

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ABSTRACT

This study is an appraisal of counselors' effectiveness in post primary institutions in Enugu State. This study adopted descriptive survey research deign. It was carried out in the six educational zones of Enugu state with a total of two hundred and seventy-five (275) government-owned secondary schools. The population for the study comprises a key officer each from all the two hundred and seventy-five (275) government owned secondary schools in Enugu State. Two hundred and seventy-five (275) is small and manageable as a sample for study. Hence, the researcher used all of them for the study. Therefore, no sampling was done. The researcher explored eight research questions and formulated two hypotheses on the comparison of the performance of counselors by gender and locations using t-test statistics at 0.05 level of significance. The research questions were answered using means and standard deviations. It was found that the respondents generally had high perceptions of the counselors' performance in each of their professional roles except with respect to the referral function. It was also found that there is no significant difference in the performance of male and female counselors in both urban and rural areas. Recommendations were made that counselors should be adequately motivated and that counselors should specialize on guidance and counseling services to improve their effectiveness in post primary schools in Enugu State, Nigeria.

INTRODUCTION

The emotional and psychological status of many learners in the 21st century has been vastly affected by various issues including substance abuse, domestic poverty, teenage issues, physical disabilities, domestic violence and early pregnancy among other such factors. The consequences of this distress are dire and far-reaching. Various strategies have been employed by the education sector in an attempt to address issues that affect students. On top of these strategies featured the strengthening of guidance and counseling services in schools. Egbo

(2013) stated that counselling services are those helps rendered to clients to help them to understand themselves and their environment so as to be in a position to choose the right type of behaviours that will

help them develop, grow, progress, ascend, mature and step up educationally, vocationally and socio-personally.

Counselling services are offered in the school and non-school settings. Effective school counseling programmes empower students to realize their full potentials.

One of the primary goals of functional education system is to equip students with the necessary skills and values for productive living. In pursuance of this goal, the Federal Government of Nigeria has taken steps to make Nigerian education relevant to the life of the individual with the implementation of the new school system (FRN, 2004:30). Consequently, schools are set at the various levels of education to translate the government vision into reality. At the primary and post primary levels, the schools are expected to provide the tripartite functions of administration, instruction and guidance and counselling services. Counselling services, according to Anwana (2011), are designed to enable an individual to gain self-understanding of himself as well as his self-direction. Counselling services are offered by a counsellor who is professionally competent in relevant psychologically based skills and knowledge to assist the client. Over the years, counselling services have been adopted at the primary and post primary levels in Nigeria, and they have been found to play a good complementary role to other school programmes.

Despite these efforts, indiscipline in schools is still on the increase. This thus casts a shadow of doubt on the effectiveness of the guidance and counselling services in Nigerian schools. This prompted the researcher to attempt to ascertain the effectiveness of counselling services in various institutions of learning especially in post primary institutions, hence, this a study of extent of counselors' effectiveness in post primary institutions in Enugu State.It is assumed that with increasing complexities in the society, the growth of industrial and technological development, most students find it difficult to adjust themselves to the school challenges, the society expectations, selecting and entering into sustainable occupations as well as adjusting to satisfactory family roles. It is also observed that within the school, children have counselling needs ranging from educational, personal-social to vocational which if not properly handled, may lead to their maladjustment or frustrations in their later lives. McDanial (1966) cited in Anwana (2011) stated that the three major functions of the school counselling programme should aim at: -

(i) Assisting the individual student achieve an increasing degree of maturity in working towards the solution of his varied personal adjustment problems,

(ii) Assisting the school and its staff in security, interpreting and using information concerning the characteristics, needs and opportunities of students, and

(iii) Assisting the school and its staff in understanding and working closely with the community they serve.

The implication is that students should maximally utilize their schooling period to acquire the basic skills that would launch them into functional adulthood who would contribute meaningfully to the society's sustainable development. But situations are observed where most of our students show apparent lack of reading culture or zeal for their academic engagements. A great deal of their time is spent on social networking on "facebook", "Twitter", among others, using their cell phones. Examination fraud is fast becoming a rampant tradition among many students despite government efforts to stamp it out from the educational system. One wonders the type of manpower that would be produced for our economy in future

if this trend continues. Okon (2014) asserted that guidance and counselling within education can help in the development of skills, attitudes, and potentials of Nigerian youths so as to realize their fullest potentials for national development.

More so, the implication of technological revolution across the globe predicts that any nation that desires development deep into the 21st century and beyond should not pay lip service to guidance and counselling but should ensure that all machinery is set in motion to maximize the potentials of the youth, for their timely absorption, and survival in an uncertain technological future. Nwachukwu (2003) believed that school counselling services equip the students with skills for career adjustment in areas where jobs are available.

Statement of the Problem; The challenges of adolescents according to Melgosa (2011) include adapting to their new image, facing the growing academic demands, establishing vocational goals, learning to control sexuality, emotional and psychological independence from their parents. Most of the learners in post primary institutions are at an adolescent stage and an effective guidance and counseling programme in schools must be availed to assist these students (Onuorah, 2011). The rationale to offer counseling services especially to students in post primary institutions is very clear. The "post primary" years are periods of academic, social, personal, emotional and intellectual growth for most if not all students. In the National Policy on Education, section 11 (101), it was noted that there is need for guidance services for the young school children in view of their varied background and likely career choice problems. A recent survey by Ajowi & Simatwa (2010) has revealed that most post primary institutions in Nigeria have school-based guidance and counselling services. However, despite the availability of these services, another study by Okechi & Adegoke (2012) showed that most of the counsellors in post primary institutions in Nigeria are poorly trained. In most cases, teachers are tasked with the additional role of counselors. Most of the teachers tasked with guidance and counselling roles are overburdened due to the high number of students in post primary institutions in Nigeria. This thus casts a shadow of doubt on the effectiveness of guidance and counselling services in Nigerian secondary schools. This study thus sought to appraise the effectiveness of guidance and counseling services in post primary institutions in Enugu state, Nigeria.

Purpose of the Study; The main purpose of this study was to ascertain the extent of counsellors' effectiveness in post primary institutions in Enugu State, Nigeria. Specifically, this study sought to determine the extent to which counsellors perform;

1. Orientation guidance services in post primary institutions in Enugu State.
2. Educational guidance services in post primary institutions in Enugu State.
3. Vocational guidance services in post primary institutions in Enugu State.
4. Personal social guidance services in post primary institutions in Enugu State.

Research Questions; This study sought answers to the following research: questions.

1. To what extent do guidance counsellors satisfactorily perform orientation guidance services in post primary institutions in Enugu State?
2. To what extent do counsellors satisfactorily perform educational guidance services in post primary institutions in Enugu State?

3. To what extent do counsellors satisfactorily perform vocational guidance services in post primary institutions in Enugu State?
4. To what extent do counsellors satisfactorily perform personal social guidance services in post primary institutions in Enugu State?

Hypotheses; Two Null hypotheses were formulated and tested at 0.05 level of significance.
Hypothesis 1: There is no significant differerence in the mean response scores o male and female counselors in in the overall performance of counseling functions Enugu state post primary schools.
Hypothesis 2: There is no significant difference in the mean response scores of urban and rural counsellors in their overall performance of counseling functions in Enugu state post primary schools.
Research Design; This study adopted descriptive survey research deign. According to Nworgu (2001), survey research design is one in which a group of people or items considered to be a representative of the entire group is studied.
Area of the Study;This study was carried out in the six educational zones of Enugu state with a total of two hundred and seventy-five (275) government-owned secondary schools. These zones are Nssuka, ObolloAfor, Awgu, Agbani, Enugu and Udi post primary school management school boards (PPSMB, 2016).
Population for the Study'The population for the study comprises a key officer each from all the two hundred and seventy-five (275) government owned secondary schools in Enugu State. Such key officers include; the principal, a trained counselor, or a key administrative staff serving in all the two hundred and seventy-five (275) government owned secondary schools in Enugu State.
Sample and Sampling Technique;Thus, this study used a sample size of two hundred and seventy-five (275) persons consisting of a key officer each from all the two hundred and seventy-five (275) government owned secondary schools in Enugu State. Two hundred and seventy-five (275) is small and manageable as a sample for study. Hence, the researcher used all of them for the study. Therefore, no sampling was done.
Instrument for Data Collection;The instrument for data collection is a self-structured questionnaire developed by the researcher. It was called an appraisal of counselors' effectiveness in post primary institutions in Enugu State. The instrument has two sections. Namely; section A and B section. Section A contains the Biodata of the respondents while section B contains the questionnaire for this research work. Section one has twelve (12) items on orientation services, Section two is made up of nine (9) items on educational guidance. Section three has fourteen (14) items on vocational guidance. Section four has ten (10) items on personal social guidance. Section five is made up of eleven (11) items on information services. Section six has thirteen (13) items on planning, placement and follow-up services. Section seven has six (6) items on appraisal service while Section eight has six (6) items on referral service. Thus, section B has a total of 81 research items structured to raise the much-needed data to answer the research questions and test the hypotheses formulated for the study.The instrument has a 4-point response format of and numerical value assigned to it as fol

High extent	-	H.Ex	=4 points
Moderate Extent	-	M.Ex	=3 points
Low	-	LE	=2 points
very low Extent	-	V.LE	=1 point

Validation of the Instrument;The instrument was validated by three experts; one in measurement and evaluation and two in guidance and counseling department all from Enugu State University of Science and Technology,(ESUT),Enugu State ,Nigeria.

Reliability of the Instrument;To ascertain the internal consistency of the instrument the researcher conducted initial test using 15 Post Primary Institutions from Ebonyi State, Nigeria. The Cronbach's alpha coefficient for the entire instrument was found to be 0.85 which the researcher considered high enough and so used the instrument for the main study.

Method of Data Collection;The instrument was administered directly to the 275 respondents using six trained research assistants. One research assistant covered one education zone.. On the whole, a total of two hundred and seventy-five (275) copies of the questionnaires were correctly filled and retrieved from the respondents, giving a return rate of 100%.

Method of Data Analysis;The nine questions were answered using the mean and standard deviation. The mean rating of the numerical values assigned to the Reponses option were used. The ratings were summed up and the cut off was determined after finding the mean which was obtained by adding the sum of the nominal rating values and dividing by the number of rating items. Thus,

$$\frac{4+3+2+1}{4} = \frac{10}{4} = 2.50$$

The basis for decision would therefore be 2.50. A mean score of 2.50 and above was regarded as high extent while a mean score below 2.50 was interpreted as low extent. The research hypotheses were tested at 0.5 level of significance. The decision rule for the null hypotheses was that if t-calculated is equal to or greater than the t-critical at the chosen confidence level (0.5) and degree of freedom ($n_1 + n_2 -2$) the null hypotheses of no significant difference was rejected, if on the other hand the calculated t value is less than the value of t-critical (the table value) then the null hypothesis would be accepted.

ANALYSIS OF RESULT

Table 1

RESEARCH QUESTION ONE:								
To what extent do guidance counsellors satisfactorily perform orientation guidance services in post primary institutions in Enugu State?								
		RESPONSES						
S/N	**QUESTIONNAIRE ITEM(S)**	**High (4)**	**Moderate (3)**	**low (2)**	**V.Low (1)**		**X**	**DECISION**
	As a counselor, I understand that counselors should							
1	Welcome newly admitted students	112	90	61	12	**275**	**3.1**	**HIGH EXTENT**
		448	270	122	12	**852**		
2	Talk to new students on the history, philosophy, status, programmes, achievements, problems, rules and regulations, clubs and aspirations of the school, exhort them to identify with the progress of the school	108	90	42	35	**275**	**2.99**	**HIGH EXTENT**
		432	270	84	35	**821**		
3	Conduct them round the school premises and facilitate acquaintances with the school environment	157	57	43	18	**275**	**3.28**	**HIGH EXTENT**
		628	171	86	18	**903**		
4	Organize orientation/induction services for new members of staff, youth corper, etc.	128	91	37	19	**275**	**3.19**	**HIGH EXTENT**
		512	273	74	19	**878**		
5	Serve as parents especially to those whose parents or guardians are far from the school	143	61	41	30	**275**	**3.15**	**HIGH EXTENT**
		572	183	82	30	**867**		
	GRAND MEAN						**3.14**	**HIGH EXTENT**
	STANDARD DEVIATION						**0.11**	

Table 1 show that high means of 3.1, 2.99, 3.28, 3.19 and 3.15 were obtained for items 1, 2, 3, 4 and 5 respectively. This simply indicates that the respondents had high extent perceptions of each of the itemized

roles of counselors in post primary institution. A grand mean of 3.14, with a standard deviation of 0.11 was obtained for all the five items (items 1-5) in research question one. A grand mean of 3.14 indicates that all the respondents generally had a high extent perception of each of the itemized roles of counselors and also concur to the fact that counselors should perform orientation guidance services in post primary institutions. A standard deviation of 0.11 is considerably low which is an indication that the respondents did not differ remarkably in their perception of each of the itemized roles of counselors in post primary institutionin Enugu State.

Table 2

RESEARCH QUESTION TWO:								
To what extent do counsellors satisfactorily perform educational guidance services in post primary institutions in Enugu State?								
		RESPONSES						
S/N	**QUESTIONNAIRE ITEM(S)**	**High (4)**	**Moderate (3)**	**low (2)**	**V.Low (1)**		**X**	**DECISION**
	As a counselor, I understand that counselors should							
6	Supervise the studies of students	136	87	45	7	**275**	**3.28**	**HIGH EXTENT**
		544	261	90	7	**902**		
7	Administer tests on academic matters, score them, interpret them and use them for counseling interventions	158	42	61	14	**275**	**3.25**	**HIGH EXTENT**
		632	126	122	14	**894**		
8	Monitor students' academic performance at regular intervals.	125	85	56	9	**275**	**3.19**	**HIGH EXTENT**
		500	255	112	9	**876**		
9.	Counsel students with study problems	106	98	59	12	**275**	**3.08**	**HIGH EXTENT**
		424	294	118	12	**848**		
10.	Guide students on such academic matters as the choice of school subjects on completion of SSCE or JAMB.	116	94	54	11	**275**	**3.15**	**HIGH EXTENT**
		464	282	108	11	**865**		

11	In consultation with teachers, liaise with parents on students' academic performance and involve them in counseling programmes	142	100	20	13	**275**	**3.35**	**HIGH EXTENT**
		568	300	40	13	**921**		
	GRAND MEAN						**3.22**	**HIGH EXTENT**
	STANDARD DEVIATION						**0.1**	

Table 2 shows that high means of 3.28, 3.25, 3.19, 3.08, 3.15 and 3.35 were obtained for items 6, 7, 8, 9, 10 and 11 respectively. This simply indicates that the respondents had high extent perceptions of each of the itemized roles of counselors in post primary institution. A grand mean of 3.22, with a standard deviation of 0.1 was obtained for all the six items (items 6-11) in research question two. A grand mean of 3.22 indicates that all the respondents generally had a high extent perception of each of the itemized roles of counselors and also concur to the fact that counselors should perform educational guidance services in post primary institutions. A standard deviation of 0.1 is considerably low which is an indication that the respondents did not differ remarkably in their perception of each of the itemized roles of counselors in post primary institutionin Enugu State.

Table 3

RESEARCH QUESTION THREE:								
To what extent do counsellors satisfactorily perform vocational guidance services in post primary institutions in Enugu State?								
		RESPONSES						
S/N	**QUESTIONNAIRE ITEM(S)**	**High (4)**	**Moderate (3)**	**low (2)**	**V.Low (1)**		**X**	**DECISION**
	As a counselor, I understand that counselors should							
12	Provide students with occupational information	104	75	50	46	**275**	**2.86**	HIGH EXTENT
		416	225	100	46	**787**		
13	Administer Vocational tests, Score, and interpret them, using them in counseling students and parents on Vocational choice and subjects to offer in school	60	54	86	75	**275**	**2.36**	LOW EXTENT
		240	162	172	75	**649**		
14	Guide and counsel students and parents on vocational choice and	108	88	46	33	**275**	**2.99**	HIGH EXTENT

	combination of subjects and help in solving conflicts in such matters.	432	264	92	33	**821**		
15	Foster vocational development in students by organizing career convention	42	55	81	97	**275**	**2.15**	LOW EXTENT
		168	165	162	97	**592**		
16	Arrange vocational visits to professional vocational centres	80	61	90	44	**275**	**2.64**	HIGH EXTENT
		320	183	180	44	**727**		
17	Promote vocational clubs in the school	39	64	86	86	275	2.2	LOW EXTENT
		156	192	172	86	606		
18	Organize vocational experience, holidays, job attachments, pilot schemes, etc.	90	31	99	55	275	2.57	HIGH EXTENT
		360	93	198	55	706		
	GRAND MEAN						2.54	HIGH EXTENT
	STANDARD DEVIATION						0.32	

Table 3 shows that high means of 2.86, 2.99, 2.64, and 2.57 were obtained for items 12, 14, 16 and 18 respectively. This simply indicates that the respondents had high extent reservations that counsellors should perform the functions of vocational guidance services in post primary institutions. Conversely, a low mean rating (below 2.5) of 2.36, 2.15, 2.2 were obtained for items 13, 15 and 17 respectively, which are indicative of the disapprovals of respondents that counsellors should perform the functions of vocational guidance services in post primary institutions. A grand mean of 2.54, with a standard deviation of 0.32 was obtained for all the seven items (items 12-18) in research question three. A grand mean of 2.54 indicates that all the respondents generally had high extent perceptions of the vocational roles of counselors in schools and also agree to the fact that counselors should perform vocational guidance services in post primary institutions. A standard deviation of 0.32 is considerably low which is an indication that the respondents did not differ remarkably in their perception of the role of counselors in providing vocational guidance services in post primary institution in Enugu Sta

Table 4

RESEARCH QUESTION FOUR								
To what extent do counsellors satisfactorily perform personal social guidance services in post primary institutions in Enugu State?								
		RESPONSES						
S/N	**QUESTIONNAIRE ITEM(S)**	**High (4)**	**Moderate (3)**	**low (2)**	**V.Low (1)**		**X**	**DECISION**
	As a counselor, I understand that counselors should							
19	Counsel students on their personal and social matters and problems	112	49	44	70	**275**	**2.74**	**HIGH EXTENT**
		448	147	88	70	**753**		
20	Administer Scores, interpret tests on personal/social matters and problems and use the result for counseling	49	58	89	79	**275**	**2.28**	**LOW EXTENT**
		196	174	178	79	**627**		
21	Consult and liaise with teachers and parents as occasion requires on personal and social matters and problems and involve them with counselling programmes	58	69	81	67	**275**	**2.43**	**LOW EXTENT**
		232	207	162	67	**668**		
22	Foster personal-social development in students through group programme	50	61	83	81	**275**	**2.29**	**LOW EXTENT**
		200	183	166	81	**630**		

Table 4 Continued

23	Foster personal-social development in students through school societies	113	103	34	25	**275**	3.11	HIGH EXTENT
		452	309	68	25	**854**		
24	Foster personal-social developments in students through exchange programmes management skills	88	30	82	75	**275**	2.48	LOW EXTENT
		352	90	164	75	**681**		
25	Foster personal-social development in students through self	96	88	51	40	**275**	2.87	HIGH EXTENT
		384	264	102	40	**790**		
26	Foster personal-social development in students through social skills	59	40	81	95	**275**	2.23	LOW EXTENT
		236	120	162	95	**613**		

27	Foster personal-social development in students through training in assertiveness.	42	94	60	79	**275**	2.36	LOW EXTENT
		168	282	120	79	**649**		
	GRAND MEAN						2.53	HIGH EXTENT
	STANDARD DEVIATION						0.3	

Table 4 shows that high means of 2.74, 3.11, and 2.87 were obtained for items 19, 23 and 25 respectively. This simply indicates that the respondents had high extent reservations on the role of counsellors as personal social guidance personnel. Conversely, a low mean rating of 2.28, 2.43, 2.29, 2.48, 2.23 and 2.36 were obtained for items 20, 21, 22, 24, 26 and 27 respectively, which are indicative of the disapprovals of respondents that counsellors should perform the functions of personal social guidance services in post primary institutions. A grand mean of 2.53, with a standard deviation of 0.3 was obtained for all the nine items (items 19-27) in research question four. A grand mean of 2.53 indicates that all the respondents generally had high extent perception of the roles of counselors in schools and also agree to the fact that counselors should perform personal social guidanceservices in post primary institutions. A standard deviation of 0.3 is considerably low which is an indication that the respondents did not differ remarkably in their perception of the roles of counselors in providing personal social guidance services in post primary institution in Enugu State.

Hypothesis 1: There is no significant sex difference in the overall performance of counseling functions by male and female counsellors in Enugu state post primary schools.

Table 9: t-test comparision of the performance of male and female counselors.

Gender	**Mean(X)**	**SD**	**df**	**Criitical value**	**t-Calculated**	**Decision**
Male counsellor	6.60	2.59	275	1.96	5.54	Accepted
Female counsellor	7.04	2.61				

Decision Rule: Table 9 shows that the mean score of male respondents is 6.60 with standard deviation of 2.59 while the mean score of female respondents is 2.61 with standard deviation of 2.61. The tcalculated is 5.54 while the critical value is 1.96. The t-calculated is greater than the critical value. The null hypothesis is accepted. This implies that there is no significant difference between performance of male and female in counselors Enugu state post primary schools.

Hypothesis 2: There is no significant difference in the overall performance of counseling functions by urban and rural counselors in Enugu state post primary schools.

Table 10: t-test comparision of the performance overall performance of counseling functions by urban and rural counselors

Gender	Mean(X)	SD	df	Criitical value	t-Calculated	Decision
Urban counsellors	7.41	2.64	275	1.96	7.54	Accepted
Rural counselors	6.24	2.59				

Decision Rule: Table 10 show that the mean score of respondents from urban environment is 7.41 with standard deviation of 2.64 while the mean score of respondents from rural environment is 6.24 with standard deviation of 2.59. The t.calculated is 7.54 while the critical value is 1.96. The t-calculated is greater than the critical value. The null hypothesis is accepted. This implies that there is no significant difference between the overall performance of counseling functions by urban and rural counsellors.

Conclusions; Guidance and counselling is of paramount importance in effective teaching and learning in schools globally.UNESCO (2002) has recognized the pivotal role which guidance and counselling plays in various spheres of human existence, hence it sponsored the development of training modules for counsellors.

Recommendations; This study makes the following recommendations:

1. Government and other concerned stakeholders should make out policies to ensure that counsellors are properly trained and equipped to perform optimally.
2. The Counselling Association of Nigeria should formulate policies that will articulate the actual roles of counsellors in the Nigerian education system, especially in post primary institutions in Nigeria.
3. The Counseling Association of Nigeria should give mass publicity of the roles of counselors within the school setting.
4. The Federal Ministry of Education, in collaboration with State Education Commissions within the various States should specifically ensure that each school has functional guidance and counselling unit(s).
5. Government and educational policy makers should set policies to regulate the activities of guidance and counseling officers in schools so as to avoid abuse.

REFERENCES

Adegoke, M.A. (2012). Counseling through Web: Counselors Percepectives and Usage. Journal of Counseling Association of Nigeria (CASSON) 110-113

Awana, N.E. (2012). Measurement and Evaluation in Teaching, New York. Macmillian Publishing Company INS

Egbo, A C (2013), *Development of Guidance and Counseling*, Enugu, Joe Best Publisher.

Federal Republic of Nigeria (2004). The National Policy on Education (Revised) Lagos. Federal Government press.

Mc Daniel, L.R.(1966). Education Research and Competencies for Analysis and Application (5th edition). New Jersey: Prentice Hall Inc.

Melgosa, F.D. (2011). Educational Research . Basic Issues and Methodology. Ibadan: Wisdom Publishers.

National Policy on Education (2001). Minimum Standard for Nigeria certificate in Education (4th Ed) Kaduna: MCCE press.

Nwachukwu, C.E. (2003). Curriculum Development and Management in Vocational Technical Education. Owerri: Cape Publishers International Ltd.

Nworgu, E.O. (2001). Assessment of the Quality of Guidance and Counseling Services to Students' Adjustment in Secondary Schools in Edo State of Nigeria. *Research Journal of International Studies,* Issue 8.

Okon, S.E. (2014). Guidance for the 6-3-3-4 Systems of Education: Zaria; Ahmadu Bello University Press.

Onuorah, U. (2011). Curriculum Development for Africa. Onitsha Educational Publishers Ltd.

Head Teacher-Parent Collaboration Policies' Usefulness for The Improvement of Inclusive Education in Public Primary Schools in Meru County, Kenya

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Abstract

Through head teacher-parent collaboration, Inclusive education can be improved. The purpose of the study was to analyse the usefulness of head teacher-parent collaboration policies for the improvement of inclusive education in regular public primary schools in Meru County. The objective of the study was to examine the usefulness of policies that govern head teacher-parent collaboration for the improvement of inclusive education. The significance of the study was to inform education policy makers, who need the study results to evaluate the current policies on inclusion and formulate appropriate ones for promoting head teacher-parent collaboration to improve the status of inclusive education for all learners. The study was guided by Bronfenbrenner's bio-ecological systems theory and Peters' input-process-outcome-context framework of Inclusive Education. Qualitative research approach method was predominantly used. The target population was 101,612. Through purposive sampling, 24 participants were selected. The study instruments used included; questionnaires, interview schedules, focus group discussion guide, observations and documents' analysis schedules. Qualitative data analysis was done with the help of computer package, ATLAS. ti. The study findings were presented using narratives within themes generated from the collected data. The findings indicated that head teacher-parent collaboration policy context enhanced the improvement of inclusive education. Most of the schools used informal policies. It was concluded that, head teacher-parent collaboration policy context is crucial to the improvement of inclusive education. It was recommended that the Ministry of Education should formulate appropriate inclusive education policies.

Key words: Policies, head teacher-parent collaboration, inclusive education

1. Introduction

Internationally, there are a number of policies on ensuring children with special needs more effectively access and benefit from inclusive schooling. Recently, UN 2030 Agenda for Sustainable Development Goals (SDGs) with seventeen (17) goals and in particular goal number four (4) strongly renews focus on inclusive education. The goal number four is on quality education, which aims at ensuring inclusive and equitable quality education and promotes lifelong learning for all (UNDP, 2015). Many countries are trying

to comply with the international and domestic inclusive education policies. However, despite the efforts to implement the IE, its improvement has been slow.

Sweden, which is often regarded as having one of the most inclusive school systems in the world, has put in place school policies to avoid segregation by educating all pupils in the same classroom (Lindqvist & Nilholm, 2013). Further, for several decades, Sweddish politicians have expressed the principle of 'A school for all' (Göransson, Nilholm, & Karlsson, 2011). However, according to Göransson, Nilholm, and Karlsson (2011), the inclusiveness in Sweden, is not yet perfect since the system allows schools to place learners in segregated settings.

Countries like; England, Germany, Denmark, Norway, Iceland, USA and Canada, have reformed schools, according to inclusive education policies, in ways that extend their capacity to respond to diversity (Hunter, 2004, Kalabula, 2007, UNDP, 2015). Inclusive education (IE) policies facilitate strengthening of head teacher-parent collaboration in improving IE status in regular schools (Szwed, 2007).

In Africa, Kenya included, there are significant concerns about usefulness of IE policies (Levin & Lockheed, 1993). These realities exist in spite of the ratification of the Universal Declaration of Human Rights (UN, 1948), Salamanca Statement, Dakar Conference and more recently, the UN 2030 Agenda for Sustainable Development Goals (SDGs).

2. Statement of the Problem

Head teacher-parent collaboration policy context improves inclusive education. Inclusive education improvement through effective head teacher parent collaboration policy context was evident in many other countries such as; Great Britain, Netherlands, Indonesia Hong Kong, Australia, New Zealand and United States.

In Meru County, Kenya, there appeared to have been ineffective school-home collaboration which was linked to poor status of inclusive education. There seemed to be ineffective head teacher-parent collaboration policy context that resulted in poor status of inclusive education (stakeholders' level of acceptance to work together to provide quality education for all learners in ordinary schools) in public primary schools in Meru County (Meru County Director of Education Office, 2016).

Head teacher-parent collaboration policies' usefulness is what this study sought to analyse to address the low improvement in inclusive education. Addressing low improvement in inclusive education through head teacher-parent collaboration policies may result in all learners having opportunities to develop socially and economically, making it easy to achieve the sustainable development goals. It was for this reason that the researcher decided to carry out a study on "Head teacher-parent collaboration policies' usefulness for the improvement of inclusive education in public primary schools in Meru County, Kenya".

3. Significance of the Study

The study findings are of great use to education policy makers, who may need the study results to evaluate the current policies on inclusion and formulate appropriate ones for promoting head teacher-parent collaboration to improve the status of inclusive education for all learners. The study findings give crucial information to leaders and managers of inclusive schools on the need to have appropriate formal inclusive education policies to enhance head teacher-parent collaboration for the improvement of inclusive education.

4. Methodology

The study was guided by Bronfenbrenner's bio-ecological systems theory and Peters' input-process-outcome-context framework of Inclusive Education. Qualitative research approach method was predominantly used. The target population was 101,612 (772 head teachers, 6,840 teachers and 94,000 parents). Out of the target population, there was a unique population of 218 (77 head teachers, 68 teachers and 73 parents) who were actively involved in inclusive education in 77 inclusive public primary schools in Meru County (Meru County Director of Education Office, 2016). Through purposive sampling, a number of eight (8) regular public primary schools and a sample size of 24 participants were purposively selected from the population. Creswell (2009), suggest for sample size in the range of 5-25 as being adequate for collecting qualitative data. The researcher adopted the Creswell (2009) recommendation to select the 24 participants.

The study instruments used included; questionnaires, interview schedules, focus group discussion guide, observations and documents' analysis schedules. The tools were piloted for reliability and validity in Isiolo County, Kenya. Data was collected by the researcher through meeting with the participants face-to-face, which ensured whole response return rates. Qualitative data analysis was done with the help of computer package, ATLAS. ti. The study findings were presented using narratives within themes generated from the collected data.

5. Findings on usefulness of policies that govern head teachers in collaborating with parents of learners with special needs for the improvement of inclusive education

The head teacher respondents were interviewed using the question, "Are the school policies which govern you in collaborating with parents of learners with special needs to improve inclusive education useful? Please explain their usefulness." Further, the parents gave descriptions on the item "Are the school policies which govern you in collaborating with head teachers to improve inclusive education useful? Please explain their usefulness." The teachers gave narratives on the question, "Are the school policies which govern head teachers in collaborating with parents of learners with special needs for the improvement of inclusive

education useful? Please explain their usefulness." The participants' responses were presented in the following descriptions;

5.1 Head teachers' data narratives on usefulness of policies that govern the collaboration

When the participant head teacher A was requested to comment on the usefulness of the school policies which governed him in collaborating with parents of learners with special needs to improve inclusive education, he said that they were useful, but to a small extent. He further explained that there was need for legal people, who are conversant with law, to take school stakeholders through legal documents, pointing out and interpreting sections that provide for collaboration and inclusive education. He emphasized that, in his opinion, open-door policies were more useful than the formal policies.

Respondent head teacher B said that her school policies were relevant and useful, pointing out that they guided them on what they did with the learners and their parents. She gave an example of Kenya National Examination Council (KNEC) policies that allow for separate registration of learners with special needs for Kenya Certificate of Primary Education (KCPE). Head teacher C asserted that her school policies that governed her in collaborating with parents of learners with special needs to improve inclusive education were very useful because they were promoting education access for all children.

The participant head teacher D felt that all policies should be useful although she said that she had not taken time to have any copy of the documents in use in her school. Head teacher E said that, his school informal policies (academic performance improvement, wholesome growth of the child, nutrition policy and acceptance of learners with special needs to fight stigma and discrimination) were useful because the acceptance of the learners with special needs and their health had improved and consequently enhanced provision of inclusive education. He shared, "Also the children without special needs have accepted to settle in the same class with the ones with special needs ready to assist them in anything they require in their studies according to their capabilities." This head teacher supported the usefulness of the policies with illustrations. This implies that, he understood the worth of the policies. Participant head teacher F asserted that her school policies that governed her in collaborating with parents of learners with special needs to improve inclusive education were very useful because they promoted good relationship among school stakeholders to educate all learners.

Head teacher G explained that his institutional policies were useful because they assisted in bringing school stakeholders together in improving inclusive education. He added that the policies had not yet been fully implemented. This participant seemed to contradict himself when he thought that, there was partial implementation of the policies and yet their worth was experienced. This implies that, if the policies were fully implemented, they could have been more useful.

Head teacher H reported that, the policies on love were very useful because learners felt at home in school. The participant shared that, most of the learners did not absent themselves from school since they had the urge to be in school to share with all other learners. He said that, they took lunch together, and they loved school, which they viewed as an extension of their home. The head teacher felt that, to many of the learners, school was even better environment than their homes, where they missed many meals. He further shared that, learners with special needs were really loved by other "normal" learners. He remarked, "During the

holidays, the learners miss the care they get in school". All the head teachers indicated that, the informal policies in their schools were useful. This implies that, they were conversant with their school guidelines. However, during the head teachers' focus group discussions, it was indicated that though the informal policies were useful, they were ineffective in raising head teacher-parent collaboration, which consequently had resulted in insignificant enhancements in improving inclusive education.

5.2 Parents' data narratives on usefulness of policies that govern the collaboration

Parent A jokingly said, "Even without policies, we educate our children". However, parent B felt that, when his child's school gets policies, he would be able to learn their usefulness. This implies, there may be no outcome for evaluation in the absence of the policy context. Parent C shared that, the school governing policies were useful, they guarded against some children being ignored despite their differences. She further felt that all children were able to access education in regular classes, giving an example of her child with physical handicap who was in standard six.

Parent D felt that, school routines were useful for they ensured that, there was good coordination among stakeholders. Parent E was of the opinion that his school policies which he described as "love and care" for learners with special needs were useful in that, they guided the parents and head teacher to do the right thing in their collaboration to improve inclusive education. Parent F indicated that, since she knew of no policies, she would not discuss usefulness of any of them. This parent concurred with parent B, in that; there is no worth of what does not exist. According to parent G, since the school had no policies, then there was no usefulness of the non-existence policies. This parent was in agreement with parent B and F.

Parent H felt that, since he had no information concerning policies in the school, the issue of usefulness of policies to him was immaterial. Respondent parent H could not evaluate the usefulness of the policies due to lack of information. This implies, there is need of having information to enable one in judging the worth of the policies. In contrast to the head teachers, the parents were not familiar with the school guidelines. However, during the parents' focus group discussion, the participants indicated that, the school guidelines were ineffective in developing head teacher-parent collaboration for the improvement of inclusive education.

5.3 Teachers' data narratives on usefulness of policies that govern the collaboration

Teacher A felt that, he had nothing to share on usefulness of policies which governed head teachers in collaborating with parents of learners with special needs for the improvement of inclusive education, since he was not aware of the school policies. Teacher B indicated that, he could not talk about usefulness of non-existing policies concerning her school. Teacher C shared that, the policy, "all children should get education from a school near their home", was useful because it gave direction to the head teacher and parents on the right thing to do. The participant explained that, any child had right to be included in regular schools irrespective of his or her differences according to the policy.

Teacher D felt that, the policies were very much useful, for example, placement issues were made clear by the policies. She explained that the policies also clarified the roles of stakeholders in the provision of inclusive education and thus the head teacher knew how to collaborate with parents of learners with special

needs in the implementation of individualized educational programmes (IEPs). Teacher E indicated that, the policies had enhanced head teacher-parent collaboration for the improvement of inclusive education. He explained that, the feeding programme relieved parents from the burden of preparing lunch for their children and that made parents feel closer to the school than before. He also felt that, the programme promoted learners retention in school too. The participant felt that, the guidance and counselling policy provided the necessary impetus to improve on the collaboration.

Teacher F felt that, she could not share about usefulness of the policies that governed her head teacher in collaborating with parents for the improvement of inclusive education since she had not heard of any policies for the school. Teacher G shared that, he was not aware of any policy or its usefulness in the school. Teacher H felt that, the policy, "what we agree," was not very useful due to negative attitude of the head teacher and parents of learners with special needs. He felt that, the policies "on what we agree" could be very useful if the negative attitude issue was addressed. This implies that, negative attitudes of the school stakeholders could be a barrier towards the implementation of policies. The teachers agreed with the head teachers that, the school policies were useful. Their focus group discussion however indicated that, despite the informal policies being useful, head teacher-parent collaboration had made negligible developments in improving inclusive education due to ineffectiveness of the policies for the collaboration. Nevertheless, one teacher seemed ignorant like the parents, who could not identify the usefulness of the policies. This implies that, there was need of bringing the parents and some teachers on board on school guidelines. They needed to be sensitized on school policies.

The findings revealed that most of the policies were useful. They enhanced head teacher-parent collaboration for the improvement of inclusive education. Some participants could not discuss about the usefulness of the policies since they knew nothing about the policies. Most of the participants, especially the parents and the teachers, were ignorant and unaware of policy issues. The findings indicated that, some participants were not able to share on the usefulness of policies which guided head teacher-parent collaboration in raising IE status, since the policies did not exist in the schools, in the context of the participants' experiences, understanding and interpretations. This implies that, policies were not accorded seriousness in the schools. The results differed with study findings of Hunter (2004), Kalabula (2007) and UNDP (2015), who reported that, the seriousness accorded to the international policies by individual countries like England, Germany, Denmark, Norway, Iceland, USA and Canada, have modified schools, according to policies, in ways that extend their capacity to respond to diversity.

6. Conclusion

Most of the policies were informal, but, useful. They enhanced head teacher-parent collaboration for the improvement of inclusive education. However, most of the participants especially the parents and the teachers were ignorant and unaware of the usefulness of policies which guided head teacher-parent collaboration in raising IE status. Policy issues were not taken seriously in the schools. This contributed to minor enhancement on head teacher-parent collaboration for the improvement of inclusive education.

7. Recommendations

The government should formulate clear inclusive education policies, with implementation support systems, and induct all the school stakeholders on their implementation. It should create awareness about inclusive education to all stakeholders and also increase support in promoting the inclusion. It should be more serious in offering and treating inclusive education as a normal practice. Further researcher should be carried out to establish the usefulness of the policies in public secondary schools.

8. REFERENCES

Bloomberg, D. L. & Volpe, M. (2008). *Completing your Qualitative Dissertation: A Roadmap from Beginning to End*. London: Sage.

Lindqvist, G. & Nilholm, C. (2013). Making Schools Inclusive? Educational leaders' Views on How to Work with Children in Need of Special Support. *International Journal of Inclusive Education,* 17(1), 95-110.

Creswell, J. W. (2007). *Qualitative inquiry and research design: choosing among Five approaches*. Thousand Oaks, CA: Sage Publications.

Creswell, J.W. (2009). *Research design, qualitative, quantitative, and mixed methods approaches.* London: Sage Publication.

Denzin, N. K. & Lincoln Y.S. (2005). *Landscape of qualitative Research, theories and issues, The Sage handbook of qualitative research*. London: Sage Publications.

Göransson,K., Nilholm, C.& Karlsson, K.(2011). Inclusive education in Sweden? A critical analysis. *International Journal of Inclusive Education*,15(5),541-555.

Hunter, S. (2004). The methods of educating special needs children in the public school system have undergone dramatic changes in recent years. *Valley Gazette*. Retrieved from http// www. zwire.com/site/news.cfm.

Kalabula, D. M. (2007). *Special Education in Zambia*. Lusaka: Musumali Press.

Levin, H. M. and Lockheed, M. E. (1993). *Effective Schools in Developing Countries*. London: Falmer.

Meru County Director of Education Office (2016). Statistics. Meru County Director of Education Office.

Norwich, B. & Nash, T. (2011). Preparing teachers to teach children with special educational needs and disabilities: the significance of a national PGCE development and evaluation project for inclusive teacher education. *Journal of Research in Special Educational Needs,* 11(1), 2-11.

Szwed, C. (2007). Reconsidering the role of the primary special educational needs co-ordinator: policy, practice and future priorities. *British Journal of Special Needs*, 34(2), 96-104.

UN (1948). *Universal declaration of human rights*. New York: United Nations

UNDP (2015). Sustainable Development Goals. New York: Author.

Factors Involved in Evaluating Health Services and Products

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Abstract

Health services and products are of paramount importance at reforming and improving the performance of health system. The evaluation of health services and products should be based on the therapeutic needs of the health care system. This paper focuses on the factors involved in evaluating health services and products. Various ailments /indications, definitions and products recommendations were identified and some factors for evaluating various health products and health services were also reviewed. The individual, community, government, health care givers or professionals and the general public were advised to be equipped and guided by these factors involved in evaluating health services and products in other to achieve sound physical, mental, emotional and social well being. Claims about health products can be persuasive and misleading. This paper has been designed to help individual, community, health care givers or professionals, government and the general public learn to evaluate information about health products, especially those that target the youth market. Thus health servicesand products are those self growth tools for those seeking to improve their health and wellness through herbal supplement, over -the-encounter drugs, mental enrichment, and physical fitness product (such as exercycle exercise), arthro-aquatic fitness system, treadmills, total-body elliptical cross-trainers, wheel chair bike. These groups of people highlighted above are consumers of a range of health products and services throughout their lives, hence, it is important that they gain the knowledge and skills to select and evaluate those that will best meet their health needs.

Key words: Factors, Evaluating, Health, Services, Products.

Introduction

In light of scientific and technology advancement, it is not surprising that many people believe that health is purchasable. The health market place abounds with products of every description to accommodate people's desire [1]. Factors involved evaluating health services and products are vital to the efforts directed at reforming and improving the performance of Health system [2]. Health services and products are essential self growth tools for those looking to improve their Health and wellness through physical fitness, herbal supplements and mental enrichment [3]. Evaluating health services and product plays vital roles such as, assuring the delivering of a high quality services and products; serving as a tool for monitoring care and controlling costs; promoting accountability for public and private programmed expenditures [4].

Factors for evaluate health services and products helps to increase professional health worker's knowledge of selected research findings and theories so that they may better understand why and under what conditions people take action to prevent, detect and diagnose disease [5]. Hence the individual has become consumers of a range of health products and services throughout their lives, it is important that they gain the knowledge and skills to choose those that will best meet their health needs. Claims about health products can be persuasive and misleading [6]. This paper has been, designed so that people can learn to evaluate information about health products and services, especially those that target the youth market.

Some factor has been reviewed in this paper to equip and increase awareness among individuals, government and professional health workers in evaluating health services and products that are preventive, curative, promotive, and rehabilitative service. Factors on the other hand can be regarded as issues, influence, features, aspect, reason, cause, dynamic, element, things, consideration circumstance, component, part or component that has to be considered in evaluating health services and products [7][8].

Evaluation is the collection of vital information to measure the relevance, progress, efficiency, effectiveness and impact of a programmed or project against set objectives [9]. Clement and Thomas [10] observed that, evaluation is a means by which a programmed, services, or a success in reaching predetermined goals. Evaluation are done for variety of purpose, to improve the delivery of care, to test an innovation, to determined the effectiveness of continuing or altering an intervention, or to compare health system effectiveness across nations [10].

Park [11] further noted three types of evaluation to include:

- Evaluation of "structure**":** This is evaluation of whether facilities, equipment, manpower and organization meet a standard accepted by experts as good.
- Evaluation of "process": This process of medical care includes the problems of recognition, diagnostic procedures, treatment and clinical management, case and prevention.
- Evaluation of "outcome": This is concerned with the end results, that is, whether persons using health services experience measurable benefits such improved survival or reduced disability.

Within the context of this paper, evaluation is the collection of vital information to measure the relevance, progress, efficiency, effectiveness and impact of health services and product. Service on the other hand refers to an individual, government or private organization that is responsible for a particular type of activity, or for providing a particular health product or health services that people need [12]. Service

delivery systems also consider the whole spectrum of care from promotion and prevention to diagnostic, rehabilitation and palliative care, as well all levels of care including self-care, home care, community care, primary care, long-term care, hospital care, in order to provide integrated health services throughout the life course. WHO is supporting countries in moving towards universal health coverage through improving the efficiency and effectiveness of their health service delivery systems.

WHO [13] defined health as a state of complete physical, mental, and social well-being of an individual, not merely the absence of disease or infirmity? Health is a qualifying factor for living [14]. The health of an individual is the sum total of a number of factors ranging from environmental, socio-cultural, political, genetic and behavioural, to health services [9]. Health services are those services that are and can be rendered within the communities by community care givers or health professionals [15]. These services are part of the primary health care programmes that are preventive, promotive, little bit of curative, rehabilitative and environmental health Services [15]. They maintained that services are rendered by community organizations working in the health sectors under the supervision of the health officials. Within the context of this paper, health services refer to the sum of all the units that deals with the heath and disease of members of a community. The units included medical care services, public care services, health education, health promotion, research, preventive and curative health services as well as traditional health services.

Welfare Information Gateway [16] has noted the following types of health services as important for children, youth, and families. These includes: dental health services; Early and Periodic Screening, Diagnostic, and Treatment (EPSDT) services; HIV/AIDS care; American Indian health services; prenatal care; teen pregnancy prevention; and Women, Infants, and Children (WIC).

Factors involved in Evaluating Health Services

Park [11] has noted the following components of evaluation process:

Relevance: Relevance or requisiteness relates to the appropriateness of the service, whether it is needed at all [17]. If there is no need, the service can hardly be of any value. Example, vaccination against small pox is now irrelevant because the disease no longer exists.

Adequacy: It implies that sufficient attention has been paid to certain previously determined courses of action. For example, the staff allocated to a certain programmes may be described as inadequate if sufficient attention was not paid to the quantum of work-load and target to be achieved.

Accessibility: It is the proportion of the given population than can be expected to use a specified facility, services, etc. The barriers to accessibility may be physical (e.g. Distance, travel, time) economic (e.g.travel cost, feel charged), or social and cultural (e.g. cast or language barrier) [1984].

Availability: The percentage of the population to whom the services or intervention is available or designed for needs to be put into consideration [11].

Acceptability: Services are directly and permanently accessible with no undue barriers of cost, language, culture, or geography. Health services are close to the people, with a routine point of entry to the service network at primary care level (not at the specialist or hospital level). Services may be provided in the home, the community, the workplace, or health facilities as appropriate. Alderson and Robin [19] observed that

the services provided may be accessible, but not acceptable to all, e.g. male sterilization, screening for rectal cancer

Effectiveness: It is the extent to which the underlying problem is prevented or alleviated. Thus it measure the degree of attainment the predetermined objectives and targets of the programme, service or institution-expressed, if possible, in terms of health benefits, problem reduction or an improvement of an unsatisfactory health situation. The ultimate measures of effectiveness will be the reduction in morbidity and mortality rate [13].

Efficiency: It is a measure of how well resources (money, men, material and time) are utilized to achieved a given effectiveness [20]. The following examples will illustrate thus, the number of immunizations provided in a year as compared with an acceptance norm, the percentage of bed occupancy, cost per day in hospital, cost per patient treated, [21].

Impact: It is an expression of the overall effect of a programme, services or institution on health status and socio-economic development for example, as a result of malaria control in Nigeria, not only the incidence of malaria control in Nigeria, nor only the incidence of malaria dropped down, but all aspects of life-agricultural, industrial and social improvement [22].

Other factors involved in evaluating health services as identified by Cochrane [21]; Aral and Peterman [23]; WHO, [24]; WHO [25] and Harrison, et al [26] is as follows:

- **Comprehensiveness:** A comprehensive range of health services is provided, appropriate to the needs of the target population, including preventative,curative, palliative and rehabilitative services and health promotion activities.
- **Coverage:** Service delivery is designed so that all people in a defined target population are covered, i.e. the sick and the healthy, all income groups and all social groups.
- **Continuity:** Service delivery is organized to provide an individual with continuity of care across the network of services, health conditions, levels of care, and over the life-cycle.
- **Quality:** Health services are of high quality, i.e. they are effective, safe, centered on the patient's needs and given in a timely fashion.
- **Person-centeredness**: Services are organized around the person, not the disease or the financing. Users perceive health services to be responsive and acceptable to them. There is participation from the target population in service delivery design and assessment. People are partners in their own health care.
- **Coordination:** Local area health service networks are actively coordinated, across types of provider, types of care, levels of service delivery, and for both routine and emergency preparedness. The patient's primary care provider facilitates the route through the needed services, and works in collaboration with other levels and types of provider. Coordination also takes place with other sectors (e.g. social services) and partners (e.g. community organizations).
- **Accountability and efficiency:** Health services are well managed so as to achieve the core elements described above with a minimum wastage of resources. Managers are allocated the necessary authority to achieve planned objectives and held accountable for overall performance

and results. Assessment includes appropriate mechanisms for the participation of the target population and civil society.

Health Product

Product is a thing produced during a natural, chemical or industrial process [27]. Natural Health products [28] stated that product may be used as part of a meal or taken to replace a meal. Health product is a product or substance of nature that provide the nature the nutrient such as carbohydrate, protein , Dietary fiber, vitamins and minerals which contribute to normal health diet [29]. Health product is those product or substance of food nature that provide the nutrients such as carbohydrate, protein, dietary, fiber, vitamins and minerals which contribute to normal health diet [3]. Exercise product provides people with a practical learning experience in product benefit segmentation [30]. According to Rishma Walji [31] the following natural health product were highlighted as: Vitamins and minerals; Herbal remedies; Traditional medicines; Probiotics that is substances containing beneficial microorganism. Other products like amino acids and essential fatty acids. Natural Health product must be safe for consideration, as over-the-counter drugs are not requiring a prescription to be sold. Product requiring a prescription will continue to be regulated under the food and drug regulations [32].

The health product may be used as part of a meal or taken to replace a meal [30]. Example of products that can be taken as part of a diet includes: Energy food; essence of chicken/dunk/fish; herbal teas and drinks for general regular consumption; wine or vinegar drinks containing herbal ingredient commonly used in food. Merk [33] spelled out the following product that can be taken for a medical purpose to include: Singular, this is a prescription medicine that blocks substance in the body called leukotrienes. It does not contain a steroid. It prevents exercise induced asthma in adult and children; Tradition Indian medicines; Chinese proprietary medicines; Western pharmaceutical drugs (e.g. Synthetic Caffeine, Aspirin).

Product that can be taken for nutritional or functional benefits, particularly for specific nutrient deficiencies or in terms of stress when normal includes: Garlic (alluim sativum) extracts e.g. oil and allicin; Ginger (zingiberofficinallis) extracts e.g. oils; Omega-3 or omega-6 oils e.g. Eicopentaenoic acid (Epa); Soya bean isolates; Amino acid e.g. Leycine, methionine; Tea tree extract and wild yam extracts.
Durable Medical Equipment [34] describes product for exercise as shown in table 1 below:
Table 1.

PRODUCTS	DEFINITIONS	MANUFACTURER
Facial-flex	Product for flexibility, to move or tense a muscle, Or become tense or contracted.	Facial-flex corporation
Tread mills	Exercise machine with an endless belt on which somebody can walk, jog or run, use for Exercise and stress testing.	Lifefittness.com.
Exercycle Exerciser	**An apparatus for physical fitness**	**Exercycle corporation**
Kneel/ankle mobilier	Machine used for movement of ankle/knees.	Hayes kam systems
Exercise bike	Exercise machine in the form of a stationary bicycle that is pedaled vigorously for exercise.	

Total body Elliptical	An exercise machine	Lifefitness.com
Cross-Trainers	Intended to develop many group of muscles.	
Wheel chair Bike	Life cycle exercise bike.	Chiefs manufacturing company
Motorized bicycle exercise Trainer	An exercise machine in the form of stationary bicycle that is pedaled for exercise	Lifefitness.com

Table 2: This Table below According to Vital Health food show a guide for selecting health services and products, Recommendation of various Ailments/indication "Vital Health food" (www.Vital.com).

Ailment	Definition	Product Recommendations
Acne	Acne is a common skin disease characterized by pimples on the face, chest, and back. It occurs when the pores of the skins become clogged with oil, dead skin cells and bacteria.	Multiline Hair, skin and nails, vitamin A&E, Vitamin E. Zinc, selenium complete, Garlic, Garlic & parsley, odourless Garlic Brewer's yeast.
Ageing	Ageing is associated with a slowdown in regeneration of body cells, Resulting in a gradual degeneration of body tissues. Poor blood circulation, .wrinkling of skin and graying of hair are typical physical characteristics.	Multiline over 60's, multiline Eyes, Vitamin E, calcium, complete, selenium complete Ginkgo Bibola, omega 3 concentrate
Bladder	Bladder problems include cystitis, which is caused by a bacterial infection of the bladder. Resulting in a burning sensation while urinating.	Multitime woman, Bunch, zinc, Garlic & parsley odorless Garlic, kelp, Antioxidant.
Blood circulation	The heart is responsible to pump blood throughout the body, so that it circulates through all tissues and organs. Poor circulation is often caused by smoking cigarette, but is also associated with ageing and heart disease.	multitime heart, vitamin c, vitamine, folic complete, garlic, garlic & parsley, odorless garlic,ginkgo biloba, omega 3 & 6 concentrate, lecithin, antioxidant, evening, primrose oil
Bone Health	Calcium is the main structural mineral in bones and teeth. Calcium balance is maintained by in taken of sufficient calcium and supporting nutrient such as magnesium and vitamin D	Calcium complete , dolomite, multitimemenopausal women, magnesium
Candida	Candida albicans is a fungus naturally found in the body. Under certain circumstance, an overgrowth of Candida can result in vaginal thrush or Digestive complaints such as bloating	Brewer's yeast, vitamin B complex, maxi B, zinc, selenium complete, garlic, garlic & parsley odorless Garlic, Herb time immune system (Echinacea), Buchu.
Cholesterol	Cholesterol is a fatty substance present in the blood, which in high levels can increase the risk	Multitime Heart, Garlic, Garlic & omega 3, salomn oil vitamin C, vitamin E maxi B , folic lecithin omega 3 concentrate.

	of heart disease by compromising blood circulation.	
Cold & Flu	Cold and flu are caused by viruses which infect the respiratory system, resulting in symptoms such as fever, blocked sinuses, catarrh, coughing sore throat and body aches.	Vitamin C, Vitamin A & D, Emulsion, zinc, selenium complete, viral Boost , Herbal time immune system (Echinacea), Garlic, Garlic & parsley, odorless Garlic, cod-liver oil, Garlic omega 3
Pre-menstrualTension	Pre-menstrual tension is caused by the hormonal fluctuations in the week before the one set of the menstruation. symptoms include breast tenderness, mood swing, and irritability and skin breakouts	Multitimewomen , vitamin B& 6 magnesium, Ginseng, Evening primrose oil, omega 3&6 concentrate
Concentration & Memory	The brain, aspart of the nervous system, is responsible for memory and concentration may be caused by stress, being overworked, insomnia; fatigue, ageing or certain medical conditions	Herbtime memory & contraction (Ginkgo biloba), Ginkgo Biloba, vitamin C large multiboost, kids time focus, vitamin E ,vitamin B complex, maxi B , lecithin, salmon oil, omega 3 concentrate.
Constipation	Constipation is characterized by a reduced frequency in bowel movements and difficulty in passing dry, hard stools.	Bio-fiber, colon complete, muesli, maxiB , magnesium, kelp , Brewer's yeast, Green tea, Rice, cakes
Cramps	Muscle cramps often occur during strenuous exercise, in which case they may be caused by the severity of the exercise, or by nutritional imbalances. Night time muscular cramps in the elders may be caused by deficiencies in calcium and magnesium.	Dolomite, calcium complete, molasses, vitamin B complex,Maxi B, vitamin C, vitamin E, salmon oil, Brewer's yeast, omega concentrate
Dry skin	Skin moisture is dependent on sufficient intake of skin nutrients such as vitamin E, omega 3 and omega 6 fatty - acid. dry skin can be aggravated by exposure to wind, sunlight and very cold or hot air	Vitamin E, multi-time Hair, skin & nails, omega 3 concentrate, wheat Germ oil, salmon oil , Evening primrose oil
Eyes	Optimal nutrient is essential for the maintenances of health eyesight, especially through the developmental childhood years and also with ageing	Multi-time Eyes, vitamin A&D, over 60', zinc, selenium complete Beta carotene, cold liver oil, omega 3 concentrate, Antioxidant

Fatigue	Fatigue is characterized by the feeling of low energy levels persistent tiredness, and inability to perform normal tasks. Fatigue is typically a symptom of being overworked, loss of sleep or medical disorder	Vitacharge, vitacharge multi boost, vita charge fizzy, vitamin B complex, magnesium, iron , ginsengs, Alfalfa, Antioxidant, green Tea, Day break Tea
Weight management	Slimming or weight loss is usually an attempt to loss excess body fat and is facilitated increasing energy outputthrough exercise, as well as reducing in dietary intake.	Fat Burner, vital-slim capsules & vita-slim shakes, Apple cider Diet, Buchu, Kelp, vitamin B complex, maxi B, multitime women, multitime adults.

Table 3: **This table indicates other Ailment/Indication and Product Recommendations**

Ailment/ indication	Definition	Product Recommendations
Hair	Health hair requires sufficient intake of variety of essential vitamins, mineral and essential fatty acid. The condition of Hair is effected by nutrition, hair products, environment etc.	Multitime Hair, & vitamin A & D, vitamin B complex , maxi B, folic complete, Dolomite magnesium, zinc, Brewers, yeast, cod hair oil, salmon oil omega 3 concentrate.
Menopause	Menopause represents the end of reproductive cycle of a woman, which is characterized by cessation of menstrual cycle with accompanying symptoms such as mood swings, irritability, mild depression, insomnia and hot flushes.	Multi-time menopausal women, maxi B, vitamin B 6 & magnesium, calcium complete, Herb time mild Depression (st john worth) Evening primprose oil, omega 3& 6 concentrate.
Pregnancy	Optimal nutrition during pregnancy will optimize the healthy development of the baby, while preserving nutrient stores of the mother	Multitime pregnant women, calcium complete, omega 3 concentrate, vitamin B complex, maxi B, vitamin C, folic complete , magnesium , iron, zinc, salmon oil , Brewer's yeast.

Retrieved from http://www.vital.co.za/index.php

Factors Involved in Evaluating Health Product

Angela [35] indentified the following factors and method to be used in evaluating health product:

- Is the health product effective for health condition
- What are the health benefits?
- Cost-effectiveness: Does the health product contain ingredients safe for human use and consumption?
- Is the health product reasonably priced?
- Are you getting value for money in purchasing the health product?
- Are there other similar and more affordable health products that guarantee the same results?

- Is the health product Safe for Consumption?
- Who can use health product and who cannot use it?
- How much or how many of the content can be used or consumed?

Obionu [36] further identified other factors to be included in evaluating healthproduct as follows:

- The product should be based on the therapeutic needs of the health care system of the individual's communities.
- The drug must be proven efficacy and safety.
- Side effect must be minimal,
- The quality and availability of dosage form should be assured,
- The dosage form should have reasonably long stability under the expected conditions of storage
- Tablets should be preferred to syrups and solutions because they can keep better.
- The drugs should be in generic names as much as possible
- They must be financially affordable.

According to Babalola [37] exercise product evaluated should help to enhance the following:

- Aiding circulation
- Increasing red corpuscles and hemoglobin
- Aiding the removal of waste from tissue
- Strengthening the muscular system
- Aiding digestions
- Improving mental health
- Improving the heart -regulating mechanism
- Facilitating relaxation and sleep.

Summary

A major point of emphasis is factors involved in evaluating health services and products. These factors are essential to the effort directed at reforming and improving the performance of health system. This has been reviewed in this paper together with various health product and services to equip and increase awareness among individuals, professional health workers and government at all level in evaluating health services and product that are preventive, promotive, curative and rehabilitative. Hence, Individuals, communities, government, health care givers or professionals and the general public were urged to be guided by these factors involved in evaluating health services and product in other to achieve sound physical, mental, emotional and social well being.

Conclusion and Recommendations

Health services and product are necessary for those seeking to improve their health and achieve wellness through physical fitness, herbal supplements and mental enrichment. Taking cognizance of those factors involved in evaluating health services and products as stated in this paper will serve as a remedy to the menace involved during selection of various products. Based on this, the following recommendations

were made:

- The Individual, The Government at all level, Health care givers or professionals should take cognizance of various factors involved in evaluating health services and product to ensure better preventive, promotive, curative and rehabilitative of health systems.
- That the individual communities, society and general public should be guided by those factors reviewed in this paper so as to enhance wise evaluation of each product.
- The individual communities, professional health workers or community health care givers should be guided by the national agency for food and drug administrational and control law in evaluating health services and product.
- The government at all level, health care givers or professionals, individuals, communities and society were urged to take cognizance of the NAFDAC numbers, manufacturing date and the expiration date.
- Policy makers should enact laws regulating standard of the environment in which product is manufactured, processed, packaged, stored, produced and sale, to avoid food or products contamination

References

[1] Larkin, M. "Confession of a former women's magazine".2000, pp.26.. Retrieved from http://www.nutri.watch.com

[2] Denise, M.O. "*Epidemiology and the delivery of health care services: Method and appliances"*. USA: Springer us.2007.

[3] Vijaya, N. *"The official self growth guide to Health product and services"* 2009. Retrieved from http://.Selfgrowth.com/experts/html

[4] Oleske, D.M. "*Epidemiology and the delivery of health care services: Methods and Applications"*. New York: Springer. 2009.

[5] Kasl, S.V., & Cobb, .S. "Health behaviour". *Unpublished manuscript available at the Institute for Social Research,* University of Michigan. 1999.

[6] Stephen, F. "*Evaluating health products"*. The State of Queensland. The Office of the Queensland School Curriculum Council. 2000.

[7] Redmond,W.A. "*Microsoft students with Encarta premium*: Microsft Corporation, 2008.

[8] Thesaurus. "*Encarta Dictionaries".* Microsoft Corporation [DVD], 2008.

[9] Olise, P.O. "*Primary health care for the sustainable development"*. Abuja: Ozege publishers, 2007.

[10] Clement, D.G., &THomas , T.H. (eds.) "*Epidemiology and the delivery of health care services"*. New York : Springer, 2002.

[11] Park, K.(Eds.). "*Preventive and social medicine"*. India: BanardsidaBhanot publishers, 2007.

[12]Pearson, E.L., *Longman Dictionary of contemporary English: The living dictionary*.(4th.ed.).England: India, 2005. Also available www.Longman.com/dictionary/support

[13] WHO., *Health for all*.WHO:Geneva.(6). 1971.

[14] Onuzulike, N.M., *Health care delivery systems*. Owerri: Megasoft Publishers, 2005.

[15] Community Based Health services Package. "*Community care Giver Packages per Programme".(*Draaft 1). 2009.

[16] Welfare Information Gateway. About CAPTA: A legislative history". Washington, DC: U.S. Department of Health and Human Services, Children's Bureau. Child, 2017.

[17] Abramson, J.H., *Survey methods in community medicine*. U.S.A: Churchill Livingston, 1979.

[18] WHO. Health Planning and management glossary. New Delli: Health Papers, 1984.

[19] Alderson, M.R., and Robin, D. (1979). *Health surveys and related studies*. London: Pergamum Press.

[20] Cochrane, A.L,. *Effectiveness and Efficiency*. London: Nuffield provincial Hospital Trust, 1972.

[21] Deniston, O. L., *Public Health Reports,* 2000. pp 83:603.

[22] Knox, E G., *Epidemiological health care planning*. 1979. Retrieved from Oxford University database

[23]Aral,S.O., and Peterman, T.A. Measuring outcome of behavioral intervention for STD/HIV prevention. *International Journal AIDS/ & STD*, 1996. vol. 7 (2), pp. 30-38.

[24] WHO. *Risk and Protective factors affecting adolescent's health and development*. Geneva: WHO/FCH/CAH/00.20, 1999.

[25] WHO., *Issues in health services Delivery: Improving provider skills*. WHO/E.p/OSD/00.1., 2000.

[26] Harrison, P.A., Beebe, T., and Park ,E., The adolescent review. A brief multidimensional screening instrument. *Journal of Adolescent Health*, 2001. (29), 131-139.

[27] Welmier-Weitz, A., Reddy,P.,Van de Born, K.G., and Pieter, S.J., The determinant of health care seeking behavioural of adolescents attending STD clinics in South Africa. *Journal of Adolescence*. 2000, (23)741-91.

[28] Natural Health Products. "*Proactive disclosure: Drug and health products"*. Canada. 2009. Retrieved from http://www.selfgrowth.com/healthproducts.html

[29] Stacey, A. P., An audit of health products and services marketed on chiropractics. *Journal of the Canadian Chiropractics Association*. Albert: 2009, 51(2),91-98

[30] George,G.J., Russel, I.H., and Taylor, J.S., *Exploring experiment learning simulations and Experimental exercise.*1998, Vol.5 Retrieved from Wright State University Database.

[31] Rishma Walji, ND, RAc, Educational module: Introduction to natural health products, NHPs., 2014 Retrieved from ***https://www.healthkey.tv/***

[32] Health Canada. *Natural health product,* 2004. Retireved from http://www.hc.gc.ca.

[33] Merck,C.I., [White house station]. USA: Merk Sharp &Dolume crop. 2010.

[34] Durable Medical Equipment Medicare Administration contractors. Code for exercise, 2007.Retrieved from http://www.dmepdac.com/dmecsapp/do/serch.

[35] Angel, C., Criteria for evaluating health products. 2015. Prezi Classic Support Inc.

[36] Onionu. C. N., Primary health for the developing countries.(2nd ed.). Enugu: Evanseens Printing and Publishing. 2001.

[37] Babalola, J.F., Effects of sleep deprivation on selected physiological performance variables of college men. *Unpublished Doctoral Thesis,* University of Ibadan, Nigeria, 1987.

Adding Walls: Awareness of Street Art for Critical Literacy in Ras Beirut

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Abstract

This study investigates Grade 10 English teachers' awareness of place and street art in two schools' learning environments in Ras Beirut, Lebanon. Overall, this study aims to demonstrate the gap in and need for teaching critical literacy and advocates street art as a multimodal text to accomplish this. This research employs mixed methods in multiple case studies to address research questions. Teachers were given a mapping activity to gauge awareness and a follow-up semi-structured interview was conducted. This study engages with literature from fields of street art, place-based learning, multimodality, critical literacy, and teacher identities to create a theatre in which to advocate using street art for critical literacy pedagogy. These fields of literature then shaped a discussion, which ultimately revealed low awareness of place and street art and a need for richer cultural connections with place for both students and teachers.

Keywords: street art; critical literacy; multimodality; place-based learning

1. Introduction

This research questions how aware English language teachers are of immediate learning environments in two Ras Beiruti private schools. This study considers teacher understandings and prioritizing of critical literacy. Overall, this study aims to address these research questions as well as advocate the need for teaching critical literacy via local street art as multimodal text in Ras Beirut, Lebanon. This study ultimately aims to demonstrate the aptness of street art for critical literacy and its academic potential as alternative text in the language arts beyond the Lebanese context.

Much of street art connotes political messages and histories. For schools, street art surrounding the learning environment is surrounded by silence, as local political discussions are illegal on school campuses. Political implications are beyond the scope of this study. Rather, implications for critical literacy are explored. Also beyond the scope of this study was a discussion of languages and linguistics in street art, as they reflect political power dynamics. This study included six Grade 10 English teachers in two private schools in Ras Beirut (one of Beirut's twelve quarters) where English is a first language. The schools exist in the same learning environment and have roughly similar curricula, allowing teachers' awareness and opinions to be studied in relatively comparable conditions. Only street art in the immediate vicinity was included in the survey of the schools' learning environments.

2. Literature Review

Graffiti is usually perceived as menacing, criminal and corruptive due to its illegal and rebellious nature. Some graffiti, especially spraying a name or insignia to mark territory (tagging) is considered vandalism. However, street art challenges graffiti's condemnation (Randazzo & Lajevic, 2013). When tolerated by police and loved by community, graffiti is produced without time limits, birthing intricate and evocative street art (Shaw, 2009). Street art is graffiti that is planned and meaningful, often for a specific initiative and theme. Four bodies of literature pertinent to this study are:

- learning environments,
- street art,
- multimodality and
- critical literacy.

Each theoretical field frames its successor, interlocked by demonstrating the pedagogic value of street art as multimodal text in learning environments that can significantly foster critical literacy. Political and defacing graffiti will not be considered, as they are not advocated or appropriate for the setting of this research.

2.1 School Learning Environments

All schools exist within distinct environments where the immediate neighbourhood is most influential upon student learning (Beames, Higgins & Nicol, 2012). Design factors manifested in learning environments subtly infiltrate everyday linguistic choices of teachers and students (Marquez-Zenkov, 2003). In such ways, texts enveloping school environments permeate consciousness and inform learning (Cotton, 2011). If raised to consciousness, all types of print in local environments are highly stimulating to learners. This print is socially positioned, with a reader, writer, context, and purpose delivered through specific media. Studying environmental print involves noticing and questioning these factors as well as analyzing their effects (Cotton, 2011). Linguistically, educational settings can be made more effective by noticing environmental print (Makin, 2003).

Although defined as learning environments, schools offer contained settings that consistently fail to connect with students' life experiences (Austin, 2007). Meaningful connections compound learning. Accordingly, neglected realities of students' lives should be discussed in classrooms, as authentic environmental material has undeniable pedagogical value (Freire, 1998). Neglected and excluded material, subjects, approaches, and locations are known as the 'null curriculum' (Ahwee et. al., 2004). Limited understanding, welling from limited material, hinders developing an entire society's knowledge and skills (Shirley, 2007). Aspects of learning environments included in the null curriculum require pedagogic involvement as local literacies illuminate intricate relations with and between individuals, words, actions, beliefs, and values (Gee, 2000). Classroom environment is widely acknowledged as vital to learning, but effective and creative teaching opportunities can also be pinpointed outside school in the immediate landscape (Haslam, 1971). Schools traditionally view local environments as impenetrable, static, and

removed from learning experiences. However, this alienates students from locality (Stone, 1989). Indeed, most environments, regardless of potential stimulation, become invisible with repeated exposure (Jarvis, 2009). Subsequently, even when open to incorporating the local environment into classrooms, most potential learning opportunities outside school are rarely noticed or questioned. Making the familiar strange redefines pedagogy and makes learning more engaging (Albers & Harste, 2007).

Noticing which languages and how they occur in local settings provides insight into cultural identities of students and their formation (Cotton, 2011). Furthermore, providing positive literacy environments across student life is hugely important to successful reading (Makin, 2003). In truth, literacy practices go beyond classroom walls. Moving beyond classrooms transcends formal and informal teaching methods, assisting student participation and integration into culturally valued community activities and multiple literacies of everyday life (Larson, 2006). Inherently unique and authentic learning environments are vital to developing all senses and multiple intelligences through integrated means impossible within classroom constraints (Beames, Higgins & Nicol, 2012).

As well as placing local environments in classrooms, constructing classrooms in local environments can also constitute teaching material. Place-based learning (PBL) is one pedagogic method that embeds education in local phenomena and culturally relevant student experiences facilitating inquiry-based learning (Smith, 2002). Accordingly, PBL emphasizes the familiar but not necessarily the understood (Beames, Higgins & Nicol, 2012). Although traditionally envisioned in green spaces, PBL is ripe for and equally applicable in urban settings (Nicol, personal interview, May 9th, 2014). However, prior to planning and engaging in PBL, teachers must develop awareness of various locations where learning experiences can occur. (Wurdinger & Carlson, 2010). Implementing this innovative approach can revitalize teachers and students, raising levels of learning, enthusiasm, and motivation to optimal levels. It is important to realize awareness is only a prerequisite to effective PBL. Teacher willingness and initiative are crucial to responding to learning opportunities beyond classroom walls (Sobel, 2004). One learning opportunity manifested outside classrooms is street art, which will now be explored.

2.2 Street Art

Street art is firmly entrenched in social mainstreams, yet remains isolated from institutionalized structures (Rafferty, 1991). Research shows that when street art is brought within a social mainstream its preservation is vigorously defended (Shaw, 2009). Accordingly, if street art is a valued and recurring cultural phenomenon, maximizing its pedagogic value should be advocated. Although often overlooked, street art inherently promotes lingering, reflection and interaction (Shaw, 2009). These innate effects have massive educational implications and can contribute to developing critical reflective learners engaged in current local issues (Halsey & Young, 2006).

Through street art, decaying urban areas are vividly transforming, ultimately creating sociocultural spaces promoting freedom of expression and intentionally instigating public discussions about local issues (Cotnam-Kappel, 2014). Hence, studying street art has academic value as it is a platform where community members purposefully converse, reflect, and act (Iddings, 2009). Knowing how and why street art was introduced into public space enhances awareness, appreciation, and enjoyment of message (Miles, 1989).

For this reason, if street art appears from an external culturally irrelevant source, its importance and reactive qualities diminish (Shaw, 2009). This phenomenon was observed with the work of Chilean artist INTI in Beirut, which will be later discussed. Street art as PBL can overcome learning bubbles, as although street art is local, it reflects global concerns. Thus, through street art, local places and global issues are connected and made relevant to students as developing citizens of the world.

Language is the core of street art (Cotnam-Kappel, 2014). Gilmore defines language as any communication conveying a genuine message (2011). Thus, even when unaccompanied by words, street art is an example of language and text. As text, street art has a wealth of daily engaged readers who automatically form connections between the art and life. Street art significantly affects communities as a product of them, for them and addressing them, contributing to developing language, culture and politics (Cotnam-Kappel, 2014). Hence, street art is authentic text. Especially when visually focused, using authentic text in classrooms has been widely acknowledged as motivational and highly effective in developing students' receptiveness to new vocabulary aiding comprehension. Furthermore, authentic material should be rich and accessible to students (Gilmore, 2011). Street art meets all these criteria. As text incorporating words and images, street art will now be considered and explored as multimodal text.

2.3 Multimodality

Conceptually, written language is being displaced from its previously unchallenged dominant position, but not replaced. Multimodal texts characteristically consist of numerous pathways conveying information, encouraging extensive cross-referencing and transmitting evocative graphics extending meaning (Hasset & Curwood, 2009). Multimodal texts are not simply exposed to students in classrooms. Children grow up in highly multimodal environments where streets, homes, and schools are submerged in texts that blend picture, sound, and words (Bearne & Wolstencroft, 2007). Young adults are increasingly consuming and producing texts, learning from surroundings (Vasudevan, 2007). However, these literacies are often ignored by teachers due to perceived distance from academic literacy. In truth, relying on traditional language arts skills when dealing with alternative text is repressive and leads to academic blindness (Chaplin, 1994). Visionary teachers enable students to move fluently between text and image and, in turn, between literal and figurative worlds (Crafton, Silvers & Brennan, 2009).

Blending images, writing, and design elements into multimodal ensembles challenges readers and demands more resources for meaning-making than conventional texts (Youngs & Serafini, 2013). Pictures exist within systems of learned codes, making little sense to anyone without prior knowledge of those culturally ascribed systems (Torr, 2008). Accordingly, students must learn to read pictures as adeptly as words. With practice, students realize all representations are, in fact, re-presentations of reality. This contributes to immunity against being influenced by unquestioned ideologies pervading language.

Comics are multimodal text that emerged from the margins to mainstream in literacy instruction (Jacobs, 2007). Historically viewed as simplified literacy for struggling and lazy readers, comics have been re-conceptualized as complex multimodal texts. Using comics can develop critical readers and, as multimodal text, be wielded to develop critical literacy (Jacobs, 2007). As such, comics can act as a precedent to street art. Street art has immense potential as meaningful multimodal text that can expand

literacy skills and increase student reading range. Visual technologies, like spray paint, and images they convey, such as street art, render worldviews in subjective ideological multimodal terms. In this way, images are not windows or reflections, but interpretations (Rose, 2007). Sensitizing students to semiotics of pictures depicting worlds empowers them to negotiate their own subjectivities (Nodelman, 2005). This frames future critical literacy (Crafton, Silvers & Brennan, 2009).

2.4 Critical Literacy

Critical literacy is the brainchild of Paolo Freire, Brazilian philosopher and teacher (Comber, 2003). Critical literacy arose from dissatisfaction with understandings and teaching of language as neutral. Hence, the notion was born that texts and teaching practices both reflect and sustain class structures in addition to racialized, gendered, and cultural environments (Freebody & Freiberg, 2011). The key to critical literacy is concientization, defined as the process through which students achieve empowerment by deepening awareness and recognizing human intentions, powers and purposes shaping their lives (Darder et. al., 2003) and either assuming its authority or resisting it (Holme, 2004). Freire hoped and advocated that critical literacy encouraged natural movement from reflection to action (Quintero, 2009).

As previously discussed, looking at multimodal texts, such as street art in local learning environments, guides students to criticality and critical reading. Critical reading involves analysis of content presented in text. However, critical literacy extends beyond this by encouraging readers to be suspicious of ways texts might serve interests of groups at disadvantage to others (Mission & Morgan, 2006). Furthermore, critical literacy aids learners to understand that while words are significant, they are also limited. Instead of protecting students from complex socio-political issues, educators should allow students to embrace, examine, and understand them (Larson & Marsh, 2005). Critical literacy fulfills teachers' duty to not represent reality as motionless, compartmentalized, and predictable (Freire, 2003). Critical literacy programs transcend reader-response approaches by devoting attention to semiotics and challenging supposedly natural and authentic reactions to texts. Especially in multimodal texts, looking carefully at images with a critically literate mind involves thinking about what and how visions of social categories are presented (Rose, 2007).

In context of all previous literature discussed, critical literacy is extremely pertinent. Developing critical literacy implies deconstructing everyday texts, of which street art is included (Gruenewald, 2003). Analyzing globalized narratives in local contexts is one way to form critical agents. Students also need exposure to texts critical of dominant value systems (Morrell, 2008). Street art is one such example of text. Although PBL is often removed from urban arenas, cities are often claimed by critical pedagogues (Gruenewald, 2003). Thus, unconventionally merging PBL into urban locations facilitates including critical literacy. Creating situations where students deal with feelings of being manipulated by outside forces should be prioritized, as without such scenarios, students face feeling powerless. Without having a sense of agency, students are unlikely to pose meaningful questions which source learning (Greene, 1988). Stimulating epistemological curiosity, disrupting cultural assumptions with new perspectives, and helping learners make the familiar strange engenders amplified understandings of issues where new visions of reality become available and change becomes possible (Iddings et. al., 2011).

Previously, critical literacy has addressed itself unevenly to pop culture, primarily focussing on mass media (Gibson, 1986). However, art, specifically street art, has academic value in its huge potential to reveal society and be critically read. Art reflects values, injustices, fears, hopes, and socioeconomic relationships (Gibson, 1986). Thus, acting as an informal avenue, street art already instigates critical awareness (Iddings et. al., 2011). When exploited in classrooms, optimal learning of critical literacy can be attained. The process of deconstructing street art in lessons allows students to rebuild and produce meaningful discourses that are socially, geographically, linguistically, politically, and culturally relevant.

In conclusion, environment, multimodality, street art, and critical literacy merge coherently and with concrete pedagogic value. However, a hole in the literature exists in using street art as a text for critical literacy instruction in educational institutions. While street art and critical literacy have both haltingly infiltrated most schools, they have never been conjoined. Moreover, street art has been largely invisible in PBL and as a form of multimodal text.

3. Methods

This work acknowledges multiple realities and aims to explore and examine one facet of the world. How teachers view and interpret the world of street art in learning environments was investigated. Accordingly, a mixed methods design and multiple case studies were selected to carry out data collection. In this research, four pilot interviews were carried out amongst university professors in the United Kingdom. The pilots refined the interview guide and schedule. The mapping tool was also piloted on six students of a local university in the same neighbourhood as the two schools of this study. These pilots indicated the difficulty level of the mapping activity.

A photo-mapping tool was devised and implemented with participants. Tests measure the extent of prior knowledge (Thomas, 2013). In this case, the test was intended to informally measure awareness of street art and general learning environment in Grade 10 English Language Arts teachers in Ras Beirut, Lebanon.The test centred on a map of the school and immediate learning environment with several accompanying photographs of both street art and general landmarks. Teachers were given colour-coded stickers corresponding to photographs which they were required to place on the map as accurately as possible. In this way, mapping provided a lens into ways space is experienced and shaped and how environmental relations are formed and maintained (Gieseking, 2013). Sticker tasks, as used in this study, stimulate maps and are highly suggestive of which information in an environment has been attended to and which were considered irrelevant (Kastens & Liben, 2010).

Six teachers were interviewed and given a mapping activity to complete for this study investigating teacher awareness of street art in learning environments. Due to complex and sensitive factors involving history and politics of the area, no political street art was included in this study. Three teachers from each of two schools in the same learning environment teaching Grade 10 English participated in this study. In each school, two teachers were North American and one teacher was local. Furthermore, two teachers from each school were in their thirties except for one North American teacher in his sixties. Both of the local teachers were female. Thus, teacher demographics for each school were highly similar as are the schools in terms of area and curriculum. For these reasons, teachers will be compared to each other rather than on

a school-wide level. Limitations to this study included some teachers having difficulty with map-reading skills and low spatial awareness. This occasionally led to a teacher correctly identifying an area verbally but being unable to locate it on the map provided. However, this did not greatly affect results as when this was the case, both locations were inaccurate for identifying the pictures shown.

Ethics are crucial to all stages of research where ensuring no harm to any living creature is paramount (Wisker, 2009). This study was extremely low-risk for participants and all participants were able to consent after approval from each school board, headmaster, and principal was granted. As informed consent extends beyond paperwork (Sieber, 1998), virtual communication was maintained after interviews and opened for contact at any point during the study's synthesis. In addition, all participants were made aware of how data would be collected, analysed, and subsequently, destroyed (Thomas, 2013). Although absolute confidentiality is impossible (Christians, 2000), by using pseudonyms and not mentioning place of employment, every effort was made to protect participant identities. All teachers interviewed were questioned about Language Arts teaching, PBL, and street art. Interviews were transcribed and coded with fine-grained analysis and a second reader to refine and validate findings.

4. Findings

After analysis, themes centering on criticality, place-based learning (PBL), culture, tailoring instruction, and street art emerged from data. Aisha and Lulwa are both Lebanese teachers in their thirties with a background outside of education. Ben and Fred are both North American teachers in their sixties and Audrey and Robin are both American teachers.

Although in Lebanon Grade 10 has no national standardization or examinations, topics such as recent local history and sectarianism are still forbidden, ultimately restricting teachers to a certain extent. Participants generally felt restictions in discussions impaired developing critical thinking abilities in practice. Audrey exemplified this by stating:

> "I don't think necessarily the curriculum and the books we pick hinder [students'] critical thinking. But…in books where you really see these issues are applicable to the country, it is sad how you are not able to actually show the kids how it is directly applied to their life…you are talking about everyone in the world but not about where you are."

Fred extended this sentiment by noting the importance of students being able to:

> "respond to literature in a meaningful way…and I don't mean just in writing, I mean in their own human experience and in…literature and art and film and any advertisements on TV. [It is important] that they are aware of how these…operate on them…[and] are aware of these things as meaningful."

Lulwa outlined "literature [as] actually a reflection of many of our issues…it not only gives me the chance to say what I think but also hear what they think." Audrey elaborated that restrictions are not only felt by teachers, saying "being not allowed to talk about certain things, I am a little more fenced in...Even the kids know when a discussion goes towards [sectarianism, to]...not get into it." However, not all teachers interviewed associated or prioritized criticality with language arts. Robin felt he was "not even at a point now where [he was] looking to get [students] to analyse thoroughly…just write with clarity."

Although most teachers acknowledged the language arts' potential for criticality, other teachers,

such as Aisha, seemed to struggle with the notion of critical questioning as a language arts goal altogether, citing close reading and annotation instead. Ben seemed to perceive print sources as unquestionable, claiming "anyone can just throw stuff out there on the net. So, it's just not the same kind of quality filter we had around in the days of traditional publishing" when asked about which materials deserve critical analysis.

In addition to detaching criticality from language arts teaching in practice, PBL was also dissociated from practice. Robin perceived PBL as "so much more accessible to history," while Fred agreed "history would be ideal for PBL." Only Aisha immediately drew a connection between PBL and creative writing.

Overall, teachers were not highly aware of the school's learning environments, as confirmed by the mapping test. Robin, having taught in seven different countries, could not "say any particular school stands out in terms of environment." Aisha felt place was important, but could only express superficial features, saying "kids are so privileged, and teachers as well because we have the sea nearby. We can look out and see the Mediterranean and see the mountains…I think the environment contributes to people's feelings of wellbeing." Lulwa attempted to capture potential of the area expressing "I find [Hamra][1] very special. It has a certain vibe…something you cannot find anywhere else in Beirut." However, Lulwa felt this atmosphere would not be relevant to students as "they are still young…they are not exposed to Hamra's atmosphere." Fred was also sensitive to culture and heritage contributing to place, noting:

> "I've felt this sense of chaos and of upheaval and the environment around is a part of that…a picture won't do it because there is a sensory experience…it's everything around and this is an attitude, this is an environment that I'm really aware of…I mean here we are on the corniche and the Mediterranean, it's right down there and it's just incredible…and I'm so aware that the ravages of war are just everywhere. Even last year, I just realized that I was just walking around in the structure and destruction of war."

However, in practice Fred believed "it's enough to just try to get people to focus in class…it would be cool to go on AUB campus and write…but, I mean, we get out of class during advisory and we go to Starbucks." Indeed, every teacher interviewed negatively perceived PBL in practice. Aisha took her class "up to the roof to read…but they were really very distracted and I thought 'never again.'" Audrey never tried because at first "I was new myself. So, I didn't feel comfortable and I didn't know the country. I hadn't travelled a lot within Lebanon and then what happened was this year we weren't allowed." Robin also never attempted PBL, but because he felt Lebanon had minimal offer in comparison to "countries like England [which are] rich in cultural heritage…and that…helps…shape a certain mentality. It gives…a greater sense of life." As the most novice teacher, Lulwa was simply "not sure how to integrate" PBL.

Another interesting trend that emerged in interviews was the notion of culture, both national and school. Foreign teachers all experienced a form of culture-shock and block. Ben seemed oblivious to the notion of constructing culturally relevant lessons as his example of such a lesson was a teacher-centered closed-activity "I've always liked doing." Robin refused to acknowledge value in the host culture, stating

[1] A street at the heart of Beirut that is historically an intellectual and liberal hub located in between the region's two most prestigious universities. Hamra is one of the few areas that are sect-neutral adding to its unique history and rendering it loved and accessible to all citizens.

"I wouldn't say here, that there is a rich cultural heritage in terms of the arts…there is a little bit, but I don't find myself personally interested in it." Fred was perplexed saying "I didn't know what I was dealing with in term of classroom culture…they're nuts." Audrey struggled to remember the name of the native component, the internationally renowned poet Gibran Khalil Gibran, she had attempted to incorporate in her lessons. Lulwa, as a local herself, was quick to contrast with her colleagues saying "I am actually the only English teacher here that is Lebanese and I think this is a big advantage…I can give examples about Lebanon, about our culture, and I can make them relate to whatever [students] are learning…it helps them understand more deeply." However, Audrey was the only foreigner to attempt to rationalize this cultural barrier between teachers and students claiming:

> "I wouldn't say that they think about [student home culture] that much with the curriculum because I think that the [school] mission statement is more broad and they actually want a more liberal education and an international education…We have such a mix at [school] that there are very Lebanese students who speak Arabic all the time at home and they…don't have another passport and they are coming from the Lebanese Bacc…I think those kids really loved [local literature] but it's interesting because even the other Lebanese students, if they live in Beirut for example, they are like 'who cares about the village and what does this have to do with anything' or they just thought that the other kids are exaggerating and it's not really like that in Lebanon because it is such a mix, depending on where you live. So some students loved [local literature]…but, no, other books that have nothing to do with Lebanon, other students enjoy much more."

When the conversation moved towards opinions of street art, preemptive of a discussion on its academic value, Fred exclaimed "I love it!" This sentiment was shared by Lulwa and Aisha, who even declared "there should be much more [street art] in Lebanon because Beirut is so ugly." Ben had "not too many strong feelings one way or the other." However, both Audrey and Robin were negative about the practice. Robin commented that when he "was a kid, they used to call it graffiti," negatively connoting tagging practices and vandalism. Audrey clearly stated that she was "not really into street art…I guess I just don't find it pretty. I don't like the way it looks aesthetically…the colours are so primary and stark."

Teachers who held positive views of street art were more alert to the impacts of street art on the environment. Fred communicated that "there is a connection between environment and people creating the space they want." Lulwa expressed that "street art is a physical manifestation of the atmosphere of a place," and Aisha said "when I see [street art], I feel happy. It makes me feel optimistic." Audrey had a negative perception of street art, but realized her views had been altered by the unique art scene and mentality of her new country of residence recalling "I just couldn't understand it…no, it's not ok. And I laugh about it now. Here, these things really don't matter. Street art is just so acceptable here. There is a huge contrast between what happens elsewhere and here."

When placing street art inside classroom contexts, teachers implicitly defined it as alternative text and often expressed a preference for mainstream materials. Robin felt that street art he appreciated were "the ones [he saw] in museums…done in much the same way but of much higher quality." Audrey felt that "if [street art] is in an approved space, I think that it is really healthy and nice. Just so long as, you know, you need to do it in an orderly fashion. Graffiti is vandalism." In giving an example about how street art

might fit into a language arts classroom, Audrey said:

> "In advertisements in English or French I find the Lebanese so good in word play. So, it's not street art but it's still out there and you look at it and that has been really interesting to me…there is this Arabic ad about *labneh*[2] I used and I guess it means sandwich and bride? I'm not sure if I used it successfully. So, we used that and talked about how you can play on words and double meaning. I used it just because of the world play and I knew they would get it."

Ben believed that "a lot of people don't see street art as a legitimate art form, but it's just not a mainstream art form…it is legitimate in the same way now, for example, we accept graphic novels as a legitimate form of English." Aisha even proposed that the Beirut "municipality should take advantage and have artists paint the whole city."

While most of these opinions seemed promising, actual awareness of street art and its presence in immediate learning environments was not entirely congruent with them. Audrey made the apparently plausible claim that "linguistically, graffiti is possibly valuable, but unfortunately I don't read Arabic." However, it should be noted that most street art in Beirut, when incorporating text, is in English. Ben mentioned he had recently been exposed to a famous artist named "Bankski" by his students and Robin spent 1:22m of his interview expressing disbelief at the location of one of the pieces shown. Robin walked past this building-sized piece nearly every day for two years and yet, had never seen it.

In conclusion, all teachers were asked if they would incorporate street art in future lessons following the interview and mapping activity. Fred thought that "students can respond to street art as they do with other works." Ben felt "it was kind of an education for [him]" and Lulwa said "if I feel I need to show [students] something that conveys a certain message, street art would be a good idea." Aisha was also positive, pinpointing that she has students "write about paintings and photographs, so why not street art? Especially in protest writing because that is what it is all about." Two teachers less positive in outcome were Robin, who was "unsure of the teaching potential" of street art and Audrey, who simply said she would not integrate it in future hypothetical lessons. Forthwith, these findings will be discussed according to the literature previously framed.

5. Discussion

The discussion will span across arenas of place-based learning (PBL), street art, multimodality and critical literacy. As previously exhibited in the literature review, each area of discussion is intended to be framed according to its predecessor, weaving findings, literature, and analysis together in a conclusive way to demonstrate the advantages and opportunity for incorporating local street art as multimodal text into critical literacy language arts teaching juxtaposed with its current invisible state.

[2] A form of waterless yoghurt, typically enjoyed for breakfast with bread. However, it should be noted that labneh does not mean sandwich and bride, *"arouss"* is the word allowing for that pun, which in fact, is not a pun as *"labneh arouss"* means sandwich, named such for the white colour which resembles a bridal veil and simply *"arouss"* means bride. There is absolutely no confusion or double meaning as the specification of *"labneh"* is always necessary when referring to the sandwich.

5.1 Place-Based Learning

Place-based learning (PBL) is the frame in which all discussion can be placed. Teachers participating in this study did not grasp the importance of school environments as pivotal to learning and sociocultural integration. Teachers revealed minimal awareness of immediate surroundings as none correctly identified all three campus pictures. As seen under findings, teachers mostly emphasized views of the sea and mountains rather than immediate grounds as environmentally distinctive. Although Robin, Audrey and Aisha made tenuous links between environment and mental states reinforcing literature that environment pervades consciousness, Lulwa and Fred were teachers who specifically referenced features of local environment.

Fred was most aware of place compared to his peers but romanticized the "structure and destruction of war" and was far more aware of ideas manifested in the physical environment than actualities. Mesmerized by war, Fred mentioned that, on more than one occasion, he encouraged students to write about their traumatic experiences of war as it was authentic to them. While accurate on some level, the last 'wartime' Beirut experienced was ten days in 2008 and one month in 2006 when Fred's students were 10 and 8 years old respectively. Moreover, the vast majority of Fred's students come from privileged backgrounds with multiple houses in "safe zones" within the country or abroad. Thus, restricting students to writing about experiences of war, however physically obvious by bullet holes in nearby buildings, is superficial, at best. As seen in the literature, schools offer constricted settings that systematically fail to relate to student life-experience. In dismissing nearby Hamra's academic potential after noting its unique quality, Lulwa separated her own life from her students' and reinforced divisions between the reality of school and the reality of the external world. In this, there is clear space for street art as meaningful and authentic text for students, bridging the gap between external and internal school lives. Moreover, examples given by teachers from both schools indicated student interest in street art; therefore, through the use of street art, PBL can be meaningfully and interestingly implemented to enhance learning in language arts classrooms.

In order for street art to augment teaching and learning, educators must be aware of its presence in local environments. This study demonstrated that street art was included in the null curriculum. Audrey noted that students are socialized into silence concerning Lebanese sectarianism and consequently have impaired critical thinking skills. Removing street art from the null curriculum can provide a platform on which to sensitively tackle national issues and liberate students from silences pervading all facets of life in Lebanon. Such disconnection with environment leads to cultural alienation. In fact, this alienation was perceived by Audrey in her students. Audrey observed that students from different areas had radically different experiences of their country and typically never explored unfamiliar territory. Accordingly, Audrey struggled to find material that would relate to all of her students. Including text in places all students can identify with counters this cultural alienation.

This study confirmed that local environments are often viewed as removed from learning experiences. However, this study also showed that teachers removed learning experiences from local environments. Even when venturing into the immediate neighbourhood, teachers conducted lessons that were place-insensitive and thus, not reaching full learning potential. Ultimately, teachers, for reasons ranging from

difficulty, seeing Starbucks as a good learning location, discomfort with the country and politics, lack of skills, and dismissal of the country's cultural value, totally misunderstood the meaning of place and how to engage students through it.

The crux of PBL is making appropriate connections between place, learning objectives, and student interests. Some teachers mentioned struggling to relate external literature to internal situations due to political issues, yet none contemplated the ease of relating internal situations to global contexts. Despite inherent political association, sectarian-neutral street art in school environments exists and can be used to instigate critical pedagogy of non-political discussions where the local is framed according to global concerns.

5.2 Street Art

As participants noted, texts, such as street art, envelop school environments, permeate consciousness and attract student interest. However, awareness transcends exposure. Literature claims knowledge of how and why culturally relevant street art is installed into public space augments awareness, prominence and evocative qualities. The mapping activity participating teachers performed resoundingly confirmed this claim. One photo depicts the largest street art piece in the Middle East by internationally known Chilean artist INTI. Not only is this piece massive, spanning around 8 stories, it is located on Hamra Street within 100m of where most teachers from both schools are housed and inevitably pass daily. Only Fred recalled ever having seen this piece before and correctly identified its location. Far from identifying with Chilean culture, Fred described an event where numerous street artists exhibited in the city's most prestigious gallery and collaborated to create art across city walls over a weekend. The name of the event he could not recall was "White Wall," created by local and international curators to give Lebanese street art new impetus in 2012. Thus, it can be inferred that Fred was the only teacher who identified INTI's piece because only he was aware of how and why it was created. Although Fred was highly aware of street art and other environmental features compared to his colleagues, all teachers studied were minimally aware of learning environments.

Initially, it was thought that attitude towards street art would lead to heightened awareness of it. However, the two most enthusiastic teachers, Aisha and Lulwa, were the least aware teachers interviewed. A relation between attitude towards street art and effort made in identifying pictures was found. For example, Robin, who didn't find any worthwhile art in the country, let alone the street, placed the majority of his stickers in the sea. Audrey, the other teacher who was largely opposed to street art, opted to "pass" on placing most of her stickers on the map. She claimed she had never seen most of the pictures before, including one visible from the window at her back. Conversely, Fred, the most environmentally-aware teacher, took the longest time to complete the mapping activity, deliberately thinking about each picture and often narrating anecdotes about how he identified them. In each case effort to correctly identify photos reflected enthusiasm about street art.

Participants were rightly enthusiastic about street art and its pedagogical potential as it demonstrates its capacity to merge with preexisting teaching goals, pushing students beyond current boundaries. It was also seen that street art is firmly embedded in social mainstreams, but neglected within institutional ones

as teachers narrated high levels of student interest but low pedagogical integration. When asked about alternative texts used in class, teachers listed poetry jars, free verse, advertisements, and other conventional textual sources displaying an unwavering preference for conventional texts. Hence, a wider view of literacy is needed amongst teachers as relying solely on traditional language arts skills is repressive. Reluctant to deviate from custom, these teachers were blind to their surroundings and its bounty. Furthermore, in limiting texts in language arts teaching, students are denied varied paths to expand knowledge and develop communicative skills. Street art has the potential to remedy this along with the dissatisfaction most teachers expressed at student linguistic abilities, initiative, and creativity. Audrey conditionally approved of street art "in an orderly fashion" and Robin maintained that street art in museums were of "much higher quality." Thus, even when considering street art, which is unregulated in essence, teachers expressed comfort only with control or prestige such as the ludicrous claim that artwork in museums is the only artwork worth enjoying. Only Ben saw potential in street art's future legitimization in schools when he likened it to graphic novels.

That a teacher was aware of material outside mainstream channels and precedents of text crossing is promising as awareness precedes change. As literature illustrates, street art can be an agent for social change. In Lebanon, using street art to reduce stagnant silences in society would certainly have transformative effects. Currently, teachers' superficiality, such as Aisha listing street art's effect simply as optimistic, contrasts with the hyperawareness most teachers possess concerning classroom design. However, spatial designs outside classroom walls and windows demand recognition despite lack of teacher control over them. Similarly superficially, Audrey could only describe her attitude towards street art due to its "primary and stark" colours. Attention must be drawn to the actual meaning imbedded in street art and its value as an ongoing critical commentary of society. Teachers must develop critical awareness, as without it they have extremely reduced chances of fostering it in their pupils. As noted in the literature review, vision is a fundamental sense through which the world becomes known. Therefore, incorporating contemporary art into classrooms is important. Street art encourages critical thinking and forging meaningful connections between the self and environment. Evidently, street art has massive advantages when incorporated into language arts classrooms.

5.3 Multimodality

As language arts teachers, all except Audrey stressed on improved reading as their ultimate goal. As demonstrated by literature, providing positive literacy environments is highly important to reading success. Therefore, if street art were positively incorporated into language teaching, another layer would be added to print-rich environments surrounding the school. Furthermore, multimodal texts, such as street art, develop stronger readers and have the capacity to redefine reading practices. In this way, a space for street art in pedagogy to meet preexisting teaching goals exists. In addition, Ben advocated using shorter selections of text to increase range but maintain depth of study. Street art also meshes nicely with this teaching preference, adding variation to standard texts while being appropriate in length for an enriching discussion.

Teachers generally have freedom of resources and approach when teaching set curricula. Whatever

is available is used, typically whiteboards, computers, posters, books and suchlike found in most schools and classrooms. Environment is also a resource, often overlooked. Within literature advocating environmental features for PBL, street art is a form of text that is also overlooked. If the local environment is utilized as a pedagogical tool, only context, not curriculum, changes. In order to be effective and beneficial, PBL should enhance rather than detract or distract as Audrey and Aisha's previous experiences indicated. In Audrey's opinion "a reason Lebanon has been unable to move on and still continues to have that same continual strife is because in the educational system, we are not teaching kids to learn to disagree and do it diplomatically." Audrey accredited this stagnation to restrictions and forced silences in curriculum. However, not being allowed to discuss certain sensitive issues and not being allowed to discuss those issues in certain ways are different things. By law, some topics such as the Lebanese Civil War and sectarianism are absolutely forbidden in schools, yet speaking of political issues is not confined to those unmentionable topics. In addition, much more can be said of society than its politics. Street art provides multiple facets of society to critique and consider in politically-sensitive ways and can develop critical literacy without impinging on the law. Although incorporating street art cannot solve Lebanon's problems, or even the strife Audrey mentioned, it can pave the first steps to progress.

5.4 Critical Literacy

Before progress can occur, teachers must possess the necessary skills to make it happen. In addition to pedagogical skills required to implement PBL, awareness of street art, and acceptance of multimodal texts, teachers must also be critically literate to foster critical literacy. Most teachers are familiar with critical thinking or reading; however, critical literacy exceeds both practices. Ben seemingly had no grasp of criticality, claiming traditional print sources required no critical questioning as publishing is the highest form of reliability. Critical literacy calls for questioning all things. Furthermore, critical literacy does not question content, as Ben seemed to suggest, but delivery and insinuations of power dynamics. In addition, insight into how societies organize language for social purposes and how meaning is communicated is derived. When Audrey narrated her lesson concerning puns and her understanding of Lebanon as multilingual, she portrayed awareness of how society organizes and uses language to convey meaning. However, Audrey never delved deeper into implications of linguistic structures in Lebanon, which incidentally, highly reflect power structures. These examples demonstrate a definite need for teacher professional development in critical literacy. Being of the opinion that analysis, let alone criticality, was relatively low as a language arts teacher's priority, Robin highlighted this need.

Aisha equated critical literacy to close reading and annotation. Critical literacy requires critical reading skills, and fostering them is advantageous. Incorporating critical literacy into pedagogy would hone skills Aisha valued, in addition to an ideological appraisal of society and its power processes. Critical literacy is rooted in exposing, discussing, and analyzing societal silences rather than reinforcing them. As such, critical literacy is perfectly suited to a Lebanese theatre, a country without even a unified history curriculum beyond the Phoenician period and more silences than speech. Of all teachers interviewed, Audrey solely expressed frustration at lack of critical skills in her students. Audrey advocated needs for criticality, both for the community at large and individuals, but felt helpless in actualizing it. Fred was most

aware of critical literacy and indicated understanding of how various media operated and controlled. However, beyond acknowledging a need for students to develop critical literacy and abstractly understanding its concepts, critical literacy never materialized in Fred's classroom. As previously explored, street art would provide an excellent route for developing critical literacy skills in both teachers and students with the added benefit of a localized context.

Evidently, critical literacy is advantageous for school communities. Although criticisms showed critical literacy will not move students to action, it also communicated that tools bestowing choices and power to transform society into the new generation's hands are provided. Empowerment is attained through deepening awareness of social realities, of which street art depicts one facet. Combining street art with critical literacy reduces silences and transforms society by abolishing indoctrinating children into a preexisting stagnant conflict. As Audrey noted, her students independently held back from broaching socio-politically charged silences of the community. As students' role models, teachers breaking the silence in critically constructive ways could begin an era where national problems are overcome rather than tolerated. If handled delicately, both students and teachers enhance critical consciousness and forge stronger identities as empowered citizens.

6. Conclusion

In conclusion, this study connected and explored street art as multimodal text and place-based learning under the umbrella of critical literacy. Six teachers in two schools within the same learning environment in Ras Beirut, Lebanon were studied for this research. Multiple case studies through mixed methods revealed that participating teachers were minimally aware of place and its pedagogic value. Furthermore, teachers had incongruent understandings of students' life experiences outside school and the actuality. Teachers were largely unaware of street art despite mostly positive attitudes towards the practice highlighting cultural disconnections between teachers, students and place.

Limitations to this study included its scope. By refusing to engage with political discourse a rich layer of analysis was omitted and unexplored. As critical literacy is inherently political, avoiding the issue reduced areas of discussion. Regarding what was performed, the quantitative mapping tool was also limited. Some teachers struggled with map-reading and could not orient themselves on it. Moreover, as noted by several teachers, street names were off-putting as they are rarely used in reality. More pictures could have been used to accurately gage environmental awareness. Moreover, difficulty levels of identifying photographs may have been too high. This study was also limited in terms of time. All raw data was gathered over a span of two weeks. Follow-up interviews and activities would have resulted in deeper findings and over time, may have yielded greater insights into teacher awareness of place.

This study revealed the existence of a concrete space for street art in language arts teaching. Street art can not only ameliorate critical literacy practices, but can also fulfill existing learning objectives. In addition, street art bridges the perceived discrepancy between school life and reality outside it. From the results of this study it can be suggested that teachers are in need of professional development to grow as critical educators. Through awareness of PBL and street art, teaching can be invigorated and lessons can establish much-needed cultural connections to engage students. Indeed, by becoming more aware of street

art as one facet of place, teachers may become more aware of local culture and develop new levels of appreciation and understanding of it. Ultimately, this study advocates and demonstrates a need to reduce silences in Lebanese and international education and proposes critical literacy via street art as the route to do so.

In future, this study has the potential to be greatly expanded. Investigating which factors teachers are most aware of in local learning environments is of interest. Exercises of identifying photographs with different zooms would indicate which contextual features teachers notice most. Using this study to construct a professional development workshop for in-service teachers is also an opportunity to investigate awareness and attitudes before, during, and after the sessions. Another clear area for expansion would be to conduct a similar research on students. Such a study would enlighten developing both material for teacher professional development and engaging material for lessons. In greater ambition, a model for using street art for critical literacy in classrooms can be developed and piloted as a need for such teachings was demonstrated to be beneficial.

7. References

Ahwee, S., Chiappone, L., Cuevas, P., Galloway, F., Hart, J., Lones, J., Medina, A. L., Menendez, R., Pilonieta, P., Provenzo, E. F., Shook, A. C., Stephens, P. J., Syrquin, A. & B. Tate. (2004). The Hidden and Null Curriculum: An Experiment in Collective Educational Biography. *Educational Studies, 34,* 25-43.

Albers, P. & J. C. Harste. (2007). The Arts, New Literacies, and Multimodality. *English Education, 40(1),* 6-20.

Austin, R. (2007). Introduction. In Austin, R. (Ed.), *Letting the Outside In: Developing Teaching and Learning Beyond the Early Years Classroom* (pp. ix-xviii). Staffordshire: Trentham Books Limited.

Beames, S., Higgins, P. & R. Nicol. (2012). *Learning Outside the Classroom: Theory and Guidelines for Practice.* New York: Routledge.

Bearne, E. & H. Wolstencroft. (2007). *Visual Approaches to Teaching Writing: Multimodal Literacy 5-11.* London: Paul Chapman Publishing.

Chaplin, E. (1994). *Sociology and Visual Representation.* London: Routledge.

Christians, C. G. (2000). Ethics and Politics in Qualitative Research. In Denzin, N. K. and Y. S. Lincoln (Eds.) *Handbook of Qualitative Research* (pp. 133-155). Thousand Oaks, CA: SAGE Publications, Inc.

Comber, B. (2003). Critical Literacy: What Does It Look Like in the Early Years? In Hall, N., Larson, J. & J. Marsh (Eds), *Handbook of Early Childhood Literacy* (pp. 355-368). London: SAGE Publications Ltd.

Cotnam-Kappel, M. (2014). Reflexive Graffiti Remixing: Curriculum, Corsican Language, and Critical Pedagogy. *Journal of Canadian Association for Curriculum Studies, 11(2),* 44-74.

Cotton, H. (2011). English and Language Outside the Classroom. In Waite, S. (Ed.), *Children Learning Outside the Classroom: From Birth to Eleven* (pp.66-79). London: SAGE Publications Ltd.

Crafton, L. K., Silvers, P. & M. Brennan. (2009). Creating a Critical Multiliteracies Curriculum:

Repositioning Art in the Early Chilhood Classroom. In Narey, M. J. (Ed), *Making Meaning* (pp. 31-51). Wisconsin: Springer.

Darder, A., Baltodano, M. & R. D. Torres. (2003). Critical Pedagogy: An Introduction. In Darder, A., Baltodano, M. & R. D. Torres (Eds), *The Critical Pedagogy Reader* (pp. 1-23). New York: RoutledgeFalmer

Freebody, P. & J. M. Freiberg. (2011). The Teaching and Learning of Critical Literacy: Beyond the "Show of Wisdom." In Kamil, M. L., Pearson, P. D., Birr Moje, E. & P. P. Afflerbach (Eds), *Handbook of Reading Research Volume IV* (pp. 432-452). New York: Routledge.

Freire, P. (1998). *Pedagogy of Freedom: Ethics, Democracy, and Civic Courage.* Maryland: Rowman & Littlefield Publishers Inc.

Freire, P. (2003). Pedagogy of the Oppressed. In Darder, A., Baltodano, M. & R. D. Torres (Eds), *The Critical Pedagogy Reader* (pp.57-68). New York: RoutledgeFalmer.

Gee, J. P. (2000). Meanings in Discourses: Coordinating and Being Coordinated. In Muspratt, S., Luke, A. & P. Freebody (Eds.), *Constructing Critical Literacies: Teaching and Learning Textual Practices* (pp. 273-302). New Jersey: Hampton.

Gibson, R. (1986). *Critical Theory and Education.* London: Hodder & Stoughton.

Gieseking, J. J. (2013). Where We Go From Here: The Mental Sketch Mapping Method and Its Analytic Components. *Qualitative Inquiry, 19(9),* 712-724.

Gilmore, A. (2011). "I Prefer Not Text": Developing Japanese Learners' Communicative Competence with Authentic Materials. *Language Learning, 61(3),* 786-819.

Greene, M. (1988). *The Dialectic of Freedom.* New York: Columbia University Teachers College Press.

Gruenewald, D. A. (2003). The Best of Both Worlds: A Critical Pedagogy of Place. *Educational Researcher, 32(4),* 3-12.

Halsey, S. & A. Young. (2006). "Our Desires are Ungovernable;" Writing Graffiti in Urban Space. *Theoretical Criminology, 10(3),* 275-306.

Haslam, K. R. (1971). *Learning in the Primary School.* London: Unwin Education Books.

Hasset, D. D. & J. S. Curwood. (2009). Theories and Practices of Multimodal Education: The Instructional Dynamics of Picture Books and Primary Classrooms. *The Reading Teacher,* 63(4), 270-282.

Holme, R. (2004). *Literacy: An Introduction.* Edinburgh: Edinburgh University Press Ltd.

Iddings, A. C. D. (2009). The Writing on the Wall: Graffiti and Other Community School Practices in Brazil. In Scott, J. C., Straker, D. Y. & L. Katz (Eds.), *Affirming Students' Right to Their Own Language: Bridging Language Policies and Pedagogical Practices* (pp.291-302). New York: Routledge.

Iddings, A. C. D., McCafferty, S. G. & M. L. T. da Silva. (2011). Conscientizao Through Graffiti Literacies in the Streets of a Sao Paulo Neighborhood: An Ecosocial Semiotic Perspective. *Reading Research Quarterly, 46(1),* 5-21.

Jacobs, D. (2001). More than Words: Comics as a Means of Teaching Multiple Literacies. *The English Journal, 96(3),* 19-25.

Jarvis, T. (2009). Promoting Creative Cross-Curricular Work through an In-Service Programme. *SSR, 90(332),* 39-46.

Kastens, K. A. & L. S. Liben. (2010). Children's Strategies and Difficulties While Using a Map to Record Locations in an Outdoor Environment. *International Research in Geographical and Environmental Education, 19(4),* 315-340.

Larson, J. (2006). Multiple Literacies, Curriculum, and Instruction in Early Childhood and Elementary School. *Theory into Practice, 45(4),* 319-327.

Larson, J. & J. Marsh. (2005). *Making Literacy Real: Theories and Practices for Learning and Teaching.* London: SAGE Publications Ltd.

Makin, L. (2003). Creating Positive Literacy Learning Environments in Early Childhood. In Hall, N., Larson, J. & J. Marsh (Eds.). *Handbook of Early Childhood Literacy* (pp. 327-337). London: SAGE Publications Ltd.

Marquez-Zenkov, K. (2003). The "Public Art" of Language Arts: A New Lens on Educational Standards. *Language Arts, 80(5),* 384-391.

Miles, M. (1989). Questions of Language. In Miles, M. (Ed.), *Art for Public Places: Critical Essays* (pp. 39-50). Hampshire: Winchester School of Art Press.

Mission, R. & W. Morgan. (2006). *Critical Literacy and the Aesthetic: Transforming the English Classroom.* USA: National Council of Teachers of English

Morrell, E. (2008). *Critical Literacies and Urban Youth: Pedagogies of Access, Dissent, and Liberation.* New York: Routledge

Nodelman, P. (2005). *Decoding the Images: How Picture Books Work.* London: Routledge.

Quintero, E. P. (2009). *Critical Literacy in Early Childhood Education: Artful Story & the Integrated Curriculum.* New York: Peter Lang Publishing, Inc.

Rafferty, P. (1991). The Street Art/Graffiti of Youth: Questioning the Normalizing Influence of Tradition. *Phenomenology & Pedagogy, 9,* 15-27.

Randazzo, G. & L. Lajevic. (2013). Cleaning Our World Through Reverse Graffiti. *Art Education, 9,* 39-45.

Rose, G. (2007). *Visual Methodologies: An Introduction to the Interpretation of Visual Materials.* London: SAGE Publications Ltd.

Shaw, H. (2009). *Graffiti: Can and Should Landscape Architecture Create a Place for Graffiti in the Urban Landscape* (MA(Hons) Dissertation). Edinburgh College of Art: Edinburgh.

Shirley, I. (2007). Exploring the Great Outdoors. In Austin, R. (Ed.), *Letting the Outside In: Developing Teaching and Learning Beyond the Early Years Classroom* (pp. 1-12). Staffordshire: Trentham Books Limited.

Sieber, J. E. (1998). Planning Ethically Responsible Research. In Bickman, L. & D. J. Rog (Eds.) *Handbook of Applied Social Research Methods* (pp. 127-156). Thousand Oaks, CA: SAGE Publications, Inc.

Smith, G. A. (2002). Place-Based Education: Learning To Be Where We Are. *Phi Delta Kappan, 83(8),* 584-594.

Sobel, D. (2004). *Place-Based Education: Connecting Classrooms and Communities.* Massachusetts: Orion Society.

Stone, D. (1989). The Islington Schools Environmental Project. In Miles, M. (Ed.), *Art for Public Places:*

Critical Essays (pp. 116-122). Hampshire: Winchester School of Art Press.

Thomas, G. (2011). *How to do Your Case Study: A Guide for Students & Researchers.* London: SAGE Publications Ltd.

Torr, J. (2008). Multimodal Texts and Emergent Literacy in Early Childhood. In Unsworth, L. (Ed), *New Literacies and English Curriculum* (pp. 47-65). London: Continuum International Publishing Group.

Vasudevan, L. M. (2007). Looking for Angels: Knowing Adolescents by Engaging with their Multimodal Literacy Practices. *Journal of Adolescent and Adult Literacy, 50(4),* 252-256.

Wisker, G. (2009).*The Undergraduate Research Handbook.* London: Palgrave Macmillan.

Wurdinger, S. D. & J. A. Carlson. (2010). *Teaching For Experiential Learning.* Plymouth: Rowman & Littlefield Education.

Youngs, S. & F. Serafini. (2013). Discussing Picturebooks across Perceptual, Structural and Ideological Perspectives. *Journal of Language & Literacy Education,* 9(1), 185-200.

Appendix

Appendix 1. **Participants' Mapping Raw Data**

Note: All original maps of participants and original photographs are available upon request.

TEACHER	AGE	NATIONALITY	SCHOOL	LIVED IN LEBANON	TRANSPORT	PHOTOGRAPHS CORRECTLY IDENTIFIED
AISHA	30-39	LEBANESE	#1	6 YRS	CAR	1/15
FRED	60-69	AMERICAN	#1	2 YRS	WALKING	5/15
ROBIN	30-39	AMERICAN	#1	7 YRS	WALKING	3/15
AUDREY	30-39	AMERICAN	#2	3 YRS	WALKING	2/15
BEN	60-69	CANADIAN	#2	2 YRS	WALKING	1/15
LULWA	30-39	LEBANESE	#2	WHOLE LIFE	CAR	2/15

OF CORRECTLY IDENTIFIED PHOTOGRAPHS			
TEACHER	STREET ART	SCHOOL ENVIRONMENT	LEARNING ENVIRONMENT
AISHA	0/1	1/1	0/1
FRED	2/5	2/5	1/5
ROBIN	0/3	1/3	2/3
AUDREY	0/2	2/2	0/2
BEN	0/1	1/1	0/1
LULWA	0/2	2/2	0/2

Young Adults' Attitudes toward Mental Illness in Saudi Arabia

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Abstract

***Background**: Public attitudes influence social acceptability of mental illness and one's decision to seek help. Despite the high prevalence rate of psychological disorders in Saudi Arabia, few studies have been conducted to examine young adults' attitudes toward mental illness in the Kingdom. Up until today, no studies have examined the differences in attitudes toward mental illness between Saudis and non-Saudis living in Saudi Arabia.*

***Aim**: The main aim of the study is to examine associations between demographic characteristics (educational level, gender, past experience with mental illness and nationality), and attitudes toward mental illness in Saudi Arabia.*

***Participants and methods**: The sample in this study consisted of 242 participants (females = 188; males = 54), aged 18-29. Attitudes toward mental illness were assessed using a modified version of the Attitudes to Mental Illness (AMI). The 20-item instrument measures four factors of attitudes: social distancing, tolerance and support for community care, social restrictiveness, and prejudice and misconception. The data was collected using surveys posted online.*

***Results**: Results revealed that people with bachelor's degrees or higher are more socially distant and socially restrictive toward people with mental illness. Consistent with previous findings, participants with past experiences with mental illness scored higher on positive attitude scale, scoring lower on social distancing, social restrictiveness, prejudice and misconception and higher on tolerance and support for community care than people with no past experiences with mental illness. In addition, females scored higher than males on the positive attitude scale, scoring lower in social distancing, prejudice and misconception and higher on tolerance and support for community care. Furthermore, Saudis scored higher on positive attitude scale, scoring lower than non-Saudis on social distancing and prejudice and misconceptions.*

***Conclusion and recommendations**: The findings of this study revealed that young adults' attitudes toward mental illness are influenced by educational level, gender, past experience with mental illness and nationality.*

Keywords: Mental illness; Attitudes; Young adults; Stigma; Saudi Arabia

Background

Mental health is defined as a state of well-being in which a person is able to recognize his/her own ability, cope with life stressors, work productively, and make a contribution to her/his community (World Health Organization, 2018). According to the World Health Organization, mental illnesses are the leading causes of disability in the world. The National Institute of Mental Health (2017) reported that one in six U.S. adults live with a mental illness (44.7 million adults in 2016). In Australia, it is reported that one in five individuals aged between16 and 85 had a mental disorder in the previous 12 months (Slade *et al*, 2009). The prevalence of mental illness in Saudi Arabia is quite high. In 2007, Saudi mental health hospitals revealed that approximately 5,700,902 people (about 25% of the population) suffer from various mental health problems (Dawood & Modayfer, 2016). Furthermore, Al Khathami and Ogbeide (2002) reported that around one fifth of primary care patients suffer from mental illness.

Public attitudes influence social acceptability of mental illness and subsequently an individual's decision toward seeking help. The significance of investigating attitudes toward mental illness and its influencing factors is therefore crucial. Studies examining public attitudes toward mental illness in Saudi Arabia reported that people with higher level of education have more positive attitudes toward mental illness (Dawood & Modayfer, 2016), Jelaidan *et al*., 2018); Khalil, 2017). This is consistent with other international studies (Longkumer & Borooah,2013; Mirnezami *et al.*, 2016; Tang, 2015). The literature reported conflicting results related to the association between gender and attitudes toward mental illness. International studies have reported that females have more positive attitudes than males toward mental illness (Aghanwa, 2004; Borooah & Ghosh, 2017; Savrun *et al*., 2007; Yuan *et al*.,2016). This finding has been confirmed in a Saudi-based study (Khalil, 2017). However, some studies reported that males have more positive attitude toward mental illness than females (Dessoki & Hifnawy, 2009). In addition, international studies (Dessoki & Hifnawy, 2009; Tang, 2015) as well as ones conducted in Saudi Arabia (Dawood & Modayfer, 2016; Khalil, 2017) revealed that people with past experiences with mental illness have more positive attitudes toward mental illness compared to people with no past experience. No study examined the difference in attitudes toward mental health between Saudi nationals and non-Saudi residents,

Significance of the Study

Despite the high prevalence rate of mental illnesses in Saudi Arabia, limited studies were conducted to examine factors influencing young adults' attitudes toward mental illness in the Kingdom. Furthermore, no study examined the differences in these attitudes among Saudi and non-Saudi populations living in Saudi Arabia. It is important to examine factors influencing attitudes toward mental illness.

Public attitude can influence help seeking behavior and successful treatment of mental illness (Wolff *et al*., 1996). As a result of the stigma associated with mental illness, people are also subjected to social exclusion and restricted chances to education and employment which negatively impact the quality of their lives (Rusch, Angermeyer & Corrigan, 2005; Quinn, 2007).

Aim of the Study

The main aim of this study is to examine associations between socio-demographic characteristics (educational level, gender, past experience with mental illness and nationality) and attitudes toward mental illness amongst young adults in Saudi Arabia. The study aims to answer the following question:

- What are the association between socio-demographic characteristics and attitudes toward mental illness in Saudi Arabia?

Methodology

Participants

A total of 242 out of 298 participants, mainly from Jeddah and Riyadh, completed the questionnaire, creating a response rate of 81%. The online survey was self-administrated and was shared using social media applications to the target group age. The inclusion criteria was as follows: (1) age range (18-29) (2) both genders and (3) resident in Saudi Arabia.

Amongst the 242 participants, 77.7% were female (n=188) and 22.3% were male (n=54). With regards to age, 40.1% (n=97) were between the ages of 18-20, 47.5% (n=115) of the participants aged between 21 to 25 and 12.4% (n=30) aging 26-29. The analysis showed that 76.4% (N=185) of the participants were Saudi and 23.6% (n=57) were of other nationalities. The majority was single (never been married), 94.6% (n=229). Their levels of education were as follows: 38.4% (n=93) with bachelor's degree or higher, 29.3% (n=71) with post-high school courses, 26.9% (n=65) with high school diploma and 5.4% (n=13) with incomplete high school education. Most of the participants were students 70.7% (n=171). With regards to their socioeconomic status, the majority came from middle class and upper middle class families, 45.9% and 35.5% respectively. More than two thirds had a mental illness or personally knew someone with a mental illness 71.9% (n=174) in comparison to 28.1% (n=68) with no past experience of mental illness. Descriptive characteristics of participants are presented in Table 1.

Table 1. Descriptive characteristics of participants of the study (No. =242)

Characteristics	**N**	**%**
Age		
18-20	97	40.1
21-25	115	47.5
26-29	30	12.4
Gender		
Male	54	22.3
Female	188	77.7
Nationality		
Saudi	185	76.4
Other	57	23.6
Marital Status		

Married	8	3.3
Never married	229	94.6
Others (divorced, widowed, separated)	5	2.1
Education Level		
Incomplete high school education	13	5.4
High school diploma	65	26.9
Post-high school courses	71	29.3
Bachelor degree or higher	93	38.4
Employment Status		
Homemaker	2	0.8
Student	171	70.7
Unemployed	23	9.5
Employed	46	19
Socio-economic Status		
Upper class	13	5.4
Upper middle class	86	35.5
Middle class	111	45.9
Lower middle class	22	9.1
Working class	10	4.1
Past experience with mental illness		
Yes	174	71.9
No	68	28.1

Outcome Tool of the Study

The measures of this study were:

Part I. Socio-demographic questionnaire which consists of information regarding age, gender, marital status, employment status, educational level, nationality and past experience with mental illness.

Part II. The Modified version of the Attitude to Mental Illness (AMI) instrument consists of twenty items measuring four factors of attitude: social distancing (3 items), tolerance & support for community care (9 items), social restrictiveness (3 items) and prejudice and misconception (5 items). The original version of this instrument covered twenty-seven items (UK Department of Health, 2014). The current instrument has a reported internal reliability of 0.66- 0.70 (Yuan *et al*., 2016). Items are rated on a 5-point Likert scale ranging from 1 = strongly disagree to 5 = strongly agree.

Ethical Considerations

Ethical approval was obtained from the Research Department and Ethics Committee at the University. Prior to proceeding with the survey, participants provided their consent after receiving a full description and explanation of the study. To ensure confidentiality, anonymity of participants was maintained. No names or personal information were collected from the questionnaires and study ID numbers were used instead.

Data Analysis

Data was analyzed using Statistical Package for the Social Sciences (IBM SPSS Statistics) version 24. Frequencies and percentages were computed for the socio-demographic variables. Independent Samples T Test, one-way ANOVA and multiple regression analyses were conducted to examine associations between the demographic variables and the four factors of the attitude scale.

Results

For data interpretation, 'lower' scores in social distancing, social restrictiveness, prejudice and misconception indicate more positive attitudes, while 'higher' scores in tolerance and support for community care represent positive attitudes.

Association between Level of Education and the 4 Factors Measuring Attitude toward Mental Illness

One-way ANOVA revealed a significant difference across educational levels in two of the four factors of attitudes (social distancing and social restrictiveness). Scores of social distancing were significantly different across educational levels (F (3) = 3.78, p = 0.011). Further analysis, using a LSD post hoc test, revealed that people with bachelor's degree or higher scored significantly higher in social distancing compared to those with incomplete high school education or high school diploma. The LSD post hoc test found a significant mean difference in social distancing between those with bachelor's degree or higher compared to those with incomplete high school education (MD = 2.26, p = 0.008). In addition, a significant difference in social distancing was found between those with bachelor's degree or higher compared to those with high school diploma (MD = 1.21, p = 0.01). Furthermore, ANOVA results represent significant differences in social restrictiveness across educational levels; (F (3) = 3.04, p = 0.03). As with social distancing, LSD post hoc test revealed a significant difference in social restrictiveness for those with bachelor's degree or higher compared to those with high school diploma (MD = 1.02, p = 0.004). People with bachelor's degree or higher had significantly higher scores in social restrictiveness than people with high school diploma.

Association between Gender and the 4 Factors Measuring Attitude toward Mental Illness

Results showed that females have lower scores in social distancing and prejudice and misconception and higher scores in tolerance and support for community care than males. Independent T Test revealed significant differences between females and males in three of the attitude factors. The scores of social distancing in males (M = 7.38, SD = 3.48) were significantly different than in females (M = 6.30, SD = 2.65); t (71.60) = -3.00, p = 0.004. Similar results were found in tolerance & support for community care, where males (M = 38.28, SD = 4.09) and females (M = 39.64, SD = 3.79) had significantly different scores; t (240) = 2.29, p = 0.023. Furthermore, results of prejudice and misconception showed the same pattern where males (M = 12.48, SD = 3.66) and females (M = 11.14, SD = 3.60) differed significantly; t (240) = -2.41, p = 0.017. However, there were no significant difference in social restrictiveness in both genders; $p >$ 0.05.

Association between Past Experience and the 4 Factors Measuring Attitude toward Mental Illness

Results showed that people with previous experience of mental illness scored lower in social distancing, social restrictiveness, prejudice and misconception and scored higher in tolerance and support for community care. Significant differences were found in all four factors. The results of social distancing were significantly lower in people with past experience with mental illness (M = 6.25, SD = 2.84) compared to individuals with no experience (M = 7.65, SD = 2.90); t (240) = -3.43, p = 0.001. The scores of tolerance and support for community care were significantly higher in people with past experience (M = 39.88, SD = 3.65) compared to those without any experience (M = 37.96, SD = 4.17); t (240) = 3.54, $p < 0.001$. Furthermore, people with past experience with mental illness had significantly less social restrictiveness scores (M = 5.35. SD = 2.14) than those with no experience with mental illness (M = 6.22, SD = 2.31); t (240) = -2.78, p = 0.006. Prejudice and misconception was found to be significantly lower in people with experience (M = 10.90, SD = 3.63) compared to individuals with no experience (M = 12.82, SD = 3.33); t (240) = -3.80, $p < 0.001$.

Association between Nationality and the 4 Factors Measuring Attitude toward Mental Illness

Results indicate that Saudis scored lower in social distancing and prejudice and misconception than other nationalities. Significant differences in nationality were found in two out of the four factors of Attitude to Mental Illness (AMI). The scores of social distancing in Saudis (M = 6.37, SD = 2.90) significantly differed from scores of other nationalities (M = 7.53, SD = 2.85); t (240) = -2.65, p = 0.009. The results of prejudice and misconception were also significantly different across nationality; Saudis (M = 11.12, SD = 3.45) and other nationalities (M = 12.47, SD = 4.08); t (240) = -2.48, p = 0.014. However, no significant difference was found in factor tolerance & support for community care and social restrictiveness.

Regression

A multiple regression was used to further examine the relationship that the independent variables have on factors of the attitude scale. Four variables were entered into multiple regression models (educational level, gender, past experience with mental illness and nationality). The interaction of the four independent variables examined in the study explained 15.2% of social distancing (R^2 = 0.152, F (4,237) = 10.581, $p <$ 0.01), 7.0 % of tolerance and support for community (R^2 = 0.070, F (4,237) = 4.453, $p < 0.01$), 7.6% of social restrictiveness (R^2 = 0.076, F (4,237) = 4.871, $p < 0.01$) and 9.4% of prejudice and misconception (R^2 = 0.094, F (4,237) = 6.117, $p < 0.01$).

Discussion

While examining the association between socio-demographic variables on attitude factors, our results showed that individuals with previous experience with mental illness scored higher on the positive attitude scale compared to those without any experience. This finding is consistent with international studies (Taylor & Dear, 1981; Dessoki & Hifnawy, 2009; Tang, 2015) as well as studies conducted in Saudi Arabia (Dawood & Modayfer, 2016; Khalil, 2017). This could be attributed to improved knowledge regarding mental illness as a result of immediate contact with affected individuals. Moreover, females scored higher

than males on the positive attitude scale. This is consistent with international studies (Aghanwa, 2004; Borooah & Ghosh, 2017; Savrun *et al*., 2007; Yuan *et al*., 2016) and a Saudi-based study (Khalil, 2017). Gender differences can be due to cultural factors and differences in gender expectations. Females are often expected to be supportive, tolerant and caring while males are expected to be tough. These expectations can eventually influence individuals' attitudes. Similarly, the discrepancy between attitudes in Saudi citizens compared to non-Saudis could be due to the lack of services available to non–Saudis which in turn can lead them to resist or deny mental illness. It may seem somewhat surprising at first that people with higher degrees scored lower in the positive attitude scale. However, this finding is parallel to another study where people with higher education scored lower in the positive attitude scale (Bedaso *et al,* 2016). It could be that people with higher education have higher expectations for social responsibility. However, this finding is inconsistent with studies supporting the impact of higher educational level on positive attitudes (Dawood & Modayfer, 2016; Jelaidan *et al*., 2018).

Findings of this study should be interpreted with caution, given certain limitation relating to participant recruitment and study design. First, study participants were mainly from Jeddah and Riyadh, two major cities in Saudi Arabia with better access to health care and educational institutions. Therefore, it is important to acknowledge that the study sample is not representative of the Saudi population. Another limitation is that the study focuses on attitudes toward mental illness in general and not specific type of mental illness. As a result, people might answer questions based on their knowledge of a particular mental illness. Given that stigma may be associated with one mental illness more than others, the responses may be biased.

Conclusion and Recommendations

Findings revealed that young adults' attitudes toward mental illness are influenced by educational level, gender, past experience with mental illness and nationality. People with bachelor's degrees or higher are more socially distant and socially restrictive toward people with mental illness. Females, participants with past experiences with mental illness and Saudis scored higher on the positive attitude scale. Further studies should include participants from different Saudi cities as well as rural areas, where awareness and exposure to medical knowledge is minimal. Moreover, future studies should examine attitudes toward different types of psychological disorder in order to understand the stigma associated with it and to examine other possible reasons behind negative attitudes toward mental illness.

References

Aghanwa, H. S. (2004). Attitude toward and knowledge about mental illness in Fiji islands. *International Journal of Social Psychiatry, 50*(4). 361-375. doi: 10.1177/0020764004050336

Al-Khathami, A. D. & Ogbeide, D. O. (2002). Prevalence of mental illness among Saudi adult primary-care patients in Central Saudi Arabia. *Saudi Medical Journal, 23*(6), 721-724. Retrieved from https://www.smj.org.sa/index.php/smj/article/view/4102

Aghanwa, H. S. (2004). Attitude toward and knowledge about mental illness in Fiji islands. *International Journal of Social Psychiatry, 50*(4). 361-375. doi: 10.1177/0020764004050336

Bedaso, A., Yeneabat, T., Yohannis, Z., Bedasso, K. & Feyera, F. (2016). Community attitude and associated factors toward people with mental illness among residents of worabe town, silte zone, southern nation's nationalities and people's region, Ethopia. *PLoS ONE, 11*(3), 1-12. doi: 10.1371/journal.pone.0149429

Borooah, I. P. & Ghosh, S. (2017). Attitudes and beliefs toward mental illness in Central Assam. *Journal of Humanities and Social Science*, *22*(2), 31-37. doi: 10.9790/0837-2202013137

Chong, S. A., Verma, S., Vaingankar, J. A., Chan, Y. H., Wong, L. Y. & Heng, B. H. (2007). Perception of the public toward the mentally ill in developed Asian country. *Social Psychiatry and Psychiatry Epidemiology, 42*(9), 734–739. doi: 10.1007/s00127-007-0213-0

Dawood, E. & Modayfer, O. (2016). Public attitude toward mental illness and mental health services in Riyadh, Saudi Arabia. *Research on Humanities and Social Sciences*, *6*(24). 63-75. Retrieved from http://www.iiste.org/Journals/index.php/RHSS/article/view/34798/35779

Dessoki H.H. & Hifnawy, T. (2009). Beliefs about mental illness among university students in Egypt. *Europe's Journal of Psychology, 5(*1), 1-19. doi: 10.5964/ejop.v5i1.284

Ganesh, K. (2011). Knowledge and attitudes mental illness among general public of Southern India. *National Journal of Community Medicine*, *2*(1). 175-178. Retrieved from www.njcmindia.org/home/download/117

Hogg, M. A., & Vaughan, G. M. (2005). *Social psychology* (4th ed.) (p. 150). London: Pearson Education

Jelaidan, M., Alkhair, L., Thani, T.M., Susi, A. & Shuqdar, R. (2018). General background and attitude of the Saudi population toward mental illness. *Journal of Psychology and Clinical Psychiatry, 9*(1)*,* 127-133. doi: 10.15406/jpcpy.2018.09.00510

Khalil, A. I (2017). Stigma versus mental health literacy: Saudi public knowledge and attitudes toward mental disorders. *International Journal for Innovation Education and Research, 5*(3)*,* 59-77. Retrieved from http:// ijier/article/view/639

Longkumer, I., & Borooah, I. P. (2013). Knowledge about and attitudes toward mental disorders among Nagas in North East India. *Journal of Humanities and Social Science, 15(*4), 41-47. doi: 10.9790/0837-1544147

Mirnezami, H. F., Jacobsson, L. & Edin-Liljegren, A. (2016). Changes in attitudes toward mental disorders and psychiatric treatment 1976-2014 in a Swedish population. *Nordic Journal of Psychiatry*, 70, 38-44. doi: 10.3109/08039488.2015.1046916

National Institute of Mental Health (2017, November). Mental illness. Retrieved from https://www.nimh.nih.gov/health/statistics/mental-illness.shtml

Quinn, N. (2007). Beliefs and community responses to mental illness in Ghana: the experiences of family carers. *The International Journal for Social Psychiatry*, *53*(2*)*, 175-188. doi: 10.1177/0020764006074527

Rusch, N., Angermeyer, M.C. & Corrigan, P.W. (2005). Mental illness stigma: Concepts, consequences, and initiatives to reduce stigma. *European Psychiatry*, *20*(8), 529-539. doi: 10.1016/j.eurpsy.2005.04.004

Savrun, B. M., Arikan, K., Uysal, O., Cetin, G., Poyraz, B. C., Aksoy, C. & Bayar, M. R. (2007). Gender effect on attitudes toward the mentally ill: A survey of Turkish university students. *Israel Journal of Psychiatry and Related Sciences, 44*(1), 57-61. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/17665813

Slade, T., Johnston, A., Browne, M. A., Andrews, G. & Whiteford, H. (2009). 2007 national survey of mental health and wellbeing: methods and key findings. *Australian & New Zealand Journal of Psychiatry, 43*(7), 594 – 605. doi: 10.1080/00048670902970882

Tang, A. Y. (2015). Cross-sectional survey: public attitude toward mental illness in China. *International Archives of Nursing and Health Care, 1(*3), 1-4. doi: 10.23937/2469-5823/1510025

Taylor, S. M. & Dear, M. J. (1981). Scaling community attitude toward the mentally ill. *Schizophrenia Bulletin*, *7*, 225 – 240. doi: 10.1093/schbul/7.2.225

UK Department of Health (2014). Attitudes to Mental Illness 2014 Research Report. Department of Health, United Kingdom, 2014.

Wolff, G., Pathare, S., Craig, T. & Leff, J. (1996). Community attitudes to mental illness. *The British Journal of Psychiatry*, *168*(2), 183-190, doi: 10.1192/bjp.168.2.183

World Health Organization (2018). Depression. Retrieved from http://www.who.int/mediacentre/factsheets/fs369/en/

Yuan, Q., Abdin, E., Picco, L., Vaingankar, J. A., Shahwan, S., Jeyagurunathan, A., … Subramaniam, M. (2016). Attitudes to mental illness and its demographic correlates among general population in Singapore.

PLos ONE, 11(11), 1-13. doi:10.1371/journal.pone.0167297

Utilizing Student-Generated Materials in the Classroom

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Abstract

With the heightened use of technology in most industries, disruptors serve to create extensive and (sometimes) permanent change to current models of operation. The textbook industry is no exception where factors such as digital technology, consolidation, open sourcing, and economics have resulted in, among other things, student-generated classroom materials. Discussing the strategies for implementing student-generated materials into the class will be an essential part of looking at how to harness new material in a fast-paced digital age.

Keywords: OER, course materials, student-generated materials, free textbooks

Introduction

As disruptors impact industries, changes are apt to take place. In many cases, such changes may be unwanted by various participants of the industry. For example, Uber has created a significant change in how people pay to ride from point A to point B. This entails no tipping, an exact pickup time and place, GPS tracking, and the ability to rate the driver. In the meantime, the taxi industry has been turned upside down as the common driver can partake in offering driving services as a way to make extra money. Similarly, higher education has been levied with a number of transitionary factors that are making huge changes in the industry. Among such factors are technology, free access to information, cost structures, and the questioning of the value of the product offered by the industry.

When one industry is disrupted, it tends to influence other industries. For example, the disruption that has occurred in higher education is showing a similar impact on textbook publishing. At one point in time, it was assumed that practically every course required a textbook that students would purchase from the campus bookstore. This led to a substantial layout of money by students, thus increasing the overall cost of education. Relatedly, publishers, authors, and colleges profited by the transactions. As economists can attest, it was quite easy to earn monopolistic profits from students. Think of it from the standpoint that, once a textbook is selected for a course, it becomes the course material required of the students. With the advent of numerous disruptors (technology, free access to information, and cost structures), we've come to a point where the easy cash stream of book sales has been changed in a way not seen twenty years ago. Along with just saying "no" to buying the required textbook, students are seeing other options such as used books, free access to materials, Open Educational Resources (OER), and the ability to create materials.

In order to evaluate the effectiveness of using alternatives to textbooks, several methods were implemented into different courses. Along with the sharing of such findings, additional insight will be provided by an extensive research of information. Although the textbook hasn't been altogether eliminated from higher education, many options are proliferating the decision tree. Of the many alternatives, the main focus will look at how students are using technology as a way to create their own materials. Such an idea wasn't at the forefront of higher education in previous decades but will be shown as an extremely beneficial substitute to purchasing textbooks.

Literature Review

Given the newness of disruptors, recent literature focuses on the cost of textbooks, alternatives to textbooks, and how to replace them with other materials. Textbook expenses came to the forefront when stakeholders began to question the cost of education. Numerous studies note the excessive costs associated with purchasing materials for class. The U.S. Public Interest Research Group surveyed more than 2,000 college students and found many conclusions relating to textbook costs (Senack, 2014). The findings includes 65% of students who said they decided against purchasing textbooks because of the cost and that 94% of such student are concerned about course grades because they didn't make a textbook purchase. Similarly, Shin (2013) notes the Daily Clog (blog by The Daily Californian) conducted a survey and found freshmen buy just 69% of required books.

As one would expect, textbook expenses impact higher education in more than just cost. Morris-Babb and Henderson (2012) report that over 23% of students say they occasionally don't register for a specific course or section simply because of the high textbook costs associated with the registration. It is important to realize that making course selections based on the cost of the materials (and not tuition) should be an attention grabber for all individuals associated with higher education. This decision is important because numerous entities post varying average costs for textbooks. The College Board's *Trends in College Pricing 2017* states that cost of materials for the typical student exceeds $1,200 per year. Such costs vary by major, type of institution, and other factors. The main point being that textbooks and materials are impacting students' decisions in higher education. One should be willing to question textbook expenses when it impacts course selection as well as the willingness to forgo buying the materials needed for the course.

When students do buy textbooks, it doesn't guarantee the use of the materials. A survey conducted by Hattenberg and Steffy (2013) resulted in finding that students are more likely to read material if it is tied to a graded item. Worse yet, Connor-Greene (2000) found that 72% of students rarely or never completed required reading assignments. Similarly, Howard (2004) noted an alarming rate of reading as only 40% of students reported that they usually or always complete required assignments. Thus, even in cases where students have access to materials, it appears they must be prodded into reading the contents. Generally, tying a grade to the assignment is the true inducement for the decision to read the material.

If students aren't purchasing textbooks, what are the alternatives for educators? One logical choice is the Open Educational Resources (OER) movement. This idea has existed since July 2002 when a UNESCO (United Nations Education, Scientific, and Cultural Organization) forum resulted in coining the term "open

educational resources" and has been in use since that time (Commonwealth of Learning, 2015). As the title suggests, the resources are those that are free to use and reuse. Primarily, the intellectual property license is such that individuals are permitted to use the materials without cost. This relates to the disruptors of technology and access to information and has transformed many levels of education into cost-saving mode. OER is impactful as it sets the cost of the material at zero.

As some of the previous information notes, another alternative is to avoid making the textbook purchase. In what was previously unthinkable, some students realize the cost is greater than the benefit, hence they refuse to buy required materials. Additionally, a negative trend in higher education has been the requirement of a textbook that is seldom or never used it in class. The logic of the student veers to the side of not buying something that isn't needed or used in class. Given the alternative, a student would much rather utilize free materials as opposed to buying items for class. Senack (2014) notes students could save hundreds of dollars per course with OER materials. It would provide huge savings over the time it takes to earn a degree at any type of institution. Getting the material cost to zero would be a significant milestone for any course.

Another thoughtful alternative is to have students generate their own materials for the course. Why not as technology, access to information, and the ability to share documents can be imperative factors in creating materials for the class. This would be a significant challenge to the textbook industry. Publishers are taking notice as, similar to the pharmaceutical industry, they started to market textbooks, digital products, and supplementary materials directly to students (Straumsheim, 2015). However, getting the cost to zero outweighs other options as students can create their own materials. It would match a blog from *The Teaching Professor* with the topic "Do you think colleges and universities should do away with textbooks?" Such changes are appreciated as students see similarities to the digital changes brought about in the music industry (Young, 2010).

It appears that numerous benefits occur when students are responsible for generating material for the class. This includes taking pride in the material, making changes on the fly, allowing class members to edit materials, eliminating the complaints of textbook costs and lack of use, and engaging students in course materials. Such materials can take the form of textbooks, homework problems, quiz questions, case studies, class notes, apps, and other learning tools as designed by students and used in class (Kelly, 2013). Additionally, it appears that providing a level of structure by using a template and instructions are quite beneficial in allowing students to provide materials needed for class.

All of the mentioned ideas are important and a significant challenge to the $13.7 billion textbook industry as such is being impacted by many factors including education nonprofits, governments, professors, tech startups, publishers, and established firms like Apple (Lee, 2013). In fact, before his death in 2011, Steve Jobs was looking at the textbook industry as one where technology could serve as a disruptor (Watters, 2011). Steve seemed to be visionary as rapid changes are occurring in the once unyielding industry.

Methodology

The process of evaluating student-generated materials entailed utilizing alternatives to textbooks in two separate classes and comparing results of the classes to outcomes assessment. Using the student-generated materials would be deemed successful if students could maintain a consistent meeting of the outcomes required for the courses. A threshold of 75% average attainment was selected as a basis of being at least average (a "C" grade) for the specific course. Otherwise, anything below average would denote not meeting the standard for utilizing student-generated materials. Two separate subject areas, levels of courses, and types of students were utilized as part of the experiment.

The first experiment required students to write a specific chapter of material for strategic management, a course that consists of senior undergraduate business students. A total of 30 chapter topics were available as was a template that would serve as a level of standardization for material. Each student had to deliver the material by an established deadline (hence, no unfair time advantage for some students). Each student would upload the chapter to a local drive (could easily use Google docs, college drive, or an LMS). By doing such, material would be readily available for all students. Once all chapters were uploaded, there was an acceptable block of chapters to use for the course. The final product would be shared and available to all students.

Results were easy to evaluate in that treating each chapter as a research paper on the specific topic could be graded via a rubric used for other research assignments in the course. The final results showed students exceeding the 75% average, attaining an average of 88%. This grade was higher than the final course average of 84.5%. Along with exceeding the average threshold, student responses were quite positive as they enjoyed the ability to select their own material, developed items based on a standard template, shared work with other students, and accessed material via electronic format. Most importantly, students took pride in self-generated material that saved approximately $300 over the cost of a new textbook.

The second experiment involved an undergraduate level issues in sports management class. With a textbook of case studies costing $350 (new textbook with no used copies available), it was decided that students would forgo such purchase. Instead, they would define, research, and present selected issues to the class. In order to do this, students were assigned to different groups each week, submitted an issue that would be covered once during the semester, and were given a standard rubric and PPT instructions. The PPT would be uploaded via a deadline set long before class (i.e. no late submissions). At that point, each group would present findings to the class. Like wash, rinse, and repeat, this process occurred each week so that the semester offered an evaluation of over 60 issues in sports management. The number of topics was much greater than that offered by the textbook. Also, material could be updated in somewhat of a real-time format.

Utilizing the 75% average like that of the first experiment, students were able to exceed the standard. The 89% average was slightly above that of the first experiment and exceeded the final average of 86.3%. The material remained available in electronic format for permanent download. As with the first experiment, students appreciated the ability to create their own work, liked the chance to select many differing topics, followed a standard PPT that offered continuity during the course, and shared information with other

students. And, as with the first experiment, students took pride in self-generated material while saving $350 over the cost of a new textbook.

Results/Findings

It appears that student-generated materials can be an effective alternative to textbooks. While working through the various experiments, many benefits were found for students, educators, and higher education. For students, this includes: saving hundreds of dollars by not purchasing textbooks, taking a sense of ownership in generating materials, being able to change material on the fly and update it throughout a course, offering a chance for the entire class to edit materials, downloading electronic copies to smartphones and other devices, utilizing access to the growing volume of OER materials, enhancing written and verbal skills, garnering feedback from peers, gaining empowering by becoming somewhat of an expert in a topic area, and feeling free from the monopoly of the publishers.

Educators, like the students, stand to gain much by the same endeavor. By researching and working through experiments, it is obvious that educators benefit in areas such as: being free from the tyranny of book publishers, requiring students to come prepared for class activity, creating motivation to read other materials, earning praise by saving money for students, avoiding having students inquire of the need to purchase a specific book, not worrying about the failure associated with selecting a wrong book, eliminating the complaints of not using a book that cost so much money, avoiding outdated material, eliminating the hassle of book orders, and creating a link between materials and course outcomes.

On a macro level, higher education benefits from seeing zero cost materials, nurturing a move to student-centered education, offering students input in materials covered in class, catering to specific subject areas, creating real-time information, utilizing document sharing and technology to create efficiencies, offering a direct link to the process of outcomes assessment, and seeing a high level of freedom from the monopolistic publishing industry.

As these benefits were derived for students, educators, and higher education, one soon realizes that it is possible to maintain a standard of assessment while allowing students to create materials that would be used for the class. In the meantime, no textbook purchase would be expected for students. The link among student-generated materials, maintenance of quality, and outcomes assessment offers a great accumulation of efficiency for all realms of higher education.

Discussion

Can we allow students to generate materials in lieu of the standard textbook? Are we beyond the days of needing a textbook for each course? Can we utilize vast technology and access to information in order to depend on students for materials? “Yes” is the resounding answer to each question. In fact, a number of benefits can be gleaned for students, professors, and those in higher education. It is about deciding among textbook purchases as one extreme, no materials as the other extreme, and something that could fit in between these choices. That something in between could be something like OER, reduced price books, or student-generated materials.

Based on findings from the experiments, it seems that student-generated materials are an effective choice. Most importantly, it offers zero cost to students and allows students to feel ownership, generate skill sets, and build upon what is learned in class. Additionally, faculty members are free from textbook decisions, see that material can be updated on a continuous basis, and can assess results. Finally, higher education sees a reduced cost, gains in skills for students, and can connect to the vast system of outcomes assessment.

Overall, student-generated materials are a great choice for the future of an industry that is pressured from many disruptors attempting to feed upon the weakness of the industry. Where do educators go from here? It is purely speculative but one would think higher education realizes that dependence on textbook publishers isn't an effective approach to materials required for class. Students want to utilize items that are cost-free, can be changed with technology, are dependent upon the skills of the students, are available in electronic formats, and allow individuals to gain in communication and other skills. Overall, student-generated materials are critical to the future of higher education and will be utilized more and more as part of the learning process. Otherwise, students pay the high cost of textbooks and fail to capitalize on the disruptors of higher education.

References

College Board. (2017). *Trends in college pricing*. 1-32.

Commonwealth of Learning. (2015). *Understanding open educational resources.1.*

Connor-Greene, P.A. (2000). Assessing and promoting student learning: Blurring the line between teaching and testing. *Teaching of Psychology.* 27, 84-88.

Hattenberg, S.J., and Steffy, K. (2013). Increasing reading compliance of undergraduates: An evaluation of compliance methods. *Teaching Sociology.* 41 (4), 346-352.

Howard, J.R. (2004). Just in time teaching in sociology or how I convinced by students to actually read the assignments. *Teaching Sociology.* 32, 385-90.

Kelly, Rob. (2013). Managing curricular conflict. *Online Classroom.* 12 (10), 4-5.

Lee, Ellen. (2013). E-books and cost pressures push college students away from textbooks. Retrieved from http://www.thedailybeaast.com/articles/2013/06/24/death-of-the-textbook-and-the-50-pound-bookbag.html6/24/13

Morris-Babb, Meredith, and Henderson, Susie. (2012). An experiment in open-access textbook publishing: changing the world one textbook at a time. *Journal of Scholarly Publishing.* 43 (2), 148-155.

Senack, Ethan. (2014). Fixing the broken textbook market: How students respond to high textbook costs and demand alternatives. *U.S. PIRG Education Fund & The Student PIRGS*. 1-18.

Shin, Sujin. (2013). How often do students actually use their textbooks? *The Daily Clog.* November 25. Retrieved at http://www.dailycal.org/2013/11/25/often-students-actually-use-textbooks/

Straumsheim, Carl (2015). A textbook market strategy that moves beyond professors. *Inside Higher Ed.* Retrieved at https://www.insidehighered.com/news/2015/09/09/textbook-publishers-explore-direct-student-marketing-and-sales?utm_source=Inside+Higher+Ed&utm_campaign=a6202d0822-DNU20150909&utm_medium=email&utm_term=0_1fcbc04421-a6202d0822-19741338.

Watters, Audrey. (2011). Steve jobs plans to disrupt the textbook industry. How disruptive were they? *Inside Higher Education.* Retrieved at https://www.insidehighered.com/blogs/hack-higher-education/steve-jobs-plans-disrupt-textbook-industry-how-disruptive-were-they?

Young, Jeffrey R. (2010). To save students money, colleges may force a switch to textbooks. *The Chronicle of Higher Education* October 24. Retrieved at: chronicle.com/article/The-End-of-the-Textbook-as-We/125044/

The Role of Women Empowerment Clubs in Poverty Reduction in Zambia

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ABSTRACT

The purpose of the study was to investigate the role of women empowerment clubs in poverty reduction in Zambia. The study targeted some women empowerment groups in different parts of the country. The objectives of this study were as follows; to find out if women's clubs contribute to poverty reduction among women, to examine the challenges that women's club experiences and to determine measures that could be put in place to overcome the challenges.

The research design of the study was a survey design which used both qualitative and quantitative approaches. A sample of 50 women was selected from 10 women empowerment clubs in various parts of Zambia which include Lusaka, Chinsali and Senanga. The data was collected using questionnaires.

The findings of the study revealed that women have been empowered by the clubs. They have acquired skills and knowledge that some of them have used to start small businesses. These small businesses help the women to earn an income that helps them to run their households and send children to school.

The study therefore recommended that the government and other stakeholders must help in financing the women empowerment clubs and a local and international market should be created to allow women to sell whatever the make and produce in their empowerment group or clubs.

Key words: Women, Empowerment, Club, Poverty, Reduction

INTRODUCTION

Women are usually at the centre of human, social, economic, cultural and political development. They are generally assigned a second class status in most traditional societies, especially in Africa. Women suffer all forms of discriminatory disadvantages both on account of their sex and class. Scholars explain that because of their productive and community management roles in society, the effects of poverty hit women particularly hard. This is in spite of the application of numerous strategies and several efforts by the United Nations, international donor agencies and individual countries, aimed at reducing minimizing or eradicating poverty (Mayoux, 2002).

REVIEW OF LITERATURE

Statistically the number of very poor women in the world has increased from 10-30 million at the end of 1999 to 69 million at the end of 2005. The increase represented additional 58.7 million poorest women

receiving empowerment in form of micro- loans in the last six years. Women are considered as preferred clients since their improved income benefits families' through improved nutrition, health, education and well-being. This is because women have higher repayment rates and work better in group based programmes (World Bank, 2004).

In Zambia various strategies aimed at addressing the needs of the poor women especially in rural areas are devised. Among the interventions are the public welfare (PWAS) under the Department of Social Welfare and WEP under the Department of Community Development. The national policy on Community Development focuses on poverty eradication through the empowerment of communities for sustainable human development. However, the capacity of these departments charged with the responsibility of dealing with the poor is almost non-existent (Chinguta et al, 1998).

The role of women's club activities are that they are extension oriented. That is to mean extension of something such as skills, knowledge, information and ideas from one person to another. Thus, extension is one of the main objectives of promoting any project through women's groups as a way of transferring power or resources to those who do not have. Given an economic and materialist framework, the term empowering seem proper. It entails that the have nots, the powerless or disadvantaged acquiring or being given more power, resources and knowledge than before. In this regard, women's groups function as bridges to receive packages of empowerment and to enable outers to gain access to those invisible or hidden within poverty (Gboku and Lekoko, 2007).

Women empowerment clubs main goal is to reduce poverty, sometimes, the money earned by the male member of the family is not sufficient to meet the demands of the family. The added earnings of women helps the family to come out of poverty trap ensuring that all home demands are met. The clubs targets all women, divorced, married and single to be part of the increasing rise of women independence looking at programmes aligned such as the contributions of sum of money by all members which they are able to borrow to undertake their various projects such as paying schools and building projects (Ministry of finance and Economic Development).

Empowerment of women would mean equipping women to be economically independent, self-reliant, have positive esteem to enable them to face any difficult situation and they should be able to participate in development activities (Hazarika, 2011).

Women empowerment clubs encourage women to participate in economic activities and this helps to bring about growth at household and national level.According to Department of foreign affairs and trade (2016) societies that make better use of the skills, talents and time of all members will more likely to prosper. Women are often more likely than men to use income to support development outcomes within their families.

Women's economic empowerment is a pre-requisite for sustainable development and pro poor growth and the achievements of all the millennium development goals. Achieving women's economic empowerment will directly enhance sound polices, holistic approach and long-term commitment and gender-specific perspectives integrated at the design stage of policy and programing. Gender equality and empowered women are catalysts for multiplying development efforts. Investments in gender equality yield the highest returns of all development investments. Women usually invest a higher proportion of their earnings in their

families and communities than men. A study in Brazil showed that the likelihood of a child's survival increased by 20% when the mother controlled household income (Narayan, 2002).

Economic empowerment is the only way to help women's social status to change. Economic empowerment is an important component of human survival, individual development and potential change for the better in terms of social status.it has also been noted that income generating programs allow the poor to be more self-reliant and substantially encourage women to engage in economically productive activities (Nanyunga, 2010).

OBJECTIVES OF THE STUDY

1. To find out if women's clubs contributed to poverty reduction among women.
2. To examine the challenges that women's club experienced.
3. To determine measures that could be put in place to overcome the challenges.

RESEARCH QUESTIONS

1. Do women empowerment clubs contribute to poverty reduction among women?
2. What are the challenges that women empowerment clubs experienced?
3. What are some of the measures that could be put in place to overcome the challenges?

METHODOLOGY

RESEARCH DESIGN

A research design is a plan or strategy of investigation used to obtain evidence to answer research questions. It describes the strategy for conducting the study, including when, from whom and under what conditions the data will be obtained (Kagan, 2012).The study used a descriptive survey design in which both numeric and non-numeric data was collected. McBurney (1994:170) define the survey assessing public opinion or individual characteristics by the use of questionnaire and sampling methods.

POPULATION

Polit and Hungler (1999:37) define the population as an aggregate or totality of all the objects, subjects or members that conform to a set of specifications. In this study the population was women's clubs/groups in Zambia.

SAMPLE

A sample is a subset of a population selected to participate in the study. It is a fraction of the whole, selected to participate in the research project (Brink 1996:133; Polit & Hungler 1999:227).

SAMPLING PROCEDURE

Researchers normally use two major sampling procedures to select a sample and these are probability and non-probability sampling. Probability sampling gives everyone or everything an equal chance of being

selected. Non probability sampling on the other hand is used in situations where the population is not clearly defined. The study used purposive sampling procedure.

DATA COLLECTION

Questionnaires with open and closed ended questions where used to collect data from the respondents.

FINDINGS

Distribution of respondents' age group

Age	Frequency	Percentage
15 to 25	**7**	**14**
26 to 35	**7**	**14**
36 to 45	**14**	**28**
46 to 55	**16**	**32**
56 and above	**6**	**12**
Total	**50**	**100**

The table above showed that 14% of the respondents were between the age group 15 to 25, another 14% were in the age group between 26 to 35, 28% of the respondents were in the age group between 36 and 45, 32% of the respondent were between 46 and 55 and 12% were 56 and above.

Distribution of respondent's level of education

Grade	Frequency	Percentage
Grade 7	14	28
Grade 9	13	26
Grade 12	15	30
Other	8	16
Total	**50**	**100**

The table showed that 28% of the respondents had gone up to grade 7, 26% of the respondent had gone up to grade 9, 30 % of the respondents had gone up grade 12 and 16% of the respondents had other education qualifications.

Have women empowerment clubs empowered participants

Response	Frequency	Percentage
Yes	45	90
No	5	10
Total	**50**	**100**

The table above showed that 90% of the respondents said that empowerment clubs empowered participants while 10% said that empowerment clubs don't empower participants**.**

The majority of the respondents agreed that women's clubs have empowered them with skills and knowledge. These skills and knowledge are applied in real life situation and have enabled them to be able to support their homes financially with the money they earned from these skills. The majority of the respondents have been able to start small business and become self-employed. They respondents stated that some of the skill they have learnt include making feed from soya beans, keeping chickens and goats, growing vegetables, tailoring, and financial skills.

Some of the benefits of participating in women's empowerment clubs have been stated by the majority of the respondents to include, being able to start a business, they can able to take their children to school and they are able to become self-reliant and reduce on the dependence syndrome.

The respondents indicated that women empowerment clubs face a lot of challenges in their operations. Some of the challenges are as follows, lack of proper funding from Government or private organisations, the women lack market to sell their goods, some club do not have qualified instructors to teach the women skills and some of the clubs members do not commit fully to their clubs.

Some of the measures that must be but in place to overcome the challenges that women empowerments experience have been stated as follows government and other stakeholders like Non-governmental organisations should help in funding the women empowerment clubs. The respondents also suggested that women should be given loans so that they can start up business, government should find ways to promote products that are made by the women's clubs and a market must be created for women to be able to sell their products.

CONCLUSIONS

From the finding it is very clear that there are a lot of benefits that women find in participating in the empowerment clubs. These clubs help the women to acquire skills and knowledge that they can use to empower themselves. However there is more that can be done by the government and private organisations.

RECCOMENDATIONS

The following were the recommendations;

1. The government and other stakeholders must helping in financing the women empowerment clubs.
2. The government should help women in the empowerment groups or clubs to access loans.
3. More women should be encouraged to take part in the empowerment clubs for their own benefit.
4. A local and international market should be created to allow women to sell whatever the make and produce in their empowerment group or clubs.
5. It is important that more women empowerment club are established in all the province in Zambia.

REFERNCES

Chigunta, F. C., Chisanga, B., and Masiye, G. (1998) Will the Poor always be with us? Poverty experiences in Zambia. Lusaka: Committee for Campaign against poverty.

Department of Foreign Affairs and Trade (2016) Gender equality and women Empowerment Strategy. Australian Government

Hazarika, D. (2011) Women Empowerment in India: A brief discussion. International journal of Education Planning and Administration. ISSN 2249-Volume 1, Number 3

Mayoux. (2006) Women's empowerment through sustainable microfinance: Rethinking best practices, Discussion Draft. Retrieved February 20, 2011 from http: www.genfinance. Infor/documents/Mayoux_backgroundpaper.pdf

Nanyunga, M. (2010) Assessment of the Economic Empowerment of Women and its Effect on their Social Status Mitchel compound-Siavonga. Research report. University of Zambia.

Narayan, D. (2002) Empowerment and poverty Reduction. Washing D.C; World Bank.

World Bank (2004) Beyond Economic Growth: An Introduction to sustainable Development. Washington DC: World Bank.

Ministry of Finance and Economic Development (2001) Poverty Reduction Strategy Paper-Education chapter: Republic of Zambia.

Kagan, D.M (2012) Implications of Research on Teacher Belief. Educational Psychologist, 27(1), 65-90.

The curriculum reform of CAD graphic design for combining theory and practice

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Abstract

As a tool course, CAD graphic design in engineering is assisting other professional courses to achieve professional training goals. According to the characteristics and existing problems of CAD graphic design, this paper puts forward some constructive measures to connect the course with practice application and improve the students' learning enthusiasm. The proposed measures include: teaching method combining theory with practice, teaching mode containing "teaching" and "learning" content, the matched evaluation mechanism guiding correctly students to learn.

Keywords: CAD; Theory; Practice; The curriculum reform

1. Introduction

With the fast development of mould industry, mould design has the basic requirement of high-efficiency and precision. Researchers mainly rely on traditional technology of experience and skills to design and manufacture molds. This method cannot meet the requirements of modern mold design and manufacturing. With the intelligentization of the manufacturing industry era，CAD software has been exploited and wildly applied in the many industry fields. The application of CAD technology in the mold design and processing has become the inevitable trend of mold development.[1] However, the existing teaching mold only adopt theoretical teaching, (Power Point) PPT teaching model and single appraisal mechanism, which cause the courses to divorce from reality and kill students' learning enthusiasm. Therefore, to obtain a better teaching effect and improve the students' learning interest, CAD course should combine the course theory and practice application. In the paper, we will discuss the existing teaching mode of the CAD course and propose a series of teaching reformation to achieve the goal of modern engineering education reform.

2 The problems existing in traditional course teaching

2.1 Pure theoretical teaching

In the traditional teaching model, the "teaching" and "learning" content of the CAD course are mutually independent. The teachers only impart pure theoretical knowledge in the class and rarely put the theory into practice. Most of the theoretical content is only the predecessors' experience. In addition, the

students generally reflect that the theory is difficult to understand and the curriculum practicality is not strong for the existing teaching situation. Therefore, their learning interest is hard to be motivated.

To some degree, these both prejudice against teaching objects of generating the innovative thinking. Solving practical engineering problems is the prerequisite of the existence of CAD course. Pure theoretical teaching is easy to cause the theory to divorce from reality, and not conducive to cultivate high-quality talents in the field of engineering application.

2.2 The improper teaching method

CAD graphic design course covers all kinds of operational approaches for implementing graphic design.[2][3] For students, the information amount is massive and difficult to be consolidated and digested immediately. The existing teaching method used in the classes is usually PPT teaching model. In the PPT teaching, the knowledge was expressed only by graphic and text structure, which easily can accepted by students and their interests easily run away slowly. Therefore, the teachers for CAD graphic design course should adopt more proper teaching methods for knowledge instruction.

2.3 The unreasonable appraisal mechanism for course teaching

Nowadays, the appraisal mechanism of evaluating the learning effect of the CAD graphic design course is single[4][5]. The appraisal mechanism is generally based on the writing papers in the test. This evaluation model is liable to cause students pursue the test score one-sidedly. They will only pay attention to the CAD content on the book and do not care the detail graphic design with CAD software. Therefore, the students ignore the practical application and forget the knowledge in the end, which goes against the original intention of CAD course.

3. Reform measures

3.1 Teaching method combining theory with practice

Under the new teaching environment, the class hours are constantly compressed and the practice session becomes less. It is difficult for students to master CAD courses systematically. The teaching method of CAD theory course should mainly focus on combining theory with practice which can enlighten students to think more deeply about CAD theory and develops students' logical thinking ability in this field. In addition, this course should also provide some CAD application example in this professional field for expanding the students' vision. Therefore, computer practical is an important part of learning CAD and the key for truly mastering the application of CAD software and programming.

3.2 Teaching mode reformation

The teaching mode reformation is one of the important contents for the current high education reformation. In the traditional PPT teaching model for CAD graphic design, only the "teaching" content of CAD course is reflected. However, the "learning" content for students witch is the most important in the teaching process is not implement. Therefore, the "teaching" and "learning" content of the CAD course is detached. To some degree, these both prejudice against teaching objects of generating the innovative

thinking. As one of the courses for strong engineering practices, CAD course should not only focus on indoctrinating the theoretical knowledge, but also cultivating students' ability to solve practical engineering problems. To motivate students' learning enthusiasm of the CAD and master the operational capacity, it is important to change the teaching mode of the CAD course from the traditional teaching mode to combining "teaching" and "learning" mode. In the proposed teaching mode, the role of teachers is more reflected in guiding, organizing the discussion and inspiring students' innovative thinking. At the same time, more time in the course will be spent on students' "learning", not the "teaching".

3.3 The matched evaluation mechanism

Any teaching reformation must have a matched evaluation mechanism which can overcome the blindness of students' study and enhance the scientificity of teachers' teaching. The final grade of the practical course should consist of two parts: practice and theory. At the same time, the practice grade are even more than that of the theory. Therefore, the teachers will reserve some time for students' practical operation in the classes. Moreover, the students are willing to spend time in CAD application, which is the ultimate course purpose.

Conclusion

CAD graphic design course is a very important instrumental course in engineering specialty, which can combine with a large number of engineering courses to serve the professional training goal. At present, the problems existing in course teaching include pure theoretical teaching, improper teaching method and the unreasonable appraisal mechanism. To solve these problems, a series of specific measures are put forward for guaranteeing the students' interest in learning and enhancing the course application.

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References

[1] He H, An L, Yang X, et al. Study on the teaching practice of CAD technology courses in the geoscience field[J]. AGRO FOOD INDUSTRY HI-TECH, 2017, 28(1): 1793-1795.

[2] Kabouridis G, Giannopoulos G L, Tsirkas S A. On the development of course interconnections within a mechanical engineering training programme via single CAD/CAM/CAE software[J]. World Transactions on Engineering and Technology Education, 2015, 13(3): 1-7.

[3] Chang Y S, Chien Y H, Lin H C, et al. Effects of 3D CAD applications on the design creativity of students with different representational abilities[J]. Computers in Human Behavior, 2016, 65: 107-113.

[4] Srinivasan A, Smith J D, Bairaktarova D. Identifying Freehand Sectional View Technical Drawing Activities in Engineering Design Graphics Course to Enhance Spatial Skills of Engineering Students[C]. ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. American Society of Mechanical Engineers, 2016:

V003T04A012-V003T04A012.

[5] Gül Ö. A Study on instructional methods used in CAD courses in interior architecture education[J]. Procedia-Social and Behavioral Sciences, 2015, 174: 1758-1763.

Higher-order accurate finite volume discretization of Helmholtz equations with Pollution Effects Reductions

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Abstract

Higher-order accurate finite volume schemes are developed for Helmholtz equations in two dimensions. Through minimizations of local equation error expansions for the flux integral formulation of the equation, we determine quadrature weights for the discretization of the equation. Collocations of local expansions of the solution and the source terms are utilized to formulate weighted quadratures of all local compact fluxes to describe the equation error expansion within the computational domain. In using the source term distribution to account for fluxes along all compact directions about each grid point as the centroid of a local control volume, the right minimizing quadrature weights are determined and optimized for stability and uniform higher-order convergence. As a result, the resulting local residuals form more complete descriptions of the wave number k and the complexities of the associated pollution effects. The leading terms of the residual errors are optimized for pollution effects reductions to ensure stability and robust convergence of the resulting schemes. Numerical results and analysis of the schemes demonstrate the effectiveness of the methodology.

Introduction

Numerical methods for simulating the Helmholtz equations have continued to receive significant attention as reported in the literature [7,28] addressing the quality of the numerical solutions due to pollution effects associated high wave numbers. As clearly described [28], there have been a lot of published work utilizing the finite element method [1,7], the finite difference method [30], the boundary element method [15] as well as the spectral element method [17] addressing the problem of the pollution effects of the numerical solution of the Helmholtz equation. The compact finite difference method has also been utilized for the Helmholtz equation [5] as well as for general elliptic equations [20,24,26] since they achieve high-order accuracies without significant increase in the size of the resulting system matrices.

The use Taylor series expansions to develop numerical schemes is not new and in [25], the traditional fourth order scheme for the Poisson equation on the compact nine-point stencil was derived.

The technique has been extended to develop higher-order compact schemes [12] and for other application problems [8,13,30]. Basically, the univariate series expansion is utilized to derive the finite difference approximations of the individual terms of the differential equation and then coupled to obtain the numerical schemes for multi dimensions. Associated truncation errors are formulated to assess the accuracy of the schemes.

In [11], local multivariate expansions are utilized to develop higher-order discretizations for the Poisson equations in 3D. First, local expansions for the solution and the source terms are utilized to formulate the equation error for discretizing the equation using weight parameters for the grid functions in characterizing the derivatives in the equation in an undetermined fashion. By determining the parameters to annihilate the leading coefficients of the error, the parameter-based fourth order compact schemes are derived. In [10], the approach was extended to develop a space-time finite volume differencing framework for effective higher-order accurate discretizations of parabolic equations. In [11], the traditional fourth order compact scheme [25] is recovered as a parameterized version of the general parameter-based discretization of the Poisson equation. Numerical experiments show that other parameter-valued schemes are much more stable and robust than traditional fourth order compact scheme. In [10], several higher-order discretizations are constructed for the parabolic equation including a new scheme on the Crank-Nicholson stencil which is fourth order accurate along a parabolic space-time curve. In these cases, the resulting local residual errors are utilized to optimize the resulting schemes to achieve uniform computational convergence rates as reported.

In this paper we present higher-order finite volume discretizations of the Helmholtz equations in two dimensions with a framework for effective reductions in the pollution effects associated with the numerical simulations of the equations. The schemes are designed based on using a multivariate series expansions to approximate local manifolds of the solution to ensure a more accurate charaterization of local fluxes. Generalized weighted quadratures of the local solution expansions are utilized to formulate local equation error expansions based on flux integral formulations of the equation in order to capture all local compact fluxes and preserve operator properties of the equation. The weighted quadrature descriptions express the approximation of the divergence of flow about each grid point on the computational domain and offers the right framework to allow for effective higher accuracies and ensure a more uniform higher-order convergence. Considering flux divergence at each grid point, the interconnections to neighboring points may be expanded to improve local flux modeling within the computational domain. Therefore, as more neighboring grid points are included in this framework more robust higher accuracies are achieved.

The local equation residual from the flux differencing within the balanced formulation of the equation includes all directions of grid points instead of just coordinate directions as in traditional finite difference schemes [12,22,25]. This formulation exhaustively captures the sum of the approximation errors as the local equation error residual. The formal error is then minimized by eliminating much of the terms coupled with the wave numbers in the error to improve consistency, stability, and increase the order of the resulting schemes as much as possible. The extent and effectiveness of the resolution of the couplings of the wave number depend on the number of grid points utilized locally. Numerical results and analysis of the schemes demonstrate the effectiveness of the methodology on stability and accuracy for higher wave numbers.

Consider the elliptic boundary value problem

$$-\mathrm{div}(\mu \nabla u) + c\,u = q, \quad x \in \Omega \tag{1.1}$$

$$\mu \frac{\partial}{\partial \nu} u + \alpha\, u = g, \quad x \in \Gamma \tag{1.2}$$

where Ω is an open regular bounded domain in $\mathbb{R}^2$ with v as the outward normal to the smooth boundary Γ and assume that μ, f, c, α, g are sufficiently smooth.

To obtain higher computational efficiencies and performances desired of higher-order methods, a complete characterization of the local equation error within the computational domain must be formulated using the balanced flux integral formulation the equation. We therefore base our approach and methodology on multivariate Taylor series expansion to approximate the solution locally in order to more accurately represent and account for all local compact fluxes. To conserve the properties of the equation and be applicable to a range of applications, we use the finite volume idea [20] of conservative integral representation of the equation. However, we adopt grid-point centered control volumes in this formulation to reflect the series expansion of the local manifold containing the solution. Adopting a uniform distribution of grid points on the control volume ensures that symmetric system matrices are achieved for the resulting schemes.

The contributions of this paper include:

- A systematic framework based on the finite volume methodology is described for a general elliptic equation which allows for using local fluxes in discretizing the more balanced integral formulation of the equation. Adaptive ways to utilize more local as well as nonlocal fluxes are supported and all fluxes are accounted for by the framework to ensure conservation within the computational domain.
- The residual errors for the resulting schemes are more completely and accurately determined through optimizations of the equation error expansion to ensure uniform higher-order convergence rates.
- Effective ways to optimize sensitivities of resulting numerical models to coefficients of the differential equation.
- The design supports the use of other vertex-centered control volumes [26] to develop efficient higher-order accurate methods.

The paper is organized as follows: In Section 2 we present the framework of the method by describing the discretization for a general elliptic equation in flux divergence form locally in ^{2}. In Section 3, we apply the method to develop new efficient higher-order schemes for the Helmholtz equations in two dimensions. We present the resulting fourth order schemes in Section 4 and illustrate the pollution effects for the fourth order schemes due to high values of the wave number k. We further illustrate the effectiveness of the new schemes in reducing the indefiniteness associated with Helmholtz equation in the fourth order schemes and consistency improvements in Section 4.1. Then the extension to the sixth order schemes are described in Section 4.2 and numerical results demonstrating the accuracies of the methods are illustrated in Section 5. Conclusions are presented in Section 7.

The finite Volume Discretization Framework

We describe the finite volume differencing discretization method for the elliptic boundary value problem

$$-\nabla \cdot (\kappa \nabla u) + c\,u = q, \quad \text{in} \in \Omega \tag{2.1}$$

$$u = g, \quad \text{on} \in \Gamma \tag{2.2}$$

where Ω is a bounded domain in $\mathbb{R}^2$ with a smooth boundary Γ. We assume that $\kappa \in L^{\infty}(\Omega)$ and is positive and the source $q \in L^2(\Omega)$.

To develop a higher-order accurate discretization for (2.1) with robust computational accuracy, the discretization framework must effectively account for all local compact fluxes to describe the diffusion effectively within the computational domain. That is, the framework must be conservative of all local fluxes [6] required for consistent and robust higher-order accuracies. We therefore formulate the equation (2.1) over local control volumes which can provide the needed support for local fluxes to neighboring grid points rather than independently in univariate Cartesian coordinate directions [21] as in traditional finite difference formulations.

We first write the integral formulation of the equation (2.1) as

$$-\int_{\Omega} \nabla \cdot \kappa \nabla u \; dv + \int_{\Omega} c\,u\,dv = \int_{\Omega} q\,dv \tag{2.3}$$

where $dv = dxdy$ in $\mathbb{R}^2$. By the divergence theorem, equation (2.3) is rewritten into the flux integral balanced form as

$$-\oint_{\partial\Omega} \kappa \nabla u \cdot \nu \; dS + \int_{\Omega} c\,u\,dv = \int_{\Omega} q\,dv \tag{2.4}$$

where v is the unit outward normal to the boundary S of the domain Ω.

Now, consider the domain Ω partitioned into control volumes where each control volume is identified by its centroid mesh point and a distribution of neighboring mesh points as in Figure 1. A uniform distribution of grid points is utilized for this work but the approach is applicable for a non-uniform distribution as well. A combination of uniform distribution for regular grid points and non-uniform distribution for irregular grid-points may be adopted for handling discretizations on non-rectangular domains [8]. The grid-point clouds for neighboring control volumes overlap [27] to create interlocking configurations which help to capture and track local fluxes effectively on the computational domain necessary for higher level of conservation and robust higher-order rates of convergence.

We thus describe (2.4) about the centroid of each control volume $\mathbf{Q}_h$ by

$$-\oint_{\partial \mathbf{Q}_h} \kappa \nabla u \cdot \nu_h \, dS_h + \int_{\mathbf{Q}_h} c\,u\,dv = \int_{\mathbf{Q}_h} q\,dv \tag{2.5}$$

where v_h is the unit outward normal vector to S_h which is the boundary of $\mathbf{Q}_h$. The equation (2.5) represents the conservation of u about the centroid of the control volume such that variations in the source distributions

within the control volume are compensated for by the local diffusive fluxes through the boundary S_h [9]. Thus, the distribution of u within the control volume $\mathbf{Q}_h$ is completely determined by the sum of all diffusive radial fluxes about the centroid and the corresponding source distribution. Hence, the associated equation error, $E(u)$, about the centroid is given by

$$E(u) \;=\; -\oint_{\partial \mathbf{Q}_h} \kappa \nabla u \cdot \nu_h \, dS_h - \int_{\mathbf{Q}_h} c\, u \, dv \; - \int_{\mathbf{Q}_h} q \, dv \; = 0. \tag{2.6}$$

where $\mathbf{Q}_h = [x_m - h, x_m + h] \times [y_n - h, y_n + h]$ is a typical control volume with centroid $X_0(x_m, y_n)$, as illustrated by Figure 1. The control volume $\mathbf{Q}_h$ illustrated with centroid X_0 and a compact cloud of quadrature points $X_1(x_m + h, y_n)$, $X_2(x_m + h, y_n + h)$, $X_3(x_m, y_n + h)$, $X_4(x_m - h, y_n + h)$, $X_5(x_m - h, y_n)$, $X_6(x_m - h, y_n - h)$, $X_7(x_m, y_n - h)$, and $X_8(x_m + h, y_n = h)$ overlaps with control volumes centered on all these compact quadrature points.

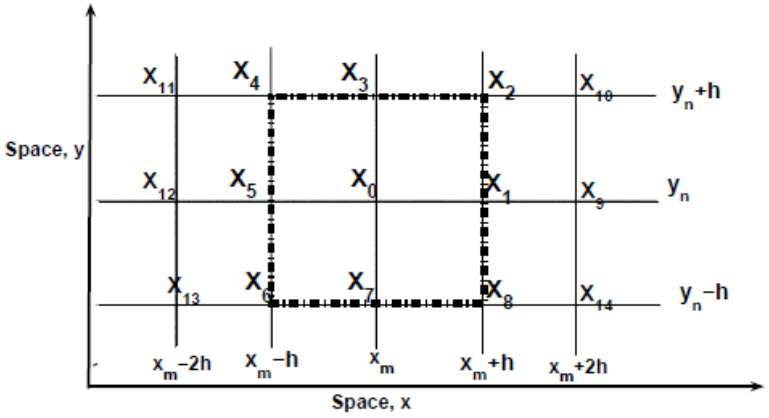


Figure 1: Control volume $\mathbf{Q}_h$ in $\mathbb{R}^2$ with local uniform compact cloud of quadrature points with $X_0(x_m, y_n)$ as the centroid

By using a finite number of quadrature points to approximate the local equation error, the discrete version of (2.6) is therefore nonzero. In fact, we approximate local diffusive fluxes about the centroid of the control volume by a generalized weighted quadrature of the radial fluxes to the neighboring quadrature points by

$$\int_{\partial \mathbf{Q}_h} \kappa(u) \nabla u \cdot \nu_h \, dS_h \;\approx\; \sum_{\partial \mathbf{Q}_h} \kappa(u_0) \nabla u \cdot \nu_h \approx \kappa(u_0) \sum_{i=1}^{n_i} w_i (u_i - u_0) \tag{2.7}$$

where n_i is number of quadrature points, w_i is the collocation weight for the local directional flux, $\nabla u \cdot \nu_{hi} = (u_i - u_0)$ along the radial direction ν_{hi} toward location of u_i. The number of quadrature points forming the desired local distribution is part of the available degrees of freedom, which may be increased to improve local accuracy by incorporating more local and nonlocal fluxes [3].

Based on the adopted set of neighboring quadrature points, the quadrature formulation of (2.4) about the centroid of the control volume becomes

$$-\kappa(u_0) \sum_{\partial \mathbf{Q}_h} W_i \; (u_i - u_0) - \sum_{\mathbf{Q}_h} w_i u_i = \sum_{\mathbf{Q}_h} v_i q_i, \tag{2.8}$$

where $\kappa(u_0)$ is an averaging value of $\kappa(u)$ about the centroid. Clearly, the framework as described in (2.8) allows for both regular and non-regular distribution of quadrature points locally about each centroid and adaptively.

For a more complete modeling of the local equation error (2.12) in all radial directions, we adopt a local multivariate Taylor series expansion for u about each centroid (x_0,y_0) by

$$\phi(x_0+x,y_0+y)=\sum_{m=0}^{\infty}\sum_{i+j=m}\frac{C(m,i)}{m!}\frac{\partial^m\phi}{\partial x^i\partial y^j}(x_0,y_0)x^iy^j \tag{2.9}$$

where φ is sufficiently smooth and locally defined everywhere such that

$$\begin{aligned}\phi(x_0,y_0) &= u(x_0,y_0)\\ \frac{\partial^m\phi}{\partial x^i\partial y^j}(x_0,y_0) &= \frac{\partial^m u}{\partial x^i\partial y^j}(x_0,y_0).\end{aligned}$$

Consequently, we define the local source term by

$$f(x_0+x,y_0+y)=-\Delta_\kappa\left(\sum_{m=0}^{\infty}\sum_{i+j=m}\frac{C(m,i)}{m!}\frac{\partial^m\phi}{\partial x^i\partial y^j}(x_0,y_0)x^iy^j\right) \tag{2.10}$$

where Δ_κ is the local differential operator description of (2.1) with unique characteristics of the equation [16] such that

$$f(x_0,y_0)=q(x_0,y_0)=\triangle_\kappa\phi|_{(x_0,y_0)}:=(\nabla\cdot(\kappa\nabla\phi)+c\phi)|_{(x_0,y_0)}=(\kappa\Delta\phi+c\phi)|_{(x_0,y_0)}. \tag{2.11}$$

In this way, *any* grid functions of φ and f on the control volume may be utilized to describe the approximations the integral fluxes in (2.4) in the form of (2.8). Thus, the grid point spacings may not need necessarily to be uniform and can be adaptively determined locally. As a result, *any* desired quadrature points about the centroid may be included in the approximation of the flux integrals to discretize (2.4).

To enable effective higher-order accuracies, the Cauchy-Kovalevskaya procedure [14] is applied to replace higher order derivatives of φ in the expansions (2.9) and (2.10) by lower order derivatives of the local source term f. Thus, coefficients such φ_{xxxy}, φ_{xyyy}, φ_{xxxx}, etc in (2.9) and (2.11) are replaced by f_x, f_y, f_{yy}, f_{xx}, etc in order to more accurately represent the physics of the problem in the local expansions. As a result, the source term derivatives are introduced into (2.9) through higher-order derivatives of the equation (2.11) given as

$$\begin{aligned}-\kappa(\phi_{xx}+\phi_{yy})+c\phi &= f,\\ -\kappa(\phi_{xxx}+\phi_{xyy})+c\phi_x &= f_x,\\ -\kappa(\phi_{xxy}+\phi_{yyy})+c\phi_y &= f_y,\\ -\kappa(\phi_{xxxy}+\phi_{xyyy})+c\phi_{xy} &= f_{xy},\\ -\kappa(\phi_{xxxx}+\phi_{xxyy})+c\phi_{xx} &= f_{xx},\\ -\kappa(\phi_{xxyy}+\phi_{yyyy})+c\phi_{yy} &= f_{yy},\ \text{etc}.\end{aligned}$$

The local equation error expansion E_{Qh} is described using the weighted quadrature approximations of the local fluxes by

$$\mathrm{E}_{Q_h}(\phi) \;=\; -\kappa(\phi_0)\sum_{\partial \mathbf{Q}_h} W_i\ (\phi_i - \phi_0) - \sum_{\mathbf{Q}_h} w_i\phi_i - \sum_{\mathbf{Q}_h} v_i f_i, \neq 0 \qquad (2.12)$$

where

$$\sum_{\partial \mathbf{Q}_h} W_i = 0, \quad \sum_{\partial \mathbf{Q}_h} w_i = 1, \quad \sum_{\mathbf{Q}_h} v_i = 1. \qquad (2.13)$$

such that the differential and integral operator properties of the equations are preserved about each centroid. This error expansion measures the sum of the discrepancies of all possible flux formulation of (2.1) on the control volume. Thus, the formulation (2.4) offers a more complete accounting of local fluxes than traditional finite difference approximations which is a parameterized version of this framework.

To obtain the specifics the discretization for (2.1), the discrete minimax approach is utilized to determine the quadrature weights to annihilate the leading terms of the error expansion hierarchically. That is, the weights W_i, w_i, and v_i are determined to annihilate the leading terms of the error expansion of (2.5) and to further regulate the growth of the residual error. One advantage here is that for various innovative ways [18,29] to incorporate local micro scale properties into the numerical model, our comprehensive approach is naturally efficient in determining the right sampling and collocations of the source required for effective and robust higher-order accuracy.

Discretization of Helmholtz Equations in 2D

In this section, we demonstrate the advantages of the finite volume method described in Section 2 in developing consistent higher-order accurate schemes for the Helmholtz equation

$$-\Delta u - k^2 u \;=\; q \quad \text{in } \Omega, \qquad (3.1)$$

where q is a given source function with compact support, $\Omega \subset {}^2$ is a bounded domain, $k = \omega/c$ is the wave number with ω and c as the circular frequency and speed of light respectively.

Many application problems in science including acoustic wave scattering from submarines, noise reduction in silencers and mufflers, earthquake wave propagation and others [17] are governed by the Helmholtz equation. The quality of the numerical solutions of the Helmholtz equation depends significantly on the size of the wavenumber k [4,17,19,31]. Our goal in developing higher-order accurate schemes for (3.1) is to demonstrate the pollution effect [31] in the local equation error expansion as well as the effectiveness of our approach in reducing the pollution effects to improve the qualities of the numerical solutions.

Consider the local approximation φ of u about the centroid of the control volume Q_h in two dimensions such that

$$-\Delta\varphi - k^2\varphi = \; f, \qquad (3.2)$$

where k is the wave number and $f : \mathbb{R}^2 \to \mathbb{C}$ is a local source term with local compact support defined according to (2.9) and (2.10) such that

$$\lim_{(x,y)\to(x_0,y_0)} \phi(x,y) = u(x_0,y_0) \quad \text{and} \quad \lim_{(x,y)\to(x_0,y_0)} f(x,y) = q(x_0,y_0).$$

We describe the approximation of balanced flux integral form of the Helmholtz equation (3.1) about the centroid of the control volume Q_h in two dimensions by

$$-\sum_{i=1}^{8} W_i \nabla\phi_i - \sum_{i=0}^{8} w_i \phi_i = \sum_{i=0}^{8} V_i f_i \tag{3.3}$$

and the local equation error expansion E_{Qh} by

$$\mathrm{E}_{Q_h}(\phi) = -\sum_{\partial \mathbf{Q}_h} W_i \,(\phi_i - \phi_0) - \sum_{\mathbf{Q}_h} w_i\phi_i - \sum_{\mathbf{Q}_h} V_i f_i \tag{3.4}$$

where

$$W_0 = \sum_{i=1}^{8} W_i, \quad w_0 = (1 - \sum_{i=1}^{8} w_i)k^2, \quad V_0 = 1 - \sum_{i=1}^{8} V_i \quad . \tag{3.5}$$

As discussed above, the source function approximations f_i on the control volume are defined specifically for the Helmholtz equation (3.2) by

$$f(x_0+x, y_0+y) = -(\triangle + k^2)\phi(x_0+x, y_0+y \quad) \tag{3.6}$$

such that

$$f_0 = f(x_0,y_0) = -\phi_{xx}(x_0,y_0) - \phi_{yy}(x_0,y_0) - k^2\phi(x_0,y_0)$$

which is consistent at the centroid of the control volume.

By substituting (2.9) and (3.6) into (3.4), the leading terms of the local equation error expansion are sorted to display the leading coefficients as functions of the weight parameters. The weight parameters are then determined to annihilate the leading coefficients sequentially. After eliminating the leading terms up to the third order terms, the weights are determined as

$$\begin{aligned}
W_0 &= \frac{10}{3h^2}, \quad W_1 = W_3 = W_5 = W_7 = -\frac{2}{3h^2}, \; W_2 = W_4 = W_6 = W_8 = -\frac{1}{6h^2}, \\
v_0 &= \frac{2}{3} + 4v_4, \; v_1 = v_3 = v_5 = v_7 = \frac{1}{12} - 2v_4, \; v_2 = v_6 = v_8 = v_4 \qquad (3.7) \\
w_0 &= (\frac{5}{6} - 2w_5)k^2, \; w_1 = w_3 = w_7 = w_5k^2, \; w_2 = w_4 = w_6 = w_8 = (\frac{1}{24} - \frac{w_5}{2})k^2,
\end{aligned}$$

and the associated equation error residual is obtained as

$$\text{Local Truncation Error} = T_4h^4 + T_6h^6 + T_8h^8 + O(h^{10}) \tag{3.8}$$

where

$$
\begin{aligned}
T_4 &= -\frac{k^2}{240}(k^2\triangle\phi+\triangle f)+k^2(\frac{1}{45}-\frac{w_5}{2})\frac{\partial^4\phi}{\partial x^2\partial y^2}+(v_4-\frac{1}{90})\frac{\partial^4 f}{\partial x^2\partial y^2}+\frac{1}{240}(\frac{\partial^4 f}{\partial x^4}+\frac{\partial^4 f}{\partial y^4}),\\
T_6 &= \frac{11k^4}{60480}(k^2\triangle\phi+\triangle f)+\frac{k^4}{24}(w_5-\frac{19}{315})\frac{\partial^4\phi}{\partial x^2\partial y^2}-\frac{11}{60480}(k^2(\frac{\partial^4 f}{\partial x^4}+\frac{\partial^4 f}{\partial y^4})-\frac{\partial^6 f}{\partial x^6}-\frac{\partial^6 f}{\partial y^6})\\
&\quad+\frac{k^2}{24}(v_4-\frac{29}{420})\frac{\partial^4 f}{\partial x^2\partial y^2}+\frac{1}{12}\left(v_4-\frac{5}{1008}\right)\left(\frac{\partial^6 f}{\partial x^4\partial y^2}+\frac{\partial^6 f}{\partial x^2\partial y^4}\right)+\frac{1}{3024}\frac{\partial^8\phi}{\partial x^4\partial y^4},\\
T_8 &= -\frac{13k^6}{3628800}(k^2\triangle\phi+\triangle f)+\frac{k^6}{720}(\frac{17}{252}-w_5)\frac{\partial^4\phi}{\partial x^2\partial y^2}-\frac{13k^4}{2628800}(\frac{\partial^4 f}{\partial x^4}+\frac{\partial^4 f}{\partial y^4})\\
&\quad+\frac{k^4}{720}(\frac{61}{840}-w_5)\frac{\partial^4 f}{\partial x^2\partial y^2}+\frac{k^2}{144}(\frac{73}{6300}-\frac{w_5}{10}-v_4)\frac{\partial^8\phi}{\partial x^4\partial y^4}\\
&\quad+\text{Higher order derivatives of f.}
\end{aligned}
$$

As clearly illustrated by the local truncation error (3.8), any selections of w_5 and v_4 subject to (3.5) guarantee fourth order accuracy mathematically. For $v_4 = 0$ and $w_5 = \frac{1}{12}$, the resulting scheme uses a 5−point stencils for the discretizations of k^2u and f and a 9−point stencil for the diffusion [12,23,25]. As indicated by (3.8), the mass and the stiffness matrices still depend on w_5 and v_4 respectively and their stabilities [11] may be further determined to optimize the scheme for a uniform of fourth-order accurate convergence. Furthermore, as illustrated by T_4, T_6, and T_8 in (3.8) which are polynomial functions in k, the numerical accuracies of the resulting schemes are significantly affected for high values k.

It is clear from the last terms in T_6 and T_8 that a larger twenty-five point control volume is needed to achieve beyond a sixth-order accuracy. In fact, a tenth-order accuracy can easily be achieved for interior grid points on the computational domain with twenty-five point control volumes. Now, in order to computationally achieve the order of accuracy of the schemes for high values of k, we must discretize and absorb $\triangle\phi$ and $\triangle f$ in T_4, T_6 and T_8 into the scheme and also choose w_5 as $w_5 = \frac{2}{45}$. As a result, the size of the leading term of the error may not be much affected by large values of the wave number k, and thus render the scheme to be consistently fourth-order accurate for moderate sizes of k.

Pollution Effects Reductions in Fourth-Order Accurate Schemes

As illustrated by (3.8), the tuncation error terms are polynomial functions of k with the same degree as h. The basic polynomial

$$P_E = A_p k^4\triangle\phi + B_p k^2\triangle f + C_p k^2\frac{\partial^4\phi}{\partial x^2\partial y^2}+D_p\frac{\partial^4 f}{\partial x^2\partial y^2} \qquad (4.1)$$

appears in T_4, in T_6 multiplied by k^2, and in T_8 multiplied by k^4, and so on. Furthermore, the couplings get more complicated with additional derivative terms in higher order terms beyond h^4 as indicated by T_6, T_8, and therefore the source of associated pollution effects and drag on numerical accuracies and convergence for large values of k. Thus, the pollution effects cannot be eliminated in numerical computations since terms like $\frac{\partial^8\phi}{\partial x^4\partial y^4}$ as in T_6 and T_8 require a larger computational stencil. However, the pollution effects can be

reduced on the 9−point stencil and our strategy is to resolve the terms $\triangle\phi$, $\triangle f$, $\frac{\partial^4\phi}{\partial x^2\partial y^2}$ and $\frac{\partial^4 f}{\partial x^2\partial y^2}$ that are coupled with k in the truncation error. For instance, the compact differencing of the Laplacians of φ and f on the control volume are given by

$$\begin{aligned} h^4\triangle\phi &= -h^2\frac{20\phi_0-(\phi_2+\phi_4+\phi_6+\phi_8)-2(\phi_3+\phi_1+\phi_3+\phi_7)}{6}+\frac{1}{12}(k^2\triangle\phi+\triangle f)h^6 \\ &\quad -\frac{1}{360}(k^4\triangle\phi+k^2\triangle f+2k^2\phi_{xxyy}+4f_{xxyy}+f_{xxxx}+f_{yyyy})h^8+O(h^{10}) \qquad (4.2) \\ h^4\triangle f &= -h^2\frac{20f_0-(f_2+f_4+f_6+f_8)-2(f_3+f_1+f_3+f_7)}{6} \\ &\quad -\frac{1}{12}(2f_{xxyy}+f_{xxxx}+f_{yyyy})h^6+O(h^8), \qquad (4.3) \end{aligned}$$

which are used in resolving the couplings of k in the residual error.

We rewrite the new symmetric fourth-order scheme for (3.1) on the control volume after resolving the k couplings in T_4 as

$$\sum_{i=0}^{8}\alpha_i\phi_i=\sum_{i=0}^{8}\beta_i f_i+\text{Residual Error} \qquad (4.4)$$

where

$$\begin{aligned} \alpha_0 &= \frac{10}{3h^2}-\frac{67k^2}{90}+\frac{17h^2k^4}{1512}, \quad \alpha_1=\alpha_3=\alpha_5=\alpha_7=-\left(\frac{2}{3h^2}+\frac{2k^2}{45}+\frac{11h^2k^4}{7560}\right) \\ \alpha_2 &= \alpha_4=\alpha_6=\alpha_8=-\left(\frac{1}{6h^2}+\frac{7k^2}{360}+\frac{41h^2k^4}{30240}\right), \\ \beta_0 &= \frac{2}{3}+4\beta_8-\frac{h^2k^2}{72}, \ \beta_1=\beta_3=\beta_5=\beta_7=\frac{1}{12}-2\beta_4+\frac{h^2k^2}{360}, \\ \beta_2 &= \beta_6=\beta_8=\beta_4+\frac{h^2k^2}{1440}. \end{aligned} \qquad (4.5)$$

The associated truncation error is then given as

$$\begin{aligned} \text{Error} &= \left\{\left(\beta_4-\frac{1}{90}\right)\frac{\partial^4 f}{\partial x^2\partial y^2}+\frac{1}{240}\left(\frac{\partial^4 f}{\partial x^4}+\frac{\partial^4 f}{\partial y^4}\right)\right\}h^4 \\ &\quad \left\{\frac{k^4}{6048}(k^2\triangle\phi+\triangle f)-\frac{k^2}{6048}\left(\frac{4k^2\partial^4\phi}{\partial x^2\partial y^2}-\frac{\partial^4 f}{\partial x^4}-\frac{\partial^4 f}{\partial y^4}\right)-\frac{11}{60480}\left(\frac{\partial^6 f}{\partial x^6}+\frac{\partial^6 f}{\partial y^6}\right)\right\}h^6 \\ &\quad \left\{-\frac{k^2}{3024}\frac{\partial^4 f}{\partial x^2\partial y^2}+\frac{1}{12}\left(\beta_4-\frac{5}{1008}\right)\left(\frac{\partial^6 f}{\partial x^4\partial y^2}+\frac{\partial^6 f}{\partial x^2\partial y^4}\right)+\frac{1}{3024}\frac{\partial^8\phi}{\partial x^4\partial y^4}\right\}h^6 \\ &\quad +O(h^8) \end{aligned} \qquad (4.6)$$

where β_4 still remains a free parameter.

To improve consistency of the discretization furthermore, we apply (4.2) and (4.3) repeatedly to resolve the couplings in T_6 and T_8 after which the fourth-order scheme becomes

$$\sum_{i=0}^{7} \alpha_i u_i = \sum_{i=0}^{7} \beta_i f_i + \text{Truncation Error} \tag{4.7}$$

where

$$\begin{aligned}
\alpha_0 &= \frac{10}{3h^2} - \frac{67k^2}{90} + \frac{17h^2k^4}{1512} + \frac{83h^4k^6}{226800} + \frac{h^6k^8}{51840} \\
\alpha_1 &= \alpha_3 = \alpha_5 = \alpha_7 = -\left(\frac{2}{3h^2} + \frac{2k^2}{45} + \frac{11h^2k^4}{7560} + \frac{h^4k^6}{56700} + \frac{h^6k^8}{259200}\right) \\
\alpha_2 &= \alpha_4 = \alpha_6 = \alpha_8 = -\left(\frac{1}{6h^2} + \frac{7k^2}{360} + \frac{41h^2k^4}{30240} + \frac{67h^4k^6}{907200} + \frac{h^6k^8}{1036800}\right) \\
\beta_0 &= \frac{2}{3} + 4\beta_4 - \frac{19h^2k^2}{1512} - \frac{187h^4k^4}{453600} - \frac{h^6k^6}{51840} \\
\beta_1 &= \beta_2 = \beta_3 = {}_4 = \frac{1}{12} - 2w_8 + \frac{2h^2k^2}{945} + \frac{37h^4k^4}{907200} + \frac{h^6k^6}{259200}, \\
\beta_5 &= \beta_6 = \beta_8 = \beta_4 + \frac{h^2k^2}{1440} + \frac{h^4k^4}{36288} + \frac{h^6k^6}{1036800}.
\end{aligned}$$

The local truncation error is now described as

$$\text{Local Error} = \hat{T}_4 h^4 + \hat{T}_6 h^6 + \hat{T}_8 h^8 + O(h^{10}) \tag{4.8}$$

with

$$\begin{aligned}
\hat{T}_4 &= \left(\beta_4 - \frac{1}{90}\right)\frac{\partial^4 f}{\partial x^2 \partial y^2} + \frac{1}{240}\left(\frac{\partial^4 f}{\partial x^4} + \frac{\partial^4 f}{\partial y^4}\right), \\
\hat{T}_6 &= \frac{k^2}{6048}\left(\frac{\partial^4 f}{\partial x^4} - 2\frac{\partial^4 f}{\partial x^2 \partial y^2} + \frac{\partial^4 f}{\partial y^4}\right) + \frac{11}{60480}\left(\frac{\partial^6 f}{\partial x^6} + \frac{\partial^6 f}{\partial y^6}\right) \\
&\quad + \frac{1}{12}\left(\beta_4 - \frac{5}{1008}\right)\left(\frac{\partial^6 f}{\partial x^4 \partial y^2} + \frac{\partial^6 f}{\partial x^2 \partial y^4}\right) + \frac{1}{3024}\frac{\partial^8 \phi}{\partial x^4 \partial y^4} \\
\hat{T}_8 &= \frac{k^4}{172800}\left(\frac{\partial^4 f}{\partial x^4} + \frac{\partial^4 f}{\partial y^4}\right) + \frac{17k^2}{907200}\frac{\partial^8 \phi}{\partial x^4 \partial y^4} \\
&\quad + \text{Higher order derivatives of f.}
\end{aligned},$$

Pollution Effects and Computational Accuracy

In this section, we demonstrate the effects on computational accuracies and convergence rates for the different fourth-order accurate schemes described in Section 4 due to different levels of reductions of incidences of k in the local truncation error. In this regard, we compare the convergence rates of the schemes (3.7), (4.4), and (4.7) which are all mathematically fourth order accurate but have different leading terms in the residual errors due k.

To demonstrate convergence rate consistencies and quality of numerical solutions for moderate sizes of the wave number k, we consider the exact solution to the Helmholtz equation (3.1) to be

$$u(x,y) = \sin(w_1 y + w_2 x^2) + \sin(w_3 x + w_4 y^2) \tag{4.9}$$

which may be described as superposition of two waves. The source function which is also a superposition of four waves is determined as

$$f(x,y) = (4w_2^2x^2 + w_1^2 - k^2)\sin(w_1y + w_2x^2) + (4w_4^2x^2 + w_3^2 - k^2)\sin(w_3y + w_4x^2) - 2w_2\cos(w_1y + w_2x^2) - 2w_4\cos(w_3y + w_4x^2). \quad (4.10)$$

The source function is much more complex with larger amplitudes depending on the frequencies of the source waves where part of the waves are out of phase with the rest.

Consider the numerical error $e(h)$, defined as the l^∞ norm of the difference between the numerical solution φ and the exact solution $u(x,y)$ of the Helmholtz equation (3.1). The convergence rate r is expressed such that

$$\begin{aligned} e(h) &= \|u(x,y) - \phi_h\| \\ &= Ch^r + o(h^r) \quad \text{as h} \to 0 \end{aligned} \quad (4.11)$$

where C is independent of the grid size h. For a sufficiently small h we have that $e(h) \approx Ch^r$ for a numerical method of order r and hence $e(h/2) \approx C(h/2)^r$. Then the convergence rate through grid refinement analysis is defined by

$$\begin{aligned} R(h) &= \frac{e(h)}{e(h/2)} \\ &= 2^r. \end{aligned}$$

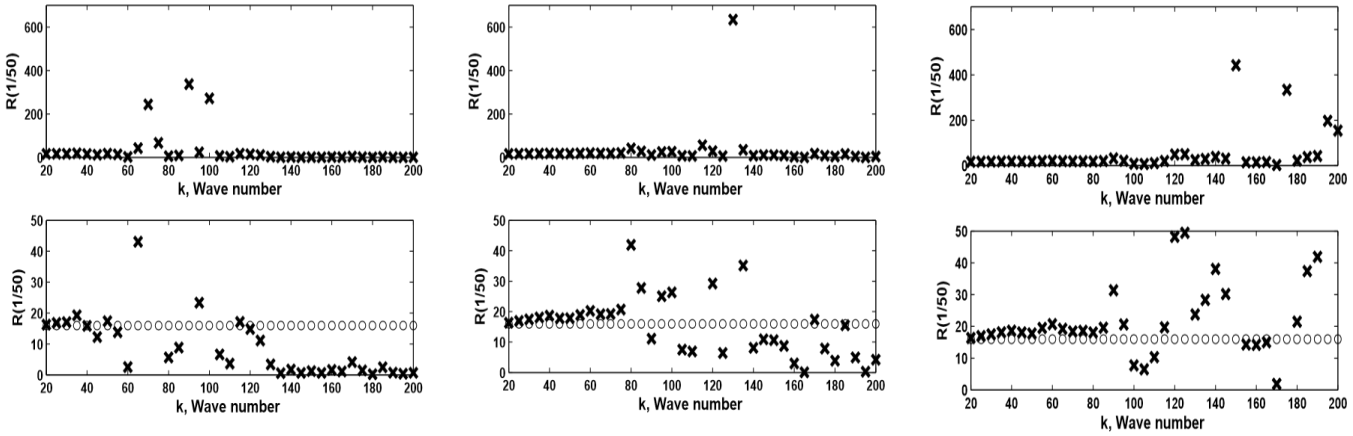
To evaluate pollution effects due to k in the truncation error, we study the convergence rate R for grid resolutions $h = \frac{1}{50}$ and $h = \frac{1}{100}$ as the size of the wave number k is increased from 20 to 200. In Figures 2, 3, and 4, the convergence rates for the three schemes are displayed for the wave with frequencies $w_1 = 34$, $w_2 = -45$, $w_3 = 25$, $w_4 = -50$ and Dirichlet boundary conditions. The top rows show the complete picture of the distributions of $R(1/50)$ and the second rows indicate the zoomed-in versions of the top rows. Figures 5, 6 and 7 illustrate similar convergence rate characterizations for the wave with frequencies $w_1 = 4$, $w_2 = -15$, $w_3 = 5$, $w_4 = -20$.

Figure 2: Convergence rate R for

Figure 3: Convergence rate R for

Figure 4: Convergence rate R for

Scheme (3.7) Scheme (4.4) Scheme (4.7)



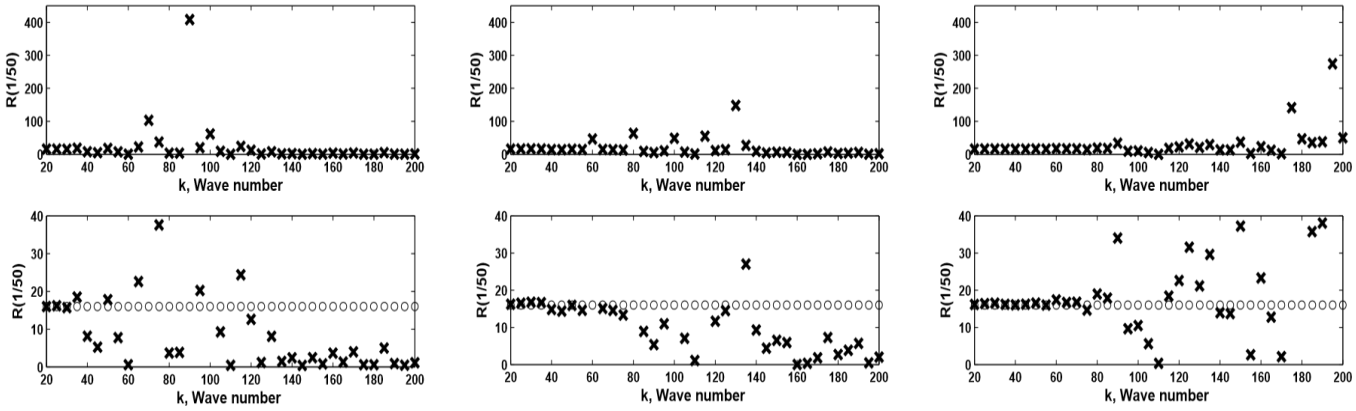
Quality of Numerical Solutions for $u(x, y) = \sin(34y - 45x^2) + \sin(25x - 50y^2)$ with $20 \leq k \leq 200$

Figure 5: Convergence rate R for

Figure 6: Convergence rate R for

Figure 7: Convergence rate R for

Scheme (3.7) Scheme (4.4) Scheme (4.7)



Quality of Numerical Solutions for $u(x, y) = \sin(4y - 15x^2) + \sin(5x - 20y^2)$ with $20 \leq k \leq 200$

The convergence rate patterns for the two waves $u(x,y) = \sin(34y-45x^2)+\sin(25x-50y^2)$ and $u(x,y) = \sin(4y-15x^2)+\sin(5x-20y^2)$ as displayed through Figures 2, 3, 4 and Figures 5, 6, 7 are similar for the three fourth-order accurate schemes 3.7, 4.4, and 4.7. Furthermore, the convergence rates for all the three schemes are uniformly fourth order accurate for $k \leq 30$ as also indicated by the figures. However, between $k = 30$ and $k = 110$, the fourth-order convergence rate for scheme 3.7 cannot be guaranteed to be uniform and solution quality breaks down beyond $k = 110$. Scheme 4.4 is uniformly fourth-order accurate for $k \leq 80$ and solution quality breaks down beyond $k = 140$. Scheme 4.7 is uniformly fourth-order accurate for $k \leq 90$ and solution quality breaks down beyond $k = 200$ when pollution level in the $O(h^{10})$ term and

beyond dominate the error. Thus, as the polluting term P_E described in (4.1) is resolved from the truncation error terms, quality of numerical solution improves. Clearly, the approach serves to demonstrate how to improve convergence sensitivities of numerical modeling to physical phenomena governed by partial differential equations.

Sixth-Order Schemes

In this section, we discuss sixth-order accuracy for (3.1) on the nine-point compact control volume. From the truncation error terms in (4.8), the numerical approximation of the fourth order derivatives of the source term are needed as indicated in [22] in order to annihilate $\hat{T}_4$ in (4.8) to ensure sixth-order accuracy.

It is clear from (4.7) that a larger computational stencil like a twenty-five point stencil is needed in order to extend to a tenth-order accuracy. For a given source term *f*, the last degree of freedom is selected as $\beta_4 = \frac{1}{90}$ and in order to annihilate $\hat{T}_4$, a second order approximation for $\frac{\partial^4 f}{\partial x^4} + \frac{\partial^4 f}{\partial y^4}$ given below

$$\frac{1}{15}\left(4f_{\frac{1}{2}} - 12f_0 - (f_1 + f_3 + f_5 + f_7)\right) = -\frac{h^4}{240}\left(\frac{\partial^4 f}{\partial x^4} + \frac{\partial^4 f}{\partial y^4}\right) - \frac{h^6}{5760}\left(\frac{\partial^6 f}{\partial x^6} + \frac{\partial^6 f}{\partial y^6}\right) + O(h^8) \tag{4.12}$$

is needed. When the above result (4.12) is incorporated in (4.7) and (4.8) with $\beta_4 = \frac{1}{90}$, sixth order accuracy is guaranteed.

For very high frequency regimes, the repeated use of (4.12) as indicated by the truncation error (4.8) is needed to reduce the size of the computational error as indicated in Tables 3 and 4.

Numerical Experiments

Several numerical tests have been performed to validate the effectiveness of this finite volume method for developing efficient, stable and consistent schemes for the Helmholtz equations on uniform mesh points. Pollution effects associated with high wave numbers has been demonstrated where the numerical schemes become more efficient for moderate sizes of the wave number for a given resolution as more truncation error terms coupled with *k* are determined and resolved.

We present some of the results of our tests to illustrate fourth- and sixth-order order accuracies for the schemes on a rectangular domain with Dirichlet boundary conditions.

The errors *e*(*h*) are measured with l^∞ norm according to (4.11) and the order of accuracy or convergence rate *r* is expressed such that for a constant *C* independent of *h* we have

$$r = \frac{\log\left(\frac{e(h_1)}{e(h_2)}\right)}{\log\left(\frac{h_1}{h_2}\right)} \tag{5.1}$$

where h_1 and h_2 are the grid spacings due to any two errors [25] measured according to (4.11)

We have demonstrated in Section 4.1 the need to resolve the terms $\triangle\phi$, $\triangle f$, $\frac{\partial^4 \phi}{\partial x^2 \partial y^2}$, and $\frac{\partial^4 f}{\partial x^2 \partial y^2}$ coupled with *k* in the truncation error for the nine-point compact control volume in order to ensure

uniformly convergent schemes for the Helmholtz equation. So we present some of the numerical results for the scheme (4.7) through the following examples :

Example 1.

Consider the exact solution to the Helmholtz equation as

$$u(x,y) = \exp(xy)$$

where the corresponding source term is determined as

$$f(x,y) = -(x^2 + y^2)\exp(xy) - k^2 \exp(xy)$$

with k as the wave number. We present grid refinement analysis for this example in Table 1 to illustrate pollution effects associated with high wave numbers.

Table 1:
Fourth order grid refinement analysis for $u(x, y) = \exp(xy)$ for Scheme (4.7)

h	$\|u - \phi_h\|_\infty$ $k = 10$	cvge. rate	$\|u - \phi_h\|_\infty$ $k = 50$	cvge. rate	$\|u - \phi_h\|_\infty$ $k = 100$	cvge. rate
1/16	$5.980e^{-06}$		$1.188e^{-06}$		$1.023e^{-05}$	
1/32	$3.686e^{-07}$	4.02	$7.838e^{-08}$	3.92	$2.180e^{-07}$	5.55
1/64	$2.296e^{-08}$	4.00	$4552e^{-09}$	4.11	$7.527e^{-09}$	4.86
1/128	$1.430e^{-09}$	4.00	$2793e^{-010}$	4.03	$8.100e^{-10}$	3.22

Clearly, convergence is uniformly fourth-order accurate for k = 10 and k = 50 but not as uniform for k = 100 for this example as has been demonstrated for example (4.9) in Figures 4 and 7.

Example 2.

Consider the exact solution to the Helmholtz equation to be (4.9) whose source term is given by (4.10). The exact solution here may be described as the superposition of two nonlinear waves whose maximum amplitude is 2. However, the source term may be seen as a superposition of four nonlinear waves with variable amplitudes and some of the waves being out of phase. Thus, the source term can be complex necessitating the use of (4.12) to demonstrate sixth-order accuracy.

Table 2:
Fourth-order grid refinement analysis for
$u(x, y) = \sin(4y - 15x^2) + \sin(5x - 20y^2)$ with (4.7)

h	$\|u - \phi_h\|_\infty$ $k = 10$	cvge. rate	$\|u - \phi_h\|_\infty$ $k = 50$	cvge. rate	$\|u - \phi_h\|_\infty$ $k = 100$	cvge. rate
1/16	$5.511e^{-02}$		$4.639e^{-02}$		$3.329e^{-03}$	
1/32	$3.351e^{-03}$	4.04	$1.244e^{-03}$	5.22	$6.346e^{-04}$	2.39
1/64	$2.081e^{-04}$	4.01	$7.779e^{-05}$	4.00	$1.832e^{-05}$	5.11
1/128	$1.299e^{-05}$	4.00	$4.860e^{-06}$	4.00	$2.081e^{-06}$	3.14

Again, convergence is uniformly fourth-order accurate for $k = 10$ and $k = 50$ but not as uniform for $k = 100$ as has been demonstrated in Figure 7.

In Table 3, we demonstrate six-order convergence analysis for $u(x,y) = \sin(4y - 15x^2) + \sin(5x - 20y^2)$

Table 3:
Sixth-order grid refinement analysis for
$u(x, y) = \sin(4y - 15x^2) + \sin(5x - 20y^2)$

h	$\|u - \phi_h\|_\infty$ $k = 10$	cvge. rate	$\|u - \phi_h\|_\infty$ $k = 50$	cvge. rate	$\|u - \phi_h\|_\infty$ $k = 100$	cvge. rate
1/16	$1.961e^{-04}$		$6.520e^{-05}$		$7.080e^{-04}$	
1/32	$2.958e^{-06}$	6.05	$8.910e^{-07}$	6.19	$2.382e^{-06}$	8.21
1/64	$4.581e^{-08}$	6.01	$1.348e^{-08}$	6.05	$4.157e^{-08}$	5.84
1/128	$7.145e^{-10}$	6.00	$2.097e^{-10}$	6.01	$6.385e^{-10}$	6.02

Again, convergence is uniformly sixth-order accurate for $k = 10$ and $k = 50$ but not as uniform for $k = 100$.

Example 3.

Lastly, we demonstrate the need to resolve the source term derivative $\frac{\partial^4 f}{\partial x^4} + \frac{\partial^4 f}{\partial y^4}$ in the truncation error terms coupled with k in order to improve computational accuracy and quality of the solution. For instance, with the wave number set at $k = 500$, and the exact solution as $u(x,y) = \sin(34y-45x^2)+\sin(25x-50y^2)$, there is a significant difference between when (4.12) is applied only in $\hat{T}_6$ and when (4.12) is applied both $\hat{T}_6$ and $\hat{T}_8$ as indicated by the truncation error (4.8). We demonstrate such numerical results in Tables 4 and 5.

Table 4:
Computational error with $k = 500$ when (4.12) is applied in $\hat{T}_6$ of (4.8)

h	$\|u - \phi_h\|_\infty$	cvge. rate
1/100	$9.6835e^{-02}$	
1/200	$3.0540e^{-03}$	4.987
1/400	$6.4445e^{-05}$	5.566

Table 5:
Computational error with $k = 500$ when (4.12) is applied in $\hat{T}_6$ and $\hat{T}_8$ of (4.8)

h	$\|u - \phi_h\|_\infty$	cvge. rate
1/100	$3.8605e^{-03}$	
1/200	$6.8845e^{-05}$	5.809
1/400	$8.1239e^{-07}$	6.405

Results in Tables 4 and 5 clearly show that using (4.12) to resolve the source term derivative $\frac{\partial^4 f}{\partial x^4} + \frac{\partial^4 f}{\partial y^4}$ in the truncation error terms coupled with k has been significant for the quality of numerical solution.

Discussion of Results

The local truncation error for the schemes may be described as a power series about the centroid (x_0,y_0) of the control volume by

$$\mathrm{E(h,k)} = \sum_{i=0}^{\infty} \{T_K(\xi,\eta,k) + T_0(\xi,\eta)\} \left((\xi - x_0)^{p+2i} + (\eta - y_0)^{p+2i}\right), \qquad (6.1)$$

where $|\xi - x_0| \le h$, $|\eta - y_0| \le h$, and $p = 4$ or $p = 6$ for the fourth and sixth order methods respectively. The term $T_0(\xi,\eta)$ represents the local truncation error for the associated Poisson equation which has been shown to computationally converge uniformly. The term $T_K(\xi,\eta,k)$ is due to the wave number k and is described as

$$T_K = (k)^{p+2n} \sum_{i=0}^{p+2n} \frac{C_i(\xi,\eta)}{k^{2i}} \qquad (6.2)$$

where C_i is a combination of higher-order derivatives of the source term and the solution. As discussed above, the truncation error terms are partly populated by k which dominate and determine the sizes of the errors for high wave numbers. One suggested way to reduce the size of the pollution error [2,7] is to require that hk be maintained as a constant. For moderate sizes of k and limited resolutions of the P_E terms in T_K, uniform convergence rates for the resulting fourth-order schemes have been achieved for the Helmholtz equations.

From (4.6) and (6.2), one way for T_K to converge uniformly is to require the option of $hk < 1$ necessitating smaller grid sizes. However, this choice which results in large size system matrices is expensive and the other way is by higher-order methods as illustrated above where the P_E terms are resolved as much as possible. The level of this reduction is limited by the number of grid points represented on the control volume. For a nine-point compact control volume, $\frac{\partial^8 \phi}{\partial x^4 \partial y^4}$ in T_6 and beyond cannot be resolved which puts a limitation on effective pollution effects reduction for high wave numbers. Therefore, for a given resolution of the control volume there is a limit on the size of the wave number for which consistency of the resulting schemes can be assured as illustrated in Section 4.1.

Conclusion

We have demonstrated the effectiveness of utilizing the finite volume discretization approach in developing new higher-order schemes for the Helmholtz equations with effective strategies for handling pollution effects associated with high wave numbers. In particular, pollution effects on convergence rates and quality of numerical solutions have been demonstrated. Using a more balanced flux integral formulation to construct an equation error expansion of the equation, a minimizing quadrature of local compact grid points are found for the discretization which further provides a more complete description and hence optimization of the pollution effects for improved quality of solutions. The fact that pollution effects associated with Helmholtz equations cannot be eliminated but may be reduced to obtain improved quality of solutions for

moderate sizes of the wave number has also been demonstrated. Thus, this approach further serves to formulate a framework for improving sensitivities of higher-order numerical models for modeling physical phenomena.

References

[1] I. M. Babuska and Ss A. Sauter, *Is the pollution effect of the fem avoidable for the helmholtz equation considering high wave numbers?*, SIAM Journal on Numerical Analysis **34** (1997), no. 6, 2392–2423.

[2] G. Bao, G. W. Wei, and S. Zhao, *Numerical solution of the helmholtz equation with high wavenumbers*, Int. J. Numer. Meth. Engng **59** (2004), 389–408.

[3] Q. Du, J. R. Kamm, R. B. Lehoucq, and M. L. Parks, *A new approach for a nonlocal, nonlinear conservation law*, SIAM J. APPL. MATH. **72** (2012), no. 1, 464–487.

[4] H. C. Elman and D. P. OLeary, *Efficient Iterative Solution of the Three-Dimensional Helmholtz Equation*, J. Comput. Phys **142** (1998), 163–181.

[5] Y. Fu, *Compact fourth-order finite difference schemes for helmholtz equation with high wave numbers*, **26** (2008), 98–111.

[6] S. Gabersek and D. R. Durran, *Gap Flows through Idealized Topography. Part II: Effects of Rotation and Surface Friction*, J. Atmos. Sci. **63** (2006), 2720–2315.

[7] F. Ihlenburg and I. Babuska, *Finite element solution of the Helmholtz equation with high wave number part i: the* h*-version of the FEM.*, Comp. Math. Appl. **30** (1995), 9–37.

[8] K. Ito, Y. Kyei, and Z. Li, *Higher-Order, Cartesian Grid Based Finite Difference Schemes for Elliptic Equations on Irregular Domains* , SIAM J. Sci. Comput. **27** (2005), 346–367.

[9] P. Knabner and L. Angermann, *Numerical Methods for Elliptic and Parabolic Partial Differential Equations*, Springer-Verlag, New York, Inc, 2003.

[10] Y. Kyei, *Space-time finite volume differencing framework for effective higher-order accurate discretizations of parabolic equations*, SIAM J. Sci. Comput. **34** (2012), no. 3, A1432–A1459.

[11] Y. Kyei, J. P. Roop, and G. Tang, *A family of sixth-order compact finite difference schemes for poisson equation*, Adv. Numer. Anal. **Article ID 352174** (2010), 1–17.

[12] S. K. Lele, *Compact finite difference schemes with spectral-like resolution*, J. Comput. Phys. **103** (1992), 1–42.

[13] M. Li and T. Tang, *A Compact Fourth-Order Finite Difference Scheme for Unsteady Viscous Incompressible Flows*, J. Sci. Comput. **16** (2001), 29–45.

[14] F. Lorcher, G. Gassner, and C. D. Munz, *An explicit discontinuous Galerkin scheme with local time-stepping for general unsteady diffusion equations*, J. Comput. Phys. **227** (2008), 5649–5670.

[15] J. Ma, J. Zhu, and M. Li, *The galerkin boundary element method for exterior problems of 2-d helmholtz equation with arbitrary wavenumber*, Engineering Analysis with Boundary Elements **34** (2010), no. 12, 1058 – 1063.

[16] W. H. Mason, *Applied computational aerodynamics*, Text/notes, http://www.dept.aoe.vt.edu/ maxon/Mason f/CAtextTop.html, 1997.

[17] O. Z. Mehdizadeh and M. Paraschivoiu, *Investigation of a two-dimensional spectral element method for Helmholtz's equation*, J. Comput. Phys. **189** (2003), 111–129.

[18] P. Ming and X. Yue, *Numerical methods for multiscale elliptic problems*, J. Comput. Phys. **214** (2006), 421–445.

[19] J. T. Oden, S. Prudhomme, and L. Demkowicz, *A posteriori error estimation for acoustic wave propagation problems*, Archives of Computational Mechanics and Engineering **12** (2005), no. 4, 343–389.

[20] M. Piller and E. Stalio, *Finite–volume compact schemes on staggered grids*, J. Comput. Phys. **197** (2004), 1064–1094.

[21] J. Santos and P. de Oliveira, *A converging finite volume scheme for hyperbolic conservation laws with source terms*, J. Comput. App. Math. **111** (1999), 239–251.

[22] I. Singer and E. Turkel, *High-order finite difference methods for the Helmholtz equation*, Comput. Methods Appl. Mech. Engrg. **163** (1998), 343–358.

[23] _____, *Sixth Order Accurate Finite Difference Schemes for the Helmholtz Equation*, J. Comput. Acoustics **14** (2006).

[24] W. F. Spotz and G. F. Carey, *A high-order compact Scheme for the Steady StreamFunction Vorticity Equations*, Int. J. Numer. Meth. Eng **38** (1995), 3497–3512.

[25] J. C. Strikwerda, *Finite Difference and Partial Differential Equations*, Wadsworth & BrooksCole Advanced Books & Software, 1989.

[26] H. Suna, N. Kanga, J. Zhang, and E. S. Carlson, *A Fourth Order Compact Difference Scheme on Face Centered Cubic Grids with Multigrid Method for Solving 2D Convection Diffusion Equation*, Mathematics and Computers in Simulation **63** (2003), 651–661.

[27] A. K. Verma, S. M. Bhallamudi, and V. Eswaran, *Overlapping control volume method for solute transport*, J. Hydr. Engrg. **5** (2000), 308–316.

[28] K. Wang and Y. S. Wong, *Is Pollution Effect of Finite Difference Schemes Avoidable for Multi-Dimensional Helmholtz Equations with High Wave Numbers?*, / Commun. Comput. Phys. **21**, 490–514.

[29] E. Weinan and B. Engquist, *Multiscale Modeling and Computation*, Notices Of The AMS **50** (2003), no. 9, 1062–1070.

[30] Y. S. Wong and G. Li, *Exact finite difference schemes for solving helmholtz equation at any wavenumber*, Int. J. OF NUMER ANAL AND MODELING, SERIES B **2** (2011), no. 2, 91–108.

[31] A. Erlangga Y, C. Vuik, and C. W. Oosterlee, *On A Robust Iterative Method For Heterogeneous Helmholtz Problems For Geophysics Applications*, Int. J. Numer. Anal. Modeling **2** (2005), 197–208.

Population Dynamics in Diffusive Coupled Insect Population

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Abstract

A variety of ecological models exhibit chaotic dynamics because of nonlinearities in population growth and interactions. Here, we will study the LPA model (beetle Tribolium). The LPA model is known to exhibit chaos. In this project, we investigate two things which are the effect of noise constant and the effect of diffusion combined with the LPA model. The effect of noise is not only to change the dynamics of total population density but also to blur the bifurcation diagram. Numerical simulations of the model have shown that diffusion can drive the total population of insects into complex patterns of variability in time. We will compare these simulations with simulations without diffusion. And we conclude that the diffusion coefficient is a bifurcation parameter and that there exist parameter regions with chaotic behavior and periodic solutions. This study demonstrates how diffusion term can be used to influence the chaotic dynamics of an insect population.

Keywords: diffusion, LPA model, insect population, Chaos, periodic behavior

1. Introduction

A variety of ecological models exhibit various patterns in population dynamics such as equilibrium steady state, periodic or chaotic dynamics caused by their nonlinearities in population growth and interactions. Sensitivity to initial conditions (initial population or control parameter) is a key characteristic of dynamics in population system. Many researchers have investigated how small perturbations of the control parameters have affected the ecology system to exhibit the chaotic behavior [1,2,3]. Population fluctuations are the result of stable points (node or spiral), stable periodic and aperiodic cycles, chaos, stable and unstable manifolds of invariant sets and multiple attractors. Population fluctuations depend on the stability of fixed points; stable points are where every trajectory goes to a fixed point, stable periodic trajectories occur when population numbers oscillate among a finite number of values and there is a limit cycle around the fixed point, aperiodic cycles occur when populations oscillate but the characteristics of the oscillation can change, and chaos which provides an unusual, apparently random, and intuitively unexpected prediction of population behavior.

The LPA model, describes the dynamics of larval, pupal, and adult Tribolium population, is known to exhibit chaotic pattern in their population. Many studies have examined the effect of small perturbations of the parameters, such as the survival rate of a pupa in the presence of an adult or the survival rate of an

egg in the presence of both larvae and adults, on the dynamics of the total population density [4, 5]. A nonlinear mathematical model, LPA model, was used to identify a sensitive region of phase space where the addition of a few adult insects would result in a dampening of the life stage fluctuations.

The few ecological studies of chaos in spatial systems consider models in discrete time and space [6,7] or in discrete time and continuous space [8]. In all these models, the diffusive dispersal of organisms drives the biological system (prey-predator or host-parasitoid system) into chaotic dynamics. The results of discrete models cannot be applied directly to nonlinear interactions and dispersal in continuous time and space. It is well known that discrete models exhibit chaos more readily than their continuous counterparts. In this paper, A nonlinear mathematical model, LPA model, was used to identify a sensitive region of phase space where the addition of a few adult insects would result in a dampening of the life stage fluctuations. In other words, we investigate the effect of diffusion on the diffusive coupled LPA model. Numerical simulations of the model have shown that diffusion can drive adults into complex patterns of variability in time. The main point of this study is to determine whether these patterns are chaotic. We will demonstrate that there is diffusion induced chaos and diffusion induced periodicity in the LPA model with diffusion. And we conclude that the diffusion coefficient is a bifurcation parameter and that there exist parameter regions with chaotic behavior and periodic solutions.

2. Model

2. 1 LPA Model with Stochastic Terms

Many species of Tribolium (flour beetle) are cannibalistic, including the species Tribolium castaneum. The following model, which is called the LPA model, describes the dynamics of larval, pupal, and adult Tribolium populations at time $t + 1$ as a function of the populations at time t by means of a system of three difference equations

$$L_{t+1} = bA_t \exp(-C_{el}L_t - C_{ea}A_t + E_{1t}) \quad (1)$$

$$P_{t+1} = L_t(1 - \mu_l)\exp(E_{2t}) \quad (2)$$

$$A_{t+1} = [P_t \exp(-C_{pa}A_t) + A_t(1 - \mu_a)]\exp(E_{3t}) \quad (3)$$

where is L_t is the number of feeding larvae (referred to as the L-stage) at time t, P_t is the number of large larvae, non-feeding larvae, pupae, and callow adults (collectively the P-stage) and A_t is the number of sexually mature adults (A-stage animals). The unit of time is taken to be the feeding larval maturation interval so that after one unit of time a larva either dies or survives and pupates. The unit of time is 2 weeks and is, approximately, the average amount of time spent in the feeding larval stage under standard experimental conditions described in the reference [5]. The unit of time is also approximately the average duration of the P-stage. The quantity b is the number of larval recruits per adult per unit time in the absence of cannibalism. The fractions μ_l and μ_a are the larval and adult rates of mortality, respectively, in one-time unit.

The exponential nonlinearities account for the cannibalism of eggs by both larvae and adults and the cannibalism of pupae by adults. The fractions $A_t\exp(-C_{el})$ and $\exp(-C_{ea}A_t)$ are the probabilities that an egg is not eaten in the presence of L_t larvae and adults, respectively, in one-time unit [4]. The fraction $\exp(-C_{pa}A_t)$ is the survival probability of a pupa in the presence of A_t adults in one-time unit. The terms E_{1t}, E_{2t} and E_{3t} are random noise variables assumed to have a joint multivariate normal distribution with a mean vector of zeros and a variance-covariance matrix denoted by Σ (The variance-covariance matrix is estimated from experimental data in [5]. The maximum likelihood estimates in the variance- covariance matrices are σ11 = 0.3412, 2 = 0.2488, 3 = 1.627 × 14, 2 = 7.312 × 12, 3 = 34−1.719 × P1, and σ23 = 3.374 × 1). The deterministic skeleton of the model is identified by setting Σ = 0, or equivalently, by letting E_{1t}, E_{2t} and E_{3t}equal to zero in Eqs. 1–3.

The noise variables represent unpredictable departures of the observations from the deterministic behavior (resulting from environmental and other causes) and are assumed to be correlated with each other within a time unit but uncorrelated on longer time scales. These assumptions were found acceptable for many previous data sets by standard diagnostic analysis of time-series residuals. The adult mortality rate, μ_a, may be experimentally set to 0.96 by removing or adding adults at time of census. In Costantino et al. 1997 [4], recruitment into the adult stage was manipulated by removing or adding young adults at the time of census to make the number of new adult recruits consistent with the treatment value of C_{pa}.

2. 2 Diffusive coupled LPA Model

To pose the problem in its simplest form, we will assume that we are investigating the deterministic skeleton and Σ = 0. We will also assume that only adults move to other insect niches and no unpredictable external factors are acting. We set the rate of diffusion, *d*, to be the same for all niches. With these assumptions, we can generalize the LPA model to include the effects of diffusion. Consider a single dimension along which adults diffuse at the same constant rate d. Larvae and pupae do not move. Thus, there is no diffusion term in the populations of larvae and pupae.

$$L_{t+1}^{j} = bA_t^j\exp(-C_{el}L_t^j - C_{ea}A_t^j) \tag{4}$$

$$P_{t+1}^{j} = L_t^j(1-\mu_l) \tag{5}$$

where *j* is *jth* bin and *t* is the time

Now, consider the dynamics of the adult population. We will assume that adults can diffuse between bins. The equations in this case become

$$A_{t+1}^{j} = P_t^j \exp\left(-C_{pa}A_t^j\right) + A_t^j(1-\mu_a) + d(A_t^{j+1} - 2A_t^j + A_t^{j-1}) \quad (6)$$

$$A_{t+1}^{j} = P_t^j \exp\left(-C_{pa}A_t^j\right) + A_t^j(1-\mu_a) + d(A_t^{j-1} - A_t^j) \quad (7)$$

$$A_{t+1}^{j} = P_t^j \exp\left(-C_{pa}A_t^j\right) + A_t^j(1-\mu_a) + d(A_t^{j+1} - A_t^j) \quad (8)$$

where *d* is a diffusion coefficient. Eq. (6) is the case for interior bins, Eq. (7) and (8) are the case for the right and left boundary, respectively.

2. 3 Numerical Methods

For the computational simulation, the computer software (MATLAB) has been used. We iterated the LPA model for 64000 steps to see the long-term behavior of the total population. By changing the parameter, C_{pa}, the population dynamics changes giving rise to bifurcations in dynamics. In the case where Σ = 0 (in the absence of noise terms), for each C_{pa} , the dynamics of the adult population shows a stable equilibrium, periodic cycles or chaos. We simulated the LPA model with both the deterministic skeleton (without noise term) and stochastic terms (with noise term) to study the effect of noise on the dynamics of insect total population. For the simulation of LPA model with diffusion term, we used the deterministic skeleton to investigate the effect of diffusion on the dynamics. The evolution of the total population will be changed from steady state (equilibrium) to periodic cycles or periodic cycles to chaos with different value of bifurcation parameter, C_{pa} (Fig. 1).

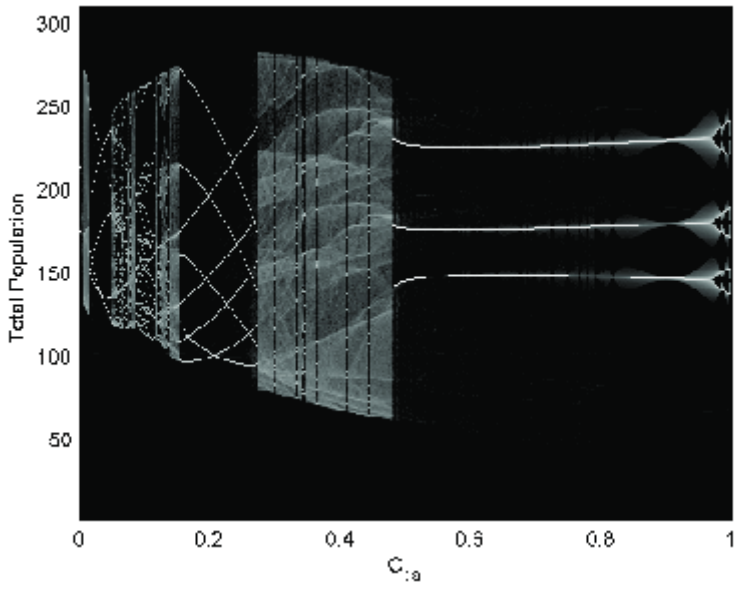

Figure 1: Density Bifurcation diagram for total population numbers (L-stage+P-stage+A-stage) using deterministic skeleton Σ = 0). For deterministic skeleton, the total population exhibits various patterns of

populations with respect to C_{pa}. We used the following parameter values b=10.45, 1 C_{el} = 0.01731, C_{ea} = 0.01310, μ_l = 0.2 and μ_a = 0.96.

2. 4 Dynamics of the Insect Population

The bifurcation diagram conveys information about how the dynamics of the total population changes as a function of the parameter, C_{pa}. The LPA model displays various patterns of populations for different values of C_{pa}. Fig. 1 shows is the density bifurcation diagram of the total population for the LPA model. The black color represents zero population, whereas white indicates high populations with gray scales in between. Smoothly distributed regions are evidence of quasi-periodicity or chaos, and the sharp lines represent periodic cycles. For C_{pa} = 0.0, the population dynamics shows a stable equilibrium. For $C_{pa} \in (0, 2.7]$, the different periodic cycles are shown and the most chaotic behaviors are shown in the range of $C_{pa} \in [2.8, 4.7]$ except some values of C_{pa}. The population dynamics over time is shown in Fig. 2. It is clearly observed that the total population is oscillating with different period for $C_{pa} = 0, 0.2$ and 0.7. However, the aperiodic cycle or chaotic pattern is shown for $C_{pa} = 0.4$

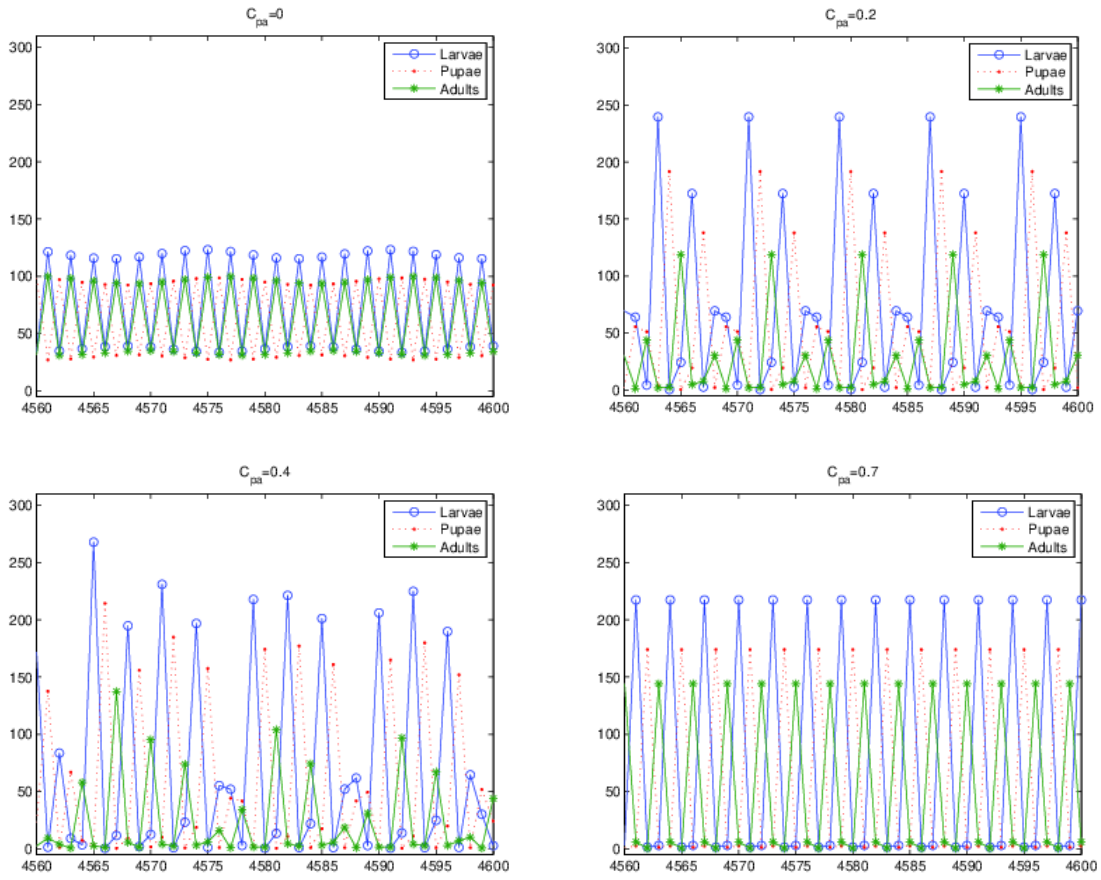

Figure 2: Dynamics of the LPA model for different values of C_{pa}. For C_{pa} = 0, 0.2 and 0.7, these graphs show periodic cycles. The total population is oscillating periodically; there are 8 periodic cycles and 3 periodic cycles, respectively. For a = 0.4, the population shows aperiodic or chaotic pattern.

3. Results

3.1 Density Bifurcation Diagram with Noise

There are several interesting things that can happen when the system is receiving noises. One of things is the pattern of noise-induced chaos in ecological system [5,9]. In general, the noise-induced chaotic pattern is referred to as an attractor with sensitive dependence on initial conditions, which changes the structure of the system upon switching off the noise. Here, we investigate the effect of noises on the LPA model.

For very small amplitude noise, the density bifurcation diagram shows qualitative changes in structures of the total population. In the deterministic skeleton, both periodic cycles and chaotic pattern co-exist in the region of $C_{pa} \in [2.8, 4.7]$. However, for the amplitude of noise $(\epsilon) = 0.00001$, the region of $C_{pa} \in [2.8, 4.7]$ is completely chaotic region, that is, no periodic cycles in the total population exist. This implies the noise can induce the chaotic pattern in an insect population. Furthermore, increasing the amplitude of noise is to blur the bifurcation diagram. Structure is still apparent even for $\epsilon = 0.0001$. However, increasing the amplitude results in destroying the structure of bifurcation diagram.

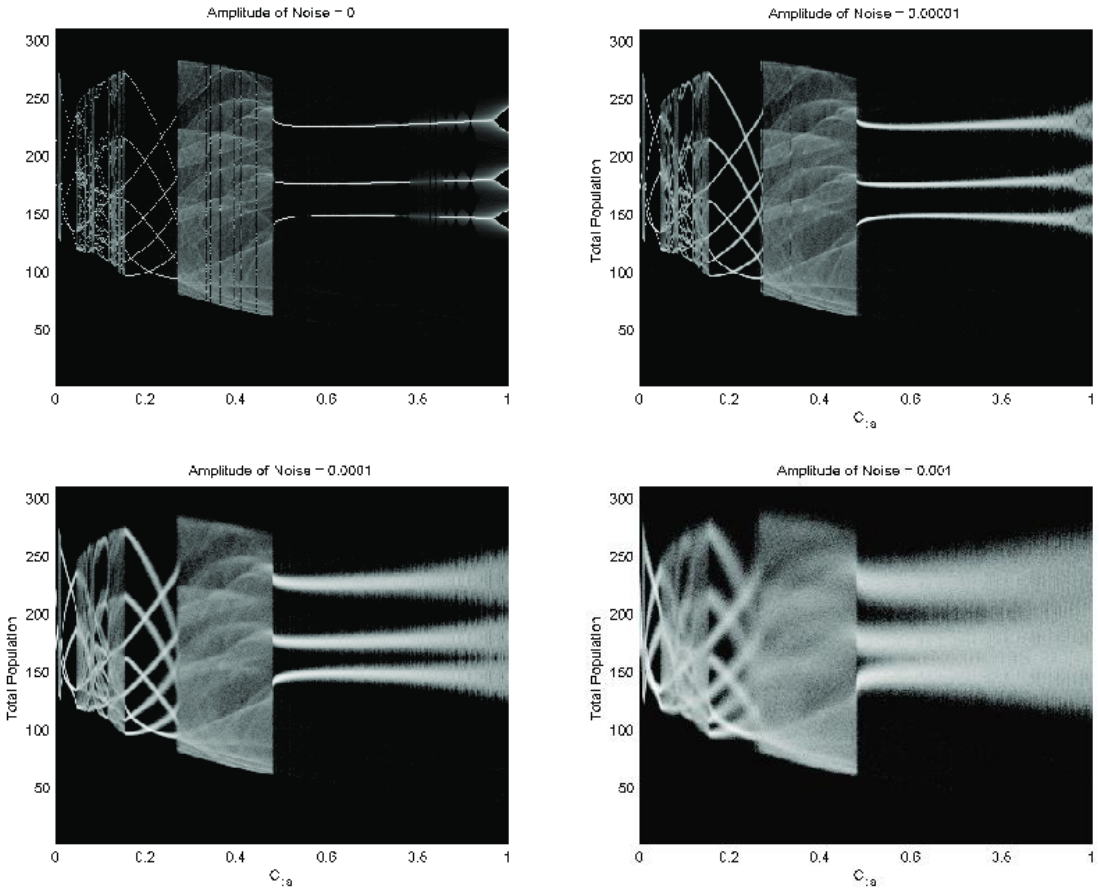

Figure 3: The effect of noise on the total population. Noise induces chaos and blur the bifurcation diagram.

3.2 Density Bifurcation Diagram for Diffusive Coupled System.

Numerous studies have demonstrated that diffusion changes dynamics patterns in biological and ecological systems. A continuous predator-prey model in which two populations diffuse along a spatial gradient is shown to exhibit temporal chaotic pattern at a fixed point in space. In other words, low diffusion values induce a periodic system to aperiodic or chaotic behavior with sensitivity to initial conditions [10]. In neuroscience, a strong diffusive connection in a diffusive coupled system induces synchronization of connected neurons in a complex neural network [11]. Here, we study the effect of diffusion in an insect population.

Figure 4 shows the bifurcation diagram for the control parameter C_{pa} with different values of the diffusion amplitude coefficient (d = 0, 0.0001, 0.001, 0.005, 0.02 and 0.03, respectively). The figures show the effect of the diffusion on the total population density. Different values of the diffusion coefficient induce either chaotic or periodic population fluctuation. We used the following parameter values b=10.45, C_{el}= 0.01731, C_{ea}= 0.01310, μ_l = 0.2 and μ_a= 0.96. For the control case (before the system is diffusive coupled or the diffusion coefficient= 0), the mixed population fluctuation (periodic and chaotic pattern in the total population) exhibits mostly in the range of $C_{pa} \in$ [0.28 0.47]. However, increasing the diffusion amplitude up to d = 0.005 results in expanding the range of C_{pa} where the population fluctuation exhibits the chaotic behavior. Furthermore, for the higher value of d=0.005, the density bifurcation diagram is shown to exhibit the different structure from the one with lower values of the diffusion coefficient.

Figure 5 shows the dynamics of the LPA model for different values of the diffusion coefficient with fixed C_{pa}=0.02, 0.2, 0.4, and 0.7, respectively. In the deterministic skeleton, the total population density exhibits 4 periodic cycles for C_{pa}= 0.02. However, increasing the diffusion coefficient values results in changing the dynamics from the periodic cycles to chaos and chaos to periodic pattern in their total population density diagram. For C_{pa}= 0.4, the total population shows aperiodic cycles or chaos. The diffusion term derives the total population density to the periodic pattern with 7 periodic cycles in the region of the diffusion coefficient between 0.033 and 0.038. Figure 6 shows how small change in diffusion coefficient induces chaotic pattern from periodic cycles.

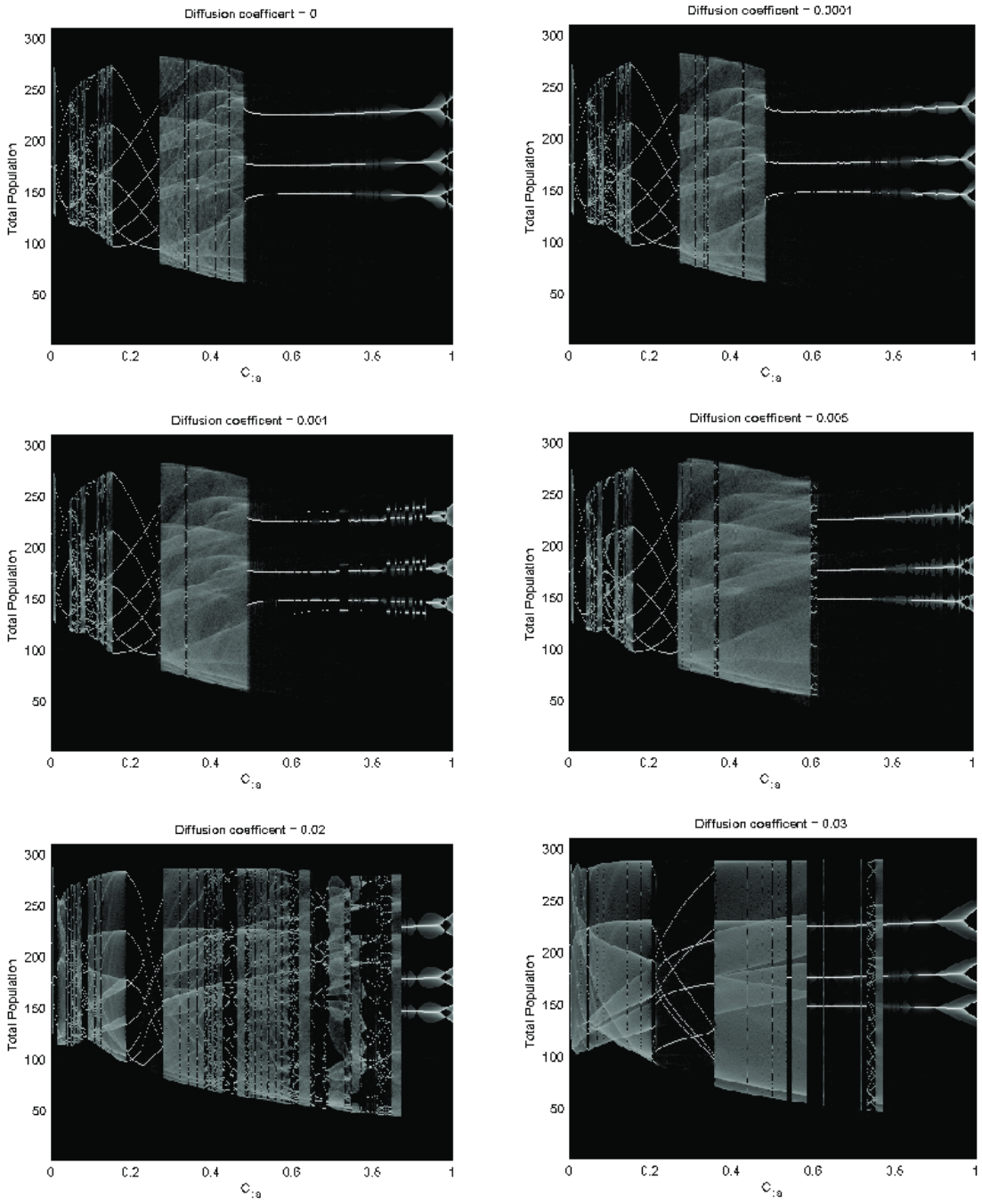

Figure 4: The bifurcation diagram for the control parameter C_{pa} (x-axis) with different values of the diffusion amplitude coefficient (d = 0, 0.0001, 0.001, 0.005, 0.02 and 0.03, respectively).

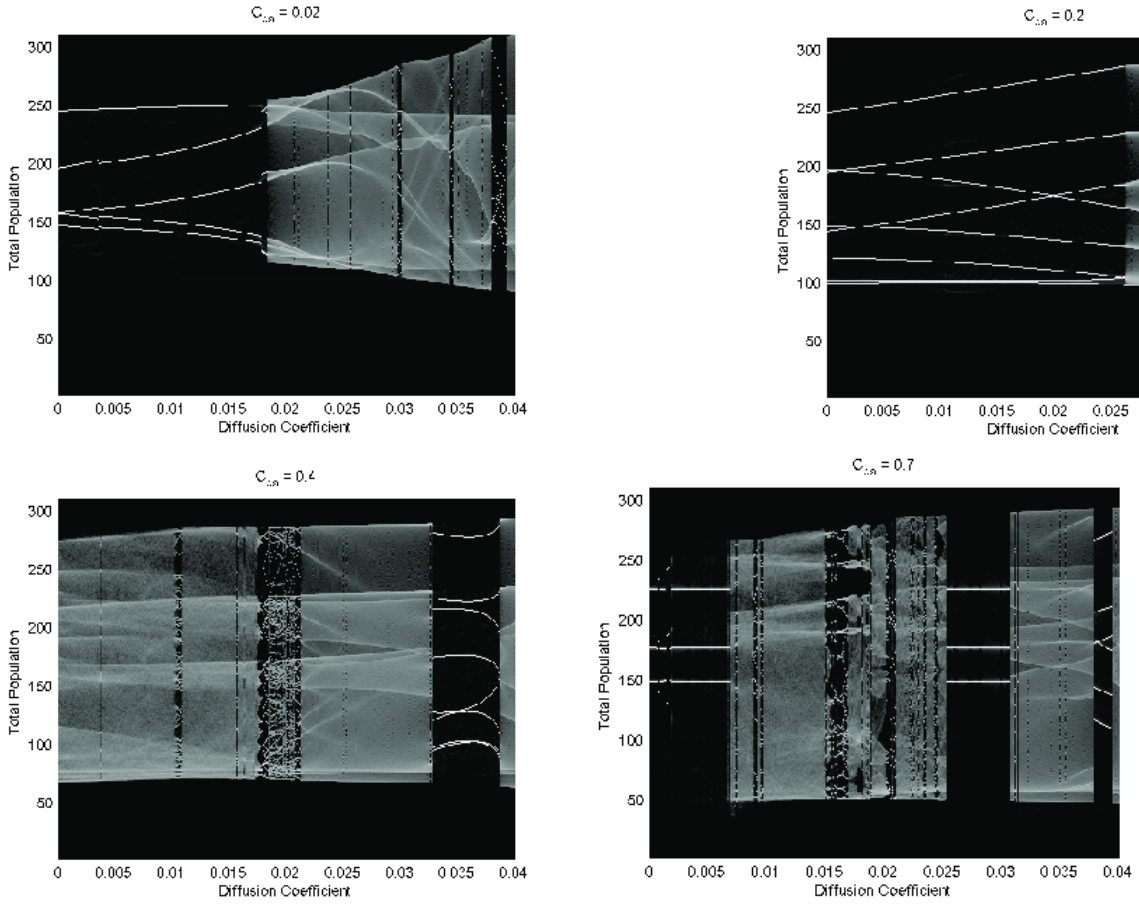

Figure 5: Dynamics of the LPA model for different values of the diffusion coefficient with fixed C_{pa}=0.02, 0.2, 0.4, and 0.7, respectively

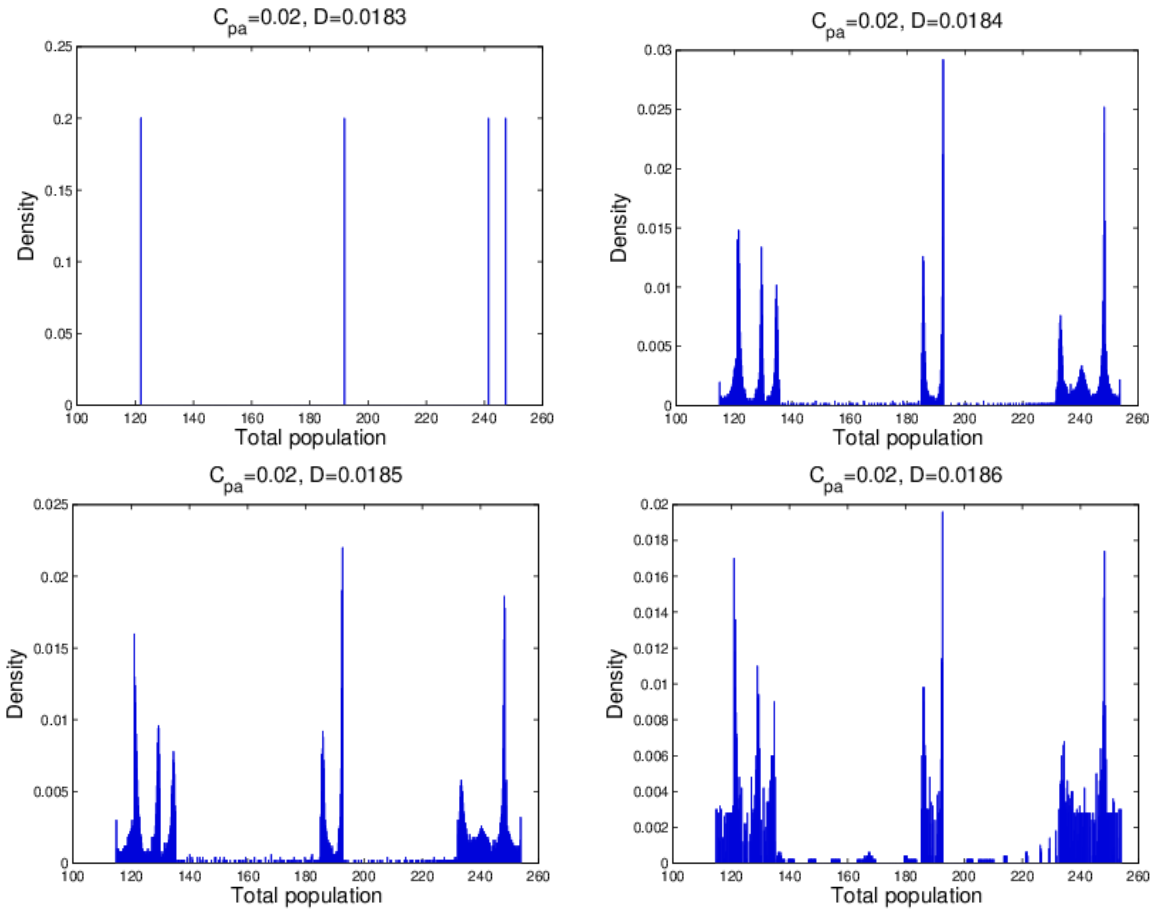

Figure 6: Histograms of how the small perturbation of the diffusion amplitude affects the population fluctuation and how the periodic cycles of the total population changes into a chaotic pattern by a small change in diffusion.

5. Conclusion

We discussed the dynamics of total population with the LPA model. In this discussion, we used the density bifurcation diagram (without noise and with noise) to see the dynamics. The effect of noise is to blur the density bifurcation diagram. Small-scale features blur most easily and large-scale features retain their characteristics longer as the amplitude of noise increases. In the experimental setting, therefore, in the last panel of Figure 3, we show predicted population densities for C_{pa} = 0 to 1. No fine detail is visible. The only relic of the solution is the change in the lower population limit as a function of C_{pa}. Even if the noise constant is large enough, the dynamics of total population is not extinct. In the diffusion case, we have shown that there is another parameter that may induce chaos, the diffusion coefficient. Conversely, we have also shown that diffusion can also induce periodicity in a previously chaotic system.

Can diffusion induced chaos be observed? In an experimental setting, if the equations for the evolution of the system are unknown, then one is at most able to determine if the dynamics is chaotic or not. However, in deliberately designed experiment, when the equations for the dynamics are known and the diffusion coefficient can be freely control, one can certainly study if diffusion induced chaos has occurred and what diffusion coefficient level can induce chaos.

6. References

[1] Shinbrot, T.,Grebogi, T.,Yorke, JA.,Ott, E, (1993) Using small perturbations to control chaos, *Nature* **volume363**, pages411–417

[2] Ott, E., Sauer, T. and Yorke, J.A. (1994). Coping with Chaos. John Wiley, New York, NY, U.S.A.

[3] Kapitanik, T. (1996). Controlling Chaos. Academic Press, San Diego, CA, U.S.A.

[4] R. F. Costantino, R. A. Desharnais, J. M. Cushing, and Brian Dennis (1997), Chaotic Dynamics in an Insect Population. *Science*. Vol 275

[5] Dennis, B., Desharnais, R. A., Cushing, J. M. et al. (2003), Can noise induce chaos? Oikos 102, 329–340

[6] Sole, R.V. and Valls, J. (1992), On structural stability and chaos in biological systems. *J. theor, Biol*. 155. 87-1-2

[7] Hassell, M.P., Comins, H.N. and May, R.M., (1991), Spatial structure and chaos in insect population dynamics. *Nature Lond*. 353, 255-258

[8] Kot, M (1989), Diffusion-driven period-doubling bifurcations. Biosystems, 22, 279-287

[9] Ellner, S. & Turchin, P. (2005), When can noise induce chaos and why does it matter: A critique, Oikos 111, 620–631.

[10] Morozov, A., Petrovskii, S., Li, B., et al. (2006) Spatiotemporal complexity of patchy invasion in a predator-prey system with the Allee effect. Journal of Theoretical Biology 238:1, 18-35

[11] X. Yang, J. Cao, Z. Yang, "Synchronization of coupled reactiondiffusion neural networks with time-varying delays via pinningimpulsive controller", *SIAM J. Control Optim.*, vol. 51, no. 5, pp. 3486-3510, Jan. 2013

Illuminance assessment: a case study in a central library of a federal University

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Abstract

The illumination has a great influence on the performance of the students influencing their learning. Thus, this work has as main objective to evaluate the levels of illuminance that the users are submitted in the reading areas of the central library of the Federal University. For this, a luximeter was used and with the support of R software, statistical tests were performed to evaluate the behavior of the variable illuminance between the shifts, days and reading areas. It was observed that, in general, the library is not in compliance with the current norm, and there was no significant change in the average level of illumination between the shifts and days of measurement, except for the reading areas chosen for analysis. Therefore, it is advisable to maintain the electrical installations of this library, besides the placement of more luminaires near the windows and replacement of the lamps with the LED ones.

Keywords: Environmental comfort. Library. Illuminance.

1. Introduction

The comfort sensation is essential for the human being to have pleasure and well-being in the exercise of their activities. On the other hand, many elements have affected into environments, and the environments have directly affected people [1]. In this sense, the environmental aspects are important for the performance, protection, and well-being of users [2, 3]. The good environmental conditions reflect directly on the productivity and quality of the activity performed and for users to feel good in their environment, they need to enjoy a favorable situation of environmental comfort.

Thus, the place's environmental comfort conditions have a direct influence on the user's performance during their leisure and labor activities, mainly in learning-oriented facilities, as is the case of libraries. For to achieve a satisfactory environmental performance a series of variables must be involved in the study of the environment; among them the acoustic, thermal, and luminous that work together for the labor conditions to be satisfied [4].

The role of lighting in daily lives is essential to operate ideally in every environment [5], in view of creates a sense of happiness and vitality that could positively affect people [6]. In the case of an educational learning environment, where people spend most of their day [7], some of these variables overlap with others in degree of importance when it refers to reading activity, in which case the light variable deserves special

attention. In this way, the luminous comfort in learning places improves and increases the performance and user productivity being able to relieve the eyes tension and accelerate the recognition of things, increasing their visual stability [8].

Therefore, the determinant factor for the activities development with efficiency is the quality and quantity of illumination, because through it one has the visual perception of the spaces and the object center of attention, defining it as visual comfort [9]. It should be emphasized that in the literature, the quality of the lighting refers to the luminance and to amount is related to the illuminance of the environment [10].

Brazil sets the minimum illuminances to be reached by the type of visual activity according to NBR 8995-1 in force since 2013, replacing NBR 5413 of 1992, due to the great time without any revision, besides the appearance of new technologies of lamps, such as the Light Emitting Diode (LED).

This paper aims to evaluate the light performance of the Central Library of the one Federal University in Brazil, evaluating the intensity of illumination (illuminance) and its variation in the different areas of reading having as a main objective to evaluate the illuminance levels to which users are submitted in its reading areas.

Besides the physiological and psychological effects of lighting, studies have also indicated positive effects of specific lighting conditions on behavior, such as working speed, productivity, and accuracy [11]. Moreover, the visual fatigue causes eye irritation and watery eyes, and with that the person starts to blink more frequently which makes vision blurred and even doubled [12].

Therefore, a study that guides this prism of environmental comfort in an educational learning environment has an important impact not only on the performance of activities, but also on the quality of life of those who enjoy this environment. Generally, 83 percent of learning takes place by the sense of sight in the learning process [13]. In addition, such research is justified by the fact that the library was founded in 1973, so the architectural design took into account luminous parameters of norms in force at the time of its construction; however, NBR 8995-1 of lighting came into effect in April 2013, and there is no survey that considers it. Thus, this light study becomes pertinent and may contribute to increase the current context of knowledge on the subject.

2. Methodology

2.2 General Aspects of Data Collection

This subsection explains the article variables and indicators, showing, subsequently, the instruments of data collection and the procedures for collecting them. Thus, the study variables were divided into 2 dimensions, in which the first is the dependent variable and the second dimension refers to the independent variables capable of varying the levels of illumination, outlined in Table 1.

Table 1. Dimensions of variables and indicators

Dimension 1 – Illuminance Values of illumination level that must be measured by a lux meter.	
Variable	Indicator

Level of illumination	Lux
Dimension 2 – Variations of illumination levels among areas, shifts, and days.	
Variables	Indicators
Area	Higher (3) or lower (1 or 2)
Shift	Morning (1), afternoon (2), and evening (3)
Day	1, 2, or 3

From Table 1, the level of illumination is considered dependent variable, measured in lux, while the variables of dimension 2 are considered independent, because these can vary the level of illumination. Moreover, quantitative data were collected by the LDR-22 lux meter and registered on a Microsoft Excel® spreadsheet.

In this context, 101 spots for measurement of illuminance were selected across the reading area from the Central Library. Three (3) measurements were done per each spot, and then an average was calculated, during 3 shifts in 3 different days, ending in 2727 measurements during 909 observations. Before the comparison with the values determined by the NBR 8995-1, the equipment was tested in order to verify the specifications of the lux meter. Finally, the layout of illuminance spots of the reading areas from the Central Library (Teresina campus) took into consideration the levels of illuminance, the quantity of lamps, the distance between lamps, and the height in relation to the users' view level.

2.2 Treatment and Analysis of Data

The collected data were organized in a systematic way to perform a detailed analysis, then the collected observations regarding the levels of illumination were tabulated with the help of Microsoft Excel® spreadsheets and saved in .txt format. After this tabulation and organization, the data were compared to that established by NBR 8995-1.

The data were then imported into the R x64 2.15.0 software®, where basic statistics (central tendency and dispersion measures) were performed for each shift, reading area, and measurement day, as well as a general analysis that considers all points without distinction of area, shift, or day. Also in the R x64 2.15.0 software® box plot graphs were elaborated with the intention of having a better visualization of the behavior of the dependent variable (illuminance) by shift, area, and day of measurement.

In addition to the aforementioned tools, some statistical tests were used. Firstly, normality of the dependent variable was observed using the histogram followed by the Shapiro-Wilk and Lillitefors tests, and both have as alternatives the null hypothesis (H_0): normal distribution and the alternative hypothesis (H_1): not normal, where for a p_{value} less than 0.05, which means at 5% of significance, the null hypothesis is rejected and does not present a normal probability distribution.

It was also necessary to use the non-parametric Wilcoxon test which considers as a null hypothesis (H_0): the means are equal, and the alternative hypothesis (H_1): the means are different. The statistic test is the p_{value} in case it is higher than 0.05, so the null hypothesis must not be rejected.

Furthermore, for the treatment and analysis of the lighting distribution, coordinates were established representing each measurement point, using AutoCAD software®, in which each area was delimited by a

rectangle, the left lower extremities of each area were taken as the reference point with coordinates (0,0). With these coordinates associated to the illuminance levels measured on the first day of measurement in the afternoon shift, the response surface was formed in order to have a 3D visualization of the distribution of illumination within each reading area. The graphs needed for that were elaborated in the STATISTICA software, being adjusted by a method called softening splines.

3. Results and Discussion

3.1 Measurements and Analysis of Illuminance Levels

Following what was planned, the measure points selected were measured during the days and shifts proposed. Thus, a sample of illuminance values gathered is shown in Figure 1 already imported to the R x64 2.15.0 software®.

Thus, for the purpose of calculations in the software, the variables were organized as follows: the morning, afternoon, and night shifts were represented, respectively, by numbers 1, 2, and 3; the two lower areas and the upper area were represented, respectively, by the numbers 1, 2, and 3; as for the variable day, this was numbered in 1, 2, and 3, since there were 3 days of measurement.

	Lux	Shift	Point	Day	Area
1	114.1	1	PI1.1	1	1
2	246.5	1	PI1.2	1	1
3	282.3	1	PI1.3	1	1
4	309.6	1	PI1.4	1	1
5	106.9	1	PI1.5	1	1
6	164.0	1	PI1.6	1	1
7	167.5	1	PI1.7	1	1
8	92.8	1	PI1.8	1	1
9	126.7	1	PI1.9	1	1
10	148.2	1	PI1.10	1	1
11	219.7	1	PI1.11	1	1
12	209.1	1	PI1.12	1	1
13	299.4	1	PI1.13	1	1
14	132.1	1	PI1.14	1	1
15	181.9	1	PI1.15	1	1
16	219.8	1	PI1.16	1	1
17	329.2	1	PI1.17	1	1
18	183.1	1	PI1.18	1	1
19	151.9	1	PI1.19	1	1
20	211.4	1	PI1.20	1	1

Figure 1. sample of illuminance levels measured by the R x64 2.15.0 software®.

Observing Figure 1, notice the first twenty observations with the due representations mentioned in the previous paragraph referring to the shift, day, and area.

From this tabulation, the statistical data analyses were started, for which three perspectives of variation of the illumination level were considered due to the independent variables, the area, the shift, and the measured day. In Table 2 the measures of central tendency and dispersion of the dependent variable (illuminance) for each independent variable presented previously, and, finally, a general analysis that considers all points without distinction of area, shift, or day is shown.

Table 2. Measures of central tendency and dispersion

Independent variables	Dependent Variable Illuminance (lux)				
	Minimum value	Median	Average	Maximum value	Standard deviation
Morning shift	67.8	197.3	219.2	583.4	92.30
Afternoon shift	52.5	193.5	216.5	621.3	90.65
Evening shift	70.3	196.4	216.8	600.3	90.39
Area 1	92.8	199.0	202.7	345.2	58.98
Area 2	86.1	178.9	184.3	303.6	44.83
Area 3	52.5	236.2	275.9	621.3	128.55
Day 1	52.5	195.2	215.1	621.3	91.21
Day 2	70.3	197.1	218.5	598.7	91.72
Day 3	69.1	196.4	219.0	604.7	91.40
OVERALL	52.5	196,4	217,5	621.3	91.02

With Table 2, a better visualization is possible of the illuminance levels behavior; additionally, verify that none of the averages have values greater than or equal to 500 lux, which is required in libraries' reading areas by NBR 8995-1.

Another important point to be mentioned regarding Table 2 is that in the maximum values found only in areas 1 and 2 did not reach values within the limit allowed by the referred norm, and thus, these areas did not have points above the allowed limit, being totally outside the standard required. On the other hand, the other variables (shifts, area 3, and days) had points within the tolerance limit of the current norm. It is important to emphasize that all values of this column in the different shifts and days belong to measurements of area 3.

In relation to the standard deviations, they were similar amid shifts, days, and the general, while in the areas there was a greater disparity mainly between area 3 and areas 1 and 2, which is the first indication of a more significant variation among the levels of illuminance measured in the different areas.

For a better visualization of these measurements, box plot graphs were developed that more clearly display the variations of the illuminance performances per shift, area, and day according to Figures 2, 3, and 4.

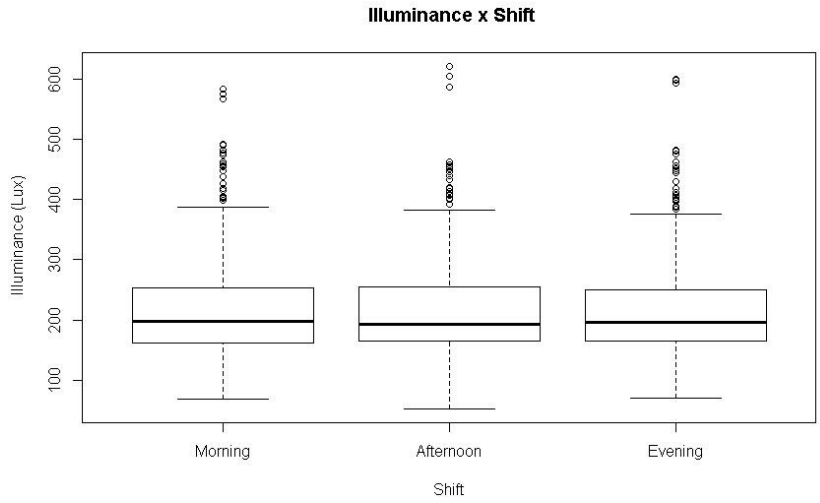

Figure 2. graph illuminance x shift

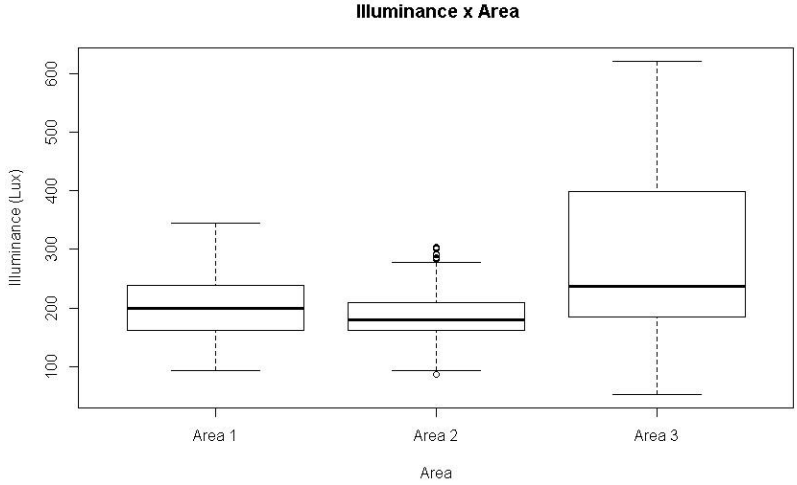

Figure 3. graph illuminance x area.

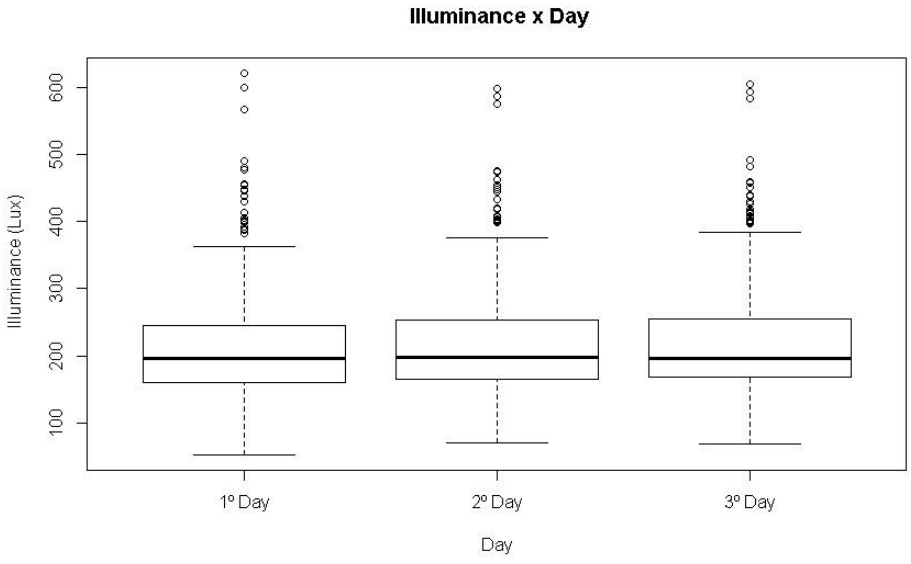

Figure 4. graph illuminance x day.

Observing the Box plot Graphs of the independent shift and day variables represented by Figure 2 and Figure 4, respectively, see that they do not present a large variation in the mean of the illuminance values observed and, additionally, a concentration of the observations around the value of 200 lux. However, the variable area Graph (Figure 3) presents indications of a greater variation, mainly between area 3 with the other areas (1 and 2), showing, once again, the indication of variation among the areas already presented by the standard deviation in Table 2. However, this clue must be checked by means of statistical tests to prove what has been exposed here.

For this, the dependent variable observations were verified by the illuminance histogram (Figure 5) followed by the Shapiro-Wilk and Lillitefors test shown in Table 3.

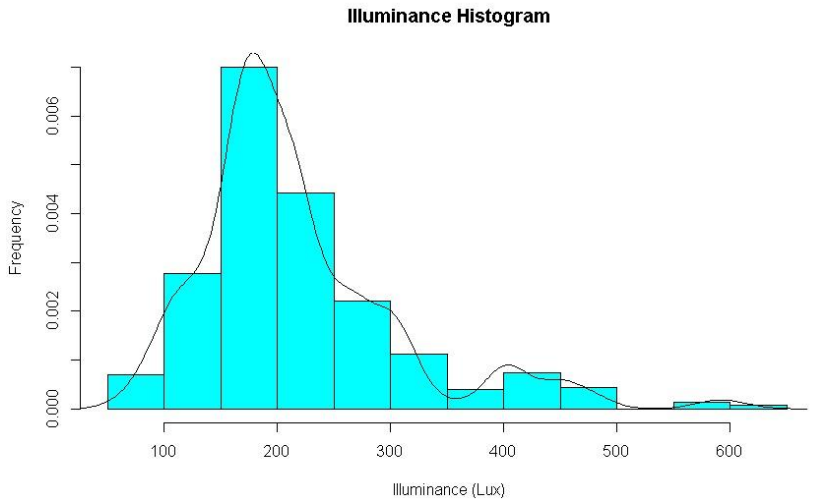

Figure 5. Illuminance histogram.

From Figure 5, verify that the majority of samples are in the intervals referring to the values of 150 to 250 lux being also notorious that there are only very few values that exceed the 500 lux, required by NBR 8995-1. It is worth mentioning that these values belong to the same point in the upper area. It is also possible to assume that the observations profile does not resemble the profile of a normal probability distribution, since the observations would have to be supposed to be equally divided around an average, which in this case is not well-defined. However, to prove this indicative the normal Shapiro-Wilk and Lilitefors tests, presented in Table 3, were applied.

Table 3. Shapiro-Wilk Test and Lillitefors Test

	P_{values} – Shapiro-Wilk Test	P_{values} – Lillitefors Test
Shift 1	$1.287 \times e^{-14}$	$< 2.2 \times e^{-16}$
Shift 2	$5.594 \times e^{-14}$	$2.873 \times e^{-16}$
Shift 3	$6.659 \times e^{-15}$	$< 2.2 \times e^{-16}$
Area 1	$1.353 \times e^{-5}$	0.006918
Area 2	$3.51 \times e^{-6}$	$3.851 \times e^{-9}$
Area 3	$3.239 \times e^{-7}$	$1.479 \times e^{-12}$
Day 1	$1.814 \times e^{-14}$	$3.226 \times e^{-15}$
Day 2	$1.174 \times e^{-14}$	$< 2.2 \times e^{-16}$
Day 3	$2.621 \times e^{-14}$	$< 2.2 \times e^{-16}$

As previously exposed, the hypothesis alternatives are considered for the above tests: null hypothesis (H0): normal distribution and alternative hypothesis (H1): not normal. Thus, Table 3 shows that the Shapiro-Wilk and Lillitefors tests results for the three independent variables (shift, day, and area) presented a pvalue of less than 0.05, that is, at 5% of significance the null hypothesis can be rejected so that the measured illuminance does not present a normal probability distribution. This confirms the indicative raised by the observation of Figure 9 of the histogram Graph.

In view of that, it is common to perform Wilcoxon non-parametric test to confirm whether or not there is variation in the mean of the illuminance due to the three independent variables (shift, day, and area). Thus, the same was applied for validation of the variation indications of the averages raised in Table 2, with the standard deviation column, and in the box plot graphs analysis of Figures 2, 3, and 4, the test results are set forth in Table 4.

Table 4. Wilcoxon Test

Wilcoxon Test	P_{values}
Shift 1 – Shift 2	0.8558
Shift 2 – Shift 3	0.9191
Shift 3 – Shift 1	0.7702
Area 1 – Area 2	$4.981 \times e^{-5}$
Area 2 – Area 3	$< 2.2 \times e^{-16}$
Area 3 – Area 1	$7.531 \times e^{-12}$
Day 1 – Day 2	0.5485
Day 2 – Day 3	0.9104
Day 3 – Day 1	0.449

Take into account that for this test it is considered as a null hypothesis (H_0): the means are equal and the alternative hypothesis (H_1): the means are different; it is verified, through Table 4, that the Wilcoxon test results for the variables shift and day presented a p_{value} greater than 0.05, that is, at 5% of significance it can be inferred that the null hypothesis cannot be rejected and that the means are equal. Therefore, only for the variable area the means can be considered distinct which also confirms the difference found in the box plot graph of Figure 3, as the result for this independent variable presented a p_{value} less than 0.05, where the null hypothesis is rejected there is no variation of the means to 5% of significance.

This observation shows that natural lighting may not be well used, since there is no significant difference between the measurements taken in the morning and afternoon shifts with night measurements, which can be related both to the library architectural design and the format of individual study tables which are in booths.

3.2 Inner Distribution of the Library's Illuminance

In this subsection, the layout mapping and the lamps distribution will be exposed, as well as the response surface analysis to verify the illumination level distribution within each area through the values measured on the first day of measurement and the afternoon shift. These values were chosen randomly, since, as evidenced in the previous subsection, there was no significant variation between the shifts and days, only

among the areas.

Thus, as expected, a layout mapping and lamps distribution in the reading areas of Central Library were carried out, and variables such as the amount of lamps, the distances between them, and the height in relation to the visual field of the user were collected. Figures 6, 7, and 8 show the layout mapping of the reading areas 1, 2, and 3, respectively, as well as the lamps distribution in these areas, represented by green and red circles in areas 1 and 2, and by green rectangles in area 3 since they try to represent a format similar to the actual of the lamps.

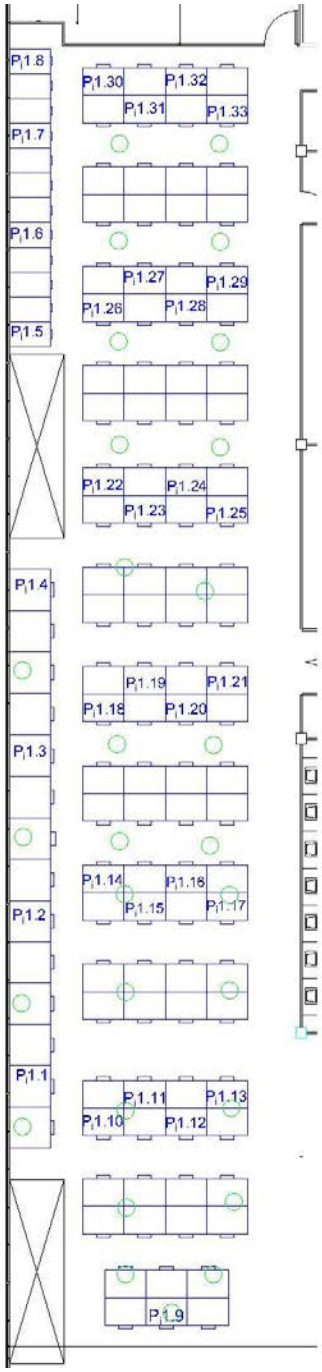

Figure 6. layout mapping and lamps distribution of the reading area 1.

Figure 7. layout mapping and lamps distribution of the reading area 2.

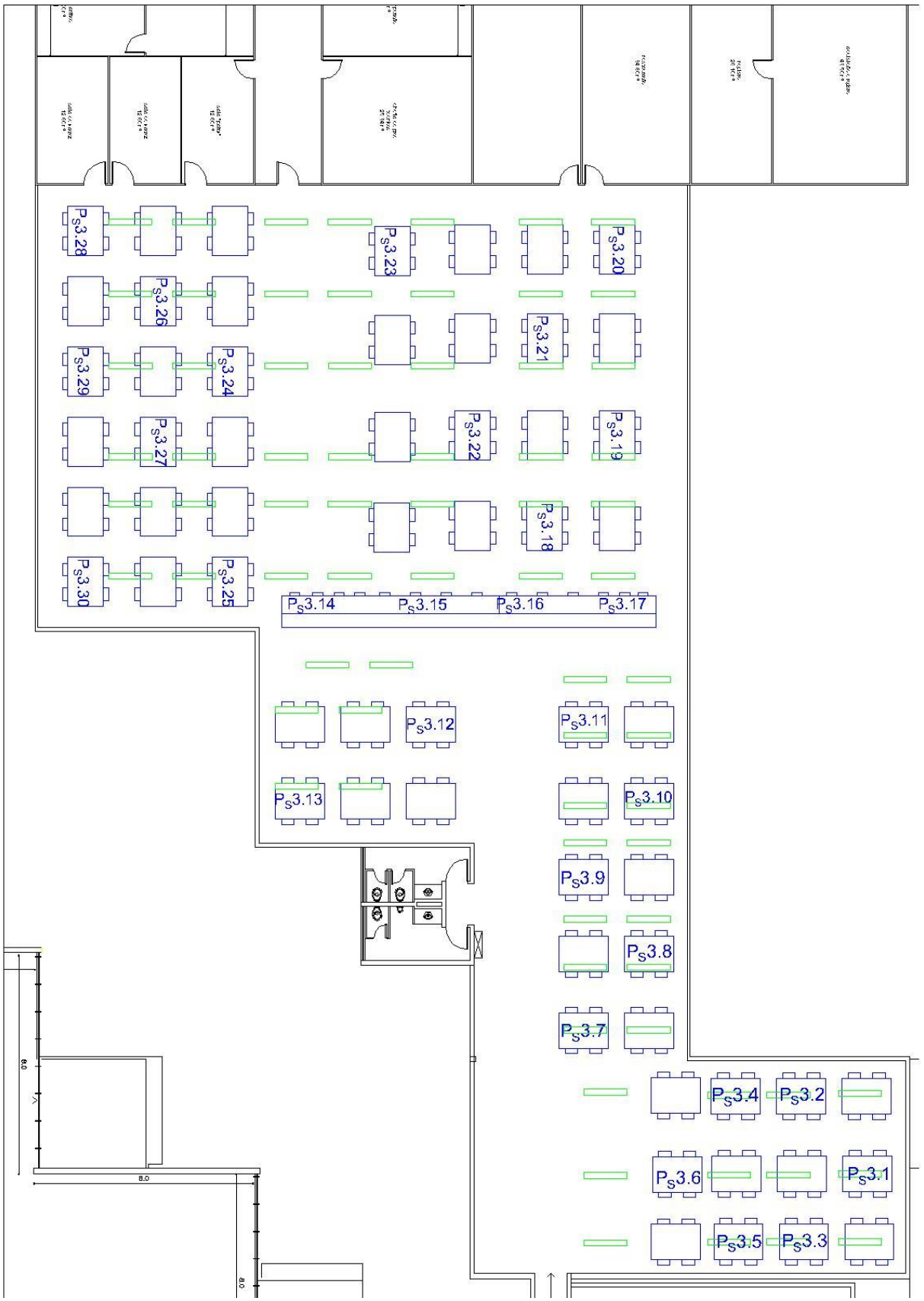

Figure 8. layout mapping and lamps distribution of the reading area 3.

From Figure 6, the presence of 29 lamps can be observed in the reading area 1 distributed among the 129 individual study tables, of which four are burned out, as shown in Figure 9, resulting in the ratio of 1:5,

where a lamp illuminates approximately 5 tables. Noteworthy is the presence of only four lamps over the tables near the windows and there are two of them burned out.

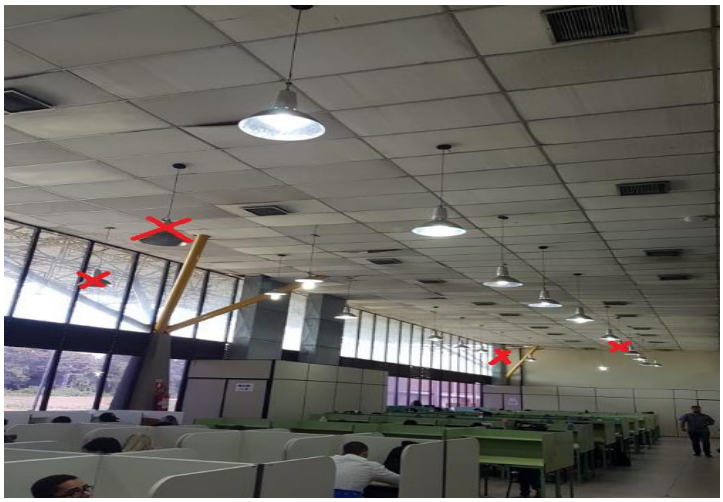

Figure 9. photo of lamps on area 1.

As cited above, there is an indication of poor lighting in this area, since it is unlikely that only one lamp will illuminate the area equivalent to 5 tables.

In the layout mapping and lamps distribution in the reading area 2 (Figure 7), 55 lamps can be seen distributed among the 206 individual study tables. However, 20 of them are burnt out (x in red) and in 3 there are only the electric wires without the lamps' structure (yellow circle), as can be seen through Figure 10, thus succeeding in the ratio 1:6, in which for each lamp there are approximately 6 tables to be illuminated, leaving this area with an even greater indication of being ill-lit.

Figure10. photo of lamps on area 2.

However, in the layout mapping and in the lamps distribution of reading area 3, there are 74 long luminaires represented by the rectangles of Figure 8, which bring 2 lamps in each of them, adding up 148 lamps distributed in the 76 group study tables, in which only 10 are burnt out, resulting in approximately 2 lamps for each group study table, i.e., one luminaire for each table, indicating a better illumination of that area in relation to the others.

Another factor that can favor the area 3 illumination is the shorter distance from the lamps to the surfaces

of the tables (field of work), being 1.3 meters in addition to its uniform distribution. However, in the other areas there is no such uniformity as they are supported by electric wires of varying sizes (Figure 11), and the nearest one is more than 4 meters away from the surface of the table.

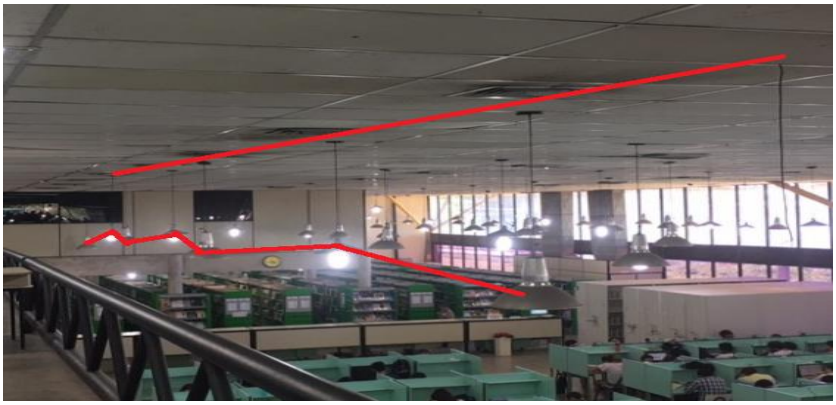

Figure 11. misalignment of lamps on area 2.

To corroborate with the aforementioned, the response surfaces of each area were elaborated from the values of the first day of measurement in the afternoon shift. In Figure 12, see the Graph of the response surface for area 1 from different perspectives.

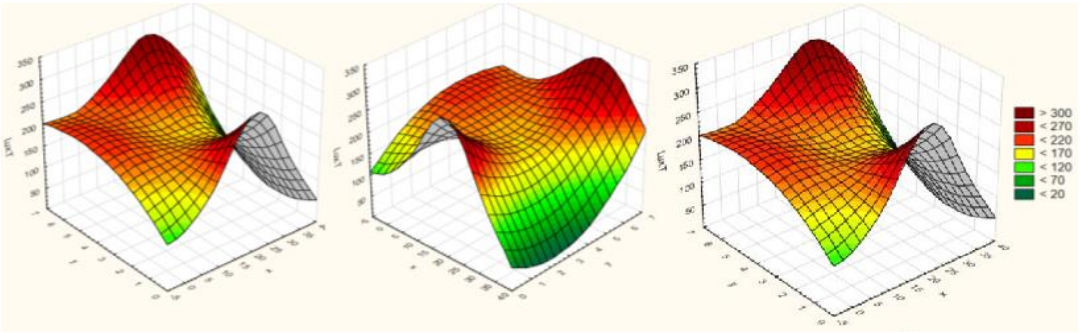

Figure 12. response Surface graph for area 1.

The graph plotted on Figure 12 shows that the majority of measured points are on the orange zone with the average value of 220 lux. There are few points with 300 lux or more corresponding to the dark red color in the graph. In addition to showing a significant number of points in the green colors, basically present at one extremity, these refer to the coordinates of the points near the windows and/or burned out lamps, indicating values below 120 lux. These findings confirm the hint raised by the Figure 6 analysis, which indicates a poor distribution of the lighting of the place.

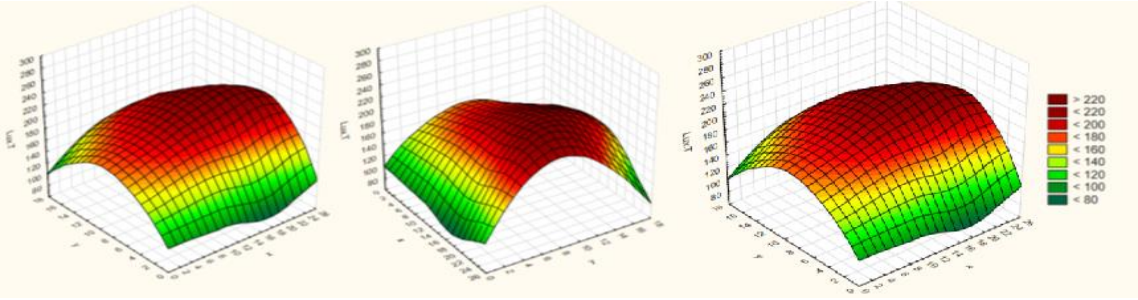

Figure 13. response Surface graph for area 2.

According to the response surface of area 2, shown in Figure 13, it can be observed that on the day considered, there were no points higher than 300 lux, which means that the average of its illumination is lower than that of the previous area, which was proven in Table 2 of subsection 3.1.

From Figure 13, it is also possible to observe the existence of many points with illuminance levels lower than 160 lux, which, when analyzed, showed that these coordinates represent mainly the closeness of areas without lamps or with these burned out.

Finally, the response surface of area 3 was analyzed as being the one that showed better results, as proved in Figure 14.

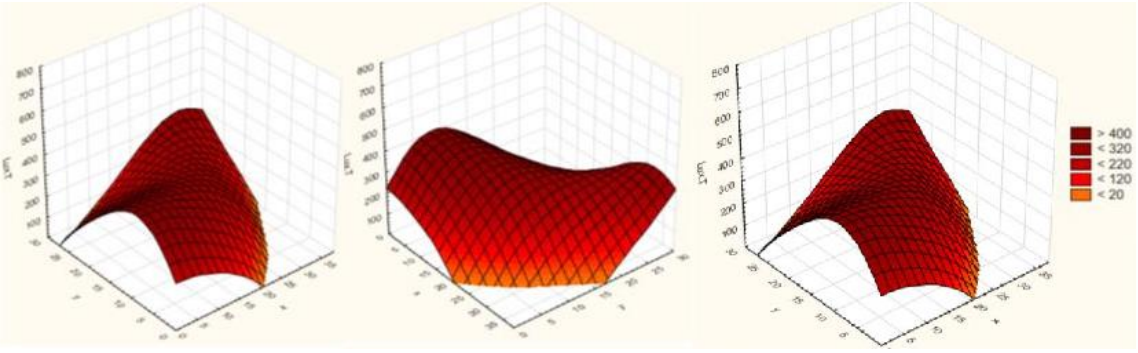

Figure 14. response Surface graph for area 3.

When analyzing Figure 14, see the prevalence of measurement points higher than 220 lux and many points between 320 and 400 lux, which surpass the average levels revealed in the other areas. On the other hand, the existence of points with lux inferior to those of the other areas was observed, which corroborates with the minimum value column of Table 1, which exhibits the lowest value found belonging to area 3.

4. Conclusion

The measurements assert that the majority of illuminance levels on the selected spots are between 150 and 250 lux and the average is 217.5 lux. Comparing NBR 8995-1 standards, it can be noted that the levels are under the minimum level of 500 lux, except for area 3, whose values were adequate according to the standards during all shifts. Thus, the statistical tests show that only amid the areas a considerable variation of illuminance was found, chiefly on area 3. Shifts and days did not register significant variations.

Area 3 (upper floor) had the highest average of illuminance, which can be justified by the closest and well-aligned position of lamps in relation to the study tables, by the quantity of lamps, and its uniform distribution. For this reason, a suggestion is that the height between the lamps and areas 1 and 2 be decreased, so the illuminance performance can be enhanced. It is also important to keep the periodic maintenance of lamps and other equipment on the 3 selected areas. Moreover, it was noted that some lamps have burnt out and there were few lamps next to the windows.

Area 2 had the lowest average of illuminance among the selected areas and it is also the area with the largest number of burned out lamps. In this perspective, these lamps must be changed for brand new ones and new lamps must be installed close to the windows. It is also advised that the new lamps must be LEDs, because of the energy that might be saved, decreasing the expenditure for the maintenance of the Library.

Finally, the analysis of the surface areas indicate that the most considerable variation of the illuminance distribution among the areas occurred during the first day's afternoon.

It is important to emphasize that, generally, researches with case studies are endowed with limitations, which was not different for this research. Thus, the main limitation is the financial one due to the library objection to follow the suggestions due to the high initial cost that it would set for the lamps change by LED, with the addition of luminaires in the lower areas, besides the standardization and reduction of the distances between the study tables and the luminaires in the lower areas.

These limitations may be useful to impel new complementary researches investigating more and more problems and making it easier to propose better solutions. Thus, from the observations mentioned it is possible to suggest future studies that investigate the library in the other two areas that NBR 8995-1 still divides, such as shelves and librarians, in order to have a complete analysis of the illuminance of the studied library.

However, not only illuminance is an essential factor for good lighting, it is alsom suggested that researches to be done for verify the distribution of luminance, glare, directionality of light and the use of natural light, according to the current norm. Another recommended complementary study is the analysis of the other comforts mentioned, such as thermal and acoustic, in order to be a more complete analysis of the library environmental comfort. Finally, it is also recommended the complement of this study considering the different types of stations during the year, analysing their influence for light performance.

6. References

[1] S. A. Samani and S. A. Samani, "The Impact of Indoor Lighting on Students' Learning Performance in Learning Environments: A knowledge internalization perspective", International Journal of Business and Social Science, v. 3, n. 24, 2012, pp. 127-136.

[2] E. F. Coutinho Filho et al, Avaliação do conforto ambiental em uma escola municipal de João Pessoa, IX ENCONTRO NACIONAL DE EXTENSÃO, João Pessoa, 2010, pp. 1-12.

[3] A. O. Azodo, "Illuminance and daylight distribution assessment for learners' comfort and safety in one-side-window oriented classroom building", Arid Zone Journal of Engineering, Technology and Environment, v. 13, n. 5, 2017, pp. 567-576.

[4] J. H. Ochoa, D. L. Araújo and M. A. Sattler, "Análise do conforto ambiental em salas de aula: comparação entre dados técnicos e a percepção do usuário," Ambiente Construído, Porto Alegre, v. 12, n. 1, 2012, pp. 91-114.

[5] M. S. Mott, D. H. Robinson, A. Walden, J. Burnette and A. S. Rutherford, "Illuminating the Effects of Dynamic Lighting on Student Learning", SAGE Open, 2012, pp. 1–9.

[6] N. Nasrollahi and E. Shokri, "Daylight illuminance in urban environments for visual comfort and energy

performance", Renewable and Sustainable Energy Reviews, v. 66, 2016, pp. 861–874.

[7] L. Bellia et al, “Methods to evaluate lighting quality in educational environments”, Energy Procedia, v. 78, 1, 2015, pp. 3138-3143.

[8] S. A. Samani, "The impact of indoor lighting on students’ learning performance in learning environments: A knowledge internalization perspective," International Journal of Business and Social Science, Malaysia, v. 3, n. 24, 2012, pp. 127-136.

[9] R. Lambert, L. Dutra and F. O. R. Pereira, Eficiência Energética na Arquitetura, São Paulo, Eletrobras/ Procel, 2014.

[10] H. A. Couto, Ergonomia Aplicada ao Trabalho: conteúdo básico: guia prático, Ergo Ltda, Belo Horizonte, 2007, pp. 1-272.

[11] K. Choi and H. Suk, “Dynamic lighting system for the learning environment: performance of elementary Students”, Optics Express, v. 24, n. 10, 2016, pp. 1-12

[12] I. Iida and L. B. M. Guimarães, Ergonomia: Projeto e Produção, Blucher Ltda., São Paulo, 2016, pp. 1-850.

[13] A. Gilavand, M. Gilavand and S. Gilavand, "Investigating the Impact of Lighting Educational Spaces on Learning and Academic Achievement of Elementary Students", International Journal of Pediatrics, v. 4, n. 5, 2016, pp. 1819-1828.

Bibliometric Analysis on Protection of Geographical Indications

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Abstract

This paper considers the importance of current certifications of origin of products seeking to examine the relevance of the registration of a geographical indication to local economies in development of regional products. The objective is to conduct an analysis of published scientific papers about the forms of registration and protection granted to geographical indications (IGs). To gather the papers dealing with the subject of Geographical Indications protection record, held a search in the database of the Web of Science, by removing the items that detail on products protected, twenty-one theme related papers were analyzed. You can see differences between the registration forms between the European Union and the United States, another fact highlighted is that most of the products protected by geographical indications are. Many countries are interested in publishing research in this area, those with greater numbers of publication, are also countries with numerous records of geographical indications.

Keywords: Protection, Registry, Geographical Indication

1. Introduction

In agribusiness the thought of innovating is increasingly strong and evident, two characteristics that food producers care about is food safety and consumer protection. Stamps and quality records come to meet this need. Since the Industrial Property Law 9,279 of May 14, 1996 – LPI / 96, the relationship between a product and its geographical origin is increasingly intensified (INPI, 2017).

Since the year of the appearance of LPI/96 to the present day, the agro-food production chains have experienced a significant movement for the differentiation of the market and the proliferation of products in many parts of the world, which translates into an increasing complexity of quality and new quality conventions (BRAMLEY, 2009).

The potential of geographical indications contributes for improvements in rural livelihoods based on local

resources that aims to contribute to the advancement in rural development. In all rural communities around the world, they have developed typical products based on the interaction between local knowledge (including selection, production and processing) and specific environmental conditions such as soil and climate (BRAMLEY, 2009).

To obtain a standard quality of products with a geographical indication is not bound to a single being, but rather the collective, a community where will bring credibility to the service by linking this product to a region of origin, where characteristics of this community are evidenced by the seal of a geographical indication (ZAN, TIBERIUS, RUSSO, 2017).

The seal of certification of a Geographical Indication is granted to products that have a distinctive character of other products on the market, thus providing valuable protection to owners by protecting them as well as consumers from misleading labels. Geographical indications are an excellent example of intellectual property rights (CONNEELY, 2015).

2. Literature Review

In order to justify the bibliometric analysis of geographical indications, have that o get a better global knowledge between the subject studied and the business sector is necessary for a overview of how the issue has been studied by the academic community, Bibliometric analysis reflects precisely this interface by means of analysis of published studies on the topic studied (MIRANDA, SANTOS, RUSSO, 2017).

Some definitions of geographical indication can be seen in Table 1. It's perceived that the term geographical indication (GI) is used to refer to places used to refer to products coming from these specific locations, their function is to protect the quality and reputation of product originating in a particular region.

Table 1: Some definitions of Geographical Indication (GI)

Authors	Definitions
Bowen, 2009	Geographical indications are local names (for example, Champagne, Roquefort) which convey the geographical origin, as well as the cultural and historical identity of agricultural products. GIisprotected under a wide range of institutions and arrangements and are found all over the world
MOSCHINI, 2008	Geographical Indications are quality attributes of interest to consumers that are linked to the specific geographic origin.The key role of the GIs is to provide a credible certification mechanism
GANGJEE, 2015	The systems for the protection of geographical indicationsare legal systems that facilitate the signaling of this provenance in the markets
DOGAN, 2012	GIis one of the intellectual property rights, it is a symbol used in goods that have a specific geographical origin and possess qualities, reputation or characteristics that are essentially attributable to that origin
MOSCHINI, 2008	Indications identifying a good as originating in the territory of a member or a region or locality in a given territory where a particular quality, reputation or other characteristic of the good is essentially attributable to its geographical origin

Source: prepared by the authors

Geographical indications have emerged with the referential of certain foods and beverages to their places of origin. With the increasing demands of product standards and provenances, a niche has been created in the market. Products that receive geographical indication registration are differentiated by agroecological conditions, or animal races, or plant varieties, and/or unique human patrimony, always correlated to the geographical environment that originated the product (DESELNICU, 2013).

Legal recognition of geographical indications gives rural communities the opportunity to value local productions based on know how to do. With the registration of a geographical indication, the joint protection of the rural development of the producer and also of the consumer is perceived, thus constructing a vision of the multidisciplinary nature of the subject that includes legal, economic, social and political dimensions (BRAMLEY, 2009).

The importance of the provenance of food and agricultural products grows each day, impacting on the sustainable and economic development of each region. The certification of the Geographical Indication (GI) is a legal device that signals this provenance (GANGJEE, 2015).

Studies aiming at the process to obtain the certification of Geographical Indications (GI) in the European Union, show that the legislation has a certain flexibility focusing attention on the particular and specific characteristics of the products to be protected. The European Union's legislation is based on the Trade-Related Aspects of Intellectual Property Rights (TRIPS), cite in one of its papers that the certification of a geographical indication occurs when there is a certain type of connection with the region of origin and the product in question, so the certification ensures regional development of the geographical origin that originated the protected paper (GANGJEE, 2015).

The system for registering a United States geographical indication uses existing administrative trade mark structures, the country doesn't protect generic terms or geographical signs for goods/services. Another feature of the registered system is that the owner of the geographical indication has the exclusive right to prevent the use of the GI by an unauthorized party when such use would likely cause confusion, error or disappointment as to the origin of the goods/services (MOSCHINI, 2008).

With the records of geographical indications, Brazil has great economic potential due to its vast agricultural and natural products. It’s perceived that LPI/96, even innovating in several aspects, this law needs to improve the adequacy of geographical indications so that the country doesn’t have economic losses and in some papers, this law isn’t in line with the TRIPS agreement (PORTO, 2009).

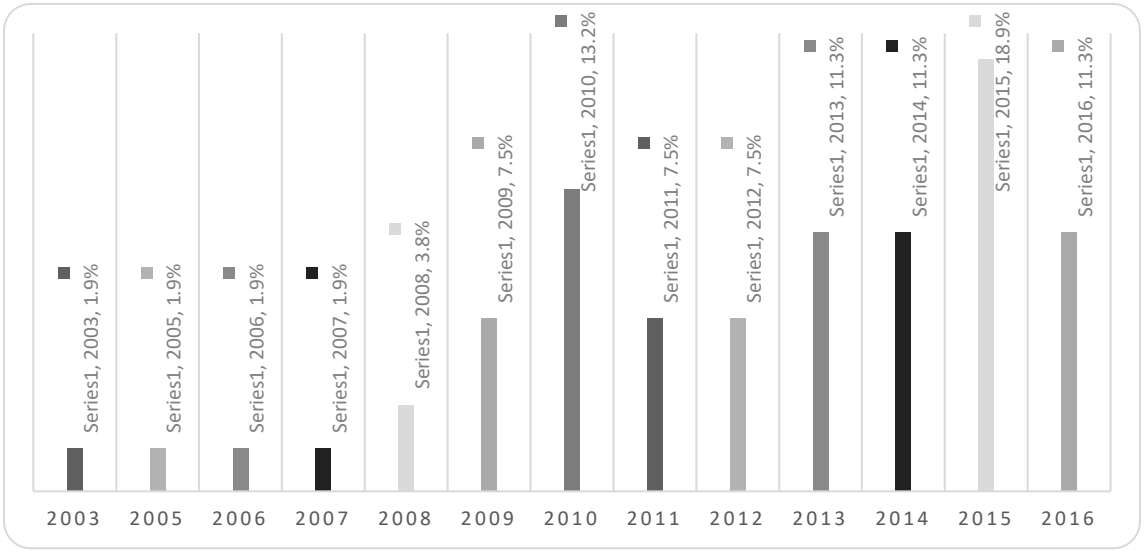
3. Analysis and Discussion of Results

This study analyzes the empirical literature to identify the factors that influence the protection and registration of a geographical indication, thus compiling a set of papers registered in the Web of Science database, by performing the search on June 20, 2017 , of the terms: (Geographical indication) and (Recognition or registration or record), resulting in 55 documents.

The analysis of the documents distributed per yearcan be seen in Figure 1, it is observed that in 2015 was the year with the largest number of papers in the area, with 11 papers discussing products being registered and protected by a Geographical Indication. The first paper published in this research was given in 2003, in this paper we study the registration of GI and the importance of certification of origin of agro-food

products

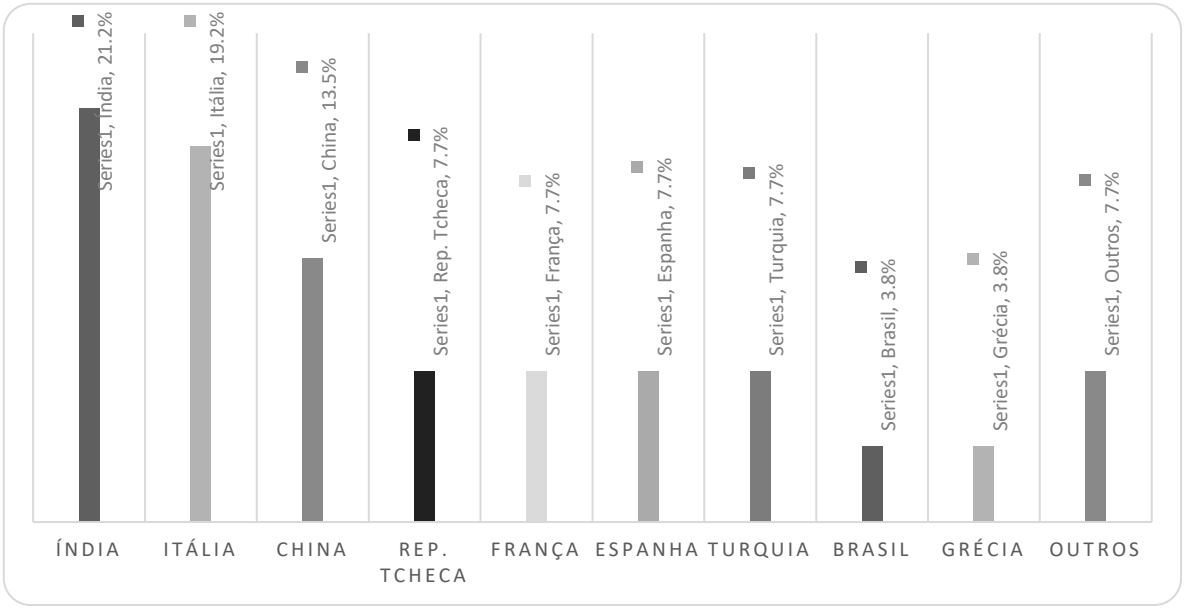
Figure 1: Distribution of papers per year



Source: prepared by the authors

In the distribution of papers by country, it's verified that India is the country with the largest number of publications, followed by Italy, this fact is reflected in the number of registrations of these countries, as can be seen in Valente (2012), Italy is one of the European countries with the largest number of geographical indication registrations, only loses to France, emerging nations, India and China are countries that are in high growth of geographical indications. Brazil, from the data contained in the National Institute of Industrial Property, has 54 national geographical indication records, of which these products resulted in 4 papers related to the theme of the research at the base of the Web of Sciense.

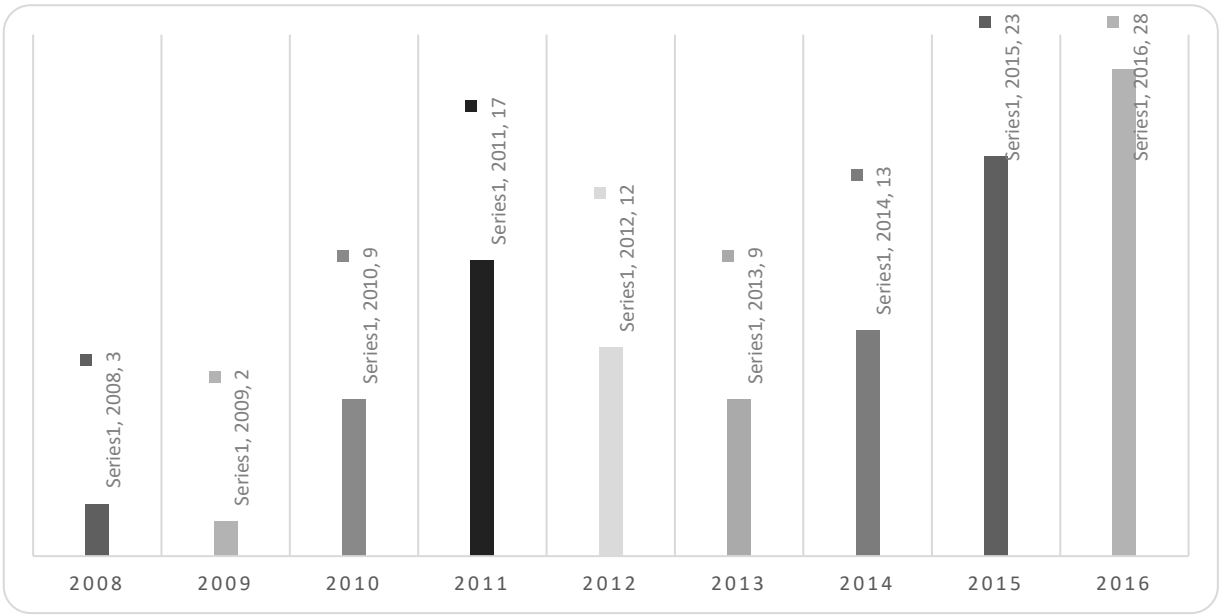
Figure 2: Distribution of papers by country



Source: prepared by the authors

The interest in the researched theme can be seen in Figure 3, with increasing numbers of citations per year. Concern about food security and the need for an increasingly high quality standard in agribusiness reflect the interest in published research in analyzing records of geographical indications.

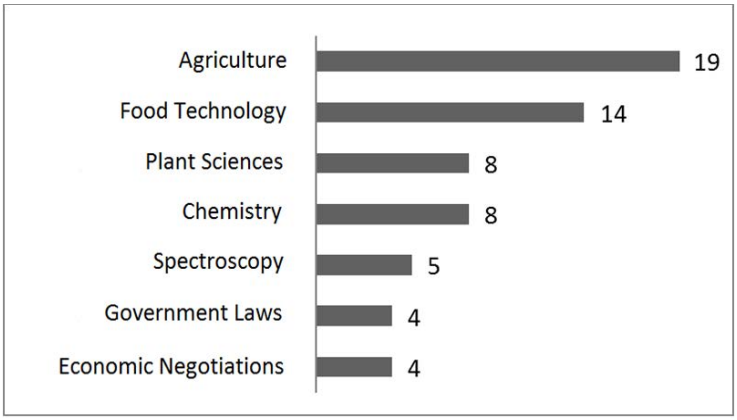
Figure 3: Number of citations per year



Source: prepared by the authors

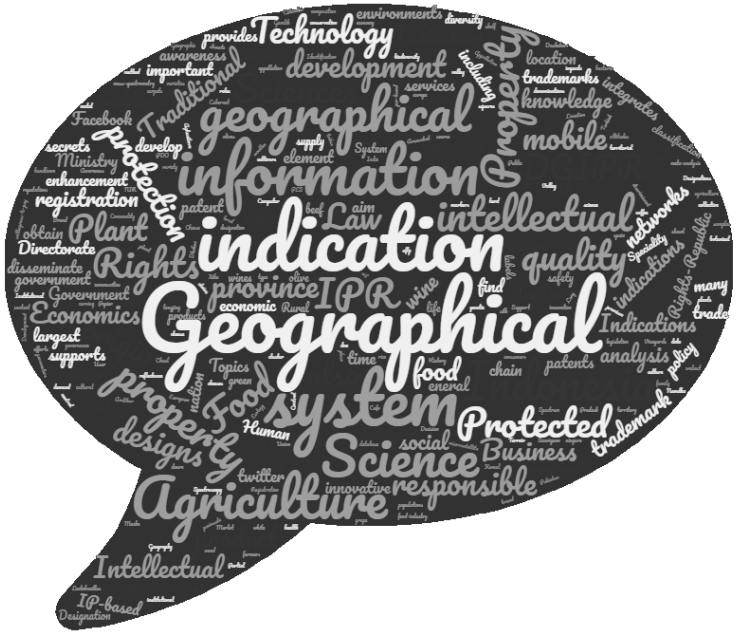
Figure 4 reflects the fact that the geographical indications contribute to improvements in the agribusiness sector,and the recognition of producers' "know do", in 35% of the papers are related to agriculture. This fact can be observed in Bramley (2009) who reports on food security, the sociocultural status of consumption of certain foods and the valuation of culinary heritage contribute to an increasing demand and increase in the need for a quality standard. Products with source specifications are an important example of this, as trends in the food industry over the past decade indicate that consumers increasingly value products they can associate with a particular location and/or special means of production.

Figure 4: Distribution of the number of papers in Web of Science research area



Source: prepared by the authors

Figure 5: Representation of key word frequencies



Source: prepared by the authors

Of the fifty-five papers resulting from the Web of Science search, the publications detailing the registered productand not being the focus of this study, selecting like thistwenty-two documents that refer to the subject studied. In Table 2, the terms used in the highlighted search in the summary of the selected papers can be observed.

Table 2: Terms used in the highlighted search in the summaries

YEAR	AUTHOR	ABSTRACT	CITATION NUMBER
2003	Elizabeth Barham	...linking to the global as intellectual property defined by the GATT and regulated by the WTO as a ‘‘**geographical indication**.’’... The AOC regulatory system has been evolving in recent years along with EU **recognition** of labels of origin	244
2006	SiriginidiSubba Rao	... It highlights international and Indian initiatives for protection of IK. India made amendments to Indian patent law; enacted Acts related to Convention on Biological Diversity, Indian legislation for the Protection of Plant Varieties and Farmer’s Right Act and **Geographical Indication** of Goods (**Registration** and Protection) Act...	19

YEAR	AUTHOR	ABSTRACT	CITATION NUMBER
2008	Giraud	Basmati is well renowned as the most aromatic rice over the world. Populated urban markets are prone to accept a premium to Basmati, whom price is the highest for rice on trade and domestic markets. ... ...The need of **protection** is clearly documented, but the **registration of a Geographical Indication**, will probably increase Basmati market shortages.	3
2009	BARDAJÍ, Isabel; IRÁIZOZ, Belén; RAPÚN, Manuel	The aim of this paper is to analyze beef retailers' behavior with respect to the sale of beef under a protected **geographical indication** (PGI). ... ... There is widespread **recognition** of the contribution towards nature conservation made by the first two of the systems described above...	5
2010	ALBAYRAK, Mevhibe; GUNES, Erdogan.	...**Geographical indications** are used worldwide as an instrument for brand management and diversifying products. In the EU (European Union), too, efforts continue to protect products through **registration** of geographical origin and traditional indication. ...practices of EU countries with respect to **geographical indication** of traditional foods, which is of importance especially to future members of the expanding EU while adapting their own **registration** systems. To this purpose, the **GI** system and practices in the EU are analyzed...	4
2010	MevhibeAlbayrak and Erdogan Gunes	...**Geographical indications** are used worldwide as an instrument for brand management and diversifying products. In the EU (European Union), too, efforts continue to protect products through **registration** of geographical origin and traditional indication.... to**geographicalindication**oftraditionalfoods...	0

YEAR	AUTHOR	ABSTRACT	CITATION NUMBER
2010	Rao, R. Bencivenni, M. ;La Mura, M. ;Araujo-Burgos, T. ;Corrado, G.	In the EU, the production of local varieties with well-known quality characteristics may be defended by a Protected Designation of Origin (PDO) or a Protected **Geographical Indication** (PGI) label. Although the award of either status is based on meeting a number of conditions, the **registration**, distinction, and protection of such plant material is based on morphological traits...	5
2010	SAMADDAR	It is essential to protect bio-cultural products from being unduly patented and from biopiracy. Identification of a **Geographical Indication (GI)** ...This paper presents a step-by-step procedure for identifying and testing of a **GI** candidate and a walk-through **GI** candidature, application and **registration** steps...	2
2011	SOAM, S. K	A survey under United Nations Conference on Trade and Development project in 25 states of India identified promising indigenous drinks that merit protection as **Geographical Indications** (GI) including 'nannari' from Andhra Pradesh, 'kokum' from Western Ghats and 'burransh' from Uttarakhand. ... In such a scenario, can **registered GIs** accelerate the growth through market penetration? The study offers solutions/models for **GIregistration** and business strategy with sustainable rural livelihood development.	1

YEAR	AUTHOR	ABSTRACT	CITATION NUMBER
2012	Bilge Dogan and UmmuhanGokovsli	A **geographical indication** (GI), which is one of the intellectual property rights, is a sign used on goods that have a specific geographical origin and possess qualities, reputation or characteristics that are essentially attributable to that origin ... The way of benefit from the marketing power of **GIs** is an effective **registration** system and also active marketing process is required to gain a place in domestic and world market. In the context of rural development and marketing, the purpose of this study is to investigate the application of **GIs** in Turkey ...	6
2012	RAY, Sujit; SAMADDAR, Shefalika Ghosh; KESERWANI, Pankaj.	Determination of potential **Geographical Indication** (GI) is a necessity for timely protection of intellectual property of geographical characteristics. The process of determination and its subsequent filling for **registration** of **GI** remains manual ... Prior **registration** of **GI** puts to an end to uniqueness. The sign/word indicating **GI** must not work against public morality of the Nation. The criteria are checked for declaring a potential **GI** ...The designed DSS methodology will provide a cost effective way for **GI registration** through **GIS** web portal.	0
2013	C. HerreroLatorre et al	...spectra of honeys with protected **geographical indication (PGI)** ‘‘Mel de Galicia’’ was processed by means of different chemometric techniques to develop an authentication system for this high quality food product. ... ...As the first step in chemometric study, display techniques such as principal component analysis and cluster analysis were applied in order to demonstrate that the NIR data contained useful information to develop a pattern **recognition** classification system to authenticate honeys with **PGI**.	0

YEAR	AUTHOR	ABSTRACT	CITATION NUMBER
2013	Maria Emília Rodrigues Valente; Ronaldo Perez; Lucia Fernandes	The process of **geographical indications recognition** for food and beverages in Brazil: regulation of use, delimitation aerea and product differentiation	0
2014	*ŠárkaVelčovskáandTomášSadílek*	We analysed the use of European Union schemes of Protected Designation of Origin, Protected **Geographical Indication** and Traditional Speciality Guaranteed labels in the European Union market according to selected criteria including type of label, country of origin, and product classes... ...data from the Database of Origin and **Registration** are used. The sample consists of 1146 labels **registered** in this database as to the 28th of March 2013	0
2015	Marcello De Rosa	The paper focuses on the role of **geographical indication** in supporting strategies of food safety... ... in his paper he underlines the opportunity to proceed with a **GI recognition** in cases where food production contributes to the *in situ*conservation of genetic resources for food and agriculture.	0
2015	Dev S. Gangjee	... **GI**s are increasingly valued for their endogenous development potential. But precisely what does legal **recognition** as a **GI** guarantee? Drawing on the EU's **registration** system as a model, this paper investigates the certification of provenance and authenticity by public authorities...	0

YEAR	AUTHOR	ABSTRACT	CITATION NUMBER
2015	Ricky Conneelyande Marie Mahon	This paper examines the importance of national-level institutional arrangements for promoting the EU's **Protected Geographic Indication** scheme **(PGI).** Taking the example of Ireland, for which PGI designations remain comparatively low, it explores whether the approach to providing institutional supports to the PGI scheme is influenced by top-down technocratic governance structures that pertain to food safety and quality **recognition** that encompass the broader operating environment for food production in Ireland. Although the **registration** of food safety and quality certification are distinct remits to the administration of the PGI scheme, ...	2
2015	ElsyandAdheenaRam	Protection and management of intellectual property rights over unique crop genetic resources, biodiversity, new cultivars in crops and unique products from crops attains significance in the back drops of globalisation and trade liberalisation. ... The **Geographical Indications** (**Registration** and Protection) Act-1999 provides for the protection and management of IP rights of communities over unique cashew products. Fenny is a unique product of cashew from Goa and this has been accepted as a **Geographical Indication** (GIs) from our country. Similarly, there are other cashew products in different parts of our country that can be protected and marketed as **GIs** in national and international markets...	0

YEAR	AUTHOR	ABSTRACT	CITATION NUMBER
2015	María Reyes Gonzalez-Centeno	The legal **recognition** of the geographical origin of wines, named Appellation of Origin, is of great interest for both consumers and producers, since it provides decisive criteria of acceptability in terms of guaranteed quality... Thirteen Merlot and 14 Cabernet Sauvignon vineyards were selected from two Appellations of Origin, named Binissalem and PlaiLlevant, located in the Balearic Islands (Spain). Grapes and soils were sampled evenly over the whole surface of each vineyard. Climatic and landscape conditions were also **registered** at each site.....	1
2015	Xiomara F. Quiñones-Ruiz , Marianne Penker, Christian R. Vogl, Luis F. Samper-Gartner	Origin labels, more specifically **Geographical Indications** (GIs), allow organised producers to define quality standards and defend their food products' reputation while highlighting their geographical origin and value to consumers. Cafe de Colombia was the first non-European food product **registered** as Protected **Geographical Indication** (PGI) ... **GI registration** and implementation? and ii) can collective action for **GIs** reshape relations between supply chain actors and support producers in gaining control over origin products? ...	6
2015	TomášSadílek	The paper deals with European Union schemes of Protected Designation of Origin, Protected **Geographical Indication** and Traditional Speciality Guaranteed labels used in agricultural and food products sector. The aim of the paper is to analyse the utilization of these labels in European Union market according to selected criteria including type of label registered in each country, and number of agricultural products and foodstuffs **registered** as quality labels in total.	0

4. Evolutionary Discussion of Selected Papers

Barham (2003) argues that the protection of a given product by its origin is the evolution of agro-food products in the European view, verifying a way of products to stand out and acquire a quality standard, the author perceives a moment of crisis of legitimation of stamps different ideals of the United States and the European Union.

Rao (2006) seeks to defend the idea of geographical indication protection for various neglected practices of indigenous peoples in India, with this protection is intended to stimulate and refine systems of knowledge of these peoples such as protect medicines that make use of the tacit knowledge of the indigenous and protection is only given by the pharmaceutical industry, to change this framework requires national and international policy improvements to ensure the development and protection of such knowledge.

Giraud (2008) studies the registration and protection for Basmati rice, because it is a popularly known and recognized rice in the market the need for protection is clearly documented, but one point discussed is that the registration of a geographical indication will probably increase the market shortage of Basmati. Another point discussed is the geographical delimitation in case of registration, since the junction for the GI registry is pending for the Indian and Pakistani governments.

Bardají (2009) analyzes the geographical indication on the commercialization of beef in a certain European region. A fact by Bardají (2009) observed is the differential of the high quality of the product that obtained the registration of the geographical indication, shows a positive attitude towards the meats that is the development based on the valorization of local products.

Albayrak (2010) realizes the difficulty that a company has in differentiating itself from others, with the increase of competition in the market. Geographical indications are used worldwide as a critical handling for differentiating products in the world market and brand consolidation. With this vision, Albayrak (2010) analyzed the geographical indications existing in the European Union by checking the efforts to protect the products through the registration of geographic origin.

According to Rao (2010), to obtain a geographical indication seal in the European Union is based on meeting some conditions for the registration, distinction and protection of this plant material (in the case of apricot) are based on morphological characteristics. Therefore , when analyzing the molecular characterization of apricot cultivars of Vesuviano indicated the presence of incorrect labeling and wrong designations of the protected area by geographical indication. The data revealed that DNA fingerprints should always be implanted to complement the use of morphological traits in the description of plant material during the certification of an origin label.

Samaddar (2010) shows the need to protect natural and cultural products by preventing them from being neglected and unduly patented. Samaddar (2010) analyzes 'KomalChaul' as a possible candidate for a geographical indication (GI) thus creating a test to verify whether a natural product meets the requirements of this type of registration.

Soam (2011) identifies some promising indigenous beverages that deserve protection as geographical indications (GI), with a vision of entrepreneurship, such beverages have great acceptance of retailers and consumers. A requirement addressed is the fact that the shared valuation of the traditional knowledge holders and with the commercialization, the improvement in the socio-economic condition of the protected

region is obtained. In the study, Soam (2011) offers solutions/models for geographical indications, as well as logging strategies.

For Dogan (2012), a product's connection to a specific region adds value to the product and brings certification as an effective marketing tool to attract consumer attention to geographic regions. In the case of rural regions, the geographical indication is a strong ally for development, given that it's difficult in these regions to obtain a technology-based competitive advantage.

In Ray's view (2012), to determine whether a product has potential for a geographical indication (GI) requires unique geographical features, one of the difficulties in obtaining registration is still to remain manual filling in most less developed nations. Ray (2012) explores a methodology in the form of an efficient architecture that can be used for geographic indication (GI) determination. The proposed methodology proposed will provide a cost-effective way of registering GI through a web portal. Valente (2013), which aimed to characterize the Brazilian Geographical Indications with a case study, which verified the regulations, the geographical area delimitation, the evidence of the reputation and the relationship between the product and the geographic environment.

VELČOVSKÁ (2014) analyzes the quality standard of the European Union's geographical indications referring to the food sector, concludes that the certification stamps of a GI are to meet the need for consumer safety when purchasing genuine products with specific qualities referring to a specific region . The benefits of registering a GI for producers are the protection and promotion of their products.

Bhooshan (2015) argues that the economic benefit of the use of certification by geographical indication is a goal of many farmers, since it isn't only a registration certificate, this intellectual property protection refers to a business strategy contributing positively to production and also expanding the range of market in which the product is inserted.

For Conneely (2015), the priorities associated with the certification of geographical indications are to develop employment opportunities related to the specific locality of the product, to promote and maintain the added value of the product or process. Conneely (2015) seeks to promote an analysis of the European Union's geographical indications protection scheme, with the Ireland case study verifying the relationship between quality and food safety certification with GI records. In the value-added research for related producers, GIs verify that the incentives to benefit from the GI protection regime need to be better established as producers require the development of more subjective practices and processes.

Elsy (2015) looks at the cashew derivatives products in India, looking at the provisions, perspectives, problems of protection and management of intellectual property rights on exclusive cultivars. In India it's allowed to regulate access to biodiversity, so that germplasm can be protected. In Elsy's (2015) view, existing and analyzed products derived from cashew are exclusive and provide for the protection and management of intellectual property rights of communities generating such products.

Gonzalez-Centeno (2015) proposes the application of a multivariate approach to evaluate the effect that the agroclimatic fingerprint exerts on the differentiation of vines according to the Denomination of origin that they belong to.

Quinones-Ruiz et al. (2015) conceptualizes that the certification labels of a geographical indication are different from the others (eg organic certification) in the sense that producers in developing countries can

define their own production rules used in their GIs, quality standards are defined by the certification holders. Dokuzlu (2016) analyzes food products registered in Turkey seeking to describe a process to implement certification of Geographical Indication. In the suggested system one can allow the inspection of the producers as the geographical limitation.

5. Conclusions

The regions that seek certification by geographical indication are to obtain a differentiation in their products, to create a reputation of quality valuing the locality and thus to obtain a recognition of the consumers.

With the globalized world and the great demand for a quality standard, a food security renewed the interest in the use of the origin to differentiate agricultural and alimentary products being the registry like geographical indication a solution for these criteria.

Regarding the legislation of geographical indication, it was observed that in the United States some products registered as a geographical indication in other nations are considered generic terms for them, so a recognized GI in the country is protected as a registered trademark. In the European Union, it has a more flexible vision focusing on the particular and specific characteristics of the products to be protected. And in Brazil legislation needs to be improved to fit into the TRIPS agreement and thus increasingly protect its vast potentialities of geographical indications.

Certification by geographical indication is a term that is currently being studied, and is widely referenced in scientific paper. The areas with the greatest interest in scientific production on the subject are agronomic.

6. References

Albayrak, M., &Gunes, E. (2010). Implementations of geographical indications at brand management of traditional foods in the European Union. *African Journal of Business Management*, *4*(6), 1059.

Bardají, I., Iráizoz, B., &Rapún, M. (2009). Protected geographical indications and integration into the agribusiness system. *Agribusiness*, *25*(2), 198-214.

Bhooshan, N., Dutta, R., & Singh, S. (2011, June). 'MalihabadiDashehari' Mango Geographical Indication-A Case Study. In *Global Conference on Augmenting Production and Utilization Of Mango: Biotic and Abiotic Stresses 1066* (pp. 219-226).

Bramley, C., Biénabe, E., & Kirsten, J. (2009). The economics of geographical indications: towards a conceptual framework for geographical indication research in developing countries. *The economics of intellectual property*, 109.

Bowen, S., & Zapata, A. V. (2009). Geographical indications, terroir, and socioeconomic and ecological sustainability: The case of tequila. *Journal of rural studies*, *25*(1), 108-119.

Conneely, R., & Mahon, M. (2015). Protected geographical indications: Institutional roles in food systems governance and rural development. *Geoforum*, *60*, 14-21.

Deselnicu, O. C., Costanigro, M., Souza-Monteiro, D. M., & McFadden, D. T. (2013). A meta-analysis of geographical indication food valuation studies: what drives the premium for origin-based labels?. *Journal of Agricultural and Resource Economics*, 204-219.

Dogan, B., &Gokovali, U. (2012). Geographical indications: the aspects of rural development and marketing through the traditional products. *Procedia-Social and Behavioral Sciences*, *62*, 761-765.

Dokuzlu, S., &Dokuzlu, S. (2016). Geographical indications, implementation and traceability: Gemlik table olives. *British Food Journal*, *118*(9), 2074-2085.

Elsy, C. R., &Adheena Ram, A. (2011, December). Conservation and IP protection of unique crop genetic resources and products of cashew. In *I International Symposium on Cashew Nut 1080* (pp. 111-117).

Gangjee, D. S. (2015). Proving Provenance? Geographical Indications Certification and Its Ambiguities. *World Development*.

González-Centeno, M. R., Adrover-Obrador, S., Simal, S., Frau, M. A., Femenia, A., &Rosselló, C. (2015). A multivariate methodology to distinguish among wine Appellations of Origin. *Agronomy for sustainabledevelopment*, *35*(1), 295-304.

INPI. Instituto Nacional da Propriedade Industrial. **Indicação Geográfica no Brasil** Disponível em: <http://http://www.inpi.gov.br/menu-servicos/indicacao-geografica/indicacao-geografica-no-brasil/>. Acessoem: 27 jul. 2017

Miranda, D., Santos, A., & Russo, S. (2017). Technology Transfer: A Bibliometric Analysis. International Journal for Innovation Education and Research, 5(12), 78-87. Retrieved from http://ijier.net/ijier/article/view/867

Moschini, G., Menapace, L., & Pick, D. (2008). Geographical indications and the competitive provision of quality in agricultural markets. *American Journal ofAgriculturalEconomics*, *90*(3), 794-812.

da Rocha Porto, P. C. (2009). Indicações Geográficas, Modelo Brasil. *CEP*, *1311*, 928.

Valente, M. E. R., Perez, R., Mota Ramos, A., & Paes Chaves, J. B. (2012). Indicação geográfica de alimentos e bebidas no Brasil e na União Europeia. *Ciência Rural*, *42*(3).

Rao, S. S. (2006). Indigenous knowledge organization: An Indian scenario. *International Journal of Information Management*, *26*(3), 224-233.

Rao, R., Bencivenni, M., Mura, L., Araujo-Burgos, T., &Corrado, G. (2010). Molecular characterisation of Vesuvian apricot cultivars: implications for the certification and authentication of protected plant material. *The Journal of Horticultural Science and Biotechnology*, *85*(1), 42-47.

Ray, S., Samaddar, S. G., &Keserwani, P. (2012). An Efficient Architecture of Decision Support System for Testing Potential Geographical Indication in India. In *Advanced Materials Research* (Vol. 403, pp. 4476-4485). Trans Tech Publications.

Soam, S. K. (2011). Commercialization of indigenous health drinks as geographical indications. Journal of Intellectual Property Rights, Vol 16, March 2011: 170-175. *Journal of Intellectual Property Rights*.

Samaddar, S. G., &Samaddar, A. B. (2010). KomalChaul–A potential candidate for geographical indication.

Velčovská, Š., &Sadílek, T. (2014). Analysis of Quality Labels Included in the European Union Quality Schemes. *Czech Journal of Food Science*, *32*(2).

Zan, F., Tibério, M., & Russo, S. (2017). The perception of the economic agents on the quality and the control in the certification of wines in Geographical Indications (GIs). International Journal for Innovation Education and Research, 5(10), 85-98. Retrieved from http://ijier.net/ijier/article/view/829

Electricity Consumption, Corruption and Economic Growth: Evidence on Selected African Countries.

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ABSTRACT

An important prerequisite for reducing poverty, sustainable development and achievement of the millennium development goal has to some extent been tied to access to electricity. However, the subject matter; 'electricity consumption causing economic growth' has seen conflicting results from the theoretical and empirical front, if indeed a relationship exist at all.

The study tests, within a panel context the long-run relationship between electricity consumption and economic growth for 13 African Countries from 2006 to 2017 by employing recently developed panel co-integration techniques. Implementing a three stage approach made up of panel unit root, panel co-integration and Granger causality test to examine the causal relationship between electricity consumption, electricity price, corruption, employment and growth.

The study provides empirical evidence that a bidirectional causal relationship between electricity consumption and economic growth exist in the short run, suggesting that lack of electricity could hamper economic growth as well as an investment in electricity infrastructure would in turn improve economic growth. Also reveals that corruption causes the level of electricity consumption and GDP in the short run. On the long-run front electricity consumption and electricity price granger causes GDP and GDP causes electricity consumption.

Keywords: Africa, electricity consumption, economic growth, corruption, panel co-integration, panel data

1. Introduction

The role Electricity plays in our present day lives cannot be over emphasised, especially its contribution in key vital sectors, including Education, Agriculture, communication and manufacturing sectors (Adebola, 2011; Kouakou, 2011). According to Adeola (2011), Electricity consumption is key for economic development and personal satisfaction not just on the grounds that its nurtures the productivity of the factors of production (e.g Capital and Labour e.t.c.), more also that increased electricity consumption connotes

high economic status of a Country. Furthermore, according to Ouedraogo (2013) speaking of economic status, a quarter of the world's population has no access to electricity, suggesting that the lack of access to electricity is hence a hindrance to sustainable development and economic growth. As reported by UNIDO (2001), it has been widely acknowledged that in varying ways, electricity consumption affects the realisation of the millennium development goals[3]. However, Ouedraogo (2013) infers that from the theoretical and the qualitative standpoint, there seem to be consensus on the effect of electricity consumption on the growth and development of any given economy, but an empirical consensus is yet to be met.

A large number of studies have examined extensively the Granger-causal[4] relationship between electricity consumption and economic growth around the world over the past decades using different approaches, time periods and control variable(s). In any case, the result on the direction of the causality remains inconclusive. Some empiral studies (e.g. Adebola, 2011; Mozumder and Marathe, 2007; Ghosh 2002) found a one way causality from economic growth to electricity that economic growth Granger-cause electricity consumption, while some other studies disputed that electricity consumption Granger-cause economic growth (e.g. Nadia, 2012; Augueste, 2011; Tang, 2008,2009; Yuan et al., 2007; Stern, 1993).

Nonetheless the direction of causality between electricity consumption and economic growth could have critical policy implications. For instance where electriciy consumption Granger causes economic growth, policies to reduce electricty consumption may have an adverse effect on the growth of the economy. Along these lines, it is imperative to give empirical proof on the likely existence of a long run relationship between electricity consumption and economic growth for a given location. (Ouedraogo, 2013; Akinlo, 2008; Squalli, 2007; Wolde-Rufael, 2006; Jumbe, 2004)

A growing number of recent research conducted by some authors show a certain interest in African countries (see Emmanuel, 2013; Ouedraogo, 2013; Adebola, 2011; Kouakou, 2011; Odhiambo, 2009a, b; Wolde-Rufael, 2006; Squalli, 2007; Jumbe, 2004). Regardless of this expanding literature on the causality between electricity consumption and economic growth in Africa, none of these literatures has considered how the perception of corruption in Africa may affect electricity consumption. According the The Transparency International Global Corruption Index, the corruption in public utilities in both poor and rich countries alike have barely dropped. The corruption perception index (CPI) between 2004 & 2007 reveals a slight drop from 35% to 33% in the share of the population who have directly experienced corruption in the delivery utilities (e.g. electricity and water). For this reason, Lourdes & Antonio (2009) pointed out how corruption in utilities could be a major issue amongst policymakers.

Against this backdrop, this study aims to re-investigate the causual relationship between electricity consumption and economic growth in a multivarate framework. Thus, incorporating employment, corruption perception index[5], consumer price index is used as a proxy for electricity price as data for electricity price are not available for all 13 countries selected for this study. In doing so this study may

[3] The Millennium Development Goals (MDGs) are eight international development goals that were officially established following the Millennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration. which includes; eradication of poverty and hunger, achieving universal basic education, promoting gender equality and women empowerment, reduce child mortality, improve maternal health care, combat HIV/AIDs, malaria and other diseases and ensure environmental sustainability

[4] Granger causality

[5] The corruption perception index ranks countries on the scale of 1 to 10, 1 been very corrupt and 10 been very clean

increase the reliability of its findings, as the problem associated with omitted variables may be avoided. Also this would be the first study on electricity consumption-growth connection (nexus) using the corruption index as a control variable. Following this, this study would attempt to compare and capture the the effect of corruption index as against just price and employment, by examining the long run relationship with and without corruption and causality with and without corruption.

2. An Overview of the Electricity Situation in Africa

The World Bank reports (2012) that Africa's largest deficit in Infrastructure would be found in the power sector. Whether considered in terms of electricity consumed, generation capacity or security of supply, Africa lags behind when compared with other continents around the world. It is shocking to note that Africa's electricity infrastructure only delivers about a small part of what is obtainable elsewhere in the developing world. According to the World Bank report (2012), the 48 Sub-Saharan Africa countries put together with an estimated population of 800 million people, only generates just about same amount of electricity as Spain with an estimated population of 45 million people. With an average electricity consumption of about 124 kilowatt hours per capita per year and falling, just enough energy to power a 100 watt bulb per person for around three hours, this is shockingly just about the tenth of what is obtainable elsewhere in the developing world.

This wide disparity is not only observed when benchmarking electricity consumption in Africa against other developing countries, but also can be observed within Africa. Table 1 shows a ranking of Africa countries by the estimated amount of electricity consumed. For example: Nigeria with an estimated population of 160 million people consumes about 91 kilowatt per hour per capita and South Africa with an estimated population of 51 million people, electricity consumption stands at about 3552 kilowatt per hour per capita.

Table III: List of African Countries by Electricity Consumption

Country	Africa Rank	World Rank	Amount (kWh)
South Africa	**1**	18	181,200,000,000
Egypt	**2**	35	69,960,000,000
Algeria	**3**	64	22,900,000,000
Libya	**4**	69	18,770,000,000
Morocco	**5**	71	14,610,000,000
Nigeria	**6**	72	14,550,000,000
Zimbabwe	**7**	79	9,813,000,000
Tunisia	**8**	80	9,748,000,000
Ghana	**9**	81	8,835,000,000
Zambia	**10**	105	5,458,000,000
Kenya	**11**	107	3,981,000,000
Congo, DR	**12**	108	3,839,000,000

Cameroon	**13**	113	3,360,000,000
Cote D'Ivoire	**14**	116	2,983,000,000
Tanzania	**15**	118	2,752,000,000
Sudan	**16**	122	2,222,000,000
Uganda	**17**	128	1,620,000,000
Ethiopia	**18**	129	1,594,000,000
Botswana	**19**	130	1,564,000,000
Senegal	**20**	133	1,412,000,000
Mozambique	**21**	135	1,390,000,000
Angola	**22**	136	1,348,000,000
Mauritius	**23**	137	1,219,000,000
Reunion	**24**	140	1,005,000,000
Swaziland	**25**	142	962,900,000
Madagascar	**26**	146	772,100,000
Gabon	**27**	148	742,500,000
Guinea	**28**	149	735,200,000
Malawi	**29**	151	715,300,000
Congo, DR	**30**	152	633,000,000
Benin	**31**	153	631,100,000
Togo	**32**	154	614,500,000
Namibia	**33**	155	603,100,000
Mali	**34**	161	446,600,000
Liberia	**35**	162	435,900,000
Niger	**36**	167	325,100,000
Burkina Faso	**37**	168	259,600,000
Sierra Leone	**38**	169	232,600,000
Somalia	**39**	171	227,900,000
Eritrea	**40**	172	205,100,000

Source: World bank Data (2017)

4. Corruption in Public Utilities and Economic Growth

Scholars have noted the adverse impact of corruption on Economic growth and development (Hanna, et al., n.d.). Mauro (1995) study on corruption and growth presents the earliest empirical evidence that corruption impedes economic growth as corruption reduces investments, thereby lowering ecomonic growth, and other recent studies have confirmed this finding. For example, Lambsdorff (2003), finds that if the level of corruption in Tanzania can be reduced to that of the United Kingdom, productivity would increase by 10 percent. Dreherand Herzfeld (2005) estimate that a 1 percennt increase in corruption reduces GDP growth by 0.13 percentage points and GDP per capita by 425 US$. Other resent studies are Bertrand,

et al. (2008) and Olken & Barron (2009). Furthermore, Transparency International points out that corruption may damage not only a country's economy, but also its political systems and institutions, civil society, and natural environment. As such, most development agencies have incorporated anti-corruption policies into their core strategies, with the World Bank alone supporting over 600 anticorruption programs since 1996.

Table 2: Summary of selected literature review on the causality between electricity consumption - growth for multi-countries

Authors	Period	Countries	Methodology Employed	Direction of Causality
Ehobon (1996)	1960-1984	Nigeria, Tanzania	Engle-Granger Causality	EC↔GDP
Murray and Nan (1996)	1970-1990	15 countries	Engle-Granger Causality Test	Mixed results
Wolde-Rufael (2005)	1971-2001	Algeria, Congo DR, Egypt, Ghana, Ivory Coast,	ARDL Bounds Testing,Toda and Yamamoto (1995) Causality Approach	EC↔GDP
Wolde-Rufael (2006)	1971-2001	Cameroon, Ghana, Nigeria, Senegal, Zambia, Zimbabwe, Algeria, Congo Republic, Kenya, South Africa, Sudan	ARDL Bounds Testing,Toda and Yamamoto (1995) Causality Approach	EC↔GDP
Yoo (2006)	1971-2002	Indonesia, Malaysia, Singapore and Thailand	Engle-Granger Causality test Hsiao's version of Granger Causality Method	GDP→EC (Indonesia, Thailand) EC↔GDP(Malaysia, Singapore)
Narayan and Prasad (2008)	1971-2002	30 OECD Countries	Bootstrapped Causality testing approach	EC→GDP (Australia, Italy, Slovak Republic, Czech Republic, Portugal) GDP→EC (Finland, Hungary, Netherlands) EC↔GDP(Iceland, Korea, UK) GDP- - -EC (rest 19 countries)
Squalli (2007)	1980-2003	11 OPEC countries	ARDL Bounds Testing, Toda and Yamamoto (1995) Causality approach	EC↔GDP (Iran, Qatar, Venezuella) GDP→EC (Algeria, Iraq, Libya) Mixed results with different model (Nigeria, Indonesia, Kuwait, Saudi Arabia, UAE)
Chen et al. (2007)	1971-2001	China, Indonesia, Hong Kong, India, Malaysia, Korea, Taiwan, Philippines, Singapore, Thailand	Pedroni panel Co-integration, ECM, Panel Causality test	EC↔GDP

Ciarreta and Zarraga (2008)	1971-2001	Austria, Belgium, Denmark, Finland, France, Sweden, Norway, Germany, Italy, Luxembourg, Netherlands, Switzerland	Panel Co-integration, GMM, panel Causality test	EC→GDP (in the long run) GDP ---ELC (in the short run)
Akinlo (2008)	1980-2003	Gambia, Ghana, Senegal, Cameroon, Kenya	ARDL Bounds testing/ VAR	EC↔GDP
Apergis and Payne (2009)	1991-2005	Commonwealth of Independent States	(Pedroni, 1999) and (pedroni, 2004) for Co-integration and ECM causality for short run	EC→GDP
Narayan and Smyth (2009)	1974-2002	Iran, Isreal, Kuwait, Oman, Syria, Saudi Arabia	Bootstrapped Causality Testing Approach	EC↔GDP
Wolde-Rufael (2009)	1971-2004	Algeria, Benin, South Africa	Toda and Yamamoto (1995) Causality Test	EC↔GDP

Note: **EC→GDP** means that the causality runs from electricity consumption to growth. **GDP→EC** means that the causality runs from economic growth to electricity consumption. **EC↔GDP** means that bi-directional causality exists between electricity consumption and growth. EC - - - GDP Neutrality

A summary of the findings in recent studies on the causal relationship beteween electricity consumption and economic growth for multi-countries are reported in Table 2 above. From the table it is observed that contracditory results are still being reported. Example of such is the studies by Yoo (2006) and Chen et al. (2007), Yoo (2006) found causality from electricity consumption to economic growth for Indonesia and Thailand using Hsiao's version of Granger Causality Method while Chen et al. (2007) found bidirectional causality for same country within a panel context. Ehobon (1996), using the Engle-Granger Causality and Wolde-Rufael (2006)using the Toda and Yamamoto (1995) Causality approach, found a bidirectional causality between electricity consumption and economic growth for Nigeria, while Squalli (2007) found a mixed result.

Overall, results from the studies reviewed shows that the literature on the electricity and growth causal relationship produced a conflicting result without consensus in the existence or direction of causality.

5. Methodology

In examining the relationship between electricity consumption, economic growth, prices, employment and corruption, firstly, panel unit root analysis is conducted to determine the order if integration of the variable, secondly, panel cointegration analysis is employed to check the existence of a long run relationship among the variables, panel causality analysis to check the direction of the causality, panel fully modified ordinary least square (FMOLS) and panel dynamic ordinary least square (DOL) estimates are employed in this study.

And finally the panel error correction model is employed to examine the long run vs. short run causality relationship and well as the direction of the causality.

5.1 Panel Unit Root Test

As part of a preliminary analysis, panel unit root tests would be used to test each variable to determine the order of integration (either integrated in level or in first deference), this is because co-integration necessitates that variables be integrated of same other. According to Ilhan, et al. (2010), when employing conventional unit root tests or cointegration tests routine (e.g., ADF or residual-based cointegration tests) it is likely to encounter the low power problem for non-stationary data. Therefore to take advantage of the additional information provided by pooled data section time series to increase test power, it is imperative to employ panel data unit root test as opposed to traditional unit root test.

Against this backdrop, the Im, Pesaran and Shin (IPS)(2003) would be used to check for unit root in this study. According to Eggoh, et al. (2011) the IPS unit root test is less restricitive and more power in comparism to the Levin and Lin (1993), Levin et al. (2002) and Breitung (2000), in the sense that IPS allows for heterogeneity within a dynamic panel data framework which solves the serial correlation problem that Levin and Lin (1993) encounters. The IPS Unit root test is based on the following equation:

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + \sum_{j=1}^{\rho} \emptyset_{ij} \Delta y_{i,t-j} + \varepsilon_{i,t} \quad i=1,2,\ldots,\ N;\ \ t=1,2..,T, \qquad (1)$$

Where y_{it} represents the series of country *i* in the panel over period *t*, α_i represents the independent fixed effect and ρ_i is chosen to make the residual uncorrelated over time. IPS unit root tests the null hypothesis of the unit root for each country in the panel. The null hypothesis is that $H_0: \rho_i = 0$ for all *i* against the alternative hypothesis $H_1: \rho_i < 0$ for some $i = 1, \ldots, N$ and $\rho_i = 0$ for $i = N_1 + 1, \ldots, N$(Ciarreta & Zarraga, 2010) (Ilhan, et al., 2010)[6]

5.2 Panel Cointegration Test

Once the variables in the series are individually integrated of the same order, the second step of the empirical analysis would be to investigate the possibility of a long run relationship between electricity consumption, gdp, price, employment and corruption, using Padroni (1999) cointegration technique. Like the IPS that takes into account the heterogeneity of the variables in the panel, Padroni's cointegration test also allows for heterogeneity among variables of the panel which makes it an improvement over other tests (Ciarreta & Zarraga, 2010) (Ilhan, et al., 2010). The Padroni co-integration test is based on the following model:

$$LGDP_{it} = \alpha_{it}^{a} + \delta_{it}^{a} t + \beta_{i1}^{a} LEC_{it} + \beta_{i2}^{a} LP_{it} + \beta_{13}^{a} LEMP_{it} + \varepsilon_{it}^{a} \qquad (2a)$$

$$LGDP_{it} = \alpha_{it}^{b} + \delta_{it}^{b} t + \beta_{i1}^{b} LEC_{it} + \beta_{i2}^{b} LP_{it} + \beta_{13}^{b} LEMP_{it} + \beta_{14}^{b} LCI_{it} + \varepsilon_{it}^{b} \qquad (2b)$$

where $i = 1, \ldots, N$ for each country in the series and $t = 1, \ldots, T$ is the time period; $\alpha_i$represents the country specific intercept, $\delta_i$represents the time fixed effects, LGDP,LEC, P, LEMP and LCI are the natural logarithms of Electricity consumption per capita, real GDP per capita, Price , Employment and

[6] A battery of Unit root test was conducted and included in the appendix due to work constraint and giving the results obtained are conflicting.

Corruption respectively. Equation (2a) and (2b) are co-integration equations of the panel series without and with corruption index. Equations (2a) and (2b) are tested to capture the possible effect of corruption in the long run.

5.2.1 Estimating the Long Run Cointegration Relationship in a Panel Context

Once the variables in the series are cointegrated, estimation of the long-run relationship between electricity consumption and economic growth is the next step. There exist various estimators for obtaining the cointegrating relationship within the panel data context, which includes, the Ordinary least squares (OLS) estimators fully modified OLS (FMOLS) estimators, Pull mean group (PMG) and dynamic OLS (DOLS) estimators. Ouedraogo (2013) puts foward that, using an OLS estimator in the cointegration panel context to estimate the long run equation would lead to a biased estimation of the variables except the independent variables are exogenous, hence conclusive inferences can not be made from the OLS estimators. The Fully modified OLS estimators was put forward by Pedroni (2001) while the Dynamic ordinary least squares was recommended by Koa and Chiang (2000) and Mark and sul (2002) as an alternative to the FMOLS.

The DOLS estimator assumes a parametric approach by adjusting th error terms to include past and future values of the I(1) regressors (Eggoh, et al., 2011). On the other hand the FMOLS estimator adopts a non-parametric appraoch, also factoring in the possibility of a corrletion between the error term and the regressors at first differnce as well as the existence of a constant term to deal with serial correlation correction, so that both the Fully modified ordinary least squares and the Dynamic ordinary least squares estimates of the standard errors are consistent and hence conclusive inferences can be made (Ouedraogo, 2013).

The DOLS and FMOLS estimations are employed in estimating the long run co-integration relation and the estimations are based on the following model:

$$LGDP_{it} = \alpha_i + \beta_{i1}LEC_{it} + \beta_{i2}LP_{it} + \beta_{i3}LEMP_{it} + \sum_{k=k_i}^{k} \gamma_{ik}\ \Delta LEC_{it-k} + \vartheta_{it}^{a_1} \quad (3a)$$

$$LGDP_{it} = \alpha_i + \beta_{i1}LEC_{it} + \beta_{i2}LP_{it} + \beta_{i3}LEMP_{it} + \beta_{i4}LCI_{it} + \sum_{k=k_i}^{k} \gamma_{ik}\,\Delta LEC_{it-k} + \vartheta_{it}^{b_1} \quad (3b)$$

$$LEC_{it} = \alpha_i + \beta_{i1}LGDP_{it} + \beta_{i2}LP_{it} + \beta_{i3}LEMP_{it} + \sum_{k=k_i}^{k} \gamma_{ik}\ \Delta LEC_{it-k} + \vartheta_{it}^{a_2} \quad (3c)$$

$$LEC_{it} = \alpha_i + \beta_{i1}LGDP_{it} + \beta_{i2}LP_{it} + \beta_{i3}LEMP_{it} + \beta_{i4}LCI_{it} + \sum_{k=k_i}^{k} \gamma_{ik}\,\Delta LEC_{it-k} + \vartheta_{it}^{b_2} \quad (3d)$$

$$LP_{it} = \alpha_i + \beta_{i1}LEC_{it} + \beta_{i2}LGDP_{it} + \beta_{i3}LEMP_{it} + \sum_{k=k_i}^{k} \gamma_{ik}\ \Delta LEC_{it-k} + \vartheta_{it}^{a_3} \quad (3e)$$

$$LP_{it} = \alpha_i + \beta_{i1}LEC_{it} + \beta_{i2}LGDP_{it} + \beta_{i3}LEMP_{it} + \beta_{i4}LCI_{it} + \sum_{k=k_i}^{k} \gamma_{ik}\,\Delta LEC_{it-k} + \vartheta_{it}^{b_3} \quad (3f)$$

$$LEMP_{it} = \alpha_i + \beta_{i1}LEC_{it} + \beta_{i2}LP_{it} + \beta_{i3}LGDP_{it} + \sum_{k=k_i}^{k} \gamma_{ik}\ \Delta LEC_{it-k} + \vartheta_{it}^{a_4} \quad (3g)$$

$$LEMP_{it} = \alpha_i + \beta_{i1}LEC_{it} + \beta_{i2}LP_{it} + \beta_{i3}LGDP_{it} + \beta_{i4}LCI_{it} + \sum_{k=k_i}^{k} \gamma_{ik}\,\Delta LEC_{it-k} + \vartheta_{it}^{b_4} \quad (3h)$$

$$LCI_{it} = \alpha_i + \beta_{i1}LEC_{it} + \beta_{i2}LP_{it} + \beta_{i3}LGDP_{it} + \beta_{i4}LEMP_{it} + \sum_{k=k_i}^{k} \gamma_{ik}\ \Delta LEC_{it-k} + \vartheta_{it}^{b_5} \quad (3k)$$

$$i = 1, \dots, N \quad t = 1, \dots, T$$

where $i = 1, \dots, N$ for each country in the series and $t = 1, \dots, T$ is the time period, LEC_{it}, $LGDP_i$, $P_{it}, LEMP_{it}$, and $LCI_{it}\ are$ the logs of Electricity consumption per capita, GDP per capita, price, employment, and corruption respectively. LEC_{it}, $LGDP_i$, P_{it}, $LEMP_{it}$ are co-integrated with slopes $\beta_{i1\dots i3}$ for equations (3a), (3c), (3e) and (3g) while LEC_{it}, $LGDP_i$, P_{it}, $LEMP_{it}$ and LCI_{it} are co-integrated with slopes $\beta_{i1\dots i4}$ in equations (3b), (3d), (3f), (3h) and (3i) following form equations (3a) to

(3i),$\xi_{it} = \hat{\mu}_{it} \Delta LEC$ is a stationary vector made up of the estimated residual of the co-integrating regression and the differences in the regressor.

5.3 Panel Granger Causality Test

Once established that Electricity consumption, economic growth, electricity price, and corruption are co-integrated in the long run implies Granger causality in at least one direction, however the Pedroni (1999) co-integration procedure does not indicate the direction of the causality. Hence to determine the direction of the Granger causality in the long run, a two-stage process is employed.

The first step involves estimating the long run models equation (2a) without corruption and (2b) with corruption, to obtain the residual series. The second step involves including the estimated error correction term as a variable into the following equations that would be estimated using the dynamic error correction model as specified below;

Series A (Granger Causality without Corruption)

$$\Delta LEC_{it} = \alpha_{1i} + \sum_{k=1}^{q} \alpha_{11ik} \Delta LEC_{it-k} \sum_{k=1}^{q} \alpha_{12ik} \Delta LGDP_{it-k} + \sum_{k=1}^{q} \alpha_{13ik} \Delta LP_{it-k} + \sum_{k=1}^{a} \alpha_{14ik} \Delta LEMP_{it-k} + \lambda_1 \vartheta_{it}^{a_2} + \mu_{1it} \quad (4a_1)$$

$$\Delta LGDP_{it} = \alpha_{1i} + \sum_{k=1}^{q} \alpha_{21ik} \Delta LGDP_{it-k} \sum_{k=1}^{q} \alpha_{22ik} \Delta LEC_{it-k} + \sum_{k=1}^{q} \alpha_{23ik} \Delta LP_{it-k} + \sum_{k=1}^{q} \alpha_{24ik} \Delta LEMP_{it-k} + \lambda_2 \vartheta_{it}^{a_1} + \mu_{1it} \quad (4a_2)$$

$$\Delta LP_{it} = \alpha_{1i} + \sum_{k=1}^{q} \alpha_{31ik} \Delta LP_{it-k} \sum_{k=1}^{q} \alpha_{32ik} \Delta LGDP_{it-k} + \sum_{k=1}^{q} \alpha_{33ik} \Delta LEC_{it-k} + \sum_{k=1}^{q} \alpha_{34ik} \Delta LEMP_{it-k} + \lambda_3 \vartheta_{it}^{a_3} + \mu_{1it} \quad (4a_3)$$

$$\Delta EMP_{it} = \alpha_{1i} + \sum_{k=1}^{q} \alpha_{11ik} \Delta EMP_{it-k} \sum_{k=1}^{q} \alpha_{12ik} \Delta LGDP_{it-k} + \sum_{k=1}^{q} \alpha_{13ik} \Delta LP_{it-k} + \sum_{k=1}^{a} \alpha_{14ik} \Delta LEC_{it-k} + \lambda_4 \vartheta_{it}^{a_4} + \mu_{1it} \quad (4a_4)$$

Series B(Granger Causality with Corruption)

$$\Delta LEC_{it} = \alpha_{1i} + \sum_{k=1}^{q} \beta_{11ik} \Delta LEC_{it-k} \sum_{k=1}^{q} \beta_{12ik} \Delta LGDP_{it-k} + \sum_{k=1}^{q} \beta_{13ik} \Delta LP_{it-k} + \sum_{k=1}^{q} \beta_{14ik} \Delta LEMP_{it-k} + \sum_{k=1}^{q} \beta_{15ik} \Delta LCI_{it-k} + \gamma_1 \vartheta_{it}^{b_2} + \mu_{1it} \quad (4b_1)$$

$$\Delta LGDP_{it} = \alpha_{1i} + \sum_{k=1}^{q} \beta_{21ik} \Delta LGDP_{it-k} \sum_{k=1}^{q} \beta_{22ik} \Delta LEC_{it-k} + \sum_{k=1}^{q} \beta_{23ik} \Delta LP_{it-k} + \sum_{k=1}^{q} \beta_{24ik} \Delta LEMP_{it-k} + \sum_{k=1}^{q} \beta_{25ik} \Delta LCI_{it-k} + \gamma_2 \vartheta_{it}^{b_1} + \mu_{1it} \quad (4b_2)$$

$$\Delta LP_{it} = \alpha_{1i} + \sum_{k=1}^{q} \beta_{31ik} \Delta LP_{it-k} \sum_{k=1}^{q} \beta_{32ik} \Delta LGDP_{it-k} + \sum_{k=1}^{q} \beta_{33ik} \Delta LEC_{it-k} + \sum_{k=1}^{q} \beta_{34ik} \Delta LEMP_{it-k} + \sum_{k=1}^{q} \beta_{35ik} \Delta LCI_{it-k} + \gamma_3 \vartheta_{it}^{b_3} + \mu_{1it} \quad (4b_3)$$

$$\Delta EMP_{it} = \alpha_{1i} + \sum_{k=1}^{q} \beta_{41ik} \Delta EMP_{it-k} \sum_{k=1}^{q} \beta_{42ik} \Delta LGDP_{it-k} + \sum_{k=1}^{q} \beta_{43ik} \Delta LP_{it-k} + \sum_{k=1}^{q} \beta_{44ik} \Delta LEC_{it-k} + \sum_{k=1}^{q} \beta_{45ik} \Delta LCI_{it-k} + \gamma_4 \vartheta_{it}^{b_4} + \mu_{1it} \quad (4b_4)$$

$$\Delta LCI_{it} = \alpha_{1i} + \sum_{k=1}^{q} \beta_{51ik} \Delta ECI_{it-k} \sum_{k=1}^{q} \beta_{52ik} \Delta LGDP_{it-k} + \sum_{k=1}^{q} \beta_{53ik} \Delta LP_{it-k} + \sum_{k=1}^{q} \beta_{54ik} \Delta LEC_{it-k} + \sum_{k=1}^{q} \beta_{55ik} \Delta LCI_{it-k} + \gamma_5 \vartheta_{it}^{b_5} + \mu_{1it} \quad (4b_5)$$

Where represents the lagged error correction term gotten from equations (2a) and (2b), Δ is the differenced operator, k is the number of lags[7]. The specification of equation (4) makes provision for both the short run and long run causality to be tested.

[7] The optimal lag length are established using the Schwarz Bayesian information criteria

6.0 Data and Empirical Results

This study uses annual electricity consumption per capita, EC hereafter, Electricity Price[8] (Consumer price index is used as a proxy for electricity price, as data for electricity prices are not available), Employment (EMP) and Corruption index (CI) data in this study. EC is kilowatt per hour per capita, GDP per capita data with constant 2000 US$, Price (2005 = 100), Employment (Employment to population ratio, 15+, total (%)), and Corruption Index[9]. The data are sourced from World Bank (2013). The 13 countries included in this study are; Algeria, Cameroon, Cote D´Ivoire, Gabon, Ghana, Kenya, Namibia, Nigeria, Senegal, South Africa, Tanzania, Zambia, and Zimbabwe and are selected based on the availability of data for the 1991–2010 period[10]. The variables employed are used at the natural logarithms form. Table 3 provides the descriptive statistics of these five series for all countries.

Table 3: Descriptive statistics of variables over 1991-2010

	CORRUPTION INDEX	PRICE	ELECTRICITY CONSUMPTION PER CAPITA (KWh)	EMPLOYMENT	GDP PER CAPITA
Mean	827.6289	60.25033	1074.544	2043.51	2.97755
Median	247.1777	64.1	510.2134	98.5906	2.8
Maximum	5108.41	83.1	4213.882	293318	6
Minimum	55.2078	33.1	251.7653	0.116701	1
Std. Dev.	1316.012	12.85098	1155.205	23861.8	0.992351

6.1 Panel Unit Root Results

Table 4: IPS (2003) panel unit root test result

Null Hypothesis: No unit root (Non Stationary)					
Methods	Im, Pesaran and Shin (IPS) W-stat				
Variables	Constant	Constant & trend	Variables	Constant	Constant & trend
	Level			*1st Difference*	
LGDP	5.09 (0.999)	0.48 (0.684)	ΔLGDP	-4.73* (0.000)	-4.01* (0.000)
LCI	-1.23 (0.110)	0.84 (0.799)	ΔLCI	-4.85* (0.000)	-2.69* (0.000)

[8] Price is included in the multivariate framework because recent studies show that price has a crucial role in affecting income and energy consumption. The rational for using consumer price index as a proxy for electricity price is due to the fact that data for electricity price isn't available and studies like Mahadevan and Asufu-Adjaye (2007), Eggoh, et al. (2011) used consumer price index as proxy for energy price.

[9] The corruption perception index ranks countries on the scale of 1 to 10, 1 been very corrupt and 10 been not corrupt

[10] Only these 13 countries have complete data for the selected controlled variables (Employment, price and corruption index) and data for employment and price were not available for the selected countries before 1990, this informed the analysis period of 21 years. All 13 of these countries are below 5 on the corruption perception index scale making them perceived as corrupt countries according the corruption perception index.

LP	-2.52 (0.592)	-1.04 (0.150)	ΔLP	-3.09* (0.001)	-3.62* (0.001)
LEMP	1.26 (0.895)	4.19 (0.999)	ΔLEMP	-4.93* (0.000)	-3.64* (0.000)
LEC	2.82 (0.998)	0.08 (0.530)	ΔLEMP	-6.99* (0.000)	-5.02* (0.000)

Notes: * Rejection of null hypothesis of the null hypothesis of no unit root at 1% significance level, Δ stands for first difference operation, probability values are reported in parenthesis.

The results derived from the IPS unit root test at level and first difference, with and without trend are shown on Table 6. Ng and Perron (2001) propose the use of the Modified Schwarz Information Criterion (MSIC) to determine the number of lagged first differences to be included. Therefore it can be concluded from the IPS unit root test results in Table 6 that the null hypothesis of no unit root ($H_0: \rho_i = 0$) can not be rejected at level (either with or without trend) at 1 or 10% level of significance for all the variable (electricity consumption per capita, GDP per capita, price, employment and corruption). However, when the variables are checked at first differenced, the null hypothesis of no unit root ($H_0: \rho_i = 0$) is strongly rejected at 1% significance level, implying the variables in this series are integrated of other one (I(1)). Since it is required for all variables to be integrated at same level (either at level of at first difference) for co-integration test to be carried out, and the series are integrated at order one, the next test would be to test for co-integration among variables at I(1) level.

6.2 Panel Co-integration Results

Having established the variables in the series are integrated of I(1) level, as explained in section 3.2. Table 7 reports the panel co-integration results as groups as 'within' and 'between' dimensions for equations (2a) and (2b).

Table 5: Pedroni Panel Co-integration Test

Methods	Within dimension (panel statistics)			Between dimension (panel statistics)		
	Test	Statistics	Prob	Test	Statistics	Prob
LGDP LEC LP LEMP						
Pedroni (1999)	Panel v-Statistic	-2.86	0.998	Group rho-Statistic	2.41	0.992
	Panel rho-Statistic	1.15	0.876	Group PP-Statistic	-6.91	0.000*
	Panel PP-Statistic	-6.54	0.000*	Group ADF-Statistic	-5.51	0.000*
	Panel ADF-Statistic	-5.86	0.000*			
Pedroni (2004) (Weighted statistics)	Panel v-Statistic	-3.32	0.999			

	Panel rho-Statistic	0.77	0.780			
	Panel PP-Statistic	-7.16	0.000*			
	Panel ADF-Statistic	-6.59	0.000*			
LGDP LEC LP LEMP LCI						
Pedroni (1999)	Panel v-Statistic	-3.86	0.999	Group rho-Statistic	4.67	0.999
	Panel rho-Statistic	3.94	0.999	Group PP-Statistic	-7.74	0.000*
	Panel PP-Statistic	-1.54	0.062	Group ADF-Statistic	-1.69	0.045
	Panel ADF-Statistic	-0.57	0.284			
Pedroni (2004) (Weighted statistics)	Panel v-Statistic	-3.56	0.999			
	Panel rho-Statistic	3.04	0.999			
	Panel PP-Statistic	-4.50	0.000*			
	Panel ADF-Statistic	-3.04	0.001*			

Notes: *indicates 1% significance level.

From table 5 above, the results of equation (2a) suggests that at 1% significance level it is not conclusive that the null hypothesis of no co-integration cannot be rejected. As out of the 11 tests 6 are statistically significant at 1% and 5 are not significant. Also for equation (2b) the test results were also inconclusive, as only 3 of the 11 test are statistically significant.

Table 6: Kao's residual co-integration test

Model	ADF	P-value
LGDP LEC LP LEMP(2a)	-2.105581	0.011*
LGDP LEC LP LEMP LCI (2b)	-3.619637	0.000*

Notes: *indicates 1% significance level. The ADF is a residual-based ADF statistic (Kao 1999)

As discussed in section 3.2, the Kao residual co-integration test result is reported in table 8, which rejects the null hypothesis of no co-integration at 1% significace level for both equations (2a) and (2b) meaning there is a panel co-integration relatioship betwen the variables for both model. Therefore, the variables in equations (2a) and (2b) move together in the long run thus the next step is estimating the relationship.

4.1 The FMOLS and DOLS estimations Results

The estimation of equations 3a and 3b[11] (without and with corruption index) using both FMOLS and DOLS as is presented in tables 7 and 8.

[11] Equations 3c to 3i are estimated but not reported as only their error terms are required for the Granger causality test but are contained in the Appendix

Table 7: FMOLS and DOLS results for Equation 3a

FMOLS (3a)				
	Independent			
Dependent variable	variables			
LGDP	LEC	LP	LEMP	C
	0.344	0.085	-1.642	10.906
	(0.074)	(0.045)	(0.362)	(1.820)
R-squared	0.667			
DOLS (3a)				
	Independent			
Dependent variable	variables			
LGDP	LEC	LP	LEMP	C
	0.342	0.053	-1.560	10.960
	(0.080)	(0.052)	(0.405)	(2.059)
R-squared	0.738			

Notes: t-stats of null hypothesis $H_{0:}$ β_i=1is reported in parenthesis,

Table A presents the estimated coefficients, LEC, LP and LEMP from Equation 3a (FMOLS) and 3b (DOLS),the coefficients from Equation 3ai was checked for statistical significance testing the null hypothesis $(\mathbf{H_0}: \boldsymbol{\beta_i} = \mathbf{1})$, using their respective t-statistics LEC 8.889, LP 20.206 and LEMP 7.304 against their corresponding critical value 1.972[12] at 5% significance level. The test result suggests that all coefficients except employment have the correct signs and the null hypothesis $(\mathbf{H_0}: \boldsymbol{\beta_i} = \mathbf{1})$ is rejected, hence, inferring that all the variables are statistically significant. Hence, given that the variables are expresses in natural logarithm, the coefficients can be interpreted as elasticities. The result from Equation 3a suggests that a 1% increase in electricity consumption per capita, price and employment increases real GDP per capita respectively by 0.344%, 0.085% and -1.642%.

Equation 3a (DOLS) produced a relatively similar result to the results of FMOLS, the coefficients obtained where equally check for statistical significance testing null hypothesis $(H_0: \beta_i = 1)$. The t-statistic obtained for LEC was checked against their corresponding critical value at 5% significance level 1.972 suggests that all coefficients are statistically significant with the correct signs with the exception of employment, therefore 1% increase in electricity consumption per capita, price and employment cause real GDP per capita to change by 0.342% 0.054% and -1.580% respectively.

Thus, the outcome of equation 3a shows a long-run relationship between real GDP per capita, electricity consumption per capita and the other control variables (employment and energy price).

[12] Critical values are obtained from t-statistical table using a degree of freedom of 205 for FMOLS and 194 for DOLS, at 5 percent significant level.

Table 8: FMOLS and DOLS results for Equation 3b

FMOLS (3b)					
Dependent variable	Independent variables				
LGDP	LEC	LP	LEMP	LCI	C
			-		
	0.191**	0.073**	2.167**	0.234**	
	(-7.796)	(-16.047)	(-8.454)	(-2.551)	13.649
R-squared	0.696				
DOLS (3b)					
Dependent variable	Independent variables				
LGDP	LEC	LP	LEMP	LCI	C
			-		
	0.189**	0.032**	2.007**	0.326***	
	(-5.772)	(-10.001)	(-5.135)	(-1.745)	13.123
R-squared	0.766				

Notes: t-stats of null hypothesis $H_{0:}$ β_i=1is reported in parenthesis, ** and ***indicates 5% and 10% significance levels respectively

Table 8 above, represents result obtained from equation 3b (with Corruption included as one of the control variables). For equation 3b (FMOLS) the coefficients were equally examined to ascertain statistical significant. The t-statistics obtained from the null hypothesis $(H_0: \beta_i = 1)$ are 7.796, 16.047, 8.454 and 2.515 for LEC, LP LEMP and LCI respectively, when compared with their critical values 1.972[13] at 5% significance level. All the variables were statistically significant and with the right signs with the exception of employment. Implying, 1% change in electricity consumption per capita, price and employment would real GDP per capita to change by 0.191%, 0.073 and -2.167% respectively. As for the corruption index, the estimate suggests that in a long run if corruption reduces by 1% real GDP per capita increases by 0.234%. Same hypothesis test $(H_0: \beta_i = 1)$ was examined on $3bii$ (DOLS), and the t-stat obtained from the coefficients are; 5.772, 10.001, 5.135and 1.745 for LEC, LP and LEMP and LCI respectively, check against their respective critical value 1.984 at 5% significance level shows that the coefficients are statistically significant, with the exception of the corruption index (LCI).

However, after re-examining LCI at 10% significant level (critical value 1.660), it became significant. Hence, the estimation result suggests; a 1% increase in electricity consumption per capita, price and employment would increase real GDP per capita by 0.189, 0.032 and -2.007 respectively. In the case of corruption, 1% decrease in corruption would increase real GDP per capita by 0.326%

Thus, for what is worth mentioning, the study suggests that the inclusion of corruption as a control variable is statistically significant and equally suggests a long-run relationship.

[13] Critical values are obtained from t-statistical table using a degree of freedom of 201 for FMOLS and 95 for DOLS, at 5 percent significant level.

6.3 Granger Causality Results

Table 10: Granger Causality Result without Corruption

Dependent Variables	Short-Run				Long-Run	Short Run Direction of Causality
	DGDP	DELC	DEMP	DP	ECT	ELC→GDP
		0.2133**	-0.0647	-0.0426**	-0.0215*	P→GDP
DGDP 4a(*i*)	-	(4.66)	(0.05)	(4.06)	(-2.46)	
	0.3117**		0.2813	-0.0087	-0.0163**	GDP → ELC
DELC 4a(*ii*)	(3.74)	-	(0.45)	(0.09)	(-2.09)	
	0.0618	-0.0403		0.0123	-0.0089	No causality
DEMP 4a(*iii*)	(1.93)	(1.09)	-	(2.25)	(-0.81)	
	0.1595	0.5205***	-0.2849		0.0289	ELC→P
DP 4a(*iv*)	(0.16)	(3.31)	(0.36)	-	(2.76)	

Note: Figures denotes the sums of the lagged coefficients for the respective short run change. Values for f-statistics are giving in parenthesis for short run and t-statistics for long run. *,** and *** denotes statistical significance at 1%, 5% and 10% level respectively. "X → Y" means variable X Granger causes variable Y.

Table 11: Granger Causality Results with Corruption

Dependent Variables	Short-Run					Long-Run	Short Run Direction of Causality
	DGDP	DELC	DEMP	DP	CI	ECT	ELC→GDP
		0.114**	-0.076	-0.031	0.176***	-0.019	CI→GDP
DGDP 4b(*i*)	-	(3.86)	(0.04)	(0.91)	(3.55)	(-1.37)	
	1.597**		0.171	-0.007	0.053**	-0.028***	GDP→ELC
DELC 4b(*ii*)	(3.14)	-	(0.09)	(0.02)	(3.12)	(-1.70)	CI→ELC
	0.038	-0.050		0.012	-0.006	-0.015	No causality
DEMP 4b(*iii*)	(0.25)	(0.83)	-	(0.68)	(.02)	(-0.67)	
	0.474	0.531***	-2.031		0.493	0.052**	ELC→P
DP 4b(*iv*)	(0.76)	(3.14)	(1.85)	-	(2.73)	(2.39)	
	0.887*	0.554**	-0.520	0.109		-0.129**	GDP→CI
DCI 4b(*v*)	(5.61)	(4.13)	(0.40)	(2.20)	-	(-2.06)	ELC→Ci

Note: Figures denotes the sums of the lagged coefficients for the respective short run change. Values for f-statistics are giving in parenthesis for short run and t-statistics for long run. *,** and *** denotes statistical significance at 1%, 5% and 10% level respectively. "X → Y" means variable X Granger causes variable Y.

Having established that there is evidence of co-integration long run relationship in equations 2(a) and 2(b), the next step is to examine the causality between these variables in both equations. Panel A and B reports the results for the short run and long run Granger Causality for equations 4a(1-4) for causality without

corruption and equations 4b(1-5) for causality with corruption. The optimum lag structure of 2 was chosen using the Akaike and the Schwarz information criterions.

With respect to Equation 4a(1), electricity consumption per capita has a statically significant and positive impact on real GDP per capita in the short run, as well as price, whereas employment is not statically significant in the short run. However, comparing the results of equation 4a(1) to result in equation 4b(2), it is observed that the inclusion of corruption shows that electricity consumption per capita as well as corruption has a statistical significance impact on real GDP per capita, while employment and price are not statistically significant in the short run. This highlights in 4a(1) the fact that electricity consumption granger causes economic growth and can be said to be an important driving force for economic growth in the selected Africa countries, also the consumer price paid for electricity[14] in the short run granger causes (contributes to) real GDP per capita. While in 4b(1) real GDP per capita is also determined by electricity consumption per capita as well as provides empirical evidence that corruption (measured by the corruption perception index) affects growth in the selected countries. Moreover the error correction terms for 4a(1) is statistically significant at 1% and this represents the speed of adjustment to long run equilibrium while that of 4b(1) is not statistically significant implying there is no long run causal relationship. In electricity consumption 4a(2), it appears that GDP per capita has a positive impact on electricity consumption in the short run while employment and price are insignificant, and when corruption is included (4b(2)), the impact of real GDP per capita is relatively higher in the short run, it also puts forward that corruption affects the level of electricity consumption per capita. It implies that GDP is important to see an increase in the level of electricity consumption amongst selected countries, also that for an improvement in electricity consumption to be seen, the level of corruption has to drop. These empirical findings may infer bi-direction causality between economic growth and electricity consumption in the short run. The statistical significance of the error terms suggests that electricity consumption responds to deviations from long run equilibrium.

As regards price index, it is expected that electricity consumption has an impact on price, and after testing empirically it can be suggested that for 4a(4) and 4b(4) there is a positive and statically significant impact of electricity consumption on price without and with corruption respectively in the short run, implying that the price paid for electricity is granger caused by the amount of electricity consumed. In 4a(4) the error correction term is not significant implying that price do not respond to deviation in the long run, while for 4b(4) the error term is significant and infers price responds to deviations to long run equilibrium.

Finally for corruption 4b(*v*), real GDP per capita and electricity consumption per capita are statistically significant and has an impact on corruption in the short run. Thus suggesting, an increase in GDP and an improvement in the electricity consumption can in turn curb corruption in the selected countries.

Overall, the results from Panel A and Panel B (Granger causality without corruption and with corruption) shows a bi-directional casual relationship between economic growth and electricity consumption. Hence, an increase in GDP enhances electricity consumption and an increase in electricity consumption may in turn increase production in real sector. The results also show a unidirectional causality from price to GDP and electricity consumption to price in Panel A, and electricity consumption to price in Panel B. In Panel B, there is a bi-directional causal relationship between economic growth and corruption and between

[14] Note that Consumer price index was used as a proxy for electricity price.

electricity consumption and corruption. This suggest, that an increase in economic activities may reduce the level of corruption as well as a reduction in corruption would in turn increase productivity and hence economic growth. As for the corruption-electricity consumption relationship, it infers a reduction in corruption would increase the level of electricity consumption and hence increase productivity, which would in turn reduce corruption activities. Generally the inclusion of corruption in the electricity consumption- growth relationship, do not provide any tangible change to the result. Except that, the addition of corruption shows that it granger causes electricity consumption and GDP. This answers the research question and provides empirical evidence; that the corruption level in the selected countries not only affects the level of electricity consumption both in the short and long run, but also affects the level of GDP in the short run.

7.0 Conclusion and Policy Recommendation

This study examines the empirical evidence for the relationship between electricity consumption, electricity price, employment, corruption and economic growth (GDP). Aimed to check if the inclusion of corruption in the empirical evidence would provide empirical proof that the present level of electricity consumption in these selected Africa countries are currently affected by corruption.

For this purpose, recent development in unit root test for panel, panel co-integration, long and short run elasticities and causality techniques was employed to the investigation of the electricity consumption and economic growth relationship with price, employment and corruption as additional variables for 13 Africa countries for the period 2005-2017.

On the short run dynamic front, the results obtained from without and with corruption reveals that economic growth has a positive and statistically significant effect on electricity consumption and electricity consumption equally has a positive and statistically significant effect on GDP, implying there is a bi-directional causality between GDP and economic growth. This bi-directional relationship suggests an increase in real GDP would most likely affect electricity consumption in several ways. Also, an increase in electricity consumption would cause productivity to increase. As the saying goes, “energy is the ability to do work” therefore no energy, no work, and no work, no productivity.

At a micro level, when per capita income increases, people would in turn want to spend more on electricity consumption as a means to increase comfort or improve standard of living, and at a macro level an increase in GDP can induce increase in electricity consumption. On the other hand, like a virtuous circle increases in electricity consumption in the production process would in turn increase GDP (output).

Thus conversely, in the long run electricity consumption causes economic growth and economic growth causes increase in electricity consumption as well.

The implication of these findings is that, changes in electricity consumption have a significant impact in the level of income in these selected countries in the long run. Therefore since electricity is such an important factor for growth, electricity conservation policies have to be applied with caution so as to prevent it from impeding economic growth/ socio economic development in these countries both in the short run (transitory) and in the long run (permanent). Thus environmental friendly policies like electricity conservation, or efficiency improvement measures as well as demand side management policies would

adversely affect economic activities both in the short run as well as in the long run. In order to balance economic growth and environmental friendly policies, Shahbaz, et al. (2011) suggests fossil fuels should be reduced by gradually substuting it with clearner energies e.g hydro, solar, renewables and wind power e.t.c. In addition, further investment should be made in the research and development of new/clearner electricity saving alternatives in the long run, with this electricity consumption can be reduced without adversely affecting economic growth in these economies.

As mentioned above, corruption index as measured by the Transperancy International was included in this electricity consumption and growth relationship study, so as to ascertain the relationship between the level of corruption in the selected African countries and their electricity consumption. The empiral result reveals a bi-directional causality between electricity consumption and corruption as well as between corruption and GDP. In the short run, corruption Granger causes electricity consumption and GDP, in turn the level of electricity consumption and GDP accordingly Granger causes the level of corruption in these countries. This means that when corruption reduces, electricity consumption would increase, also when electricity consumption in these countries increases it would in turn increase productivity (GDP) which would consequently cause corruption to reduce.

In that, the low level of electricity consumption in these countries are somewhat caused by the high level of corruption, this means that the infrastructures required to improve the level of electricity consumption is being impeded by high level of corruptionwhich in turn stagnates productivity. Thus, the high level of corruption can be as a result of the low productivity resulting from the low level of electricity consumption. This finding is in line with recent academic study that have shown precisely how corruption can impede Governments from providing basic public goods. For example; Bertrand, et al. (2008) discloses how corruption at the New Delhi DMV (Department of Motor Vehicles) results in less qualified drivers obtaining their licences faster than the qualified drivers all for a small fee, though both set of drivers follow exactly same application process, and Olken &Barron (2009) finds how Indonesia roads which are extensively financed from taxpayers are damaged by corrupt practices between law enforcement authority and truck drivers at truck weigh stations.

From the policy pespective, definite actions have to be taken to checkmate corrupt practices that affect public utilities in these countries, as suggested by Hanna, et al. (2011); an approach to tackle the hydra headed monster 'corruption' in public utilities at a national scale would call for the privitization of these corrupt utilities like healthcare, water supply or electricity. The rationale is that privatized companies are more inclined to profiteering, in that they would be in the look out for inefficencies in the production process. Hanna, et al. (2011) also noted that critics argue how this privitization processes can equally be corrupt and end up just been a change in nomenclature, but not necessarily an improvement in service quality.

Hanna, et al. (2001), equally advocates community monitoring to be a promising approach to curbing curruption in Public utilities, this approach can be successful if the community at large are not neck deep in the corrupt practices, involving the community can reduce the bottleneck of information asymmetry as well as keep both the Government regulatory body and the service providers on check.

In conclusion, where the research questions answered?

I. As for if the electricity consumption in the selected country affect economic growth in the selected countries; the empirical evidence shows that electricity consumption does affect economic growth.
II. Also if the economic well-being of these countries does affect their level of electricity consumption, the empirical evidence agrees that economic growth causes electricity consumption.
III. As of the inclusion of corruption and any notable difference, when comparing the results obtain with and without corruption there seem to be no notable difference in the result. But corruption in the selected countries sure granger causes economic growth as well as affects the level of their electricity consumption.

8.0 References

Adebola, S. S. (2011) 'Electricity Consumption and Economic Growth: Trivariate investigation in Botswana with Capital Formation', *International Jornal for Energy Economics and Policy,* 1(2146-4553), pp. 32-46.

Akinlo, A. E. (2008) 'Energy consumption and economic growth: evidence from 11 Sub-Sahara African countries', *Energy Economics,* 30(2), pp. 2391-2400.

Altinay, G. & Karagol, E. (2005) 'Electricity consumption and economic growth: evidence from Turkey' *Energy Economics,* Issue 27, pp. 849-856.

Apergis, N. & Payne, J. (2009a) 'Energy consumption and economic growth in Central America: evidence from a panel co-integration and error correction model' *Energy Economics,* Volume 31, pp. 211-216.

Aqeel, A. & Butt, M. (2001) 'The relationship between energy consumption and economic growth in Pakistan', *Asia-Pacific Development Journal,* 8(2), pp. 101-110.

Bertrand, M., Djankov, S., Hanna, R. & Mullainathan, S. (2008) 'Corruption in the Driving Licensing Process in Delhi', *Economic and Political Weekly,* pp. 71-76.

Brown, R. L., Durbin, J. & Evans J, M. (1975) 'Techniques for testing the constancy of regression relationships over time', *Journal of the Royal Statistical Society. Series B (Methodological),* Vol. 37(2), pp. 149-192.

Chen, S. T., Kuo, H. I. & Chen, C. C. (2007) 'The relationship between GDP and electricity consumption in 10 Asian countries', *Energy Policy,* Issue 35, pp. 2611-2621.

Ciarreta, A. & Zarraga, A. (2010) 'Economic growth-electricity consumption causality in 12 European countries: A dynamic panel data approach', *Energy Policy,* 38(7), pp. 3790-3796.

Clarke J, A. & Mirza, S. (2006) 'Comparison of some common methods for detecting', *Journal of Statistical Computation and Simulation,* 76(3), p. 207–231.

Dolado, J. J. & Lütkepohl, H. (1996) 'Making Wald tests work for co-integrated VAR systems', *Econometric Reviews,* 4(15), pp. 369-386.

Eggoh, J. C., Bangake, C. & Rault, C. (2011) 'Energy Consumption and Economic Growth Revisited in Africam Countries', *Energy Policy,* Volume 39, p. 7408–7421.

Fatai, K., Oxley, L. & Scrimgeour, F. (2004) 'Modelling the causal relationship between energy consumption and GDP in New Zealand, Australia, India, Indonesia, the Philippines, and Thailand', *Mathematics and Computers in Simulation,* 64(3-4), p. 431–445.

Ghosh, S. (2002) 'Electricity supply employment and real gdp in india', *Energy Policy,* Issue 30, pp. 125-129.

Granger, C. (1969) 'Investigation causal relations by econometric models and crossspectral methods', *Econometrica,* Volume 37, pp. 424-438.

Granger, C. & Newbold, P. (1974) 'Spurious regressions in econometrics', *Journal Econometrica,* Volume 2, p. 111–120.

Gregory, A. & Hansen, B. (1996) 'Residual-based tests for co-integration in models with regime shifts', *Journal Econometrica,* Volume 70, p. 99–126..

Hanna, R. et al. (2011) '*The effectiveness of anti-corruption policy: what has worked, what hasn"t, and what we don"t know–a systematic review',* London: Social Science Research Unit, Institute of Education, University of London.

Hansen, B. (1992) 'Tests for parameter instability in regressions with I(1) processes' *Journal Econometrica,* Volume 10, p. 321–336.

Hansen, B. & Seo, B. (2002) 'Testing for two-regime threshold co-integration in vector error correction models', *Econometric,* Volume 110, pp. 293-318.

Ho, C. & Siu, K. (2007) 'A dynamic equilibrium of electricity consumption and GDP in Hong Kong: an empirical investigation', *Energy Policy,* Volume 35, p. 2507–2513.

Hsiao, C. (1981) 'Autoregressive modeling and money-income causality detection', *Monetary Economics,* Volume 7, p. 85–106.

Hu, J. & Lin, C. (2008) 'Disaggregated energy consumption and GDP in Taiwan: a threshold co-integration analysis', *Energy Economics,* Volume 30, p. 2342–2358.

Ilhan, O., Alper, A. & Huseyin, K. (2010) 'Energy consumption and economic growth relationship: Evidence from panel data for low and middle income countries', *Energy Policy,* Volume 38, pp. 4422-4428.

Johansen, S. (1988) 'Statistical analysis of co-integration vectors', *Economic Dynamic control,* Volume 12, pp. 231-254.

Johansen, S. & Juselius, K. (1990) 'Maximum likelihood estimation and inference on co-integration with applications to money demand', *Oxford Bulletin of Economic Statistics,* Volume 52, pp. 169-210.

Jumbe, C. (2004) 'Cointgration and causality between electricity consumption and GDP: empirical evidence from Malawi', *Energy Economics,* Volume 26, pp. 61-68.

Kennedy, P. (2003) 'A guide to econometrics', In: 5. edition, ed. Cambridge (MA): MIT Press.

Kouakou, A. K. (2011) 'Economic Growth and Electricity Consumption in Cote d'Ivoire: Evidence from Time Series Analysis', *Energy Policy,* Volume 39, pp. 3638-3644.

Lambsdorff, L. (2003) 'How corruption affects productivity', *Kyklos,* 56(4), pp. 457-474.

Lee, C. & Chang, C. (2005) 'Structural breaks, energy consumption, and economic growth revisited: evidence from Taiwan', *Energy Economics ,* Volume 27, p. 857–872.

Lourdes, T. & Antonio, E. (2009) 'Corruption and infrastructure services: An overview', *Utilities policy,* 17(2), p. 153–155.

Lütkepohl, H. (1982) 'Non-causality due to omitted variables', *Econometric,* Volume 19, pp. 267-378.

Mauro, P. (1995) 'Corruption and Growth', *Quarterly Journal of Economics,* 110(3), p. 681–712.

Morimoto, R. & Hope, C. (2004) 'The impact of electricity supply on economic growth in Sri Lanka', *Energy Economics ,* Volume 26, p. 77–85.

Mozumder, P. & Marathe, A. (2007) 'Causality relationship between electricity consumption and GDP in Bangladesh', *Energy Policy ,* Volume 35, p. 395–402.

Murray, D. & Nan, G. (1996) 'A definition of the gross domestic product–electrification interrelationship', *Energy Development,* Volume 19, p. 275–283.

Narayan, P. & Prasad, A. (2008) 'Electricity consumption-real GDP causality nexus: evidence from a bootstrapped causality test for 30 OECD countries', *Energy Policy,* Volume 36, pp. 910-918.

Narayan, P. & Singh, B. (2007) 'The electricity consumption and GDP nexus for the Fiji Islands', *Energy Economics,* Volume 29, pp. 1141-1150.

Narayan, P. & Smyth, R. (2005) 'Electricity consumption, employment, and real income in Australia: evidence from multivariate Granger causality tests', *Energy Policy,* Volume 33, p. 1109–1116.

Narayan, P. & Smyth, R. (2009) 'Multivariate Granger-causality between electricity consumption, exports, and GDP: evidence from a panel of middle eastern countries', *Energy Policy,* Volume 37, pp. 229-236.

Odhiambo, N.(2009a) 'Energy consumption and economic growth nexus in Tanzania: an ARDL bounds testing approach', *Energy Policy ,* Volume 37, p. 617–622.

Odhiambo, N. (2009b) 'Electricity consumption and economic growth in South Africa: A trivariate causality test', *Energy Economics,* 31(5), p. 635–640.

Olken, B. & Barron, P. (2009) 'The Simple Economics of Extortion: Evidence from Trucking in Aceh', *Journal of Political Economy,* 117(3), pp. 417-452.

Ouedraogo, N. S. (2013) 'Energy Consumption and economic growth: Evidence from the economic community of West Africa States (ECOWAS)', *Energy Economics,* Volume 36, pp. 637-647.

Ozturk, I. (2010) 'A literature survery on energy-growth nexus', *Energy Policy,* Volume 38, pp. 340-349.

Padroni, P. (1999) 'Critical values for co-integration tests in heterogeneous panels with multiple regressors', *Oxford bulletin of economics and statistics,* Issue 61, pp. 653-670.

Padroni, P. (2004) 'Panel conintegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis: new results', *Econometric Theory,* Volume 20, pp. 597-627.

Payne, J. (2010) 'A Survey of th electricity consumption-growth literature', *Applied Energy,* Volume 87, pp. 723-731.

Perron, P. (1989) 'The great crash, the oil price shock, and the unit root hypothesis', *Econometrica,* Volume 57, pp. 1361-1401.

Perron, P. (1997) 'Further evidence on breaking trend functions in macroeconomic variables', *Econometrica,* Volume 80, pp. 355-385.

Pesaran, M. & Shin, Y. (1999) '*An autoregressive distributed lag modelling approach to co-integration analysis', In: Strom S, editor,* Cambridge: Cambridge Univeristy Press.

Pesaran, M., Shin, Y. & Smith, R. (2001) 'Bounds testing approaches to the analysis of level relationships', *Applied Econometrics,* Volume 16, pp. 289-326.

Shahbaz, M., Tang, C. F. & Shabbir, M. S. (2011) 'Electricity Consumption and Economic growth nexus in Portugal Using Co-integration and Causality approaches', *Energy Policy,* Volume 39, pp. 3529-3536.

Shiu, A. & Lam, P. (2004) 'Electricity consumption and economic growth in China', *Energy Policy,* Volume 32, pp. 47-54.

Soytas, U. & Sari, R.(2007) 'The relationship between energy and production: evidence from Turkish manufacturing industry', *Energy Economics,* Volume 29, p. 1151–1165..

Squalli, J. (2007) 'Electricty consumption and economic growth: bounds and cuasality analyses for OPEC members', *Energy Economics,* Volume 29, pp. 1192-1205.

Tang, C. (2008) 'A re-examination of the relationship between electricity consumption and economic growth in Malaysia', *Energy Policy,* Volume 36, pp. 3077-3085.

Thoma, M. (2004) 'Electrical energy usage over the business cycle', *Energy Economics,* Volume 26, pp. 363-385.

Toda, H. & Yamamoto, T. (1995) 'Statistical inference in vector autoregressions with possibly integrated processes', *Econometrica,* Volume 66, p. 225–250.

UNIDO, (2011) '*Energy for all–time for action',* s.l.: Vienna Energy Forum.

Westerlund, J. (2006) 'Testing for panel co-integration with multiple structural breaks', *Oxford Bull Econom Stat ,* Volume 68, p. 101–132.

Wolde-Rufael,Y. (2004) 'Disaggregated industrial energy consumption and GDP: the case of Shanghai', 1952–1999.. *Energy Economics ,* Volume 26, p. 69–75.

Wolde-Rufael, Y. (2006) 'Electricity consumption and economic growth: a time series experience for 17 African countries', *Energy Policy,* Volume 34, pp. 309-317.

Yang, H. (2000) 'A note on the causal relationship between energy and GDP in Taiwan', *Energy Economics,* Volume 22, pp. 309-317.

Yoo, S. (2005) 'Electricity consumption and economic growth: evidence from Korea', *Energy Policy,* Volume 33, pp. 1627-1632.

Yoo, S. (2006) The causal relationship between electricity consumption and economic growth in the ASEAN countries', *Energy Policy ,* Volume 34, p. 3573–3582..

Yoo, S. & Kim, Y. (2007) 'Electricity consumption and economic growth in China: co-integration and co-feature analysis', *Energy Economics,* Volume 29, pp. 1179-1191.

Yuan, J., Kang, J., Zhao, C. & Hu, Z. (2008) 'Energy consumption and economic growth: evidence from China at both aggregated and disaggregated levels', *Energy Economics,* Volume 30, pp. 3077-3094.

Zamani, M. (2007) 'Energy consumption and economic activities in Iran', *Energy Economics,* Volume 29, pp. 1135-1140.

Ziramba, E. (2013) 'Hydroelectricity consumption and Econmic growth nexus: time series experience of three africa countries', *European Scientific,* 9(1), pp. 85-96.

Zivot, E. & Andrews, D. (1992) 'Further evidence on the great crash, the oil price shock, and the unit root hypothesis', *Business Economics,* Volume 10, pp. 936-954.