JOURNALOS

Volume 3, No. 8, December 2009

ISSN: 219 318 11

JASRI

Journalos of Advanced Scientific Research and Innovation

Germany, 2009

Title: Facebook users and undergraduates

(Specially reference to Selected Universities in Sri Lanka)

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Abstract

New media has play a pivotal role in enhance the relationship between the people and the media. Internet has pros and cons but more and more people all over the world using it for various purposes.Facebook is one of the largest online social network. In Sri Lankathere are more than 1.5 million Facebook users.

Problems of this research were do Facebook users (undergraduates) use their account prudently and do they have enough knowledge on privacy settings.Objectives were to find out why the face book users reveal their privacy details through the account and found out whether the Facebook users are knowledgeable enough tosafe guard their privacy. This was Qualitative and Quantitative research. I used questionnaires and interviews to collect primary data. According to this research I came across most of the undergraduates were highly interested on Facebook. But they didn't possess substantial knowledge about privacy settings.

Keywords:

New Media, Internet, Privacy , Facebook, Cyber crime

1. Introduction

Social media attract especially younger generation addicted to it. Statistic reveled that More than 2.7 million population has been using internet at the end of the March 2013. Facebook is the largest online social network. Founded in 2004. It's said that the currently Face book has more than one billion active users. It testimony the popularity of social media.

According to Sri Lankan Facebook Statistics issued by social bakers, currently (2013 May) there are more than 1.5 million .Monthly Active Users in Sri Lanka. (http://www.socialbakers.com/facebook-statistics/sri-lanka) According to their statistics, Facebook penetration in Sri Lanka is 7.09% compared to the country's population and 60.98% in relation to number of Internet users. Sri Lanka Facebook demographics – The largest age group is currently 18-24.http://studentlanka.com/2013/04/30/facebook-users-in-sri-lanka/

Facebook has become a favorite hunting ground for hackers resulting in people with malicious Intent searching for their victims within the Facebook network. Identity theft is the most common crime on Facebook where hackers create a fake profile after stealing the information from the Internet and use it to take advantage. Sri Lanka police informed "Sri Lanka has 1.2 Facebook users, 20% of them (240,000) are fake accounts - source SL Police".https://www.facebook.com/SLtelecom/posts/366614890015926)
It is learnt that over 100 complaints relating to social networking website Facebook are received every month by the authorities responsible for cyber security in Sri Lanka and monitoring cybercrimes. Around 80% of these complaints are about fake Facebook profiles created by various individuals and the rest is about hacking into other people's accounts. During the past three years the number of complaints relating to Facebook was gradually on the rise. In 2010, 80 complaints of fake accounts were received and in 2011, it shot up to 1425. Last year 1100 complaints reported.(Dissanayaka,2013)

According to a Sri Lankan details Cyber Crime Division of Sri Lankan police receives following cases on internet crime relating to Facebook social network.

- Cases of hacking into Facebook accounts.
- Cases where, after jilting the lover, one party posts personal pictures and videos recorded secretly during their affair
- Creation of false Facebook accounts under a person's name and obscene pictures included in that page
- Cases of chat-conversations on Facebook between the couple have been saved or recorded and published Instances of posting nude pictures
- Blackmailing cases by demanding money or instances of threatening to blackmail unless sexual favors were granted, if the demands were not met. (Wickramasekara, 2012)

2. Literature Review

The rapid growth of social network sites has coincided with anincreasing concern over personal privacy.University students are often forerunners in the adoption of new communication technologies, and their communication networks tend to be dense.

I referred past researches done by this topic. Sabine Trepte and Leonard Reinecke wrote a book about "Privacy Online: Perspectives on Privacy and Self-Disclosure in the Social Web.

The contributing authors offer intriguing solutions for some of the most pressing issues and problems in the field of online privacy. They investigate how users abandon privacy to enhance social capital and to generate different kinds of benefits. They argue that trust and authenticity characterize the uses of social network sites. They explore how privacy needs affect users' virtual identities.

Lior Jacob Strahilevitz, The law school of Chicago completed a research about "A Social Networks Theory of Privacy" in 2004(http://dx.doi.org/10.2139/ssrn.629283)This paper argues that insights from the literature on social networks and information dissemination can help provide courts with satisfying answers to these central questions in privacy law. The social networks literature has generated theoretical and empirical insights about the probability that information disclosed to one member of a community will ultimately become known by a large segment of the community. Using these insights, courts can gauge whether the plaintiff's previously private information would have been widely disseminated regardless of the defendant's actions in a particular case. If so, the information in question was public, and if not, the tort law ought to deem the information as private. This paper argues that such an approach, which treats the privacy question as an empirical one, is more attractive than any other method of establishing whether the plaintiff had a reasonable expectation of privacy in the information at issue.

Another research was done by Leucio Antonio Cutillo, Refik Molva, Melek Onen "Analysis of Privacy in Online Social Networks from the Graph Theory Perspective". In this paper, we analyze the relationship between the social network graph topology and the achievable privacy.http://www.eurecom.fr/en/publication/3454/download/rs-publi-3454.pdf)

The Taste for Privacy: An Analysis of College Student Privacy Settings in anOnline Social Network, done by Kevin Lewis and Jason Kaufman ,Nicholas ChristakisHarvard University.http://www.wjh.harvard.edu/~kmlewis/privacy.pdf

"Facebook Privacy Settings: who care's a research done by Danah boyd and Eszter Hargittai,http://firstmonday.org/article/view/3086/2589.This paper examined the attitudes and practices of a cohort of 18– and 19–year–olds surveyed in 2009 and again in 2010 about Facebook's privacy settings. Results were challenge widespread assumptions that youth do not care about and are not engaged with navigating privacy. Findings were that, while not universal, modifications to privacy settings have increased during a year in which Facebook's approach to privacy was hotly contested. They found that both frequency and type of Facebook use as well as Internet skill are correlated with making modifications to privacy settings.

"Social Networks and Privacy "Special Reference to Colombo District Sri Lanka, It was unpublished thesis in University of Kelaniya. In this thesis she found public audience had no proper knowledge about privacy settings. According to her study Facebook was the most famous social network. (Hu/2006/393)unpublished research in Faculty of Social Sciences at university of Kelaniya, Sri Lanka in 2011.

3. Research Design

3.1. Research Problems

Do Facebook users (undergraduates) use their account prudently?

Do they have enough knowledge on privacy settings of their account?

3.2 Methodology and Data Collection

This was Qualitative and Quantitative research. I used questionnaires to collect primary data. And refer books magazines and internet to collect secondary data.

3.3 Sample

I selected four universities. University of Kelaniya, Colombo, and Sri Jayawardanapura and distributed 150 questionnaires through these universities.50 questionnaires per each university.

3.4 Limitations:

Selected three universities only. (University of Kelaniya,University of Colombo,University of Sri Jayawardenapura)

Among the social network sites selected Facebook only.

Among the social network sites selected Facebook onlyselected population of the research was university undergraduates. They were selected due their differences from the general public by their education level. Another reason to select this sample was their age, they were in the age group of 19-27.

In this full paper I used "FB" to represent Facebook.

4. Privacy Settings and Facebook

According to Merriam Webster dictionary "the state of being alone : the state of being away from other people and the state of being away from public attention" called as privacy. (http://www.merriam-webster.com/dictionary/privacy)Internet Privacy is the ability of individuals to control the flow of information and have reasonable access to data generated during a browsing session.(http://reputationx.com/internet-privacy-definition/).Privacy is a major concern for all Internet users, but it is becoming more difficult to expect a reasonable expectation of privacy online. One of the problems with Internet privacy is that many users assume that they have control over their information. When we talk about social media privacy is big problem. Most of the usersdidn't have enough knowledge about privacy settings. Facebook is an online social networking service Users need to know the privacy settings that help them to control their information on facebook.com. Facebook is organized around a system of networks that correspond to physical locations and institutions. Facebook maintains networks across the globe. Membership in such networks, while not required, is recommended by Facebook and allows the general location of a great many users to be known. Networks also determine the default level of ''public'' exposure afforded a new profile.

5. Facebook users in Sri Lanka

Selected sample's male population represents 53% and 47% represents the female. University wise it represent as follows. University of Colombo's population 54% represent male &46% female. In Kalaniya male population represent 56%, 50% and female population represent 44% and University of Sri Jayewardenepura male and female population represent 50 % respectively.

All three universities faculty wise details represent the below table.

Faculty	Number of Students	Percentage
Art	**34**	**22.6%**
Medicine	**32**	**21.3%**
Science	**34**	**22.7%**
Law	**10**	**6.6%**
Commerce and Management	**40**	**26.7%**

Table 1

6.6% Law 26.7%Commerce & Management undergraduates.Selected sample confined to students who has FB accounts only. Main objective of the study is to find the relationship between FB and disclosing personal details. Who create the FB account is an important determinant of this study. Since there is a relationship between privacy setting & the creator of the account.

Selected sample's majority 82% created their own account and by friend of mine & by Boyfriend are the two other preferred methods of creating FB accounts.

Below mentioned the undergraduates most preferred activity in FB. Except medicine all other selected faculties' most preferred activity in FB was "searching details about friends.It was 38% in faculty of science, 42% in faculty of commerce and management and faculty of art 26% and faculty of law 50%.But it differs in the faculty of medicine. Medicos most preferred activity in Facebook was browsing home page and it represented 37%.In the faculty of art 5% represented doing business using Facebook.This can be seen in faculty of art only.

	Science	Commerce &Management	Art	Medicine	Law	Total
Searching details about Friend	**13 (38.2%)**	**17 (42.5%)**	**9 (26.5%)**	**5 (15.7%)**	**5 (50%)**	**32.7%**
Live chat	**6 (17.6%)**	**4 (10%)**	**8 (23.5%)**	**5 (15.7%)**		**15.3%**
Watching	**6 (17.6%)**	**3 (7.5%)**	**3 (8.8%)**	**5 (15.7%)**	**2 (20%)**	**12.7%**
Sharing	**3 (8.8%)**	**8 (20%)**	**5 (14.7%)**	**3 (9.4%)**	**1 (10%)**	**13.3%**
Comment	**2 (5.9%)**	**3 (7.5%)**	**6 (17.6%)**	**2 (6.2%)**		**8.7%**
Browse home page	**4 (11.8)**	**4 (10%)**	**1 (2.9%)**	**12 (37.5%)**	**2 (10%)**	**15.3%**
Business			**2 (5.9%)**			**1.3%**
other		**1 (2.5%)**				**1.3%**

Table 2

Most undergraduates (64.7%) preferred to be online and neither one in busy mode.Majority of the sample browsed the FB daily.It represented 46%. Then I wanted to study how much time undergraduates devoted to FB browsing.It was important factor in my research.Below table represented faculty wise data. Every faculty majority spend less than one hour in FB, but there are few people in every faculty spend more than two hours in FB.

Students were asked how many request they received within a week.44%said that they received 1-5 friend's request pew week, but only 3.3% said that they received more than 20 request per week.

	Art	Law	Medical	Science	Commerce &Management	Total
Anyone	**24 (70.6%)**	**4 (40%)**	**25 (78.1%)**	**21 (61.8%)**	**32 (80%)**	**70.7%**
Friends of Friends	**10 (29.4%)**	**6 (60%)**	**7 (21.9%)**	**13 (28.2%)**	**8 (20%)**	**29.3%**

Table 3

Respondents were asked who can send friends request.70% of the selected sample said that anyone can send the request. And the others said friends of friends only send the request.

	Art	Law	Medicine	Science	Commerce &Management	Total
Known	**23(67.6%)**	**8 (80%)**	**27 (84.3%)**	**28 (82.3%)**	**32 (80%)**	**78.7%**
All	**11(29.4%)**	**2 (20%)**	**5 (15.6%)**	**6 (17.6%)**	**8 (20%)**	**21.3**

Table 4

Regarding whether they confirmed friends request or not 82% said that they were confirmed the request. Majority (78.7%) accept the known request only and 21% accepted all friends request. It showed some students like to be friend with people actually they didn't know.

I asked if they confirmed unknown request why did they do so.Majority replied they wanted to friend with unknown person.The others replied "Increasing number of friends, Be friend with unknown person, and Appearance of the requested person".

Research main objective was to find out awareness on privacy settings of FB. Below table represented the faculty wise data.

	Science	**Commerce& management**	**Art**	**Medicine**	**Law**	**Total**
Yes	**27 (79.4%)**	**31 (77.5%)**	**28 (82.3%)**	**28 (87.5%)**	**8 (80%)**	**81.3%**
No	**1 (2.9%)**	**2 (5%)**	**-**	**2 (6.2%)**	**1 (10%)**	**4%**
Certain Extent	**6 (17.6%)**	**8 (20%)**	**6 (17.6%)**	**2 (6.2%)**	**1 (10%)**	**15.3%**

Table 5

In faculty of science 79% aware on privacy settings and 17% said that they aware up to certain extent about FB privacy settings and 2.9% said they didn't have enough knowledge about FB privacy settings. And 77% of faculty of commerce and management, 82% faculty of Art ,87% faculty of medicine 80%faculty of law said that they have enough knowledge about FB privacy settings.4% of the selected sample not possessed enough knowledge about privacy settings.

Majority of each and every university undergraduates had enough knowledge about FB privacy settings.58.6% of selected sample profile picture was their close up photo. And 72.7% added photo albums and 28.7% added videos into their account under the special events in personal life category.

Majority account data can be seen only their friends. But 17% in faculty of art, 20%in faculty of law,43% faculty of medicine and 38% in science and 37%5 in faculty of commerce and management data can be seen to "public". This implied that student opinion was that their private personal data can freely access to anyone. When the same data analyzed university wise the most of the undergraduates preferred to add their personal data in "public" and it was a common to each university.

They were asked how they share information.Comonly every faculty undergraduates prefer to share their information in their time line.They were asked who can add information in their ime line.Most said that friends can added information in their timeline.

I studied the privacy settings of who can see information in their time line.Most of them selected the " public".and others selected only the account holder ,friends of friend & custom .I questioned the Reason for above and popular answer was that " as their wish".But 6% unknowingly add information in their account.In university wise also answer was same, majority said that as their wish it was set.

Respondents were questioned who can see their mobile number and e –mail address in their FB account.52% said that "only their friends" but 22.7% said that "everyone "can be seen their details and most of the participants at least using basic filtering. 70% using basic filtering and balance participants 30% using strict filtering. In university wise also majority used basic filtering in Jayawardenapura ,Kelaniya university &university Colombo 72%,66% and 72% respectively.

In faculty wise also “basic Filtering was the most preferred screening method and there were few undergrads who were facing some problems due to the FB. They represent 5.8% in Art, 10% in Law, 12.5% in Medicine, 17.6% I Science & 15% in Commerce & Management.If the answer was yes what were the problems they encounter, have to select the answer from the following categories adding nude pic to the account, chat related problems, Logging problems ,fake profile, blocking like that.

Most popular method to overcome these issues was block the relevant user 26.7 % using this method. Other methods they used was ‘unfriend, respond to FB, Not chat with troublesome users, deactivate the account and tell someone’. Interestingly 13.3 % student from the arts faculty have no idea about how to react with this nature incidence.

6. ConclusionRecommendations.

Selected sample’s majority 82% created their own account.This depicted that most of the undergraduates have enough knowledge on FB and they browse the FB accounts which has created by themselves.

Majority of each and every university undergraduates had enough knowledge about FB privacy settings.87% of the selected sample were not face difficulty with fb. This situation implied that most of the respondents have a substantial awareness on privacy setting of their accounts.

When considering the answers given to the question ‘How did you response to a problem arise when you encounter any problem due to face book usage?”unfriend,complain to the FB and block were popular (68%) answers.These answers implied that they have a good knowledge on privacy setting.

Totally contrast finding come out when they were questioned on “Who can access information? Most of the students(40%) publically display their personal data. Among this students 6% unknowingly add information to their account.This depicted that they were not much concern about the safe guarding their privacy in FB. Also 22% allow public to visible their mobile no & e-mail address. When analyzing the answer given to question “How did you response to a problem arise when you encounter any problem due to face book usage?”32% responses depicted they didn’t have enough knowledge on privacy setting. Among this32%, 13% respondents from the faculty of Arts replied they don’t how to react, this depicted that among the undergraduates there were few who didn’t have enough awareness on privacy setting.

Increase the awareness among the undergraduates especially the faculty of art students on using the Face Book and other social media is essential.

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Sunday Times 2012 Feb 05

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THE VIEWS OF ACADEMIC STAFF ON PSYCHOLOGICAL CAPITAL: A QUALITATIVE STUDY IN TURKEY

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ABSTRACT

Based on positive psychology, positive organizational behavior movement which focuses positive behaviors rather than negative behaviors and positive psychological capital which is accepted as the implementation of positive organizational behavior in organizations have emerged in recent years. The studies on psychological capital are mostly based on quantitative methods and focus the outcomes of the construct. Therefore, qualitative studies need to be conducted to have a deep understanding of positive psychological capital. This study aims to determine which components of positive psychological capital the academic staff focus on and to what extent they give importance to the construct.

Key words: Positive psychological capital, self-efficacy, hope, optimism, psychological resiliency

1. Introduction

The need for employees to adapt changing environmental conditions, to improve themselves and to increase the competitive advantage of organization has led to recent developments in organizational behaviour field. In this sense, positive psychological capital has emerged, based on positive organizational behaviour which enables organizations to adopt a new perspective (Kutanis & Oruç, 2014: 154).

Beyond human and social capital, psychological capital presents a comprehensible theoretical framework to understand the value of human being by focusing on psychological capacities of individuals in organizational psychology. Incorporating these capitals into organizations synergically is important in actualizing human potential (Luthans, et. al., 2006: 21).

This construct which has been handled by Luthans and colleagues in 2000s hasn't been investigated widely in Turkey. The findings in the literature show that psychological capital has a negative relationship with employee absenteeism, deviance behaviour, turn-over intention, stress; a positive relationship with organizational commitment, job satisfaction, positive emotions, citizenship behaviour, work performance, employee performance and authentic leadership (Erkmen & Esen, 2012: 97). Although these studies focus on the outcomes of psychological capital, there have been few studies to examine antecedents of the construct in detail. In this study, it is aimed to determine which components of positive psychological capital the academic staff focus on and to what extent they give importance to the construct.

2. Positive Psychological Capital

Positive psychology was based on the studies of Maslow in the chapter "*towards positive psychology*" of the book *Motivation and Personality* in 1960s. After becoming the president of American Psychology Association, Seligman's studies have led to positive psychology movement (Wright 2003: 437; Seligman, 2002: 3). Seligman and colleagues emphasize the fact that healthy individuals need positive psychology to be happier, more productive and actualize their potentials (Luthans, et al.., 2006: 9). These

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studies examining how to increase the human potential in positive psychology have resulted in positive organizational behaviour movement which investigates the organization with this perspective. Positive organizational behaviour differs from other positive approaches to organizations in that it examines developable and open-to-research psychological capacities (Luthans & Youssef 2007: 326). In this frame, As the result of Luthans et al. (2007: 549) studies on finding a construct that meet positive organizational behaviour criteria, positive psychological capital which includes self-efficacy, hope, optimism and psychological resiliency components have emerged.

Luthans, et al. (2006: 20) defined psychological capital as positive and developmental state of individual. Positive psychological capital deals with 'who you are' and more importantly 'who you are becoming' (Luthans et al., 2004: 46). It is also focuses on strenghts of individuals and characteristics which can be changed and developed as a result of experience and training (Luthans & Youssef 2007: 326).

Positive psychological capital is showing self-confidence in the face of challenging tasks (Stajkovic & Luthans, 1998: 66), showing perseverance to attain goals and reconsider the ways to goals when it is needed (Snyder, 2002: 249), having positive beliefs to succeed in the future (Tiger, 1971: 18) and being resilient against the challanges (Benard, 1993: 44).

Consisting of self-efficacy, hope, optimism and psychological resiliency components, psychological capital is more than sum of the components (Avey, et al., 2008b: 55). These components represent a motivational tendency to accomplish tasks and goals which is a common characteristic for the four components (Avey, et al., 2008a: 705; Luthans, et al., 2007: 549).

2.1 Self efficacy

Self-efficacy is defined as organizing the behaviours to attain goals and believing one's abilities to accomplish these goals (Bandura 1986: 391). It is also refers to managing actions and tasks successfully in the future and believing the possibility of accomplishing (Gardner & Pierce, 1998: 50).

Bandura (1997: 42) asserts that self-efficacy is a context-specific capacity. In other words, self-efficacy of leaders and employees can be improved in specific situations and tasks. Bandura (1995: 3) mentions four source of self-efficacy:

1) Mastery Experiences
2) Vicarious Learning
3) Social Persuasion
4) Physical and psychological readiness

Individuals with high self-efficacy persevere to succeed and they believe to be successful (Avey, et al., 2008b:54). Therefore, employees with self-efficacy obtain successful outcomes when they put in sufficient effort. On the other hand, employees with low self-efficacy tend to give up easily (Stajkovic & Luthans, 1998: 66).

2.2 Hope

Hope is defined as finding alternative ways to attain goals and motivating yourself in using these ways. This component is associated with positive psychologist Synder's studies. According to Snyder (2002: 249-252), hope has primary components as *to be agency, pathways,* and *goals* which means it is a cognitive activity including goal directed energy, pathways to be successful and will power.

Hope, handled as a capacity improving thinking process of individuals has been a topic in a great deal of investigations (Snyder, 1994: 2). While Snyder develops his hope theory, he assumes that individuals are goal-directed and they put in effort to accomplish some outcomes in his hope theory (Luthans, et al., 2010: 44).

Hope is also important in crisis and organizational change in organizations. Employees with hope enable the organization to bounce back in challenging times (Avey, et al., 2008b: 53). Snyder (2000: 310) argues that it is less possible for hopeful individuals to experience negative situations such as uncertainty and weaknesses. Additionally, some studies show that individuals with high hope levels experience higher job satisfaction, performance and organizational commitment and lower turn-over intentions (Peterson & Luthans, 2003: 26).

2.3 Optimism

Optimism theoretical background as a positive organizational capacity is based on positive psychologist Martin Seligman's studies (Luthans et al., 2008: 222). According to Seligman (1998: 43), optimism is defined as a explanation style in which individuals attribute positive events to permanent and general situations; negative events to temporary and specific situations. Optimism is a capacity reflecting individuals' positive expectations in the future. As optimists anticipate good things, pessimists anticipate bad things to happen (Carver, et al., 2010: 879-880; Carver & Scheier, 2002: 231). On the other hand, optimism is defined as explanation of events in terms of self-wellbeing and happiness (Tiger, 1971: 18).

Carver & Scheier (2002: 235) point out that optimists strive to succeed against negative situations. On the contrary, pessimists do not expect positive outcomes even if they put in effort. Therefore optimists tend to be more successful than pessimists. Seligman (1998: 15) expressed optimism as *"learned optimism"* by focusing the developable nature of this capacity. Similarly, Carver & Scheier (2002: 240) support the idea that optimism can be developable with some interventions.

2.4 Psychological Resiliency

Benard (1993: 44) defines resiliency as an ability to bounce back against challenges. Luthans (2002: 702) asserts that resiliency is also bouncing back during positive changes, development and increasing responsibility. Accordingly, resiliency is not only coping with negative situations but also positive ones as well.

The distinctive characteristic of resiliency from other capacities is that it requires reactive and proactive behaviour against negative events. Resiliency in terms of reactivity accepts the idea that negative events and challenging tasks including positive ones have destructive effect on even the individuals with high optimism levels. Therefore, individuals need to bounce back after they go through challenging times. In terms of proactivity, resiliency means that negative events are opportunities for individuals (Youssef & Luthans, 2007: 779-780).

Benard (1993: 44) states that resilient individuals have social, problem solving abilities and autonomy. Besides, they have future plans and goals. Employees having these characteristics tend to bounce back easily against stress, burn-out, unemployment in organizations. Resiliency is argued to be changed and developed by some environmental factors (Stewart, et al., 1997: 22). Consequently, psychological resiliency is state-like capacity like the other capacities.

3. Methodology

3.1 Reserch Design

This study is a case study which is one of the qualitative research designs. Qualitative research is the study of research problems inquiring into the meaning individuals or groups ascribe to a social or human problem (Creswell, 1998: 37). Case study is a research design in which one or more events, settings and groups and related systems are examined in detail (Büyüköztürk et al., 2011: 273). This design is selected to have a deep understanding about psychological capital. Another factor in choosing a qualitative approach is that there are few qualitative studies on psychological capital.

3.2 Participants

The participants of the study consist of 20 academic staff in a public university in Marmara Region of Turkey. As a sampling method, *quota sampling*, which a non-random sampling method was used. In this sampling method, after stratification factors are identified which are thought to be relevant to the survey, the survey samplers themselves choose the participants (Neuman, 2007: 322). Therefore, 4 professors, 4 associate professors, 4 assistant professors, 4 lecturers, 4 research assistant were included in the study to determine the differences between the academic titles. Also, 50 % of the participants are females while the rest is male.

3.3 Data Collection

Data were collected with focus group interview and observations. Participants were separated into 2 homogenous and 2 heterogonous groups. Focus group interviews aim to reveal different point of views as a result of in-group interaction and to increase the reliability of themes occurred in different groups (Patton, 2002: 202). Additionally, heterogonous groups enabling diversity in groups help to collect richer data (Bogdan ve Biklen, 2007: 109).

In focus group interviews, two scenarios were used to collect data. The participants were asked to evaluate the scenarios. The scenerios reflecting core capacities of the psychological capital (self-efficacy, hope, optimism, resiliency) were made up in the light of theoretical background. Focus group interviews lasted 45 min. and the data were recorded by a tape recorder.

3.4 Data Analysis

Content analysis was used to analyse the data collected. First, the data recorded were transcripted into paper. Then the data were coded by two researchers to increase the reliability of the research. Reliability = Consensus / Separation of Consensus + X 100 formula was applied to the codings (Miles and Huberman, 1994:64). Correspondence percentage were calculated as %80. The percentage of correspondence %70 or higher is seen to be sufficient in terms of reliability. The codes as sub-themes were categorized into four themes, which have a theoretical background.

4. Results

The data collected from the academic staff were categorized into four themes, which were core components of psychological capital. Based on the theoretical framework, sub-themes are created under each theme.

Table 1. Self-efficacy theme and sub-themes

Self-efficacy	n	%
Responsibility	34	26,5%
Self confidence	29	22,6%
Taking initiative	14	10,9%

Sense of self	14	10,9%
Success	13	10,2%
Professionalism	11	8,6%
Experience	6	4.7%
Manifesting yourself	5	4%
Idealism	2	1,6%
Total	**128**	**100%**

The data on self-efficacy theme has 9 sub-themes of 128 responses. The sub-themes emphasized by the participants are having responsibility (26,5%), self-confidence (22,6%), taking initiative (10,9%), sense of self (10,9%), success (10,2%), professionalism (8,6%), experince (4.7%), manifesting yourself (4%) and idealism (1,6%).

Table 2. Optimism theme and sub-themes

Optimism	**n**	**%**
Positivity	43	64,1%
Work ownership	7	10.4%
Loving one's job	7	10.4%
Agreeableness	4	5.9%
Feeling empathy	3	4,5%
Motivation	2	2,9%
Trusting others	1	1,5%
Total	**67**	**100%**

In the theme of optimism, 7 sub-themes of 67 responses were obtained. The sub-themes under optimism are positivity (64,1%), work ownership (10.4%), loving one's job (10.4%), agreeableness (5.9%), feeling empathy (4,5%), motivation (2,9%), trusting others (1,5%)

Table 3. Hope theme and sub-themes

Hope	**n**	**%**
Goal-directedness	37	36,2%
Planning	22	21,5%
Pathways	12	11,7%
Agency	10	9,8%
Self disciplined	10	9,8%
Well adjusted	8	7,8%
Unifying	3	2,9%
Total	**102**	**100%**

102 responses were obtained in the optimism theme. 7 subthemes emphasized by the participants are goal directedness (36,2%), planning (21,5%), finding alternative pathways to goals (11,7%), agency (9,8%), self disciplined (9,8%), well adjusted (7,8%) and unifying (2,9%)

Table 4. Psychological resiliency theme and subthemes

Psychological Resiliency	**N**	**%**
Seeking solutions	48	39%
Perseverance	33	26,8%
Resiliency against challenges	16	13%
Hardworking	13	10,5%
Devoted	11	8,9%
Calm	2	1,6%
Total	**123**	**100%**

In psychological resiliency theme, 123 responses were categorized into 6 sub-themes. The sub-themes are seeking solutions (39%), perseverance (26,8%), resiliency against challenges (13%), hardworking (10,5%), devoted (8,9%), calm (1,6%).

It was observed that academic staff who were professor, associate and assistant professor emphasized self-efficacy theme more compared to research assistants and lecturers. On the other hand, academic staff didn't differ in evaluating the other themes in heterogonous groups. Lastly, there is no difference between males and females in evaluating all of the themes.

4. Conclusion

This study aims to determine which components of positive psychological capital the academic staff focus on and to what extent they give importance to the construct. According to the results, it can be seen that the participants emphasize self-efficacy component distinctively. Besides, the academic staff focused responsibility sub-theme of self-efficacy component compared to the other sub-themes. They also stress self confidence, success and experience sub-themes notably. The other sub-themes included in the study are taking initiative, sense of self, professionalism, manifesting yourself and idealism.

Studies on self-efficacy show that individuals with high self efficacy have sense of responsibility, self-confidence as a result of mastery experiences. This capacity is defined as one's having confidence in accomplishing a task in the future. Self efficacy which is context specific construct enables individuals to perceive themselves efficient (Bandura (1995: 3). Therefore, individuals should be provided with experiences in which they can accomplish their goals, observe role models and get social support (Avey, et al., 2008b: 54). It is showed that employees with high levels of self efficacy accomplish their goals when they put in enough effort (Stajkovic & Luthans, 1998: 66).

In optimism component, the academic staff focused on the positivity compared to other sub-themes. Also, the other sub-themes are work ownership, loving one's job, agreeableness, feeling empathy, motivation and trusting others. The studies on optimism argue that optimists have positive expectations and motivate themselves against challenges. According to Seligman (1998: 43), optimism reflects individuals' positivity for the future. Consequently, optimist employees maintain their motivation even if they encounter some challenges in organizations.

In the hope theme, goal directedness is the most remarkable sub-theme for the academic staff. The other sub-themes attracting the participants' attention are planning, finding alternative pathways to goals, agency, self disciplined, well adjusted and unifying. As hopeful individuals are goal directed, they persevere to succeed (Luthans, et al., 2010: 44). Additionally, they focus on finding pathways to goals and having agency. According to Snyder (2002: 249-252), hope consists of pathways and agency. The individuals with high levels of hope have the ability to find alternative ways and the expectation to accomplish their goals (Avey, et al., 2008b:53).

Lastly, the academic staff emphasize seeking solutions for resiliency component distinctively. Also, perseverance, resiliency against challenges, hardworking, devoted and calm sub-themes are mentioned by the participants. Benard (1993: 44) defines resiliency as the ability to bounce back against challenging situations. In organizations, resiliency is not only coping with negative situations such as conflict and failure but also positive ones such as increasing responsibility and organizational change as well.

Future studies on psychological capital can conduct research designs with different qualitative data collection methods. Additionally, the studies can handle different sectors cross-sectionally to get a deep understanding the psychological capital construct.

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An improvement of Jarratt method with seventh-order convergence

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Abstract

In this paper, we suggest and discuss a new higher-order iterative method for solving nonlinear equations. This method based on a Jarratt method. It is shown that the proposed method has seventh order of convergence. Numerical tests show that the new method is comparable with the well-known existing methods and gives better results.

Keywords: Iterative method; Jarratt method; nonlinear equations; convergence analysis; higher order convergence

1. Introduction

Solving nonlinear equations is one of the most important problems in numerical analysis.Due to their importance, several numerical methods have been suggested and analyzed under certain condition. These numerical methods have been constructed using different techniques such as Taylor series, homotopy perturbation method and its variant forms, quadrature formula,variational iteration method, and decomposition method. For more detail (see [2-10] and the reference therein).Inthis paper also,we consider iterative methods to find a simple root of nonlinear equation $f(x) = 0$, where $f : D \subset \Re \to \Re$ foran open interval D is a scalar function.

The known iterative method for nonlinear equation is Newton's method defined by:

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}. \qquad (1)$$

This is an important and basic method [1], which converges quadratically.

To improve the local order of convergence, many modified methods have been proposed. The Jarratt method [3], which has fourth-order convergence, is given by

$$x_{n+1} = x_n - J_{f(x_n)} \frac{f(x_n)}{f'(x_n)} \quad (2)$$

Where

$$y_n = x_n - \frac{2}{3}\frac{f(x_n)}{f'(x_n)}$$

$$J_{f(x)} = \frac{3f'(y_n) + f'(x_n)}{6f'(y_n) - 2f'(x_n)}$$

The Jarratt method is widely considered and applied for its computational efficiency. Re-cently, some variants of Jarratt method with sixth order convergence have been developed in [2,3,4], which improve the local order of convergence of Jarratt method by an additional evaluation of the function. Similar methods have also been

studied in [3-10] where the order of convergence of many classical methods has been improved. From a practical point of view, it is interesting to improve the order of convergence of the known methods.
In this paper, we present a new method of an improvement of Jarratt method, based on the composition of Jarratt method and Newton method. The error equations are given theoretically to show that the proposed technique has seventh-order convergence.per iteration the new method requires two evaluations of the function and two of its first derivatives.Several examples are given to illustrate the efficiency and performance of this method.

2. The method andconvergence analysis

We consider the following iteration scheme:

$$J_{f(x)} = \frac{3f'(y_n) + f'(x_n)}{6f'(y_n) - 2f'(x_n)} \tag{3}$$

$$z_n = x_n - J_{f(x_n)} \frac{f(x_n)}{f'(x_n)} \tag{4}$$

$$x_{n+1} = z_n - \frac{f(z_n)}{f'(z_n)} \tag{5}$$

Where

$$y_n = x_n - \tfrac{2}{3}\frac{f(x_n)}{f'(x_n)} \tag{6}$$

In equation (5) approximate $f'(z_n)$, (see [5]) by the following :

$$f'(z_n) = 3\frac{f(z_n) - f(x_n)}{(z_n - x_n)} - 2f'(x_n) - \frac{1}{2}f''(x_n)(z_n - x_n) \tag{7}$$

Now, by replacing $f'(z_n)$ in equation (5)by (7), we can suggest a new iterative method which an improvement of Jarratt method as follows:

$$x_{n+1} = z_n - \frac{f(z_n)}{3\frac{f(z_n) - f(x_n)}{(z_n - x_n)} - 2f'(x_n) - \frac{1}{2}f''(x_n)(z_n - x_n)} \tag{8}$$

Where z_n is defined by(4), y_n by (6).

Theorem 2.1. *Assume that the function* $f : D \subset \Re \to \Re$ *for an open interval* D *has a simple root* $\alpha \in D$. *Let* $f(x)$ *is sufficiently smooth in the neighborhood of the root* α, *then the method defined by* (8) *has seventh-order convergence.*

Proof. Let α be a simple root of f. Let $e_n = x_n - \alpha$.
Using Taylor expansion around $x_n = \alpha$ and taking into account $f(\alpha) = 0$, we have

$$f(x_n) = f'(\alpha)[e_n + c_2 e_n^2 + c_3 e_n^3 + c_4 e_n^4 + O(e_n^5)], \quad (9)$$
$$f'(x_n) = f'(\alpha)[1 + 2c_2 e_n + 3c_3 e_n^2 + 4c_4 e_n^3 + O(e_n^4)], \quad (10)$$
$$f''(x_n) = f'(\alpha)[2c_2 e_n + 6c_3 e_n + 12 c_4 e_n^2 + O(e_n^3)], \quad (12)$$

Where $c_k = (1/k!) f^{(k)}(\alpha) / f'(\alpha), \quad k = 2, 3, \cdots$

Dividing (9) by (10) gives us

$$\frac{f(x_n)}{f'(x_n)} = e_n - c_2 e_n^2 + 2(c_2^2 - c_3) e_n^3 + O(e_n^4). \quad (13)$$

It has been shown in [4] that

$$J_{f(x)} = \frac{3f'(y_n) + f'(x_n)}{6f'(y_n) - 2f'(x_n)} = 1 + c_2 e_n - (c_2^2 - 2c_3) e_n^2 - 2\left(c_2 c_3 - \frac{13}{9} c_4\right) e_n^3 + O(e_n^4), \quad (14)$$

From (12) and (13), we have

$$z_n - x_n = -J_{f(x_n)} \frac{f(x_n)}{f'(x_n)} = -e_n + \left(c_2^3 - c_2 c_3 + \frac{1}{9} c_4\right) e_n^4 + O(e_n^5), \quad (15)$$

Now, by using Taylor series, we have

$$f(z_n) = f'(\alpha)\left[(-c_2 c_3 + c_2^3 + \frac{1}{9} c_4) e_n^4 + O(e_n^5)\right], \quad (16)$$

From (9), (10), (11), (15) and (16), we have

$$3\frac{f(z_n) - f(x_n)}{z_n - x_n} - 2f'(x_n) - \frac{1}{2} f''(x_n)(z_n - x_n) = f'(\alpha)[1 + c_4 e_n^3\left(2c_2(-c_2 c_3 + c_2^3 + \frac{1}{9} c_4) + 3c_5\right) e_n^4 + O(e_n^5)], \quad (17)$$

Thus, using (16)and (17) in (8) we have

$$x_{n+1} = \alpha + \left(c_2 c_3 - c_2^3 - \frac{1}{9} c_4 \right) c_4 e_n^7 + O(e_n^8), \qquad (18)$$

Or

$$e_{n+1} = \left(c_2 c_3 - c_2^3 - \frac{1}{9} c_4 \right) c_4 e_n^7 + O(e_n^8). \qquad (20)$$

This means that the method defined by (8) is seventh-order convergent.

Per iteration of themethod requires two evaluations of the function, two first derivative and one second derivative. If we consider the definition of efficiency index in [9] as $p^{1/m}$,where p is the order of the method and m is the number of functional evaluations, the it-eration formula defined by(8) has the efficiency index equal to $\sqrt[5]{7} = 1.475$ which is bet-ter than that of Newton method $\sqrt{2} = 1.4142$.

3. Numerical examples

We present some examples to illustrate the efficiency of themethodwhich has been in-troduced in the present paper. We present some numerical test results for various iterative schemes in Table 1. Acomparison has been made between the Newton method (NM) , the method of Frontini (FM) [7], the method of YoonMee (YM) [10],the method of Noor an- d Noor (NRM) [6],the method of Jarratt (JAM) [3] and the new method (8) (IJAM)intr- oduced in this paper. We used the following test functions.

Function	Exact zero
$f_1(x) = 4x^4 - 4x^2,$	α=1.0
$f_2(x) = e^x \sin x + \ln(x^2 + 1),$	α=3.2375629840239213
$f_3(x) = \sin x - x/2,$	α=1.8954942670339809
$f_4(x) = e^{-x} + \cos x,$	α=1.7461395304080124
$f_5(x) = \sin^2 x - x^2 + 1,$	α=1.4044916482153412
$f_6(x) = (x-2)^{23} - 1,$	α=3.0
$f_7(x) = e^{x^2+7x-30} - 1,$	α=3.0
$f_8(x) = (x+2)e^x - 1,$	α=-0.442854401002388

All the computations were done using MAPLE using 64 digits floating point arithmetic (Digits:=64).In Table 1. Results were obtained by using the following criteria:

(i) $\left| x_{n+1} - x_n \right| < 10^{-32}$, (ii) $\left| f(x_n) \right| < 10^{-32}$.

Also in Table 1.Displayed are the number of iterations to approximate the zero (IT), the distance of two consecutive approximate for finding zero δ and the value $f(x_n)$.

Table 1
Comparison of the various iterative methods

	IT	$f(x_n)$	δ
$f_1, x_0 = 0.75$			
NM	11	0	8.95e-41
FM	8	0	1.00e-64
CHM	14	0	3.60e-42
NRM	5	0	4.60e-42
JAM	6	0	1.00e-64
IJAM	5	0	3.33e-34
$f_2, x_0 = 3.5$			
NM	7	7.00e-63	2.65e-44
FM	5	7.00e-63	4.72e-57
CHM	5	7.00e-63	7.37e-49
NRM	4	7.00e-63	0
JAM	4	7.00e-63	3.05e-47
IJAM	4	7.00e-63	2.90e-42
$f_3, x_0 = 1.6$			
NM	7	3.00e-64	1.08e-43
FM	5	3.00e-64	1.94e-54
CHM	5	3.00e-64	2.17e-36
NRM	4	3.00e-64	0
JAM	4	3.00e-64	1.26e-42
IJAM	4	3.00e-64	1.72e-34
$f_4, x_0 = 2.0$			
NM	6	3.00e-64	2.30e-42
FM	5	3.00e-64	0
CHM	5	3.00e-64	0
NRM	3	3.00e-64	1.21e-41
JAM	4	3.00e-64	0
IJAM	3	3.00e-64	2.00e-63
$f_5, x_0 = 2.0$			
NM	7	2.00e-63	9.11e-33
FM	5	2.00e-63	7.11e-41
CHM	6	1.30e-63	1.00e-63
NRM	4	2.00e-63	0
JAM	5	1.30e-63	1.00e-63
IJAM	5	2.00e-63	1.00e-63
$f_6, x_0 = 2.9$			
NM	14	0	3.05e-45
FM	10	0	3.83e-44
CHM	Divergent	-	-
NRM	6	0	2.79e-35
JAM	6	0	1.70e-56
IJAM	5	0	1.25e-37
$f_7, x_0 = 2.8$			

NM	18	0	6.34e-34
FM	18	0	0
CHM	Divergent	-	-
NRM	8	0	4.52e-53
JAM	7	0	0
IJAM	6	0	3.00e-63
$f_8, x_0 = -2.5$			
NM	34	2.00e-64	7.16e-49
FM	Divergent	-	-
CHM	Divergent	-	-
NRM	14	0	6.38e-38
JAM	11	0	0
IJAM	9	2.00e-64	2.00e-64

4. Conclusion

In this paper, we have constructed an iterative method for solving nonlinear equation. Ithas been shown by illustration that the proposed iterative method of order seven can be e-ffectively used for solving such equations, and observed from numerical examples that t- he proposed method shows at least the same performance as that of the other known met- hods.

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ENVIRONMENTAL JUSTICE – A THREE DIMENSIONAL PARTS

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Abstract

This paper explores the connectivity among the three core dimensions of Environmental Justice (EJ). These three dimensions are distributive justice, procedural justice and justice of Recognition. By relying on some secondary resources across the globe, it calls for equity in the distribution of resources; fairness in the procedures of distribution; and appropriate recognition of the less privileged, disadvantaged and often marginalise people in the entire decision making processes.

Keywords: environmental justice; three parts, dimensions.

1.0 INTRODUCTION

According to Maiese (2003:1), who refers to distributive justice as economic justice, "distributive justice is concerned with giving all members of society a fair share of the benefits and resources available". However, from prior studies on environmental justice, it is observed that whilst everyone would want wealth or resources to be distributed evenly, there is a lot of disagreement about what amount to fair share. Maiese (2003) suggests that three indicators of – need, equality and justice are possible criteria for distribution. In his critique of distributive justice, Sen (2004) argues that the problem of injustice and marginalisation of greater population of the world from enjoying the world's resources and taking part in decision on the way these resources should be distributed, are considered major challenges in recent times.

Similarly, Pulido (1996) argues that it is those who are marginalised and the poorest of the world that often bear the burdens of degradation of resources and pollution just because they found themselves vulnerable and with lack of options unlike the privileged who always reduce their level of vulnerability by preventing themselves from environmental hazards with the help of assorted mechanisms and exportations. Sen (2004) laments that distributive justice movement has not been able to tackle the problems of the most disadvantaged section of the world and has equally demobilised the movements for socio-cultural recognition. As such, the paper foresees an emergence of a new paradigm shift around the concepts of recognition and participation, even though the relationship of the shift to the various paradigms that currently exist still remains quite ambiguous.

In order to make a genuine claim about distributive justice, Bell (2004) lists out three core questions that need to be addressed. These questions are, first who are the people that receive environmental justice? What is it to be distributed? What is the pattern or principle of distribution? Walker (2012) argues that the issue of the recipients of environmental justice has to do with determining the people that matter in terms of the way environmental burdens and benefits are distributed. Dobson (1998) defines a community of justice (the people who matter when we think about the distribution of environmental goods and bads) as the present population of a nation (spatially intra-national and temporally intra-generational), which formed the early phrase of the movement for environmental justice in the US. In a more expansive way, Caney (2007) defines a community of justice to include future generations and the populations of other

countries (thereby intergenerational and international), which, as explored in the early part of this paper, has become more popular as the environmental justice frame has evolved.

On the issue of what is to be distributed, Walker (2011) observes that the contemporary knowledge of environmental justice covers a wide range of environmental features. These features include both benefits (energy consumption, green space, access to water and services) and burdens (waste, noise, air pollution and flood risk). However, Boardman et al. (1999) maintain that the difference between burdens and benefits is malleable, for instance, whilst clean air is a benefit, air pollution is a burden. Certain features or objects, depending on their evaluation and context, may shift from benefit to burden. For example, the consumption of energy can be seen as simultaneously a benefit by providing necessary energy services and a burden by contributing to carbon emissions, and its distribution can be at issues in both cases. In a similar instance, flooding can be a threat to others and a positive resource for others (Boardman et al., 1999). In the context of environmental justice, Schroeder et al. (2008) argue that the concepts of benefits and burdens are always relative in the developing world, both with respect to any particular group of potential resources users and in absolute terms. Walker (2012) identifies some crucial subtleties in an attempt to define what exactly is to be distributed. As outlined in Table 1, for each of the concerns there are issues in resolving what is to be distributed, in each case different type of optionality and complexity manifested. However, the issue of what is to be distributed also clearly has some relationship to the evidence needed to make evaluation and judgement. The ideal metric of distribution may not be available in existing empirical evidence, and there could be many circumstances in which it would not be possible to measure the primary concern for distribution, as such, there is a need to work out some kind of proxy indices of distribution (for instance, nearness to a pollution source as an indicator of impacts of pollution on health and well-being).

2. LITERATURET REVIEW

2.1 The Dimension of Procedural Fairness

Whilst Greenberg (1987) perceives procedural justice as a construct that influences the perception of organisational fairness that entirely does not rely on distributive fairness judgements and is applied to explain the psychological method of procedural fair treatment. Maiese (2003) conceives procedural justice with formulating and enforcing decisions based on fair processes that lead to fair treatment. It ensures that those formulating the procedures should maintain elements of neutrality and those affected by the procedures should be well represented in the processes of decision-making. This hypothesis supports the idea that if people can see some elements of fairness in a given procedure, they would likely accept the results. As such, fair procedures implementation is vital to dispute resolution.

However, Walker (2010) argues that procedural justice is not directly linked to the way environmental resources, risks and quality are distributed, and rather, it is concerned with the various processes involved in making decision about the environment. The paper observes that this raises issues of adequacy of the processes of participation in making decision, access to legal redress and also, the issue of access to vital information by all the necessary stakeholders. Walker (2010) further contends that procedural justice examines the whole range of issues involved in the way power and representation have been overlooked in the move towards more deliberative processes as well as emerging development in legislation and policy debate.

In particular, there are two theoretical models that have been proposed to account for some of the factors that help to explain the way people evaluate procedural fairness. These are the group-value model and the self-interest model (Greenberg, 1987). The group-value suggests that it is difficult for employees to always gain their self-interest in the course of interacting with others. They need to realise that some other outcomes must be anticipated and accepted beyond their wish if they are to attain group cohesiveness. As a

result, fairness in procedural processes is emphasised so as to prevent conflict, but to enhance long term benefits. Thus, procedures are viewed as important elements needed to help redefine the intra-relationships within groups and as norms that regulate the social structure and decision-making processes among the groups (Lind and Tyler, 1988). The self-interest model, on the other hand, has to do with the egocentric conception of an individual (Lind and Tyler, 1988). It proposes that employees are always concerned with their own circumstances and the quest to gain control over the procedures of organisation with a view to see that their personal interests are given ample considerations so as to maximize the most desirable consequence for themselves. This model therefore states that the perception of procedural justice is greatly influenced by the amount of decision control at the disposal of conflicting employees (Greenberg, 1990).

2.2 The Dimension of Recognition Equity

According to Greenberg (1987), recognition implies that unique socio-cultural and local identities of indigenous people are valued, respected and acknowledged. This requires a fair treatment for others in a way that acknowledges and accommodates their differences (Schlosberg, 1998). Recognition of societal and group differences equally means that the particular feeling of subordination is recognised as a way to tackle local problems. However, environmental policy decision-makers have often been unable to recognise these differences, as a result, have always excluded the marginalised groups. This is the reason why environmental justice discourse has continued to strive for minority recognition and representation in environmental decision-making processes and procedures. The idea behind this is that, sometimes if not most of the times, the groups that are affected by a decision know best what particular problems such decision will likely lead to (Bovenkerk, 2003). However, as Philips (2004) contends, mere representation without corresponding participation of the affected class, would not actually lead to real recognition. He maintains that it is not easy to detach ideas from the people that hold such ideas since ideas are framed by different experiences of different groups in the society. Schlosberg (1999) similarly argues that lack of participation constitutes a lack of social power. In this sense, he maintains that the inability to recognise social differences and the unjust distribution of environmental risks can be countered by authentic participation of affected people in the political processes that lead to those harms. According to Walker (2010), environmental justice has shown that stakeholders' involvement and participation in the processes of decision-making can lead to respect for groups and societal status across various differences. However, recognition and participation of disadvantaged local residents would ensure that their local experiences and knowledge are taken seriously, because they have the potential to affect the processes of decision making by providing a more accurate account of the problem. Therefore, as observed in this paper, to really empower the marginalised and disadvantage groups, there is a need to build a concrete relationship between distributions, procedural, recognition and participation. The next section of the paper sets out such a framework. However, recognition and participation do not readily imply effective power, especially where there is no sufficient effort to guarantee that everybody's opinion counts in the process of decision-making; power display and hierarchy can hinder the marginalised and disadvantaged classes from being given equal treatment though.

3.0 EMPIRICAL EVIDENCE AND DISCUSSIONS

Table 1: Issues in defining the appropriate metric of distributive justice (Adopted from Walker, 2012).

Concerns	Issues in defining what is to be distributed
Waste	What type of wastes or waste facilities? Is it proximity to waste facilities that matters and, if so, how is this to be measured? How about patterns of waste production?
Air pollution	Is it the diminishing of air quality or emissions of air pollutants that is to be distributed? And by what measure – ambient air quality, specific source emissions or levels of personal exposure; average levels, peak levels or exceedences of standards?
Flooding	Is it a level of exposure to potential flooding that is to be distributed, likelihood of being flooded or flood impacts? How about the distribution of investment in flood defences or in preparedness capacity?
Greenspace	How is greenspace to be defined given that it can take many different forms? What qualities are to be accounted for? What use values of greenspace are deemed to be important – visual impact, exercise and play, relaxation?
Climate change	What measures of carbon emissions are to be used – absolute levels, per capita levels – and at what scales? How about historic emissions? How might the distribution of climate change impacts be captured and at what scales?

The next question bothers on the principles of distribution. After a thorough study of the various claims made by advocates of environmental justice, Bell (2004) was able to identify three principles that are generally applied. First, a principle of equity, which means, for instance, the equal distribution of waste sites across a territory, or the equal per capita distribution of carbon consumption; second, a principle of equality and a guarantee standard, where inequality needs to be removed but at the same time, a standard of environmental quality ensured for everyone, this include right to clean water or a basic standard of air quality; third, a guaranteed minimum with variation above the minimum based on personal choices and spending income, in this case, beyond an ensured minimum, people can express their preferences in different ways. While focusing on the environment, Bell (2004) argues that the main problem was the failure to ensure minimum standards, rather than inequality per se. He readily extends the conception of justice as fairness to include environmental justice concerns. As such, the criterion of just distribution should be a reflection of the different meanings of goods and bads that emerge in particular contexts, and in part, should be expected to be contested. Sitting another relevant example, Hillman (2004), after a careful study of the different alternative underlying justice principles at work in priority setting for stream rehabilitation in Australia, demonstrates the differences in environmental justice concepts by identifying six ways in which distributive principles can be applied (see Box 1 below).

Box 1. Alternative principles of justice in priority setting for stream rehabilitation in Australia (Hillman, 2004).

- *Equality of rights*: where resources for streams rehabilitation are spread thinly and evenly across an entire catchment, characterised as peanut butter management;
- *Utilitarian equality*: where the vision is to maximise overall catchment health, balancing costs and benefits in the allocation of resources, a homogenising approach;
- *Democratic equality*: where priority is given to the most disadvantaged biophysical or human parts of the system, or focusing on the worst bits;
- *Proportional equality*: where the status quo and historically derived priorities are maintained, also known as the grandfather principle;
- Casual responsibility: where the polluter pays principle is paramount – those that are deemed responsible for river degradation (industry and agriculture primarily) are required to fix the problem;
- Merit based: where resources go to those communities who are most active or who have the best performance in managing their rivers.

Similar listings of alternative distributive justice principles have been reviewed earlier, including industrial pollution (Walker et al., 2005) and hazardous facility sitting (Bryner, 2002).

However, a number of these distributive principles demonstrate that it is important to study other dimensions of distribution which interact with the distribution of the direct environmental goods and bads. Walker (2012) identifies three such dimensions as vulnerability, need and responsibility. Cutter et al. (2000) argue that not all people are necessarily equally affected by an equivalent environmental burden or able to cope with or recover from its impacts. Sexton (1996) maintains that social, physiological, economic and cultural factors may mean that an entire equal distribution of exposure to a burden may still retain very unequal impacts - for example, older people are more susceptible to excess and unusual heat or cold, whilst children are more sensitive to various types of pollution because of their higher metabolic and respiratory rates as well as the on-going development of their nervous system among others. According to Kuehn (1996), people of different races can have different illness profiles for genetic reasons. Poorer people have far lesser resources to cope with and recover from disasters like flooding; new immigrants or others with language barriers may find it difficult to understand environmental health or risk warnings and protection advice (Thrush et al., 2005). For such reasons, claims of environmental justice can be very interesting in demonstrating the way distributive inequalities in vulnerability can compound distributional inequalities in exposure. The issue of need becomes important with a focus on environmental resources. Therefore, claims of justice may need to seek differentials in need, rather than focusing only on simple absolute equality. Some household may need more access to water than others, just as older people can need better access to energy and heat than others during cold weather. Some communities may need better protection from industrial pollution and flooding because they lack the resources to self-help, protect themselves and the environment from the impacts of such pollution and flooding. People living in high density and

stressful neighbourhoods arguably need more access to greenspace for achieving calm and relaxation than others (Walker, 2012). In terms of responsibility, again the relationship between different patterns of distribution is very important. Hillman (2004) refers to casual responsibility in his identification of alternative justice principles (see Box 3 above). Distinctions are made here between situations in which distributive inequalities both affect and are generated by the direct outcome of the activities or informed choices of the same people – the polluter is also the burden-taker – and those where there is a dislocation between those benefiting from and those suffering from patterns of distribution – the polluter and the burden-taker are distinct. Instances include, for industrial pollution, the contrasting distributions of oil exploration activities generating pollution and those communities suffering the health and environmental impacts of exposure to industrial pollutants and, for climate change, the contrasting distribution of greenhouse gas emissions and distributions of both exposures to changing regional weather patterns around the world and vulnerability to their impacts (Walker, 2011).

On the role of the state in the distribution of environmental benefits and burdens, an analysis of the environmental institutions and legislative framework of India, by Williams and Mawdsley (2006), suggests that there is a need for caution in allowing the government to take a leading role in advancing the course of environmental justice. As Kothari (2004) points out, the need for caution arose for two main reasons. First, is the argument that a significant part of this legislation is characterised by conceptual weakness and limited opportunities for participation. Second, is the extremely inability of the government to enforce environmental regulations. As a result of the lack of ample structures and opportunities for participation provided by and within the state, coupled with the irregularities that are associated with civil interest litigation, it is of course not surprising that direct opposition has remain a major option for challenging the existing principles of environmental governance in some countries (Kothari, 2004). However, Low and Gleeson (1998) observe that pursuit of environmental justice through pressure-movement politics only, has reached a stalemate. For research on environmental justice, Williams and Mawdsley (2006) identify three key implications of the role of the state in promoting environmental justice. First, whilst environmental justice literature must engage excessive capital exploration of environmental resources, other important areas that require justice should not be ignored. Second, studies on environmental justice need to focus attention on the various forms of injustice that emanate from lack of recognition, rather than keeping faith with the notion that inclusive processes of deliberative democracy will work out for the general good of all. Third, environmental justice seems to have a global coverage, but this requires a role to device the ways by which it can treat the differences and peculiarities of different countries and cultures.

From the foregoing, though the concepts of distributive justice are central to environmental justice claim-making; the conception of environmental justice purely as a matter of distribution is quite insufficient. Therefore, to develop a comprehensive account, the paper reviews the interrelated ideas of procedural justice and justice of recognition in the next few sections.

4.0 CONCLUSION AND RECOMMENDATIONS.

Whilst there are a growing number of environmental justice movements in recent times, not many people have focused their interest to exploring what exactly environmental justice refers to, especially in the social and cultural realms of societal and activist demands. The review that follows draws on the work of Schlosberg (2004).

The way many people have understood environmental justice seems limited by their emphases, largely on the issues of equity, or the distribution of environmental goods and bads. However, the definition of environmental justice as issues of equity only is not complete, because environmental activists, local communities groups, as well as various non-governmental organisations (NGOs) are all calling for something more than fair distribution. This paper explores the way that definitions go farther than the distributive and procedural realms assisting the development of environmental justice at a regional scale.

The debate is that the concerns of regional environmental justice are actually in three dimensions: fair distribution of environmental goods and bads, recognition of the socio-cultural differences of the local people as well as the experiences in those localities, and participation in the processes of environmental policy and management. The co-existence of these three dimensions of justice in environmental movement shows the plurality, and at the same time, the related procedures and practices of justice.

The aim of the paper is neither to advance environmental justice as a political tool, nor to assess the current level of injustice. It is to explore some emerging potentials of environmental justice as a regional policy and discourse initiative. Although the definition of environmental justice is something that has been done by both environmental and political writers, a core argument of this paper is that with all the movement demands, and the proliferation of the writings of theorists of social justice, many of these theories of environmental justice are still very inadequate in their approaches, especially as they continue to insist solely on the distributive paradigm of environmental justice, with less emphasis on recognition and participation. As such, the central debate in this paper is that a thorough idea of a regional environmental justice ought to be locally-based (i.e. needs to involve and be closer to local stakeholders to enhance their full participation as emphasised in the thesis) and theoretically broader to cover the core notions of distribution, stakeholders' recognition and their participation.

One of the short-comings of the theory of distributive justice is its singular attention to equity in the distribution processes of environmental resources. Rawls (1971) argues that in order to arrive at a commonly acceptable theory of justice, there is a need to move beyond our present knowledge to a place where our weaknesses and strengths are overlooked. He advanced the argument that without the knowledge of life circumstances, one would not be able to come up with a good notion of justice that could satisfy everyone. Barry (1995) has a similar idea of justice and contends that people should accept the principles of distributive justice and focus less attention to various ideas of good living. However, this particular focus has been forcefully criticised by other scholars like Young (1990) and Fraser (2001). Their criticisms are very helpful in understanding the principles of environmental justice.

Young (2000) observes that though the theory of distributive justice presents a framework and procedure that could improve distribution, the theory has not successfully examined the institutional and socio-cultural factors affecting uneven distribution in the first instance. Her claim is that the lack of justice is not dependent only on uneven distribution, but also a missing link of recognition of social difference. She further maintains that recognition is important and a lack of it could cause damage to communities and their images in the political and socio-cultural realms. The paper views the lack of recognition, in this case, as a form of injustice that constrains the people and serves as a basis for distributional inequity. Fraser (2000), in her call for justice of recognition, argues that justice demands consideration to recognition and distribution. She insists that culture is an important and a necessary platform of struggle. Like Young (1990), Fraser (2000) maintains that there is a need to seek to understand why injustice exists for proper understanding and remedial measures. Thus, whilst Rawls (1971) focuses on the fair processes of justice like some other theorists of liberal justice, Fraser (2000) and Young (2000) examine what might be the possible hindrances to such processes and the way they can be tackled.

According to Schlosberg (2004), these theorists observe a connection between a lack of recognition and respect as well as a decrease in personal involvement in a wider society. He argues that if someone is not recognised, they cannot participate. In this regard, the paper expects that justice should focus on the institutional and political schemes in order to be able to address the unjust distribution of environmental goods and bads and the various factors militating against individual, group and community recognition. As such, Miller (2003) contends that decision making that is based on participatory and democratic procedures is an element of social justice, which challenges misrecognition and question the current pattern of distribution of goods and benefits. However, Schlosberg (2003) draws attention to the fact that even though theorists (like Miller, 2003) support the idea of procedural justice, there had been an opposition to

recognition as a dimension of justice. Their first objection, Schlosberg (2003) points out is that recognition is not a separate issue of justice. Schlosberg (2003) claims that recognition or respect is a condition for fair distribution. Though Miller (2003) dismisses recognition as a different form of justice distributive and procedural, he however maintains that recognition is an important component of procedural justice and presents the position that recognition is not only assumed but also subsumed in the processes and schemes of procedural and distributive justice. A major issue observed in this paper, as the case in Fraser (2000), is that some writers have argued that respect and recognition are theoretical issues, as such, have not been able to give a pragmatic discussion on recognition, neither have they offer a potential link between the current uneven distribution and lack of recognition. It had been argued by writers of distributive justice that if the notion of distributive were effectively implemented in affected communities, then the communities would stop the demand for recognition, since the recognition would be a prerequisite for fair distribution.

However, Schlosberg (2004) insists that the unwelcoming attitudes towards recognition is a result of its entire misinterpretation in the theory of justice and argues that justice requires a clear attention to fair distribution, adequate recognition and effective participation since the three are interwoven in the circles of community and group demands. For those overtaken by the distributive paradigm, recognition is seen as another element to be distributed. However, given the important nature of recognition, Walker (2010) gives two responses. First he maintains that majority of the distributive theorists view recognition as a requirement for entering into a system of distribution. The paper notes this in the arguments of Miller (2003) above. Walker (2011) argues that the major issue is to address recognition rather than assuming it. Second, he refutes the argument of Young (2000), by saying that recognition is not something to be distributed; rather, it is a form of societal relationship and norm. In other words, Walker (2010) sees recognition as a form of justice that goes beyond the demand on the government and business alone for remedial measures, and moves the theory of justice to the social realm that transcends government and business. As noted above, the challenge with distributional theorists is that the point that links recognition to participation and to distribution is underemphasized. This paper argues that recognition is a vital component of environmental justice; and should be incorporated it into the core schemes and processes of environmental justice. The claim of this paper is that justice is a combination of three closely related elements (distributive, procedural and justice of recognition and participation). However, this review observes that the researches on environmental justice are not yet balanced. Fortunately, as argued in this paper, activists for environmental justice have presented some useful information on what might lead to a balanced framework.

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Enumeration of cyclic codes over $GF(17)$

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Abstract

In this paper we seek the number of irreducible polynomials of $x^n - 1$ *over* $GF(17)$. *We factorize* $x^n - 1$ *over* $GF(17)$ *into irreducible polynomials using cyclotomic cosets of* 17 *modulo* n. *The number of irreducible polynomials factors of* $x^n - 1$ *over* F_q *is equal to the number of cyclotomic cosets of* q *modulo* n. *Each monic divisor of* $x^n - 1$ *is a generator polynomial of cyclic code in* F_{q^n}. *We show that the number of cyclic codes of length* n *over a finite field* F *is equal to the number of polynomials that divide* $x^n - 1$. *Lastly, the number of cyclic codes of length* n, *when* $n = 17k$, $n = 17^k, n = 17^k - 1, (k, 17) = 1$ *are enumerated.*

1. Introduction

The basic problem of coding theory is that of communication over unreliable channel that result in errors in the transmitted messages. It is worth noting that transmitted messages like data from a satellite are always subject to noise. It is important therefore, to be able to encode a message in such a way that if noise scramble it, it can be decoded to its original form. This is done by adding redundancy to the message so that the original form can be recovered if too many errors have not occurred. Sometimes where sensitive information is being transmitted the message is highly encoded and certain dummy parameters added to the message to avoid it correctly decoded in case it lands on wrong hands.
In addition to these practical application, coding theory has many application in theory of computer science. As such it is a topic of interest to both practitioners and theoreticians.

1.1 Definitions

Code: Let F be a finite set with q symbols, there are q^n different sequences of length n. Of these only q^k are codewords since the r check digits within any codeword are completely determined by the k message digits. The set consisting of q^k codewords of length n is called a code.

1.2 Cyclic code*:* Let C be a lnear code over a finite field $GF(q)$ of block n, C is called acyclic code, if for every codeword $a_0a_1a_2, \dots, a_n$ from C, the word $a_na_1a_2, \dots, a_{n-1}$ in C obtain by acyclic right shift of component is also a codeword. This also involves the left shift. Therefore a linear code C is cyclic precisely when it is invariant under all cyclic shifts.

1.3 Cyclotomic cosets: Let n be relatively to q. The cyclotomic coset of $q \bmod n$ is defined by $C_i = \{i.q^j mod n \in \mathbb{Z}_n : j = 0, 1, 2, \dots\}$

1.3 Preliminary results

A code C is said to be cyclic if it is alinear code and it is invariant under any cyclic shift. In finding cyclic codes we factorise $x^n - 1$ into irreducible polynomials and obtain all monic polynomials that divide $x^n - 1$. Each such monic polynomial is a generator polynomial and generate a cyclic code. We wish to generate the number of cyclic code of length n over $GF(17)$.

3 Factorization of $x^n - 1$ into irreducible polynomials over $\mathbb{Z}_{17}$

Let n be a positive integer with $g.c.d\ (q, n) = 1$. Then the number of monic irreducible polynomials factors of $x^n - 1$ over F_q is equal to the number of cyclotomic coset q modulo n and if

$a)\ n = 1:\ x - 1 \equiv x + 16$ is the irreducible polynomials of degree 1 over $\mathbb{Z}_{17}$

$b)\ n = 2:\ x^2 - 1$ Consider the cyclotomic cosets 17 mod 2

$C_i = \{i.17^j mod 2\ j = 0,1,2,3, \ldots.\}$ $C_0 = \{0\}$ $C_1 = \{1\}$

There are only two cyclotomic cosets of 17 mod 2 over $\mathbb{Z}_{17}$. On the other hand the number of irreducible polynomials will only be two

$$x^2 - 1 = (x - 1)(x + 1) = (x + 16)(x + 1)\ over\ \mathbb{Z}_{17}$$

$c)\ n = 3: x^3 - 1$ Consider the cyclotomic cosets17 mod 3

$C_i = \{i.17^j mod 3\ j = 0,1,2,3, \ldots\}$ $C_0 = \{0\}$ $C_1 = \{1,2\}$

There are only two cyclotomic cosets 17 mod 3 over $\mathbb{Z}_{17}$. Therefore the number of irreducible polynomials will only be two i.e

$x^3 - 1 = (x + 16)(x^2 + x + 1)$

$d)\ n = 4:\ x^4 - 1$ Consider the cyclotomic cosets17 mod 4 $C_i = \{i.17^j mod 4\ \ j = 0,1,2,\}$

$C_0 = \{0\}$ $C_1 = \{1\}$ $C_2 = \{2\}$ $C_3 = \{3\}$

Number of irreducible monic factors will be four

$x^4 - 1 = (x^2 - 1)(x^2 + 1) = (x - 1)(x + 1)(x^2 + 1) = (x - 1)(x + 1)(x + 4)(x + 13) = (x + 16)(x + 1)(x + 4(x+13)$

$e)\ n = 5:\ x^5 - 1$ Consider the cyclotomic cosets 17 mod 5. $C_i = \{i.17^j mod 5\ j = 0,1,2,3,..\}$

$C_0 = \{0\}$ $C_1 = \{1,2,3,4\}$ There are only 2 cyclotomic cosets 17 mod 5.

Therefore the number of irreducible polynomials will be two

$.x^5 - 1 = (x - 1)(x^4 + x^3 + x^2 + x + 1) = (x + 16)(x^4 + x^3 + x^2 + x + 1)$

$f)\ n = 6:\ x^6 - 1$ Consider the cyclotomic cosets 17mod 6 $C_i = \{i.17^j mod 6\ \ j = 0,1,2,3, \ldots\}$

$C_0 = \{0\}$ $C_1 = \{1,5\}$ $C_2 = \{2,4\}$ $C_3 = \{3\}$

There are 4 cyclotomic cosets 17 mod 6.Therefore the number of irreducible monic factors will be four

$x^6 - 1 = (x^3 - 1)(x^3 + 1) = (x - 1)(x^2 + x + 1)(x^3 + 1) = (x + 16)(x^2 + x + 1)(x + 1)(x^2 + 16x + 1)$

$g)\ n = 7:\ x^7 - 1$ Consider the cyclotomic cosets 17 mod 7 $C_i = \{i.17^j mod 7\ : j = 0,1,2,3, \ldots\}$ $C_0 = \{\{0\}$ $C_1 = \{1,3,2,6,4,5\}$

There are only 2 cyclotomic cosets of 17mod7. Therefore the number of irreducible monic factors will be two.

$x^7 - 1 = (x - 1)(x^6 + x^5 + x^4 + x^3 + x^2 + 1)$

$$= (x+16)(x^6+x^5+x^4+x^3+x^2+1)$$

h) $n = 8$: $x^8 - 1$ Consider the cyclotomic cosets 17 mod 8. $C_i = \{i.17^j mod\ 8 : j = 0,1,2,3,\ldots.\}$

C_0={0} C_1={1} C_2={2} C_3={3} C_4={4} C_5={5} C_6={6} C_7={7}

Therefore $x^8 - 1$ can be factorised into 8 monic irreducible polynomials all linear factors. $x^8 - 1 = (x^4 - 1)(x^4 +$ *1=x2−1x2+1x4+1=x−1x+1x+4x+13x4+1=x−1x+1x+4x+13x2+11x+18x2+10x+16=x+16x+1x+4x+13x+2(x+8)(x+2)(x+9)*

i) $n = 9$: $x^9 - 1$. Consider the cyclotomic cosets 17 mod 9 . $C_i = \{i.17^j mod 9 : j = 0,1,2,3,\ldots\}$

C_0= {0} C_1={1,8} C_2={2,7} C_3={3,6} C_4={4,5}

$x^9 - 1$ Can be factorized into 5 irreducible monic polynomials, 1 of degree 1 and 4 of degree 2.

$$x^9 - 1 = (x-1)(x^8+x^7+x^6+x^5+x^4+x^3+x^2+x+1)$$
$$= (x+12)(x^2+3x+1)(x^2+10x+1)\,(x^2+4x+1)(x^2+x+1)$$

j) $n = 10$: $x^{10} - 1$. Consider the cyclotomic cosets 17 and 10. $C_i = \{i.17^j mod 10: j = 0,1,2,3,..\}$

C_0={0} C_1={1,7,9,3} C_2={2,4,8,6} C_5={5}

$x^{10} - 1$ Can be factorized into 4 irreducible monic polynomials, 2 of degree 1 and 2 of degree 4.

$x^{10} - 1 = (x^5 - 1)(x^5 + 1) = (x-1)(x^4+x^3+x^2+x+1)(x^5+1) = (x+16)(x^4+x^3+x^2+x+1)(x+$ *1x4+16x3+1*

k) $n = 11$: $x^{11} - 1$. Consider the cyclotomic cosets 17 mod 11. $C_i = \{i.17^j mod 11: j = 0,1,2,3,..\}$

C_0= {0} C_1={1,6,3,7,9,1,5,8,4,2}

$x^{11} - 1$ Can be factorized into 2 irreducible polynomials, 1 of degree 1 and 1 of degree 10.

$x^{11} - 1 = (x-1)(x^{10}+x^9+x^8+x^7+x^6+x^5+x^4+x^3+x^2+x+1) = (x+\ \ 12)(x^{10}+x^9+x^8+x^7+$ *x6+x5+x4+x3+x2+x+1*

l) $n = 12$: $x^{12} - 1$. Consider the cyclotomic cosets 17 mod 12 $C_i = \{i.17^j mod 12: j = \ \ 0,1,2,3,..\}$

C_0= {0} C_1= {1,5} C_2={2,10} C_3={3} C_4= {4 ,8} C_6={6} C_7={7,11} C_9={9}

$x^{12} - 1$ Can be factorized into 8 irreducible factors, 4 of degree 1 and 4 of degree 2.

$$(x^{12}-1) = (x^6-1)(x^6+1) = (x^3-1)(x^3+1)(x^6+1)$$
$$= (x-1)(x^2+x+1)(x^3+1)(x^6+1)$$
$$= (x+16)(x^2+x+1)(x+1)(x^2+16x+1)(x+4)(x^2+4x+16)(x+3)(x^2+13x+16)$$

m) $n = 13$: $x^{13} - 1$. Consider the cyclotomic cosets17mod13. $C_i = \{i.17^j mod 13: j = 0,1,2,3,..\}$

C_0={0} C_1={1,4,3,12,9,10} C_2={2,8,6,11,5,7}

$x^{13} - 1$. Can be factorized into 3 irreducible factors, 1 of degree 1 and 2 of degree 6

$x^{13}-1=(x-1)(x^{12}+x^{11}+x^{10}+x^9+x^8+x^7+x^6+x^5+x^4+x^3+x^2+1)=(x+16)(x^{12}+x^{11}+x^{10}+$
x9+x8+x7+x6+x5+x4+x3+x2+1=x+16x6+13x5+2x4+12x3+2x2+13x+1)(x6+5x5+2x4+4x3+2x2+5x+1

$n)$ $n=14$: $x^{14}-1$. Consider the cyclotomic cosets 17 mod 14. $C_i=\{i.17^j mod 10:\ j=\ 0,1,2,3,..\}$

C_0={0} C_1={1,3,9,13,11,5} C_2={2,6,4,12,8,10} C_7={7}

$x^{14}-1$ Can be factorized into 4 irreducible factors , 2 of degree 1 and 2 of degree 6.

$$(x^{14}-1)=(x^7-1)(x^7+1)=(x-1)(x^6+x^5+x^4+x^3+x^2+1)(x^7+1)$$
$$=(x+16)(x^6+x^5+x^4+x^3+x^2+1)$$
$$=(x+16)(x^6+x^5+x^4+x^3+x^2+x+1)(x^6+16x^5+x^4+16x^3+x^2+16x+1)(x+1)$$

$o)$ $n=15$: $x^{15}-1$. Consider the cyclotomic cosets 17 mod 15.

$C_i=\{i.17^j mod 15:\ j=0,1,2,3,..\}$

C_0={0} C_1={1,2,4,8} C_3={3,6,12,9} C_7={7,14,13,11} C_5={5,10}

$x^{15}-1$ can be factorized into 5 irreducible monic polynomials. 1 of degree 1, 1 of degree2 and 3 of degree 4.

$$x^{15}-1=(x-1)(x^{14}+x^{13}+x^{12}+x^{11}+x^{10}+x^9+x^8+x^7+x^6+x^5+x^4+x^3+x^2+x+1)$$
$$=(x+16)(x^2+x+1)(x^4+5x^3+15x^2+11x+1)(x^4+11x^3+15x^2+5x+1)(x^4+x^3+x^2+x+1)$$

$p)$ $n=16$: $x^{16}-1$ Consider the cyclotomic cosets 17 mod 16.

$C_i=\{i.17^j mod 10:\ j=0,1,2,3,..\}$

C_0= {0} C_1={1} C_2={2} C_3={3} C_4={4} C_5={5} C_6= {6} C_7={7} C_8={8} C_9={9}
C_{10}={10} C_{11}= {11} C_{12}= {12} C_{13}={13} C_{14}={14} C_{15}={15}

$x^{16}-1$ Can be factorized 16 irreducible monic polynomials, all linear factors.

$x^{16}-1=(x^8-1)\ (x^8+1)=(x^4-1)\ (x^4+1)(x^8+1)=(x^2-1)(x^2+1)(x^4+1)(x^8+1)=(x-1)(x+$
1x+4x+13x4+1x8+1=x−1x+1x+4x+13x2+11x+18x2+10x+16x8+1=(x+1)
$(x+2)(x+3)(x+4)(x+5)(x+6)(x+7)(x+8)(x+9)(x+10)(x+11)(x+12)(x+13)(x+14)(x+15)(x+16)$

$q)$ $n=17$: $x^{17}-1$. Consider the cyclotomic cosets 17 mod 17. $C_i=\{i.17^j mod 10:\ j=0,1,2,3,..\}$ C_0={0}
C_1={1,0} C_2={2,0} C_3={3,0} C_4={4,0} C_5={5,0} C_6={6,0} C_7={7,0} C_8={8,0} C_9={9,0} C_{10}={10,0}
C_{11}={11,0} C_{12}={12,0} C_{13}={13,0} C_{14}={14,0} C_{15}={15,0} C_{16}={16,0}

$x^{17}-1$ Can be factorized into 17 irreducible monic polynomials, all linear factors.

$(x^{17}-1)=(x-1)^{17}=(x+16)^{17}$

$r)$ $n=18$: $x^{18}-1$ Consider the cyclotomic cosets 17 mod18.

$C_i=\{i.17^j mod 10:\ j=0,1,2,3,..\}$

C_0= {0} C_1={1,17} C_2={2,16} C_3={3,15} C_4={4,14} C_5= {5,13} C_6={6,12} C_7={7,11} C_8={8,10}
C_9={9}

$x^{18}-1$ Can be factorized 10 irreducible factors , 2 of degree 1 and 8 of degree 2.

$s)\ n=19:\ x^{19}-1$ Consider the cyclotomic cosets 17 mod 19.

$C_i=\{i.17^j mod 10:\ j=0,1,2,3,..\}$

C_0={0} C_1={1,17,4,11,16,6,7,5,9} C_2={2,15,8,3,13,12,14,10,18}

$x^{19}-1$ Can be factorized 3 irreducible factors, 1 of degree 1and 2 of degree 9

$(x^{19}-1)=(x-1)(x^{18}+x^{17}+x^{16}+x^{15}+x^{14}+x^{13}+x^{12}+x^{11}+x^{10}+x^9+x^8+x^7+x^6+x^5+x^4+x^3+$
$x2+1=(x-1)\,x9+ax8+bx7+cx6+dx5+ex4+fx3+gx2+hx+kx9+mx8+nx7+px6+qx5+rx4+sx3+tx2+ux+v$
where $a,b,c,d,e,f,g,k,h,m,n,p,q,r,s,t,u,v\in\mathbb{Z}_{17}$

$t)\ n=20:\ x^{20}-1.$ Consider the cyclotomic cosets 17 mod 20. $C_i=\{i.17^j mod 10:\ j=0,1,2,3,..\}$

C_0={0} C_1={1,17,9,13} C_2={2,14,18,6} C_3={3,11,7,19} C_4={4,8,16,12} C_5={5} C_{10}={10} C_{15}={15}

$x^{20}-1$ Can be factorized 10 irreducible factors 8. 4 of degree 1 and 4 of degree 4

$x^{20}-1=(x^{10}-1)(x^{10}+1)=(x^5-1)(x^5+1)(x^{10}+1)=(x-1)(x^4+x^3+x^2+x+1)(x^5+1)(x^{10}+1)=$
$(x+16)(x^4+x^3+x^2+x+1)(x+1)(x^4+16x^3+1)(x^{10}+1)=(x+16)(x^4+x^3+x^2+x+1)(x+1)(x^4+$
$16x3+1x+4x4+4x3+16x2+11x+10x+13x4+4x316x2+13x+1$

The number of irreducible factors in $(x^n-1)mod 17$ for $n=1,2,3,\dots,20$ is Summarized in the table below.

n	x^n-1	$Number\ of\ irreducible\ factors\ in\ x^n-1$
1	x^1-1	$1\{1\ of\ degree\ 1\}$
2	x^2-1	$2\{2\ of\ degree\ 1\}$
3	x^3-1	$2\{1\ of\ degree 1, 1\ of\ degree\ 2\}$
4	x^4-1	$4\{\ 4\ of\ degree\ 1\}$
5	x^5-1	$2\{1\ of\ degree 1, 1\ of\ degree\ 4)$
6	x^6-1	$4\{\ 2\ of\ degree 1, 2\ of\ degree 2, 2\ of\ degree\ 2\}$
7	x^7-1	$2\{1\ of\ degree\ 1, 1\ of\ degree\ 6\}$
8	x^8-1	$8\{8\ of\ degree\ 1\}$
9	x^9-1	$5\{1\ of\ degree 1, 4\ of\ degree\ 2\}$
10	$x^{10}-1$	$4\{2\ of\ degree\ 1, 2\ of\ degree\ 4\}$
11	$x^{11}-1$	$2\{1\ of\ degree\ 1, 1\ of\ degree\ 10\}$
12	$x^{12}-1$	$7\{2\ of\ degree\ 1, 5\ of\ degree\ 2\}$
13	$x^{13}-1$	$3\{\ 1\ of\ degree 1, 2\ of\ degree\ 6\}$
14	$x^{14}-1$	$4\{2\ of\ degree\ 1, 2\ of\ degree\ 6\}$
15	$x^{15}-1$	$5\{1\ of\ degree\ 1, 1\ of\ degree\ 2, 3\ of\ degree\ 4\}$
16	$x^{16}-1$	$16\{\ 16\ of\ degree\ 1\}$
17	$x^{17}-1$	$17\{17\ of\ degree\ 1\}$
18	$x^{18}-1$	$10\{2\ of\ degree\ 1, 8\ of\ degree\ 2\}$
19	$x^{19}-1$	$3\{\ 1\ of\ degree\ 1, 2\ of\ degree\ 9\}$
20	$x^{20}-1$	$8\{4\ f\ degree\ 1, 4\ of\ degree\ 4\}$

***Theorem* 3.1**

The number of cyclic code in $R_n = {}^{F_q[x]}/_{x^n-1}$ is equal to 2^m where m is the number of m cyclotomic coset mod$n$. Consider the number of cyclic code of length $n = 1, 2, 3, \ldots, 20$ over $\mathbb{Z}_{17}$.

3.1 Consider the number of cyclic code of length $n = 1, 2, 3, \ldots 20$ over $\mathbb{Z}_{17}$

n	$x^n - 1$	*number of q cyclotomic coset equal m*	*number of cyclic code equal* 2^m
1	$x^1 - 1$	1	$2^1 = 2$
2	$x^2 - 1$	2	$2^2 = 4$
3	$x^3 - 1$	2	$2^2 = 4$
4	$x^4 - 1$	4	$2^4 = 16$
5	$x^5 - 1$	2	$2^2 = 4$
6	$x^6 - 1$	4	$2^4 = 16$
7	$x^7 - 1$	2	$2^2 = 4$
8	$x^8 - 1$	8	$2^8 = 256$
9	$x^9 - 1$	5	$2^5 = 32$
10	$x^{10} - 1$	4	$2^4 = 16$
11	$x^{11} - 1$	2	$2^2 = 4$
12	$x^{12} - 1$	8	$2^8 = 256$
13	$x^{13} - 1$	3	$2^3 = 8$
14	$x^{14} - 1$	4	$2^4 = 16$
15	$x^{15} - 1$	5	$2^5 = 32$
16	$x^{16} - 1$	16	$2^{16} = 65536$
17	$x^{17} - 1$	1	$2^1 = 2$
18	$x^{18} - 1$	10	$2^{10} = 1024$
19	$x^{19} - 1$	3	$2^3 = 8$
20	$x^{20} - 1$	8	$2^8 = 256$

3.2 Consider $x^n - 1$ when $n = 17k$: $(k, 17) = 1$

$x^n - 1 = x^{17k} - 1$ and if

a) $k = 1$: $x^{17} - 1 = (x-1)^{17} = (x+16)^{17}$ Number of cyclic codes $= 17 + 1 = 18$

b) $k = 2$: $x^{34} - 1 = (x^2-1)^{17} = (x-1)^{17}(x+1)^{17} = (x+16)^{17}(x+1)^{17}$ Number of cyclic codes$= (17 + 1)^2 = 18^2$

c) $k = 3$: $x^{51} - 1 = (x^3-1)^{17} = (x+16)^{17}(x^2+x+1)^{17}$ Number of cyclic codes $(17+1)^2 = 18^2$

d) $k = 4$: $x^{68} - 1 = (x^4-1)^{17} = (x^2-1)^{17}(x^2+1)^{17} = (x-1)^{17}(x+1)^{17}(x^2+1)^{17}$
$= (x+1)^{17}(x+12)^{17}(x+8)^{17}(x+5)^{17}$

Number of cyclic codes $= (17+1)^4 = 18^4$

e) $k = 5$: $x^{85} - 1 = (x^5 - 1)^{17} = (x + 16)^{17}(x^4 + x^3 + x^2 + x + 1)^{17}$

Number of cyclic codes $= (17 + 1)^2 = 18^2 = (17+1)^2 = 18^2$

$f)$ $k = 6$: $x^{102} - 1 = (x^6 - 1)^{17} = (x^3 - 1)^{17}(x^3 + 1)^{17} = (x + 16)^{17}(x^2 + x + 1)^{17}(x + 1)^{17}(x^2 + 16x + 1)^{17}$

Number of cyclic codes $= (17 + 1)^4 = 18^4$

$g)$ $k = 7$: $x^{119} - 1 = (x^7 - 1)^{17} = (x - 1)^{17}(x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)^{17} = (x + 16)^{17}(x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)^{17}$

Number of cyclic codes $= (17 + 1)^2 = 18^2$

$h)$ $k = 8$: $x^{136} - 1 = (x^8 - 1)^{17} = (x^4 - 1)^{17}(x^4 + 1)^{17} = (x^2 - 1)^{17}(x^2 + 1)^{17}(x^4 + 1)^{17} = (x + 16)^{17}(x + 1)^{17}(x + 4)^{17}(x + 13)^{17}(x + 9)^{17}(x + 2)^{17}(x + 8)^{17}(x + 2)^{17}$

Number of cyclic codes $= (17 + 1)^8 = 18^8$

$i)$ $k = 9$: $x^{153} - 1 = (x^9 - 1)^{17} = (x - 1)^{17}(x^2 + x + 1)^{17}(x^6 + x^3 + 1)^{17} = (x + 16)^{17}(x^2 + x + 1)^{17}(x^2 + 3x + 1)^{17}(x^2 + 10x + 1)^{17}(x^2 + 4x + 1)^{17}$

Number of cyclic codes $= (17 + 1)^5 = 18^5$

$j)$ $k = 10$: $x^{170} - 1 = (x^{10} - 1)^{17} = (x^5 - 1)^{17}(x^5 + 1)^{17} = (x + 16)^{17}(x^5 + x^4 + x^3 + x^2 + x + 1)^{17}(x^5 + 1)^{17} = (x^5 - 1)^{17}(x^5 + 1)^{17} = (x + 16)^{17}(x^5 + x^4 + x^3 + x^2 + x + 1)^{17}(x + 1)^{17}(x^4 + 16x^3 + 1)^{17}$

Number of cyclic codes $= (17 + 1)^4 = 18^4$

k) $k = 11$: $x^{187} - 1 = (x^{11} - 1)^{17} = (x - 1)^{17}(x^{10} + x^9 + x^8 + x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)^{17} = (x + 16)^{17}(x^{10} + x^9 + x^8 + x^7 + x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)^{17}$

Number of cyclic codes $= (17 + 1)^2 = 18^2$

$l)$ $k = 14$: $x^{238} - 1 = (x^{14} - 1)^{17} = (x^7 - 1)^{17}(x^7 - 1)^{17} = (x - 1)^{17}(x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)^{17}(x - 16)^{17}(x^6 + 16x^5 + x^4 + 16x^3 + x^2 + 16x + 1)^{17} = (x + 16)^{17}(x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)^{17}(x + 1)^{17}(x^6 + x^5 + x^4 + x^3 + x^2 + x + 1)^{17}$

Number of cyclic codes $= (17 + 1)^4 = 18^4$

$m)$ $k = 20$: $x^{340} - 1 = (x^{20} - 1)^{17} = (x^{10} - 1)^{17}(x^{10} + 1)^{17} = (x^5 - 1)^{17}(x^5 + 1)^{17}(x^{10} + 1)^{17} = (x - 1)^{17}(x^4 + x^3 + x^2 + x + 1)^{17}(x - 16)^{17}(x^4 + 16x^3 + 1)^{17}(x - 13)^{17}(x^4 + 4x^3 + 16x^2 + 11x + 10)^{17}(x - 4)^{17}(x^4 + x^3 + x^2 + x + 1)^{17} = (x + 16)^{17}(x^4 + x^3 + x^2 + x + 1)^{17}(x + 1)^{17}(x^4 + 16x^3 + 1)^{17}(x + 4)^{17}(x^4 + 4x^3 + 16x^2 + 11x + 10)^{17}(x + 13)^{17}(x^4 + x^3 + x^2 + x + 1)^{17}$

Number of cyclic codes $= (17 + 1)^8 = 18^8$

The above is summarized in the table below

k	$x^n - 1 when\ n = 17k$	$Number\ of\ factors$	$Number\ of\ cyclic\ code$
1	17	1	$(17+1)^1 = 18^1$
2	34	2	$(17+1)^2 = 18^2$
3	51	2	$(17+1)^2 = 18^2$
4	68	4	$(17+1)^4 = 18^4$
5	85	3	$(17+1)^3 = 18^3$
6	102	4	$(17+1)^4 = 18^4$
7	119	3	$(17+1)^3 = 18^3$
8	136	8	$(17+1)^8 = 18^8$
9	153	5	$(17+1)^5 = 18^5$
10	170	4	$(17+1)^4 = 18^4$
11	187	2	$(17+1)^2 = 18^2$
12	204	8	$(17+1)^8 = 18^8$
13	221	3	$(17+1)^3 = 18^3$
14	238	4	$(17+1)^5 = 18^4$
15	255	5	$(17+1)^5 = 18^5$
16	272	16	$(17+1)^{16} = 18^{16}$
17	289	1	$(17+1)^1 = 18^1$
18	306	10	$(17+1)^{10} = 18^{10}$
19	323	3	$(17+1)^3 = 18^3$
20	340	8	$(17+1)^8 = 18^8$

3.3 Consider $x^n - 1$ when $n = 17^k$: $(k, 17) = 1$

The above is summarized in the table below

K	$x^n - 1$	$Factors$	$Number\ of\ cyclic\ codes$
0	$x^{17^0} - 1$	$(x-1)^{17^0}$	$17^0 + 1 = 2$
1	$x^{17^1} - 1$	$(x-1)^{17^1}$	$17^1 + 1 = 18$
2	$x^{17^2} - 1$	$(x-1)^{17^2}$	$17^2 + 1 = 290$
3	$x^{17^3} - 1$	$(x-1)^{17^3}$	$17^3 + 1$
4	$x^{17^4} - 1$	$(x-1)^{17^4}$	$17^4 + 1$
5	$x^{17^5} - 1$	$(x-1)^{17^5}$	$17^5 + 1$
.	.	.	.
.	.	.	.
.	.	.	.
10	$x^{17^{10}} - 1$	$(x-1)^{17^{10}}$	$17^{10} + 1$
.	.	.	.
.	.	.	.
.	.	.	.
K	$x^{17^k} - 1$	$(x-1)^{17^k}$	$17^k + 1$

3.4 Consider $x^n - 1$ when $n = 17^k - 1$ in $\mathbb{Z}_{17}$.

Now $x^n - 1 = x^{17^k - 1} - 1 = \frac{x^{17}}{x} - 1 = \frac{x^{17^k} - x}{x}$ let $p = 17^k$ where p is prime. Substituting for the value of p we have $\frac{x^p - x}{x} = \frac{x(x^{p-1} - 1)}{x} = x^{p-1} - 1$. But we know that

$\frac{x^{p-1} - 1}{x - 1} = x^{p-2} + x^{p-3} + x^{p-4} + \ldots . + x + 1$ giving $x^{p-1} - 1 = (x - 1)(x^{p-2} + x^{p-3} + x^{p-4} + \ldots . + x + 1)$

Suppose that $\emptyset_{p-1}(x) = (x^{p-2} + x^{p-3} + x^{p-4} + \ldots . + x + 1)$

So that $x^{p-1} - 1 = (x - 1)\emptyset_{p-1}(x)$. One notices that Eisenstein criterion is not directly applicable. We therefore substitute $(x + 1)$ for x in equation $x^{p-1} - 1 = (x - 1)\emptyset_{p-1}(x)$. Now $(x + 1)^{p-1} - 1 = ((x + 1) - 1)\emptyset_{p-1}(x +$ *1* so that we have

$$x\emptyset_{p-1}(x + 1) = x^{p-1} - 1 = \binom{p-1}{0} x^{p-1} + \binom{p-1}{1} x^{p-2} + \ldots + \binom{p-1}{p-2} x + \binom{p-1}{p-1} - 1$$

$$= \binom{p-1}{0} x^{p-1} + \binom{p-1}{1} x^{p-2} + \ldots + \binom{p-1}{p-2}$$

$$= \sum_{k=0}^{p-2} \binom{p-1}{k} x^{p-1-k}$$

We now apply Eisenstein criterion $p - 1 \Big/ \binom{p-1}{k}$ for $k = 1,2,3, \ldots p - 2$ so $p - 1 \nmid 1$ $(p-1)^2 \nmid \binom{p-1}{p-2}$ hence $\emptyset_{p-1}(x +$

1) is irreducible over $\mathbb{Z}_{17}$ therefore $x^{p-1} - 1 = (x - 1)\emptyset_{p-1}(x + 1)$ is irreducible

Hence the number of cyclic code over $\mathbb{Z}_{17}$ when $n = 17^k - 1$ *is* 2^2=4

4. Conclusion

1.Let $\mathbb{Z}_q$ be a given field. If $x^n - 1$ factorizes into a product of linear factors over $\mathbb{Z}_q$ such that $x^n - 1 = (x - 1)^n$ then the number of cyclic code in $R_n = {F_q[x]}\Big/{x^n - 1}$ is given by $n + 1$

2. Let $\mathbb{Z}_q$ be a finite field and $x^n - 1$ be given cyclotomic polynomial such that $x^n - 1 = (x - \alpha_1)(x - \alpha_2)(x -$ *α3….(x−αn)* where *αi≠αj* $\forall i,j$ and suppose that

$n = qm$ where $m \in \mathbb{Z}^+$ then, the number of cyclic codes in $R_n = {F_q[x]}\Big/{x^n - 1}$ is given by $(q + 1)^k$ where k is the number of distinct factors over $\mathbb{Z}_q$.

3. Let $\mathbb{Z}_q$ a given field and $x^n - 1$ be given cyclotomic polynomial such that $x^n - 1 = (x - 1)^n$ then the number of irreducible monic polynomials over $\mathbb{Z}_q$ is not equal to the number of cyclotomic coset.

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Alternative Methods of Financing Higher Education in Kenya

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ABSTRACT

The impact of the global financial crises on prospects for achieving equal access in education continues to be a heavy burden for developing countries and its citizens. In the face of increased poverty and vulnerability and with inter-sectored competition for national financing, there is need to rethink on alternative methods of bridging the government financial gap especially in the higher education sub- sector. Household financing of education is faced by several challenges especially if the mechanisms include fees from savings, borrowing from commercial banks and relying on friends and relatives for contribution. Education expenditures are major component in consumption of households with children in school. As the government funding reduces in higher education, it affects access especially for the poor.

This paper analyses the alternative methods available to the poor households in, Nyeri district, Kenya and challenges they may face in bridging the government education financial burden.

Key words: Kenya, education expenditure, Education financing, poor households

Introduction

The importance of education and training in an economy has been recognized world over and countries will go to great strength in committing public funds to the education sector (UNESCO, GMR, 2012).The achievement of universal educational goals increases the overall need for human capital investment. In recent years, voices have been made to scale up education expenditure to achieve Millennium Development Goals (MDGs) and Education for All (EFA) by 2015 (UNESCO, GMR, 2012; Al-Samarrai, 2006).

Investment in human capital has both economic and non-economic benefits. Individuals' earning capacity and employment prospects is enhanced through education. This brings a spillover effect to the distribution of income, firms' productivity and economic growth (Psacharapoulos & Woodhall, 1985). Mincer (1974) estimated the effects of schooling on wages at 10% using US census data. One of his findings was education increases the probabilities of being employed and once in employment, better educated individuals earn considerably more than their less educated peers. Non economic benefits of education includes intergenerational benefits, lower clime, lower fertility, lower maternal and child/infant mortality and better political literate citizens (Psacharapoulos and Woodhall, 1985). Though the role of education in individual and society development has been questioned (Arrow, 1973, Spencer, 1973), developing countries continue using it as a vehicle of development.

Financing higher education in Kenya

Demand for higher education in Kenya has increased tremendously over the last 2 decades driven by inadequate funding for public universities to absorb most qualified candidates (ROK 2011). The Gross Enrollment Rate (GER) at university level is estimated to be 9.8 % (KNHDR, 2009). The Net Enrollment Rate (NER) is always appropriate to use but universities have continued to attract mature students as continuing students (ROK, 2009). Even with rapid growth in the sector, equality and equity remains a challenge, regional and gender disparities remain large (ROK, 2009). The highest recorded GER is in Nairobi with 26%, and the lowest is in Northern Eastern province with 0.8 percent. The percentage of women in universities is lower that of men.

Table 1 summarizes student enrollment by gender between 2004 and 2009 and by public and private universities.

	2004/05		2005/06		2006/07		2007/08		2008/09	
	Male	female	Male	Female	Male	Female	Male	Female	Male	Fe
PUB	**53394**	**28097**	**53737**	**27940**	**56517**	**34620**	**60504**	**36603**	**62753**	**37896**
PRI	4597	5453	50068	5571	111828	9064	10271	10861	10790	11408
TOT	91,541		92,316		112,229		118239		122847	

Source: Economic Survey, 2009

The rapid demand for higher education has strained the existing universities and adversely affected the capacity of the government to supply university education. Demand for higher education places outstrips supply and the places are allocated based on student performance in secondary school. The underlying assumption on this, assumes that higher education based on ability yields the greatest efficiency (ADEA,2009). However, in many developing countries, access to high-quality secondary education is determined by several factors. One major factor is household income. Since the year 1995, the Kenyan government shifted the burden of higher education costs from being borne predominantly by government, or taxpayers, to being shared with parents, students and the private sector (ROK, 2010). This cost sharing policy has implications on university enrollment. Hence, enrollment may shift from a heavily subsidized public sector to a much less subsidized, tuition dependent – private sector (Johnston 2003). The number of private candidates in Kenya, those outside Joint Admissions Board (JAB), has grown rapidly with part time students constituting 34.2% of the total student enrolment and those in private accredited universities accounting for 17.2 per cent. This is a total of 51.4 % of the total student enrolment in 2008/09 academic year. This leaves less than 50 percent who at a large extent expects government funding. Several sustained efforts have been made to improve university enrolment and retention in Kenya since the attainment of independence. In almost all African countries, financing of higher education is mainly from the public funds (Psacharopoulos, 1982; World Bank, 1988). Kenya is not an exception; one way of trying to make university education accessible to all is increased in budgetary allocations. The total development expenditure for the education sector increased from KShs 11.0 billion in 2007/08 to KShs 193.3 billion in 2010/11(Economic Survey, 2011). The recurrent expenditure for the universities increased from 9.7 million in 2004/05 to 14.1 million in 2006/07 and dropped to 11.8 million in 2008/09. Despite the increase in budgetary figures, financing challenges remain and especially per student cost. The cost per student has been diminishing with the rising demand for higher

education (GOK, 2009). The other two key interventions with the largest national coverage are financing through Higher Education Loans Board (HELB) and provision of targeted bursaries. According to various government documents, HELB was started to facilitate higher education of Kenyans (HELB, 2011). As a credit funding institution, it has financed over 300,000 students since its inception in 1995. The funding targets both government and privately sponsored students in recognized public and private universities within the East African Community. Currently, those who graduated between 1974/75 and 1994/95 academic years repay their loans at an interest rate of 2 percent. Those who took loans from 1995/96 academic year to date are repaying their loan with an interest rate of 4%. HELB can vary the interest rate anytime without referring to the loanee (HELB, 2011).The body also targets other students, categorized as continuing university students, but at competitive interest of 12 percent.

The targeted bursaries are not automatic. The student must apply with proved evidence. The existing types of bursaries are HELB, Constituency development fund and local authority transfer fund. In all these cases competition is very high and sometimes politics takes centre stage as the Member of Parliament is the patron of the identification and distribution committee. Students are never awarded more than the cost of financing and in most cases there is always a minimum amount to be awarded. Distribution is done across the board leaving deserving cases getting less than they would require as a safety for access and participation.

Despite budgetary financial efforts by the government, higher education access and participation of rural population and social –economically disadvantaged groups are still a critical concern. Recent education financing policy changes in Kenya often favor to divert resources from higher education to primary level of education (KNHDR, 2009). The policy favors for full cost recovery from students in higher education. Cost recovery methods are likely to have diverstating inequality in maintaining higher educational accessibility and participation, especially for the poor, minority, rural, and other traditionally underserved populations (Otieno, 2007).This is further aggravated by increasing income disparities being experienced in most regions of the country. The cost recovery methods in developing countries without considering minority groups may make higher education increasingly unattainable to all but the affluent. This may have long term economic growth challenges for countries with already financial challenges (World Bank, 1988).

Facing the substantial challenges that remain in the supply side of providing affordable, useful and sustainable financial services, parents and students are left, to seek alternative means of financing higher education. Based on Schultz's Human Capital Theory (Schultz 1961, 1963), it is assumed that education expenditures as the key investment of human capital are predictable, and can be planned or scheduled in advance. The expected returns will materialize in the long-term through increased market and non-market productivity. Kang (2003) postulates that , financing education expenditures is a major household concern that is approached through a great variety of mechanisms, such as diversifying production, maintaining stocks, and building a network of social relationship. A common issue is the role of wealth: wealthier households have an advantage of portioning part of their wealth to education, which to the poor, would be an opportunity cost.

A benefit incidence analysis of educational spending in Kenya (Deolalikar, 1999) noted that though access to primary education is equitable, inequity increases from the secondary level and by the time students reach university; the poorest quintile constitutes only 7.54 per cent of higher education attendance while the richest quintiles account for 44.78%. Otieno (2007) dual track study on admission to the university found out that , 78.3 percent were from high income/high middle income families, while only 21.7 percent reported being from low income families. This finding has both access and affordability implications, and especially when the question of subsidies is not formulated well. Most universities in Kenya have established income generating programs (since 1999) to secure more funds from 'private students 'and this has helped university

to meet their operational costs. This policy is based on filling admission quotas reserved for qualified students who would not meet the admission cut-off points but are able and willing to pay the full cost of their training. This has inherent flaws especially because not all students can afford. Issues of affordability and equity have negative implications to fee system.

The distribution of education subsidies is notably skewed towards the rich minority (ROK, 1999) thus making financing of education retrogressive and inequitable. As public financing dwindles, innovative methods of bridging financial gaps must be diversified and parents must expand their financial sources to increase and motivate their children to pursue higher education.

Alternative financing mechanisms

With the drive to continue financing private demand for education, households and students must continue exploring innovative financing approaches to sustain access and affordability to higher education.

Private spending on education takes many forms including spending on private tutoring , on fees where these exist, books and materials, uniforms, transport, meals and so on. The poor also have significant costs in enrolling their children, including lost child labor, both outside the home and inside it, where children, especially girls, often help with agricultural production, water collection and the care of younger siblings.

Research Objective

The basic question for the study was to identify methods and sources available to bridge the university fees paid or not paid by the government.

Kenyan education system in perspectives

Factors that have influenced education over the years are multiple. As economy develops, the educational system normally expands. For Kenya, this spans from independence days and especially to compensate for the gaps that had been experienced during the pre- independence days which was dominated by racial patterns (Sifuna, 1990). Kenya's education system comprises of pre-school, primary, secondary, university, technical and vocational training, youth and adult literacy and continuing education. Of these, primary and secondary sector takes the bulk of government funding especially after 2003, introduction of free and compulsory primary education, and in 2008, with the introduction of subsidized secondary sector (ROK, 2011).

Despite the landmark initiatives in both primary and secondary sector, the bulk of the government spending on education is on recurrent expenditure leaving little funding for capital development and infrastructure. This has left the parents with little choice but to increase household education expenditure.

Over years the social demand for education dominated the education sector. With the expansion of the social demand, private demand for education was equally on the increase, especially due to the economic benefits attached to education.

The notable government investment (after independence) in education positively increased the access at all levels of education but the commitment to government education expenditure dwindled and education infrastructure became more dilapidated. In 1985 the government introduced cost sharing policy in all government sectors including education (ROK, 2009). With the down trending of the economy due to both

internal and external factors, the growth of the education sector has had several challenges some of which has been noted in the higher education sector;

- Inadequate capacity to cater for the growing demand for more places;
- Mismatch between skills acquired by university graduates and the demand from the industry;
- An imbalance between the number of students studying science and art-based courses;
- Gender and regional disparities.
- Financing the increased demand for education.

Financing of education in Kenya has been an overwhelming challenge given the growth of public education institutions since independence. Secondary schools have grown from 3,552 in 2004 to 5019 in 2008, while primary schools grew from 17,804 to 18,130 over the same period. Public universities were 7 in 2004 but the numbers has increased to 22 in 2013 and the student numbers continues to grow. Public universities constitute 82% of the student body (UNESCO, 2010) pitying only 18.1 percent for private universities.

Financing of education has been a shared (silent) partnership between the government and other development partners'. Development partners have had on –and –off-budget with the highest funding coming from Global Education Fund (formally Fast Track Initiative (FTI)) (40.6 %) and Department for International Development (DFID) (23.7%). Parents have had their share of financing especially in the higher education. With the declining government financing, most parents has had to enroll their children in private universities. The demand for private universities has been very high in Kenya. The number of private Universities has grown from 17 in 2004 to 23 in 2013, a phenomenon growth. Since 2005, the Kenyan government has tried to address the financing equity issues in the university education by introducing several measures; establish new universities, expanding existing ones and upgrading certain middle – level colleges to universities; strengthening quality assurances mechanisms in all universities; and providing scholarships based on national economy needs, targeted bursaries and loans to the needy, taking into account gender parity (HELB, 2011).

Methodology

In order to answer to the objectives of the study, descriptive research design was used. The target population was parents with children in the university and university students from two rural districts of Kenya. The two districts were purposively selected because of the heterogeneous nature of poor and relatively rich geographical regions. Two districts were targeted, Nyeri North and Kieni West. Kieni west is categorized as an ASAL district and it attracts free food rations from the government. Nyeri north is relatively economic endowed due to the proximity to the Municipality and also have piped water to every household. This makes it relatively food sufficient. To get the representative sample, systematic sampling was applied to identify the household with at least one University student. The second stage was to get the unit of analysis, simple random sampling was used to get 50 parents and 100 students. It was reasonable to get a less number of parents compared to students. Parents were exposed to an in-depth interview and translation of English to local language took a lot of time than was expected. The students were given a questionnaire to fill which had several suggestions that the students were to choose from. The target number was equally distributed between the 2 districts.

Findings

The findings are categorized into two groups, the parents based and students based.

Parents based results. All (100%) parents expressed the desire for their children to continue with the university education despite the hard economic times. They seemed to agree that the government is not able to do as they would expect especially given that the Free Primary Education (FPE) and subsidized secondary sector (SSE) is being implemented albeit some challenges**.** They hoped the situation can improve as the government is better off than them in terms of getting alternatives. Even as they embraced the role of sacrifice they cited situations that they are not able to sacrifice further especially when the household has more than three children distributed in primary, secondary and university level. Hidden costs at both primary and secondary level make the component of educating children most difficult in rural areas. Hidden costs, according to the parents are never certain and are major component of household expenditure. Uncertainties in these costs make it difficult to be budgeted for. Several alternative methods of paying fees were cited as shown in Table 2.

Table 2: Cited alternative sources of paying university fees

Alternative method	Frequency	Percentage
Savings	15	30
Sell possessions	40	80
Piece of land	20	48
Goats /cows	50	100
Car(s) /bicycles	02	04
Farm products	45	90
Family members	30	60
Older siblings	50	100
Others	24	48
Friends	12	24
Loan from 'big' banks	08	16
Loan from Saccos	45	90
Loan from friends	16	32
Loan from group org.	32	64
Work part time	34	68
Parents	24	48
Children	38	76
Harambee	35	70
CDF	50	100
LATF	20	48
Child has to drop or differ	05	10
Others (do work for the university to compensate for fees)	13	16

From the table, observations were made. Majority (80%) of the households are willing to dispose part of their property in order to educate their children. The study area considered is not well endowed with economic activities. Kieni west is a dry area and therefore, selling household properties to educate children is a very high level of opportunity cost. The parents have very high levels of willingness to spend but, at the same time have a high level of disability to pay. The government should ideally address several educational expansion and inequality issues.

- To what extent is education an investment good that increases the marketability of a graduate equal to the level of sacrifice
- To what extent does educational expansion bring the social advantage of reducing various dimensions of access, participation inequality
- How would the funding mechanisms target the needy in order to reduce the opportunity cost and to reduce wastage and increase the transition rate to university education?

Parents are always willing to sacrifice if the rate of return to education is perceived to be higher. Majority of the parents are motivated to continue paying for higher education as long as employment is forthcoming. Studies (Psacharopolous and Woodhall, 1985) have shown , benefits of education is always assumed to be higher than cost of investment. From the study, most of the parents, expressed a lot of pessimistic for future benefits of education especially with the government of President Kibaki, there is a lot of academic emphasis in job recruitment.

Looking at the table, there is over dependency (100%) on the Constituency Development Fund (CDF). This is a government decentralized funding which targets constituencies and it has a component of bursary. Most parents rely on this to bridge the financial gaps. This has been very helpful but it is operatory misused, especially by the politicians, the area MP being the patron. For it to meet its basic purpose, several suggestions are made;

- Remove the MP as a patron
- Come up with accountability principles
- Design selection criteria which is transparent
- Involve nonpartisan stakeholders CDF committee members
- Minimum amount to be set depending with the need and not on type- of- school- bases.

The study findings, further, reveal that parents would be willing to dispose part of their livestock (100%) and farm products (90 %). This may be unreliable mechanisms and unsustainable, noting that this is a dry area. The sustainability of these method depends on weather conditions which in most cases is unreliable with the area most of the times receiving rain below average. Most of the parents have less than five acres of land, which to some households is further subdivided into small plots to accommodate the growing family structure over time. Most of the parents cited out lack of reliable source of water as a barrier to accumulating income. Though banks are few in the rural areas, those who would wish to borrow loans cited lack of collateral, especially women. The prohibitive bank interest rate would make them borrow as last resort. Most of the women opt for small village micro-financing institutions that they have confidence in and ask affordable interest.

The choice of funding from a house hold level depends on availability and the cost of sacrifice. On average, majority would sacrifice when the government fails completely to finance their children.

University students

The questionnaire return rate was 84 % (84). Most of the students did not fill the questionnaire as expected and 30 % of the questionnaires were discarded. Majority (84%) of students were not happy on the way university students are left to find their own mechanisms of bridging the 'government' financial responsibility. However, they appreciate the little they receive from the government ran credit organization, HELB. The student cited social, historical, political and economic circumstances, which would guide policies on financing of higher education to respect local and student characteristics.

The students are aware that the traditional methods that applied just 2 decades ago to help one with investing own education all of a sudden no longer apply. Parents are barely able to make ends meet let alone pay tuition. Government loans are still available. However with the rising cost of tuition, make the student to look for other alternative options of getting money. Working is an option however the amount of time taken to work can easily be used to study, while working fatigue makes it very difficult to concentrate. Hopefully the student worker will have an understanding boss that will allow for days off when tests and final exams come around. Students generally in this predicament find themselves struggling, not to do well, but to just pass the class and move on.

According to the students (84%) the broad range of alternative sources of financing should be analyzed and considered with caution. All possible effects have to be kept in mind when diversifying the financing sources. When discussing alternative financing of higher education it should be remembered that there is no uniform way of treating student as though they are homogenous. Equity considerations must be considered especially for students in rural unprivileged areas. Special attention should be given to the distribution of money especially from HELB between academic disciplines, not neglecting the ones that are of less commercial value. The students especially those in Science related disciplines felt that government guaranteed loans should be distributed on subject unit cost analysis. The government targeted bursary (CDF, Local Authority Transfer Fund (LATF)) distribution procedures should be transparent and accountable to accommodate the needy students. The students (80%) cited reservations in the way university and government sourced scholarships are distributed. Thirty percent questioned the criteria used to award in both instances. According to students (94%) alternative financing methods should only be seriously considered if they do not reduce the quality of the education or affect students' possibilities for the access to and completion of their studies, while also taking in account students' social and financial background. In all the cases access to higher education and successful completion of studies has to be guaranteed. Alternative cited methods are shown in table3. The students were supposed to pick as many items as possible.

Table 3: Cited alternative sources/methods of financing

Method	Frequency	percentage
Residing with parents if possible	56	*67*
Renting residents as a group	*34*	*40*
Part time learning	*54*	*64*

• *School based*	*29*	*34*
• *Evening*	*07*	*8.3*
• *Distance*	*18*	*21*
Minimize on Leisure	*72*	*86*
Cooking own food	*84*	*100*
Operating a small business	*78*	*93*
• Selling food to students through a proxy	10	12
• Selling stationary to other students	20	24
• Photocopy services	13	15
• Selling air time to students	10	12
• Selling old clothes (mitumba) to students	5	06
• Washing rooms/ clothes for my colleagues	2	2
• Ironing clothes in the halls of residents	6	7
• Plaiting/washing hair to female colleagues	7	8.3
• Selling shoes	5	6
Part time jobs(if a full time student)	*45*	*53*
Differ studies if there is a full time job	*12*	*14*
Petition HELB for more loan	*74*	*88*
Short term debts from friends	*12*	*14*
Financial help from relatives	*35*	*42*
Parents finance	*84*	*100*
Harambee (fund raising)	*15*	*18*
Constituency development fund (CDF)	*74*	*88*
Talk to my Member of parliament/councilor	*6*	*7*
Undisclosed sources	*15*	*18*

Conclusion

Due to the poverty levels in the area (majority leave below 2 US d per day, Economic Survey, 2009) the government should continue partnering with the parents but at several occasions better targeting methods should be used to equalize education opportunities, otherwise, the rich will always be in the first line. The alternative would be to introduce discriminatory pro poor funding system where the poor would get more money from the government funding agencies like, HELB. The successes of this would require political willingness. Meanwhile, the parents must continue sacrificing household expenditure to education, if they are to reap future rate of return in education. Affirmative policy must also be strengthened to remove both gender and regional disparities.

Recommendations

Further research should precede this research especially using econometrics analyses to establish the significance levels of the funding mechanisms' that can guide policy. This study stimulates thoughts on how micro level data and findings can be used for macro level thinking and policy formulation.

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Using Mobile Video Conferencing for Coteaching in High School Science Classes

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Abstract

This study proposes a type of video conferencing coteaching model that applies mobile communication networks and video conferencing for coteaching middle and elementary school science classes called Mobile Video Conferencing Coteaching (MVCC). Coteaching science classes originally involved two or more teachers instructing the same classroom. Scheduling suitable instruction times and locations for this type of coteaching is difficult, and students do not have much opportunity to receive knowledge from outside the classroom. Mobile communication networks enable coteaching sites to be moved from the classroom or laboratory to outdoor locations. Coteaching instructors can adopt MVCC to teach at any location enabling a connection to a mobile communication network. Therefore, the proposed model enables students to be instructed outside the classroom or laboratory and acquire real-life knowledge beyond the scope of their coursework, which can broaden their horizons and add diversity to science courses.

Keywords: Coteaching, video conferencing, mobile learning, Mobile Video Conferencing Coteaching (MVCC)

Introduction

The traditional method of science coteaching involves two or more teachers instructing a class together in the same classroom or laboratory. Every participating instructor must be present at the time of instruction in this teaching method. Consequently, most coteaching is performed by instructors who work at the same school. If coteaching is performed by instructors working at different schools, they must arrange an instruction time that conforms to their schedules and consider the time and cost of commuting to the teaching location. Research is currently being conducted on how to use the Internet for coteaching (Jang, 2006). The teaching method is performing coteaching on e-learning web sites. One teacher instructs the class in a conventional manner, and another teacher provides teaching assistance and supplementary instructional materials over the Internet, but all of the participating instructors are from the same school.

To solve the aforementioned coteaching problems, this research proposes incorporating mobile technology and video conferencing technology for coteaching science courses. Mobile technology provides new options for instructors and students so that instruction and study are no longer limited to the campus or classroom. Video conferencing can overcome distance limitations and provides two-way real-time interaction. This method offers substantial flexibility when selecting a teaching location, promotes coteaching programs among schools, and facilitates sharing and combining faculties and teaching resources among different schools so that the goals of Coteaching can be effectively reflected in instruction and study. This teaching method is called Mobile Video Conferencing Coteaching (MVCC).

The research revealed the following five results:

1. Using mobile video conferencing helps realize the curriculum integration goals of science courses for students to acquire a comprehensive knowledge of science.
2. Science courses need not be instructed in a classroom or laboratory. Coteaching may be performed wherever a mobile Internet signal can be received. Students can be exposed to knowledge outside their normal coursework, which can help increase the scope of their knowledge.
3. Mobile video conferencing enables coteaching to be used beyond the limits of instructors and students in a single school so that students can receive instruction from instructors from other schools and gain educational experiences from diverse sources.
4. Cooperation among instructors with different professional backgrounds can be enhanced. The sharing of teaching resources between schools, specifically teaching resource exchanges among schools in remote and urban areas, is encouraged.
5. Mobile video conferencing provides more professional development benefits to instructors at remote schools compared with those at schools in urban areas. Instructors at remote schools do not have much opportunity to participate in professional development activities. This research provides an opportunity and platform for instructors to actively participate in these activities.

Mobile Learning

Currently, 3G and 4G mobile networks are already widely adopted for accessing the Internet. In theory, a 4G Long-Term Evolution network can support download speeds of up to 100 Mbps and upload speeds of up to 50 Mbps (Emad et al., 2013). Using video conferencing coteaching over a 4G network would not present any problems. Video conferencing coteaching applying a 3G/4G mobile network has two major advantages: portability and mobility. Because of the rapid development of mobile communication technology, the next generation of mobile technology can bring learning directly to learners, representing a drastic change from the traditional learning environment in schools (Kossen, 2001). The limited teaching and learning environments (e.g., classrooms and campuses) have become learning sites (e.g., zoos and farms) with experiences suited to the learners. Therefore, the instructional activities planned by instructors can closely meet the requirements of learners. Chang et al. (2005) indicated that mobile technology can provide a wealth of information from the learning site. Furthermore, mobile technology can provide a broader and more flexible range of learning compared with ordinary school courses. Kukulska-Hulme (2005) mentioned that mobile learning is a study method produced by combining e-learning and mobile communication, which enables learners to have educational experiences anywhere by using mobile equipment and instruction to move outside the classroom and into the real world.

Video Conferencing

Distance teaching and learning has already become a major trend in teaching. Traditional distance learning was mainly one-way learning for both early broadcasting and e-learning over the Internet. Many courses taught over the Internet consist of instructional materials and video or audio teaching files placed on a web site that learners browse and study on their own. Although this method provides a flexible method of study, interaction between the instructor and learners is lacking. Anderson and Garrison (1998) stated that an effective learning process should provide interaction between the instructor and learner and not merely have the learner study the course material independently. Thus, distance learning activities would provide more effective online study if real-time interaction video conferencing were incorporated into the study.

Lin (2009) investigated two universities using video conferencing and an e-learning system for two-way synchronization of coteaching for distance learning between Taiwan and Japan, which can help improve student motivation and encourage students and instructors to understand cross-cultural learning. Researchers in the United States have investigated the effectiveness of science experiments in real-time online teaching. The research subjects were 35 science instructors dispersed in 15 U.S. states. The results showed that, in an online experimental course, the collaborative learning of students and inquiry teaching degree of instructors significantly increased (Crippen, Archambault, & Kern, 2013).

In promoting Project ASK in the United States, Shymansky (2008) indicated that video conferencing fostered the professional development of science instructors at township elementary schools in two major U.S. states. Annetta and Shymansky (2008) revealed that video conferencing significantly affects the professional development of instructors. In promoting a virtual learning environment in the United Kingdom, Murphy and Beggs (2010) employed video conferencing to assist practice teachers and mentor teachers in jointly conducting teaching planning and discussions.

Coteaching

Buckley (2000) defined coteaching as a team of instructors collaborating toward a certain objective in designing a course, syllabus, and courseware, jointly instructing students, evaluating results, sharing viewpoints, and engaging in joint discussions. Abell (2000) observed that, when science instructors of elementary schools and college researchers perform coteaching, consensus among the science instructors is easier to achieve for teaching improvement. Roth and Tobin (2004) fostered coteaching between preservice instructors and in-service instructors. When teaching, preservice instructors are not required to emulate in-service instructors in teaching. Instead, more emphasis is placed on the personal experience of the preservice instructors, sharing the science teaching experience and learning process of the in-service instructors, and forming the theme of professional dialogue in instruction, thereby constituting a *cogenerative dialogue* related to teaching practice. Eick and Dias (2005) determined that, when instructors begin to implement exploratory teaching in the preliminary period, developing professional knowledge in exploratory teaching is easy if they engage in coteaching with other instructors implementing exploratory teaching. Murphy and Beggs (2010) stated that students who accept coteaching may have an obvious enhancement in science-learning attitude compared with those who accept conventional teaching.

Bacharah, Heck, and Dahlberg (2010) applied science coteaching at 14 elementary schools. The research showed that students who received coteaching demonstrated superior learning performance to their classmates who did not receive coteaching, particularly in reading and mathematics. Upadhyay and Gifford (2010) used science coteaching between an Asian instructor and science instructor to instruct Asian minority students in the United States. The students who joined this course reported that the coteaching performed by the Asian instructor and science instructor made them happier learning science. Jang (2007) used network technology to facilitate coteaching. The findings showed that such a method promotes the collaborative relationship among instructors and enhances the teaching capabilities of instructors.

However, coteaching requires two or more instructors jointly teaching in a classroom or laboratory. Such a method requires that all instructors participate in teaching. Instructors from different schools who intend to coteach must ensure that they can teach at the same time. Hence, conventional coteaching is often restricted by the schedule of instructors and administrative procedures.

System Architecture

In this study, the current video conferencing system was used at the Center for Teacher Education, National Changhua University of Education (NCUE) as an instruction and research platform. The current system connects five distant learning partner schools in Central and Southern Taiwan. Each of these five schools has video conferencing classrooms or laboratories equipped with fixed video cameras (Fig 1). This type of camera uses a local area network or wide area network and a control center to connect to partner schools. Web page remote control is used to operate the camera lens and view the video of the classroom. This remote control function can be used to move the camera direction, zoom in and out, and record sound and video during screen viewing. Each partner school can use the camera to connect to the NCUE or other partner schools and add other digital teaching equipment, such as projectors or electronic whiteboards, for video conferencing teaching activities.

Figure 1 Video conferencing Fixed video cameras

The other type is portable cameras that can connect to 3G/4G mobile networks. This type of camera provides greater flexibility when selecting teaching locations. Video conferencing connections can be made at any location, including parks, farms, or zoos, where a 3G/4G mobile communication network signal can be received (Figure 2).

Figure 2 Mobile Video conferencing video cameras

In addition to this video conferencing equipment, multipoint play and control software that can simultaneously display the screens of up to nine video conferencing cameras was used in this study. In other words, the researcher or instructors at partner schools could simultaneously view the video from up to nine cameras or switch to any camera and have two-way conversations with another research or instructor. The content of the conversations were recorded as audio or video files for subsequent examination and analysis. Figure 3 shows the multipoint play and control software.

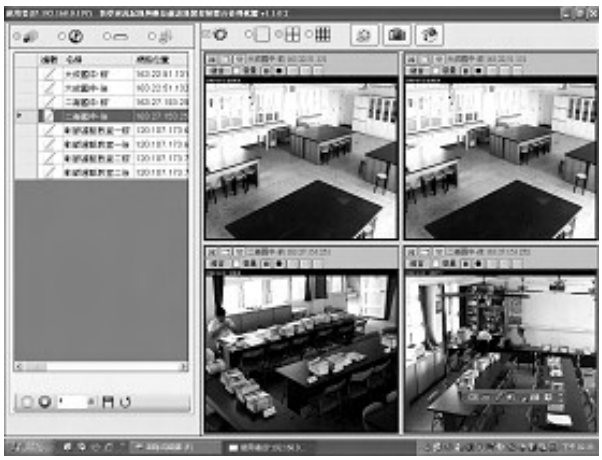

Figure 3 Multipoint play and control software

Subjects

The subjects of this research were two classes at a junior high school in Southern Taiwan. Each of the two classes comprised 36 students. The instructor who taught the classes was the school's science instructor (referred to as Teacher A). Another science instructor from a junior high school in Central Taiwan (referred to as Teacher B) was the video conferencing coteaching instructor. Teacher A specializes in chemistry, and Teacher B's field of expertise is in biology.

Implementation

Interdisciplinary coteaching was adopted in this study to implement the following steps:

Step 1: Teaching planning stage

First, two coteaching instructors and researchers meet for brainstorming sessions to determine the teaching content and objectives as well as develop a coteaching strategy and model. The instructors and researchers then create a teaching plan and schedule. First, the course contents and teaching times are decided. The coteaching times for the two instructors are then established. A study course is set up on the school's digital teaching web site to provide students and instructors with a platform for asynchronous online discussion and interaction after class.

This study proposes a type of distant coteaching method. By using a method that is similar to the "call out" model used for television shows, instructors and students can use video conferencing to achieve the highest interaction level and course integration objectives. For instance, the initial concept for the course design was to conduct coteaching of animal subjects in a science class. Teacher B, who specializes in biology, is highly knowledgeable about wild animals, and thus, the zoo can be used as a coteaching site by Teacher B. When Teacher A introduces the biology portions of the science class, supplementary materials for the course can be used. Using a video conferencing connection to Teacher B, Teacher B can introduce animal knowledge from the zoo and interact using video with the students and instructor.

Step 2: Teaching stage

Before the class begins, Teacher B uses a portable mobile camera at the zoo to establish a connection with Teacher A over a 3G/4G mobile network and performs system testing to evaluate the quality of the connection. After the class begins, Teacher A establishes a connection with Teacher B, who instructs the class according to the class schedule. For example, if buffaloes are being introduced in class, Teacher A connects by mobile video to Teacher B who is at the zoo. Teacher B first introduces information on buffaloes and then Teacher A turns the camera by using a remote control to the buffalo screen. Teacher A then explains some additional characteristics of the buffalo. Finally, Teacher B makes some final comments from the zoo and interacts through the camera with the students and instructor in the classroom. The students can ask Teacher B about further knowledge of the buffaloes and respond to the questions asked by the instructors. The video conferencing control software records the entire teaching process in real time for future study and data analysis.

During the course of instruction, the two instructors do not have clearly defined teaching missions and interact with all students in the class to encourage thought and discussion. Teacher A is like a host of a television show, and Teacher B is like a special guest to whom the program connects. The crucial part is that Teacher B must become immediately involved in the instruction and interact with Teacher A and the students. Merely providing a noninteractive introduction of the course material is insufficient. The aforementioned connection method can be used to establish a highly flexible video conferencing coteaching network. Figure 4 presents a diagram of the video conferencing coteaching framework.

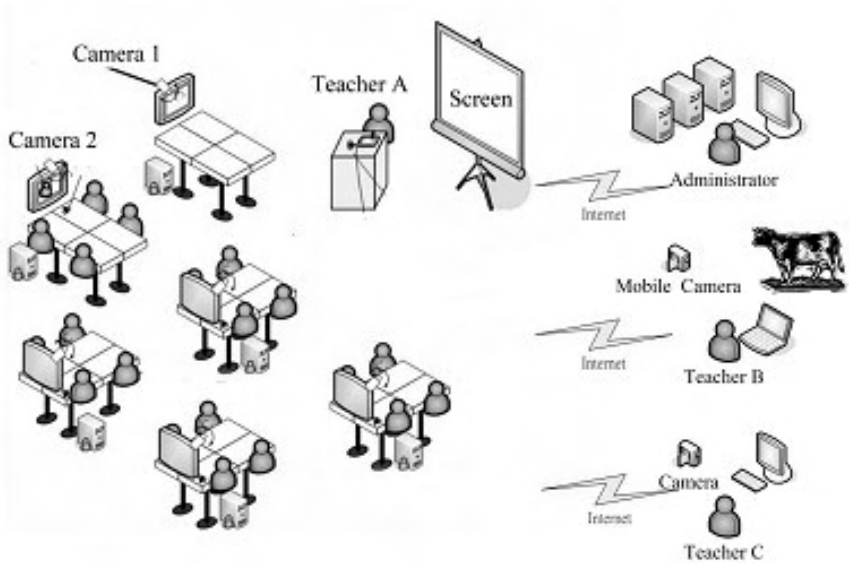

Figure 4 Video conferencing co-teaching framework

Step 3: Postteaching stage

After the class is completed, Teacher A divides the class into nine groups of four students and presents the students with two assignments. The first assignment requests each student to write an after-class report. After finishing the assignment, they send the report over the Internet to the teaching site. The second assignment involves searching for information on buffaloes on the Internet. Teacher A creates a discussion board on the Web site and students post the information that they have collected on the discussion site. First, an interactive discussion is held on the discussion site and then the final results are organized. Finally, the team leaders upload the assignment to the teaching web site. At the same time, Teacher B opens a discussion board on the teaching web site to interact with Teacher A and the students as well as to answer student questions and provide supplementary information. The students' study information on the teaching web site becomes information for future research.

Conclusions

The MVCC model for science coteaching proposed in this study applies mobile communication networks and video conferencing technology to enable science instruction to be conducted outside classrooms and laboratories such as at zoos, museums, farms, on beaches, or in forests. Through this type of instruction, students can be exposed to a diverse range of knowledge that can increase the scope of their knowledge and provide a more extensive science education. In addition, mobile video conferencing provides new opportunities for coteaching so that this instruction method is not limited to instructors and students at the same school. Students can receive instruction from instructors from other schools and have new study experiences. This study revealed more interschool cooperation among instructors with different specializations and more teaching resource sharing among schools, which positively benefits the professional development of instructors from remote school districts.

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MEANING AND APPLICATION OF EMPLOYEE VOICE

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Abstract

Meaning of employee voice has attracted several definitions without any agreement. Some scholars have suggested that voice is a difficult, non-predictable and elusive concept while to others it is simply participation of employees. The meaning of employee voice remains poorly understood in organizations. Understanding and interpretation of the concept is crucial as this will help policy makers, managers and scholars design effective policies and voice mechanisms that can help institutions achieve their goals. This paper looks at various definitions of employee voice, mechanisms used in organizations and its importance. Its implication is that further research is required in employee voice to help managers design effective voice mechanisms.

Key words: Employee voice, participation and mechanism.

1.1 Meaning of voice

The term "employee voice" elicits different understanding to both scholars and practitioners of human resource management. Some of the existing definitions that have been provided for voice are inconclusive as they reflect its application in organizations. Dundon *et al*. (2004) observe that employee voice as a concept has competing meanings. Employee voice covers all types of opportunities where employee can have their say and exert some influence over work place decisions (Boxall and Purcell, 2011). Employee voice is also defined as speaking up on important issues and problems in an organization by employees (Dyne *et al*., 2003). Dundon *et al.* (2004) give different definitions of employee voice; first, the expression of individual dissatisfaction raised with line managers or through grievance procedure; secondly, as the expression of collective dissatisfaction raised by trade unions through collective bargaining or industrial action; thirdly, contribution to management decision making process through upward communication, problem solving, suggestion schemes and attitude surveys; and lastly, through mutual partnership agreements, joint consultative committees and work councils.

Attempts to have a more conclusive definition of employee voice is by McCabe and Lewin (1992), they summarized voice as consisting of two elements, the expression of complaints or grievances in a work context by employees to management and the participation of employees in the decision-making processes or communication where there is an opportunity for employees and managers to exchange views about issues on an individual basis and through a collective consultation. Morrison (2011) summarizes employee voice as discretionary communication of ideas, suggestions, concerns, or opinions about work-related issues with the intent to improve organizational functioning. While Armstrong (2009) understands voice as a say that employees have at work comprising of involvement, participation, problem solving and communication. These definitions do not have a commonality. Is voice a broad concept whose meaning is better inferred from the context of its usage? Does employee silence also equal voice? With such questions not answered, voice usage may not be practical. Commonality in understanding employee voice is necessary to managers and policy makers for designing effective voice mechanisms in their organizations (Budd *et al*., 2010). Scholars too need to understand the concept as its usage may not correspond to conceptualizations in research. Further empirical methodologies on voice should be based on concepts. Such a situation may be problematic as theory will not be supporting practice rendering studies on employee voice purposeless. For now, meaning of employee voice remains according to how it is understood differently by different people.

Studies have been carried out to help in the understanding of voice and have shown different meanings. Study on the changing patterns of employee voice in firms in UK and Ireland done by Wilkinson *et al*. (2004) has shown that there is no particular pattern of employee voice used by organizations. The study revealed five broad ways in which managers spoke about employee voice in general. First, voice as

communication/exchange of views: an opportunity for employees and managers to exchange views about issues, generally on an individual basis but also through a collective consultation process. Second, voice as upward problem-solving: an opportunity for employees to provide feedback on specific topics hence not so much as a dialogue but more as a way of providing ideas to improve organizational performance. Third, voice as collective representation: an opportunity for employee representatives who can use union or non-union to communicate the views of the workforce to managers either through partnership or collective bargaining. Fourth, voice as engagement: a feeling on the part of staff that they are able to express their views to managers in an open environment and that management will provide support to allow this to happen. Lastly, voice as say about issues that is not only workers have opportunity to express but also expectation that their views will be taken by management and will influence how decisions are made. The study revealed that, most managers acknowledged a direct link between voice and organizational performance. About two thirds of the managers revealed change of behavior and attitudes in employees as a result of employee voice. The conclusion of the research indicates that voice promotes employee development, participation, flexibility, performance and reward within a framework of excellent communications.

The study by Dundon *et al* (2004) on meaning and purpose of employee voice in England, Scotland and Ireland had almost similar findings to that on the meaning of voice. The study was carried out in 18 different organizations through interview of senior managers revealed the following; first that voice is articulation of dissatisfaction expressed by an employee(s) and purpose is to rectify an existing problem within an organization. Secondly is an expression of collective organization whose purpose is to counter some power of management. Thirdly, voice is a contribution to management decision making that is meant to seek improvement in work organization quality and productivity. Lastly, voice is a demonstration of mutuality and cooperation relations that is meant to achieve long term viability for the organization. The study showed that purpose of voice varied substantiality among organizations.

Studies on voice recognize that it affects performance in organizations (Sako,1998; Morrison, 2011; Wilkinson *et al,*. 2004). Studies have also linked voice to retention of employees (Spencer, 1986). Dyne et al. (2003) observe that voice is used in the literature to represent the intentional expression of work-related ideas, information, and opinions. However, they also confirm that studies on meaning of voice or predicting voice are elusive. Whether this remains true or false is an area for further research.

1.2 Benefits of employee voice

Employee voice is a way of making employees an integral part the organization and it has a direct bearing on their performance. This is confirmed by Royer, Waterhouse, Brown, and Festing (2008). They argue that treating employees as stakeholders in the organization bears similar outcomes. Employees who have developed significant firm-specific human capital have invested in the organization and have earned voice just as shareholders. Providing voice to these employees provides a rationale for further emotional and human capital investment, with the same sorts of returns as noted by Wilkinson *et al*. (2004). Furthermore there is perceived linkage between employee voice and job satisfaction (Budd *et al*,. 2010)

Employee voice is a form of interaction and can be viewed as a process of organizational justice theory. Organizational justice theory relates to the perceived fairness of processes, outcomes and interactions within the decision making processes of an organization between management and employees (Tyler, 1987; Greenberg, 1990; Saunders, Thornhill and Lewis, 2002; Nowakowski and Conlon, 2005; Korsgaard *et al*.,1995). Organizational justice has its roots in the justice theories attached to theories of legal and organizational decision making and is comprised of three forms of justice (Rawls, 1999). First, distributive justice or the satisfaction with the outcome of a decision provides a measure of fairness for how justice is

distributed amongst the disputants. Second, procedural justice, or the satisfaction with the process used to reach a decision refers to the experience of fairness by the disputants (Deutcsh, 1985; Masterson, Lewis, Goldman and Taylor, 2000). Third, interactional justice, or the interpersonal treatment of the disputants which is believed to be a sub-component of procedural justice and indicates that the process must not only be experienced as being fair, but must also be accompanied by a sense of being treated with respect and dignity (Bies and Moag,1986; Tyler, 1991). Organizational Justice Theory suggests that employees will be satisfied if they feel that they are fully involved in the decision making process of the organization.

Voice at workplace may have a beneficial impact on quality and productivity and deflect on problems that might explode (Dundon *et al*., 2004). The degree to which voice is embedded in an organization is much more important than reporting collective schemes. The extent and the degree of voice is necessary for organization's success (Boxall and Purcell, 2011; Budd et al,.2010; Dundon *et al,*.2004; McCabe and Lewin,1992;). It is therefore important that the extent and degree of voice of workers within an organization should be known as this is believed to have effect on their performance.

1.3 Voice constructs

Voice mechanisms in organizations differ just as they are captured in definitions of voice. Armstrong (2009) says that employee voice can take the form of joint consultation which involves managers and employee representatives meeting on a regular basis in order to exchange views, make good use of members' knowledge and expertise and also to deal with matters of common interest. He explains that meaningful consultation takes place when managers tell employees what they want to do and they give employees enough time to respond, considering employees' views as well as response to views. The entire process should be within the existing systems of negotiation and representation. The common form of representation is trade unions, where employees form an organization to safeguard their interests (Freeman, 1976).

Freeman and Medoff (1984) indicate that trade unions provide workers with a collective voice in order to make their wishes known to the management. Mathis and Jackson (2008) consider four major areas that trade unions handle. First are matters relating to work environment which comprises staffing of employees, overtime and general working condition of the employees. Second are matters relating to pay such as inequitable pay, inadequate benefits and non-competitive pay. Third, unions handle matters to do with employee treatment at the work place such as unfair discipline, harassment and abusive treatment, job insecurity and lack of response to complaints. Lastly, unions address matters to do with management style such as fear, intimidation of employees, and lack of recognition in decision making process. Trade Unions have two major roles (Armstrong 2009), namely to secure improved terms and conditions for their members and to provide protection, support and advice to their members as individual employees. The other roles include providing legal and financial services to members whenever appropriate (Anyango *et al*,. 2013)

Employees normally find it necessary to form unions based on benefits and services that they offer to them. Bernadian (2008) says that unions achieve better wages for members, benefits and improved working conditions and this would mean that members in a union are more satisfied than non-union members. He says that non-union members experience strict supervision and strict job content which tend to create dissatisfaction. According to him, union members will be comfortable and compelled to stay in the organization because of better wages, health and insurance. According to Bernardin (2008), unions offer a voice to employees which can be used to develop rules that govern employees. However, these ideas have not been confirmed through research. The effectiveness within which unions achieve this will depend on several factors within which an organization operates. Employees' representatives in collective bargaining are involved in discussing issues of mutual concern with management. Union officials of both management and workers are involved in settling disputes, resolving collective grievances and representing members with

grievances or other disciplinary matters. Meaningful consultation takes place when management tells employees what they intend to do and then give them time to respond to proposed action. Management then gives responses to employees on the issues raised. Armstrong (2009) posits that management must believe and must be seen involving employees. Joint consultations operate only when managers are genuine in giving employees voice and advancing their interests. Marchington (1992) observes that joint consultation is one of the useful forms of employee voice.

Employee voice can also be determined through attitude surveys according to Armstrong (2009). Attitude survey is a way of getting information on preferences of employees and comparing commitment and morale in different parts of the organization. Attitude surveys constitute another form of non-unionized voice used by some organizations. Surveys can be done through interviews, use of structured questionnaires, combination of questionnaires and interviews and also through focus groups (Kelly *et al*., 2003). A focus group is a representative sample of employees whose attitudes and opinions are sought on issues concerning the organization and their work (Powell and Single, 1996). A focus group is structured, informed, constructive and confidential. The uses of attitude surveys are to provide information on the preferences of employees, give warnings of potential problem areas, and diagnose causes of problems and to compare levels of job satisfaction. Attitude surveys can be appropriate for managers in knowing how employees perceive their performance results and also taking care of their voices in the appraisal process (Taylor *et al.,*1995). Exploring the employee attitudes at work is important to creating an environment that is conducive for employee motivation (Wiley, 1997)

The third element of voice is the suggestion schemes. Suggestion schemes are the established procedures for employees to submit ideas to management with tangible recognition for those suggestions with merit (Armstrong, 2009; Moneim, 2009). Suggestions schemes are known to reduce feelings of frustration where employees feel they have good ideas that are not recognized in the formed channels of communication. Suggestion boxes or team leaders are used to encourage members of the team to give suggestions. However organizations should have a committee to vet suggestions so as to pick only what is appropriate. Participation is demonstrated when an employee plays a greater role in the decision making process by management giving employees the opportunity to influence management decisions and also to contribute to the improvement of organizational performance (Korsgaard *et al*.,1995). Involvement, on the other hand is when management allows employees to discuss issues that affect them in order to enhance organizational commitment. Employee voice can also be through communication channels within an organization (Dundon *et al*., 2004). Upward communication channels within organization provide avenues through which employees can express their views to management

Marchington and Wilkinson (2005, as cited in Armstrong, 2009) conceptualized a model of participation which particularly identifies all the relevant aspects of voice. The model captures four factors; first is the degree of involvement, which indicates the extent to which workers or their representatives are able to influence management decisions. This can range from merely being provided with information, through two-way communication, co-determination and control. Secondly, the scope of decisions open to influence by workers, relates to the type of subject matter dealt with in the participation arena, ranging from the trivial to the strategic. Thirdly, the level at which workers (or their representatives) are involved in management decisions, can vary quite substantially, ranging from workplace or departmental level through to establishment, division and headquarters. Lastly, is the different forms of voice, it may be direct or face-to-face, as is the case with many of the current employee involvement initiatives or it may be indirect as it occurs when trade unions represent workers on high-level consultation committees, or workers' councils, or through collective bargaining'. The model captures all important aspects in employee voice.

1.4 Conclusions

Employee voice has remained a difficult concept given different definitions and mechanisms applied by different managers. Studies on meaning or predicting of voice in organizations are also elusive. This calls for further research on the same to help improve its application in organizations.

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Provision of Education in a post-conflict country

A case of South- Sudan

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Abstract

While the world is experiencing an unprecedented period of peace in many countries and contexts, vast numbers of people are perishing in civil wars and from other diversities associated with failed and corrupt political systems. Countries on every continent suffer from poverty and insecurity, in part because of their political leaders' decisions and actions. Poor leadership can take a devastating toll on provision of social welfare and human security and dignity. Conflict has fundamentally distinct effects on education. Against the background of civil unrest it has become apparent that education for thousands of children is at stake and should be a major priority. As the world moves closer to Millennium Development Goals deadline, these goals especially goal number 2 and 3 will not be met by the deadline and we have no idea when, if ever, these goals will be achieved. The question is then, what will be done to start moving these numbers in the right direction, not just to fulfil the Millennium Development Goals, but because it is the right thing to do. This paper is a desktop review of education situation in South Sudan. It presents an overview of the primary education in south Sudan. Curriculum, teachers and financing shall be given attention in this paper among other issues

Key Words: Education in Fragile States, curriculum, Teachers, Financing, South Sudan, post-conflict

Background Information

War has been described as 'development in reverse'. Even short episodes of armed conflict can halt progress or reverse gains built up over generations, undermining economic growth and advances in health, nutrition and employment (UNESCO,2011). Despite all efforts by governments, civil society and the international community, the world has not achieved Education for All. There are still 58 million children out of school globally and around 100 million children who do not complete primary education. Inequality in education has increased, with the poorest and most disadvantaged shouldering the heaviest burden (UNESCO, 2015). Conflict remains a steep barrier, with a high and growing proportion of out-of-school children living in conflict zones. More than 172 million people globally were estimated to be affected by conflict in 2012 (UNESCO, 2015). Nicolai et al., (2014) notes there is a major challenge in addressing or analysing education in emergency situations. This is because there is lack of evidence on the educational and economic costs of disruption of school-age populations at the country level. Yet even without discreet data and evidence it is clear that education systems are disrupted during conflict and especially in protracted conflict countries. Conflict affects education directly and indirectly. The proportion of out-of-school children living in conflict-affected countries increased from 30% in 1999 to 36% in 2012.Based on the trends of the past five years, 57 million children are projected to be out of school in 2015 (UNESCO, 2015). These statistics give the government a compelling reason to actand lessen the burden and sufferings of the majority of the poor children who are the major victims. In the absence of solutions conflict crisis

threatens to jeopardize the Education for All goals adopted in 2000. A conflict can also transmit damage to the future because education is so central to progress in other areas, such as child survival, health, economic growth and conflict prevention (UNESCO, 2011). UNESCO (2011) notes that armed conflict is destroying not just school infrastructure, but also the hopes and ambitions of a whole generation of childrennot only in South Sudan, but in all conflict b-affected countries.

South Sudan Focus

South Sudan is the world's newest state, emerged out of a long national liberation struggle, and is now facing significant internal conflict since December of 2013.South Sudan has a troubled history, most of it characterized by domination by external powers, which has resulted in disfranchisement and underdevelopment, a situation that has gone on for centuries. This dark history has involved various kinds of subjugation, including Egyptian domination, slave trade and attempted forced conversion to Islam. The British colonialists then dominated the region with most of the South isolated from the North. However, there was hope that at independence the region would be integrated with the rest of British East Africa. But the independence of Sudan in 1956 brought even further domination of the South with most administration positions in the South occupied by the northerners and the dream of joining the rest of East Africa completely lost. The South at that point thought that the only way to resist domination was some level of provincial autonomy, warning that failure to win legal concessions would drive the South to rebellion. But by 1955, the seeds of rebellion had already been sown and southern army officers anticipating marginalization by the North, mutinied and formed the Anyanya (snake venom) guerrilla movement to demand justice, recognition, and self-determination, from the North. As expected, at independence on 1 January 1956 the new constitution was silent on two crucial issues for southern leaders: the secular or Islamic character of the state, and its federal or unitary structure. This scene shadowed the country for the next half a century when the North in 1958 began instituting a policy of 'Islamization' and reneged on the implementation of a federal system that would have guaranteed autonomy for the South
The Anyanya I war lasted until March 1972, when it ended with the signing of the Addis Ababa Peace Agreement with Sudan under General Nimeiri granting limited autonomy to the South, which ushered in a ten year period of peace for Southern Sudan. But in May 1983, continued marginalization and Islamization accompanied by the introduction of Sharia Law by President Nimeiri prompted a group of soldiers led by Colonel Gerang to revolt against the Sudan Army and eventually form the Sudan People's Liberation Army (SPLA). This episode of the war lasted up to 2003 when the SPLA/M and the Khartoum.In 2005, the Comprehensive Peace Agreement (CPA) signed in Nairobi, Kenya on 9 January 2005.

This brought an end to the 22-year conflict between the North and the South, culminating in the January 2011 referendum and independence on 9 July 2011. South Sudan is a young country with half (51%) the population under the age of eighteen and 72% under the age of thirty. It has a population of 8.3 million according to the Fifth Sudan Population and Housing Census (2008), of which 1.4 million live in urban areas, while 6.9 million live in rural areas. The population is currently predominantly rural (83%) and dependent on subsistence agriculture. Poverty levels are exceptionally high. Oil revenues create the misleading impression that South Sudan is a country with relatively high levels of per capita income. In fact, over 80 per cent of the population is estimated to live below the international poverty threshold of US$1.25 a day (UNESCO, 2011). One of the characteristics of fragile or post conflict states is inability or unwillingness of the state authority to deliver to the majority of its people such core functions as security, protection of property, basic services and essential infrastructure(UNESCO,2011). Education is one such basic service; access to quality education itself is seen both as a basic human right and a means to fulfilling other rights (Brookings, 2007).

Education in South Sudan

In a post conflict country education should be a core element of the peace premium and it is normally one of the main priorities. Recent studies show that communities in south Sudan see education as the most important peace dividend (GoSS, 2012). Across South Sudan demand for education is high and rising. Education has a crucial bearing on prospects for peace, productivity and progress in public health and overall development. Without the expansion of broad-based, equitable learning opportunities, South Sudan will not generate the economic dynamism – or produce the doctors, nurses, teachers, engineers and entrepreneurs – needed to build shared prosperity and advance human development (GoSS, 2012).

The primary sector last 8 years from P1 to P8, number of primary schools in South Sudan is 3,639, where 70% primary schools are government-owned. Progress in education mirrors wider developments since the peace accords of 2005. There have been recorded important advances, albeit with marked disparities across states. As in other areas, it is difficult to develop a clear picture of the state of education because of data limitations. Those limitations start with basic demography. The 2008 census for the whole of Sudan recorded a population of 8.3 million in southern Sudan (though the Government of South Sudan (GoSS) does not accept thisfigure). Since 2005 probably over 2 million refugees and IDPs have returned to southern Sudan, many suffering secondary displacement since arriving. Current population estimates range between 9 million and 14 million. There is also considerable uncertainty over the age profile of the population, though the average age of the population is very young –probably around half of the overall population is under the age of 18. These uncertainties imply that data on school enrolment, and particularly net enrolment should be treated with extreme caution

South Sudan's education indicators remain among the worst in the world despite increases in school enrolment over the past few years (IRIN ,2012),It ranks second lowest at44 % out of 123 countries on net enrolment rates for primary education, bottom of the ranking at 4% for 134 countries with enrolment datafor secondary education, and bottom of the global league for gender parity in primary education where for every 10 boys there are 7 girls and 5 girls for every 10 boys in secondary schools,. It is estimated that more than one million primary school aged children, mostly from rural areas, are not in school, while the few schools that do exist are not conducive to learning. The completion rate in primary schools is less than 10 per cent, one of the lowest in the world. It is important to note that access to pre-primary education is which is supposed to be feeding the primary sector is even worse than primary education.Only two per cent of pre-school aged children are in early childhood development programmes (UNICEF, 2012).The increase in the demand for education by returnee children who have been arriving in the country since late 2010 compounds the infrastructure issues. The already stretched and under-resourced system now has to contend with additional children, placing a further strain on the limited resources. Gaps between the gross enrolment ratio and the NER point to a large over-age population in primary school. This is because most children enter school late. Children attending classes at the appropriate age for their grade are a small minority –almost 90% are over-age(UNICEF, 2012).

The quantity and quality of teachers in South Sudan remains unknown. GoSS (2012) reports between 7,500 and 15,000 of South Sudan's teachers are untrained. Just over 2,000 have a diploma certificate. Reports from the government of South Sudan indicate that by 2013, national total numbers of students were 1,311,467 with an average number of teachers at 13,261 Primary School Teachers, 47% Primary School Teachers Trained;with the increase in enrolment since the 2005 peace agreement; the pupil-to-teacher ratio has risen to 50:1 (GoSS, 2012) . Among the teachers only 12 % are female teachers. This obviously can have a negative impact on the enrolment and retention of the girl child and other gender related disparities. The vast majority of these untrained teachers also work under extraordinarily challenging conditions.Enrolment has grown rapidly; student: teacher ratios at the primary level have grown steadily worse; physical facilities have not kept pace with demand; there is a shortage of teaching and learning materials; teachers are frequently underpaid or received their salaries with a 2–3 month delay, leading to strikes and even violence in some states.

Challenges of Provision of Education

The impact of armed conflict on education has been consistently and systematically underestimated. Education systems cannot be fully insulated from the effects of violence. However, current patterns of violence, with armed parties actively targeting children and schools, are destroying opportunities for education on what may be an unprecedented scale (UNESCO, 2011). Despite the positive developments in the education sector, major challenges exist that may hinder the achievement of the MDG target on education in all parts of South Sudan. Much is left to be done regarding coverage, efficiency, quality, equity and relevance. Some of the challenges include**:**

Dropout Rate

In South Sudan, most children enter school late. Gaps between the gross enrolment ratio and the NER point to a large over-age population in primary school. Children attending classes at the appropriate age for their grade are a small minority. Reports quote almost 90% of all the students as over-age. Literature points to evidence that there is a strong association between delayed entry into primary school and risk of drop-out (UNESCO, 2011). That risk is particularly pronounced for young girls, notably in environments characterized by early marriage and a household division of labour that places extensive demands on the time of adolescent girls. A large number of children had never attended a school or had to leave school due to the two decade civil war. After the war, they re-entered school while over-age. As a result, they often drop out before completion of the primary school cycle. This is particularly true of girls.

Dropout rate Per Class in primary between 2010 and 2011

Primary Level	%
P1-P2	21
P2-P3	15.9
P3-P4	18.6
P4-P5	31.9
P5-P6	31.2
P6-P7	29.3
P7-P8	20.0

Source:GoSS, 2011; UNESCO, 2011

Quantity and quality of Teacher

A teacher's role involves more than simply standing in front of a classroom and lecturing. In fact, even though a teacher spends the majority of the day in the classroom, the actual teaching component is only part of the job. No education system is better than its teachers. Years of conflict in South Sudan have not allowed for consistent training of teachers.After conflict, the supply of teachers especially trained teachers is unlikely to keep pace with the demand generated by a return to school (UNESCO, 2011). Teacher recruitment, training and deployment require long-term planning even in stable and progressing countries. Due to protracted conflict, many of the trained teachers have left South Sudan either for other government jobs, local and international organizations or have left the country. Many also have become internally displaced over the period of conflict. Only 45% of the teachers working in South Sudan are considered trained and 40% are primary school leavers. The student teacher ratio (STR) is 50.1. However, many teachers working in South Sudan are volunteers, waiting for recruitment of paid teachers. Teacher absenteeism is common and this hampers student learning.

Infrastructure

The experience of South Sudan cautions against understating the importance of physical infrastructure and teaching materials in any education narrative. There is a continued international dialogue on policy approaches which emphasis quality of teaching and learning outcomes in the achievement of Education for All. South Sudan is still struggling with access and therefore a consideration of school inputs should be a major concern for both the government and development partners. Major inputs such as classrooms, books, blackboards and desks are needed urgently. Continued localized conflicts in several counties have greatly contributed to children being displaced from their communities and moving to areas where access to schooling is not assured. This has continued to strain the already inadequate physical infrastructure and lack of resources for training and/or recruiting teachers.Classroom shortages are pervasive. According to World Bank-Global Partnership for Education (2011), One third of the children 'in school' are being taught in the open air and another quarter in semi-permanent or basic classrooms. The average pupil classroom ratio is 134:1.Provision of latrines and safe drinking water is limited , with the 2009 EMIS reporting just half of schools having access to both facilities. Textbooks are in short supply, with an average pupil textbook ratio of 1:4 rising to the worst case scenario of 1:9 in some parts of the country.

Language and Curriculum implementation

UNESCO (2011) highlights the value of language in post-conflict situations. The report notes that, "No issue better demonstrates the tough choices facing post-conflict governments than approaches to the language of instruction. Language is a vital component of identity. It is central to how people and countries define themselves. The language of instruction in school is one of the vehicles through which identities are forged. In some countries, governments have used the education system to promote a 'national language' aimed at creating a sense of national identity. Yet in some contexts, this approach might be seen as an undermining identity and reinforcing subordination of ethnic minorities.

South Sudan is making the transition to an English language education system. The government has also established English as the medium of instruction. It is already the dominant language of instruction in the first and second years of primary school, with just one-third of schools reporting mother tongue as the primary language for teaching. However, many of the country's trained teachers and better-educated adults learnt in Arabic, rather than English. Different curricula are used in different parts of the country, reflecting past adaptations by local communities to the long-running civil war. While national data is limited, partial evidence points to high levels of teacher absenteeism and low levels of instructional time. Unsurprisingly, the majority of schools and teachers do not currently cover the syllabus they are expected to teach (World Bank-Global Partnership for Education , 2011),

There are shortages of English-language text books in South Sudan. Textbook shortages compounds the problems associated with early learning in a language other than the mother tongue. Complicating matters is the fact that South Sudan has decided to switch from offering instruction in Arabic, which is associated with the north, to teaching in English. This tends to threaten and compromise curriculum reform.Another major challenge in curriculum implementation is that a large part of the South Sudan population is semi-nomadic and this prevents them from attending formal schooling (GoSS, 2012).

Way Forward

Long-term reconstruction of education in South Sudan depends on the development of effective national education planning systems. This is a process that has to start early, even against the backdrop of an unstable political environment, and continue through progressive stages. As the country move along the planning continuum, the challenge is to develop policy instruments that link goals to the provision of inputs, the development of institutions, and national financing strategies and involvement of all the education stakeholders including the parents.

The future of education in South Sudan should be focused on multidimensional approach. Since 2009, theGoSS is embarking on education reconstruction with limited resources but a high level of ambition. Its strategy reflects a strong commitment to the MDGs and wider Education for All goals, and the recognition that education plays a key role in enabling economic growth and human development. The education sector strategy in South Sudan is a work in progress. The period since the 2005 peace agreement has been one of intensive policy development, with the GoSSsetting broad goals and priorities in the South SudanDevelopment Plan (SSDP), the Ministry of education settingbudget priorities, and an Education Sector Strategic plan(ESSP) under preparation. The SSDP aims by 2013 to increasethe primary school net enrolment ratio (NER) from 46% to63%, to double the secondary NER from 4% to 8%, and toexpand the coverage of literacy and alternative educationprogrammes.

Among the key provisions:

- *Teacher recruitment*:the available data reports that GoSS aims to recruit anadditional 23,400 primary school and 1,400 secondary schoolteachers, and to reduce the qualified teacher-to-studentratio from 1:117 to 1:50 by 2013.
- *Teacher training*: The aim is to provide in-service and pre-service training for an additional 7,000 primary school and 900 secondary school teachers.
- *Textbooks:* The aim is to reduce the ratio of textbooks to primary school children from 4:1 to 1:1 by 2015 for both primary and secondary school. This will require an additional 5.6 million primary school textbooks and 576,000 secondary school books.
- *School and classroom construction*: Targets set for 2013 include the construction of 4,000 primary school classrooms with latrines, 800 community girls' schools and 80 girls' boarding schools, along with 67 secondary schools (and 10 "model" secondary schools, one for each state
- *Strengthening equity and school retention*: The capitation grant for primary and secondary schools has been set at $2 per student, for both primary and secondary school; with provisions made for bursaries of $75 for 5,000 girls

Conclusion

Education is more than just a fundamental right; it helps pave the way to a successful and productive future. The country still faces a daunting state-building task that necessitates laying solid foundations in order to ensure a sustainable future. Two decades of war have destroyed the education system leaving limited poor institutional support mechanisms to deliver quality education. As the deadline for millennium goals ends in 2015, Republic of South Sudan remains with some of the world's worst indicators for education. Education is undoubtedly the base for reconstructing sustainable development for South Sudan.

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The Effect of Cognitive Therapy on Weight Loss in Women

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Abstract

Obesity is a persistent health problem. The literature suggests cognitive therapy is a beneficial addition to diet and exercise used to promote weight loss. Thisarticle describes an evidence-based practice change project that occurred over a seven week period. Participants werewomen over the age of 30 with a body mass index (BMI) over 25. Participants attended six, weekly group presentations introducing cognitive behavior techniques to be implemented with a balanced diet. Evaluation of the practice change compared week one weights and BMIs with week seven. Implications to clinical practice could be reduction ofobese and overweight women.

Keywords: women, obesity, overweight, cognitive behavior therapy, diet, exercise

Linear time trend forecasts suggest that by 2030, 51% of the population in America will be obese (Finkelstein et al., 2012). Given the relationship between excess weight, poor health, and high medical expenditures, successful cost containment efforts will need to address obesity (Finkelstein et al., 2012). During the last century, women seem to be busier than any other time in history, many caring for families, extended families, and working one or more jobs. Making time for a healthy meal and exercise seems impossible. According to the American Congress of Obstetricians and Gynecologists (2011), approximately two out of three women in the age range of 35–65 in the United States are overweight. Women have about 25% body fat, compared with 15% for men. This extra fat makes it easier for women to gain weight and harder to lose it.

1. Background Information/Significance of the Problem

According to the Centers for Disease Control and Prevention (CDC) (2008), overweight and obesity are labels for ranges of weight that are greater than what is generally considered healthy for a given height. The terms also identify ranges of weight that have been shown to increase the likelihood of certain diseases and other health problems. Overweight is defined as a body mass index (BMI) between 25-29.9 while obesity is defined as BMI of 30 or greater.

According to the CDC (2008), over 60% of U.S. adult women are overweight. Many women are consumed by the number on the scale and are not familiar with BMI. Being overweight increases the risk of coronary artery disease, cardiovascular disease, stroke, type 2 diabetes, hypertension, asthma, arthritis, gallbladder disease, certain types of cancer, and infertility (US Department of Health & Human Services, 2009). Treatment of these disorders translates into health care dollars. According to the CDC (2010) the medical costs associated with obesity are staggering, totaling approximately $147 billion in 2008.

The current best evidence demonstrates that clinical practice in the treatment of overweight and obesity is failing. In order to determine that a practice change is necessary, it is important to assess what type of practice is occurring. In a survey completed by 620 physicians, lack of physical activity along with overeating a high fat diet were identified as the most important causes of obesity (Foster et al., 2003). Accordingly, Phelan, Nallari, Darroch, and Wing (2009) found, from a survey of 188 physicians, that the most common strategies recommended for weight reduction was increasing physical activity, reducing consumption of fast foods, reducing portion sizes, and reducing soda consumption. Less likely to be recommended was regular self-weighing, recording food intake, and temptation control.

2. Supporting Evidence for Practice Change

According to Teixeira et al. (2009), long term behavioral self-regulation is the hallmark of successful weight control. In a one year study of 225 overweight and obese women, the researchers found that decreasing emotional eating behaviors and adopting a flexible dietary restraint pattern were critical for sustained weight loss. Texiera et al. (2009) found that the majority of variables, especially eating related factors such as cognitive restraint, emotional eating, and eating self-efficacy predicted weight loss change immediately after the intervention. Long term outcomes at the two year follow-up were more associated with exercise self-efficacy behaviors.

In a similar study, Stahre, Tarnell, Hakanson, and Hallstrom (2007) compared cognitive therapy with psychoeducation and monitored weight loss up to 18 months. The control group had a mean weight loss of 0.7 kg at the end of the program and an increase of 0.3 kg at 18 months. This study was significant for several reasons. The dropout rate was low during the treatment phase suggesting that participants found both programs acceptable. The long term efficacy of cognitive treatment suggests that it was satisfactory. With the group format and short term duration, the cognitive program could be attractive from a cost-effective standpoint (Stahre et al., 2007).

In a larger study of 105 obese patients, Stahre and Hallstrom (2005) concluded that cognitive group treatment was highly acceptable among the participants. The project was completed by nearly all the participants. The 10 week treatment program resulted in an average weight loss of 8.5 kg. At 18 months the average weight loss was 10.4 kg, demonstrating that short term treatment with cognitive therapy had lasting results.

Three meta-analyses related to cognitive behavior therapy and weight loss were identified. Anderson, Konz, Frederich, and Wood (2001) in a review of 29 studies concluded that a combination of very low energy diets combined with behavior modification represents an important advance in enabling obese individuals to initially lose substantial amounts of weight. They also concluded that more research is needed to enable most individuals to sustain lifestyle changes in physical activity and food choices for successful weight maintenance. Lin, O'Connor, Whitlock, and Beil (2010) reviewed 73 studies in an effort to assist the U.S.

Preventative Services Task Force in updating previous recommendations on dietary counseling and physical activity to reduce cardiovascular disease. They concluded that high intensity counseling on lifestyle choices to improve diet or increase physical activity changed health behaviors and was associated with small improvements in adiposity, blood pressure, and lipid levels. Lastly, Spahn et al. (2010) reviewed 214 articles regarding behavior change theories and strategies in nutrition counseling to facilitate health and food behavior change. They concluded that strong evidence exists to support the use of cognitive behavioral theory in facilitating modification of targeted dietary habits, weight and cardiovascular and diabetes risk factors. In review, most studies agreed that cognitive therapy has a beneficial effect on the treatment of obesity in both the short and long term treatment.

3. Framework for Evidence-Based Practice Change

Changing clinical practice is complex. According to Malloch and Porter-O'Grady (2006), this is a new world for clinical practice. The mechanisms upon which we once depended for clinical decision-making, practice application, and documentation are passing. The challenge for clinical leaders is to introduce a framework for evidence-based practice and transform the approach to health care delivery (Malloch & Porter-O'Grady, 2006). In the past, clinical decisions relied on clinical experience, expert opinion, collegial relationships, pathophysiology, common sense, community standards, and published materials. Evidence-based practice (EBP) uses the same sources of clinical advice, but passes all of them through the filter of a question, "On what evidence is the advice based?" (Malloch & Porter-O'Grady, 2006, p.9). Because practice change is complex, many models have been developed to systematically guide the implementation of evidence-based practice (Melnyk & Fineout-Overholt, 2011). The organizational framework for this project is based on the conceptual model of cognitive behavior by Beck, the theoretical underpinnings of Pender's Health Promotion Theory, and the Model for Evidence-Based Practice Change.

The Cognitive Model, developed by Beck in the treatment of depression, proposes that dysfunctional thinking is common to all disturbances (Beck, 1976). The model hypothesizes that people's emotions, behaviors, and physiology are influenced by their perception of events (Beck, 2011). Simply stated there is a situation or an event that produces automatic thoughts that provoke a reaction (Beck, 2011).

Pender et al. (2011) revealed that each person has unique personal characteristics and experiences that affect subsequent actions. This mirrors the core values central to the cognitive behavior model. The behavior-specific cognitions in the health promotion theory are considered to have major motivational significance and formulate a "core" for intervention because they can be modified (Pender et al., 2011). These cognitions include perceived benefits and barriers to change, perceived self-efficacy, activity-related affect, interpersonal influences, and situational influences (Pender et al., 2011). In the health promotion theory, these variables are the target of nursing intervention because they are amenable to change, closely related to the basic concept of the cognitive behavior model principle number six. The third aspect of the health promotion theory is behavioral outcomes (Pender et al., 2011). According to the theorist, behavioral outcomes requires a commitment to a plan of action in a given time frame with identification of strategies to eliciting, carrying out, and reinforcing the behavior consequences.

The Model for Evidence-Based Practice Change was developed by Maryanne Russwurm and Jane Larrabee in 1999 and later revised by Larrabee (2004). There are six steps to the Model for Evidence-Based Practice Change. Each step has tasks that require skills in research, quality improvement, communication, organization, critical thinking, and use of team work tools (Larrabee, 2004). Steps include assessing the need for practice change and identification of the problem; collecting and critically analyzing the best evidence; designing, implementing, and evaluating practice change; and lastly, integrating the change into practice (Melnyk & Fineout-Overholt, 2011).

4. Purpose of the Project

The purpose of this project was to help women recognize sabotaging thoughts related to weight and diet and promote healthier changes that coulddecrease rates of overweight and obesity. The driving question in this project was: *Does group cognitive therapy affect weight loss outcomes in overweight/obese women?*

4.1 IRB Approval

To protect potential participants, the project needed to be reviewed by the agency Institutional Review Board (IRB) for safety and confidentiality purposes. An expedited IRB application was submitted and approved.

4.2 Practice Setting/Population

The idea for the practice change was generated through an expressed frustration among the providers in the clinical practice with the inability to assist women in losing weight. Many patients had tried multiple diets without obtaining lasting results and would ask the providers for help losing weight. Participants would be patients of the gynecology practice over the age of 30 with a BMI over 25.

5. Project Design

A sign was posted in the waiting room for one week asking anyone over the age of 30, and overweight who would like to participate in a 6 week weight reduction project to take the letter of information and inform the nurse when entering the exam room for their scheduled appointment. If they expressed interest, weight, height, and BMI were collected and calculated, and documented. The patients were contacted by phone, inviting them to participate if they were over age 30 with a BMI greater than 25. Participants meet individually with the project implementer during week one to discuss the project and sign the consent form. A brief diet history, weight, height, and calculation of starting BMI were obtained. Each week the participants attended a 60 minute group session with a PowerPoint presentation given. Handouts of the presentation were also given with room for note taking. Topics such as: journaling, self-talk, developing response cards, diet selection, schedule planning, and identification of thinking patterns were reviewed and discussed.

Participants were allowed to choose their own diet as long as it was healthy and well balanced. With behavior change, any well balanced diet may be beneficial, because the change is in the behavior, not necessarily the components of the diet. Initiating the chosen diet started following week two. This allowed the participants to obtain some cognitive tools for success prior to starting the diet. At the end of the six weeks, the participants met with the project implementer individually to obtain weights, and heights, calculate ending BMI, and complete a short survey.

6. Plan for Project Evaluation

To determine the effectiveness of the project, the initial measures of weight and BMI (week one of the project) would be compared to the week six weights and BMI.Pre and post weight comparison would be made using the paired *t*-test set at a two-tailed <0.05 significance. It was expected that there will be a small reduction in both weight and BMI given the short length of actual time dieting with the addition of cognitive therapy tools. All participants would be weighed using standard balanced scales. Weight and height measurements were obtained on the same scale and BMIs would be calculated using those measurements. In addition, the participant survey from week six would be collected and analyzed.

To be included in the data, participants would have to attend four of the six presentations. Options for make-up sessions would be provided in order to maintain the cohesiveness of the group. In order for the project to be deemed successful, the majority (>50%) of the participants would lose weight and the survey would report utilization of the cognitive behavior techniques and satisfaction with the intervention.

7. Results

No formal measurement tool was utilized during the evaluative stage of this project. Instead, statistical data was entered into a tabular format and comparisons were made. The comparison of interest for this project was week one weight and BMI compared to week six weight and BMI. Additionally, survey results were reviewed for overall acceptance of the intervention. Prior to this practice change, the only treatment of overweight and obesity used in the practice was diet and exercise counseling.

There were 27 patients that responded to the sign posted in the office. Of the 27 patients, 26 met the criteria of age and BMI. In order to be included in the evaluation, patients had to attend four of the six PowerPoint presentations and complete the final weight, for BMI calculation, and the post survey. Of the 26 patients that met the initial criteria, 21 patients (81%) met the criteria to be included in the evaluation.

The findings from the data evaluation can be found in **Table 1**. The mean pre weight was 202.33 (45.44standard deviation) and the mean post weight was 196.8095 (45.6439 standard deviation). Using the t-test for comparison from pre to post weight, the mean weight loss was 5.52 (two-tailed p-value <0.0001). Nineteen of the 21 patients (90.5%) demonstrated a weight loss. One patient stayed the same and one patient gained weight (3 pounds). The range of weight loss was 3-12.25 pounds. This corresponded to a reduction in BMI in those 19 patients. Of particular note, a participant had a reduction of BMI to the healthy category. The two-tailed P value was less than 0.0001 which by conventional criteria, is considered to be extremely statistically significant. The mean of Pre minus Post equals 5.52 which indicated a 95% confidence interval. In addition, the completion survey demonstrated overwhelmingly positive responses to the use of cognitive therapy as shown in **Table 2**.

8. Discussion

It was discovered during the diet histories obtained that the patients had tried a multitude of diets without lasting success. It was also revealed that primary care encounters regarding weight loss were often prompted by the patient, not the provider, and often included a lecture on low fat, low cholesterol diets and an exercise regimen. In this evidence-based project utilizing cognitive behavior techniques in addition to diet and exercise, a weight loss was experienced by 90.5% of the patients and 81% of patients completed the project. Additionally every participant (100 %) demonstrated satisfaction with the cognitive behavior interventions.

The findings of the data collected during this evidence-based practice change project were comparable to the findings presented in the literature review and proved the efficacy and significance of using cognitive behavior therapy techniques as an addition to diet and exercise to promote weight loss in women. Stahre in two separate studies (2005, 2007) found cognitive behavior techniques beneficial to traditional weight loss treatments of diet and exercise in both short term and long term settings, and also was reviewed to be an acceptable intervention due to the low drop-out rate.

9. Limitations

A limitation that was identified early in the project was the possibility of limited number of patients to participate in six consecutive sessions. If the project were to be replicated, posting the sign for longer than a one week time frame would allow for more responses from the patients wishing to participate.

10. Implications for future nursing practice

At the completion of the project, several ideas and recommendations were developed including the possibility of replicating the project, and allowing more time for patient responses to participate. The project was viewed as a starting point for practice change in this particular setting and patient population. The reimbursement aspect will need to be further investigated in order for primary care providers to allot time for this intervention in their practice schedule.

Translating evidence that will improve patient outcomes is the priority of nursing practice. Advanced practice nurses practicing in primary care are in the position to recognize and treat overweight and obese patients. Current practice can be improved through the inclusion of cognitive behavior techniques as a treatment modality to promote better diet choices and to increase exercise. On a larger scale, the dissemination of such evidence allows for evidence-based practice change, locally, nationally, and globally.

Table 1
Pre and Post Intervention Weights and BMIs

Participant	Pre Intervention Weight	BMI	Post Intervention Weight	BMI*	Weight Change (lbs)
1	223.25	42.2	219	41.4	-4.2
2	228.5	35.8	223	34.9	-5
3	221.25	40.5	209	38.2	-12.25
4	213	36.6	209	35.9	-4
5	183	27.8	175	26.6	-8
6	137	26.8	130	25.4	-7
7	160	29.3	155	28.3	-5
8	172	29.5	168	28.8	-4
9	224	35.6	227	36.1	+3
10	240	41.2	228	39.1	-12
11	193	26.9	185	25.4	-8
12	300	53.1	292	51.7	-8
13	145	26.1	135	24.3	-10
14	154	25.6	150	25	-4
15	147	27.8	143	27	-3
16	200	36.6	200	36.6	0
17	244	38.2	240	37.6	-4
18	295	53.1	291	52.4	-4
19	219	34.3	215	33.7	-4
20	180	28.2	177	27.7	-3
21	170	29.2	162	27.8	-8

*BMI range = Normal 18.5-24.9, Overweight 25.0-29.9, Obese > 30

Table 2
Completion Survey Results

Survey Question	Response (%)
1. Did you use the cognitive techniques with your diet choice?	Yes (100%)
2. Did you find them helpful in maintaining your diet choice?	Yes (100%)
3. Do you think it is likely you will continue to use the newly learned techniques as you continue your diet choice?	Yes (100%)
4. Did you find the techniques easy to implement?	Yes (100%)
5. Do you feel like you will now be better able to make better/healthier food choices consistently?	Yes (100%)

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A CORRELATION STUDY OF SECONDARY STUDENTS ACADEMIC ACHIEVEMENT IN CHEMISTRY AND THEIR SCIENTIFIC CREATIVITY IN CHEMISTRY

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ABSTRACT

The present study is an attempt to study secondary school students' academic achievement in Chemistry in relation to their scientific creativity in chemistry. Simple random sampling technique is used in the selection of sample. In the present investigation a sample of 721 higher secondary students from 4 counties in Kenya were selected. Two validated tests were used; Chemistry Achievement Test (CAT) was used to assess student's academic achievement while the Chemistry Scientific Creativity Test (CSCT) was used to asses learners scientific creativity in chemistry. Results showed that there is a positive and significant correlation between academic achievement in chemistry and scientific creativity in chemistry.

KEY WORDS:

Academic Achievement, Scientific creativity, Chemistry.

INTRODUCTION

The concept of creativity has been used frequently in various fields of study with different meanings. According to Treffinger, Young, Selby and Shepardson (2001) creativity is the ability to generate ideas digging deeper into ideas, openness, and courage to explore ideas and listening to one's inner voice. It is an open exploration or search for ideas in which one generates many ideas (fluency in thinking) varied ideas and new perspective (flexibility) and unusual or novel ideas (originality). Creative individuals are divergent thinkers (Guilford, 1959). Guilford performed important work in the field of creativity, drew a distinction between convergent and divergent production (commonly renamed convergent and divergent thinking). Convergent thinking involves aiming for a single, correct solution to a problem, whereas divergent thinking involves creative generation of multiple answers to a set problem. Divergent thinking is sometimes used as a synonym for creativity in psychology literature. Divergent thinking is taken to be the cognitive to generate ideas (Treffinger, 2002).

Other researchers have occasionally used the terms flexible thinking or fluid intelligence, which are roughly similar to (but not synonymous with) creativity. Some see the conventional system of schooling as "stifling" of creativity and attempt (particularly in the pre-school/kindergarten and early school years) to provide a creativity-friendly, rich, imagination-fostering environment for young children. The measurable characteristics associated with general creativity are fluency, flexibility, originality, elaboration and metaphoric thinking. (Guilford, 1959, Torrence, 1974).

Scientific creativity depends not only on a well-oiled imagination coupled with habits of hard work but, more importantly, on the ability to integrate in functional ways a wider range of ideas, concepts and skills than is usual. Freeman (1971) stated that creative development can be enhanced through the use of discovery methods. Sommers (1961) found out that in Industrial arts training that using discovery method may lead to superior performance in subject matter as well as gain in creative productivity. Torrance (1961) argues that perhaps the most promising areas if we are interested in what can be done to encourage creative talent to unfold, is that of experimentation with teaching procedures which will stimulate students to think independently, to test their ideas and to communicate them to others. Therefore the role of the teacher is to guide and facilitate learning rather than to tell.

According to Piaget (1970) "telling is not teaching". Moreover the teacher must be able to establish an environment that is leaner centred that facilitates collaborative as well as independent learning that encourages taking risks, that fosters problem solving and critical thinking (National Research Council, 1996). According to Okere, Changeiywo and Illa, (2010) concept mapping teaching strategy was found to inculcate scientific creativity in students. The findings of the study by Okere *et al* was that concept mapping teaching strategy enhances student's abilities of recognition of relationships and planning for scientific investigations. Recognition of relationships and planning for scientific investigations are some of the aspects of creativity in science (Okere, 1986). Scientific and general creativity are influenced by many factors such as intelligent quotient (IQ), social-economic status among many others. This study investigated the relationship between academic achievement in chemistry and chemistry scientific creativity in Kenyan secondary school students. Four aspects on scientific creativity were studied; Planning, Flexibility, Recognition of Relationships and Sensitivity.

OBJECTIVE OF THE STUDY

- To establish the relationship between learners' scientific creativity in chemistry and academic achievement in chemistry.

HYPOTHESIS

There is no statistically significant relationship between learners' scientific creativity in chemistry and academic achievement in chemistry.

1. METHOD

1.1 Research Design

The research design was mainly descriptive study. Descriptive research design was found to be appropriate since it can be used to determine the nature of prevailing conditions or relationships and practices that exist (Cohen & Manion, 1987).The research method of the study was cross-section survey since information collected was drawn from predetermined population (Borg & Gall, 1989). Its main purpose is to explore and describe the variable under the study (Kathuri & Pals, 1993, Cohen & Manion, 1987).

1.2 Sample

The guidelines given by Gall, Borg, Gall (1996) was adapted in determining the sample size. Where correlation coefficient (r) is used to test hypothesis at 0.05 level of significant, a minimum sample of 384 cases is required. When the independent sample t test is used, a minimum sample of 386 is required (Gall, Borg, Gall 1996). In view of this, a sample of 711 students was selected for the study.

Simple random sampling was used to select 8 secondary schools involved in the study. These schools were selected from 4 counties in Kenya. These schools formed the sampling frame in the random sampling of the study sample of 711 students of which 296 were boys and 415 were girls.

1.3 Instrumentation

Two instruments were used in the study;

1.3.1 Chemistry Achievement Test (CAT). The CAT had 30 items on chemistry concepts taught in secondary school. All the items were open-ended and were drawn from all the topics taught in secondary school. It was aimed at assessing learners' academic performance in chemistry. Items in CAT were not scored dichotomously, scores ranged from 1- 5 marks. The maximum score of the test was 100% while the minimum was 0%.

1.3.2 The Chemistry Scientific Creativity Test (CSCT) was used to determine scientific creativity in chemistry. The test had 13 items some (10) formulated by the researcher and some (3) adapted from the Assessment of Performance Unit (A. P. U.) tests. All the items in the CSCT were open-ended with each question testing one of the 4 aspects of scientific creativity. The test was aimed at assessing Form Three learners' competence in scientific creativity aspects which include;

a) Recognition of relationships

b) Flexibility

c) Sensitivity to the problems

d) Planning of investigation in chemistry.

2.0 MEANINGS OF GENERAL CREATIVITY

According to Treffinger, et al, 2002, Ed. creativity is ability to generate; ideas (fluency in thinking), varied ideas and new perspectives (flexibility) and unusual or novel ideas (originality). All these are aspects of divergent thinking where divergent thinkers move away from responses already known and expected. The other aspects are elaboration and metaphorical thinking (sensitivity to defect and missing elements). All this aspects are measurable.

3.0 PSYCHOLOGICAL MEANINGS OF SCIENTIFIC CREATIVITY THAT HAVE RELEVANCE TO SCIENCE EDUCATION

Meanings of Creativity that have Relevance to Science Education

Okere (1986) has summarized the psychological meanings or aspects of creativity that have relevance to science education under the following headings: sensitivity to problems, recognition of relationship, flexibility in reasoning and planning for investigations.

3.1. Sensitivity to Problems

This is defined as the ability to be aware of problems and think of possible solutions to the problems (Guilford, 1950; Torrance, 1959; Oche, 1990). This ability may be assessed in chemistry by setting problems that require students to identify inadequate scientific arguments, state possible sources of experimental errors, or criticize given experimental procedures. This is what Hu and Adey (2002) categorises as scientific problem solving sub-dimension of the Product (scientific product) dimension of SSCM. Lubart (1994) pointed out that problem solving can lead to creativity because if a problem exists then there is the possibility of creative

solution. Hu and Adey (2002) state that sensitivity to science problems is also considered a component dimension of scientific creativity. Ochse (1990) argued that sensitivity to problems is an important feature of the creative process. According to Cattell (1971) problem solving does not mean solving routine problems using a recipe but finding the answers to new problems. Einstein and Infield (1938) suggested that the formulation of a problem is often more important than its solution, which may be a matter of mathematical or experimental skill. Okere (1986) gives scientific meanings of creativity that maps sensitivity to the problem as design of investigation. This includes the following activities;

3.1.1 Reformulating General Statements

In this case a student should be able to rephrase statements in such a way that they could be checked scientifically. This means that a student should first be able to identify the inadequacy of a given statement and also suggest an experiment that could be used to check the rephrased statement and control variables.

3.1.2 Criticizing Experimental Procedure

In this case the student should be able to identify what is wrong with an experimental procedure. The student should be able to identify the variables that need to be controlled to make the results of the investigation fairer, and explain the need to control such variables.

3.1.3 Describing the Sequences of Investigation

Here the student should be able to describe a given experiment that would be used to investigate a particular problem. In doing this, a student describes the sequences of investigations and explains the criteria to be used in determining the dependent variables.

3.1.4 Devising and Describing Investigations

Here the student is not given the outline of an experimental procedure to be followed hence a student is expected to decided what experimental procedure to use.

3.2. Recognition of Relationships

Physiologists suggest that a creative individual should be able to recognize relationships among concepts and retrieve earlier experiences whenever he encounters novel situations (Rogers, 1954; Bruner, 1957; Cropley, 1967).This ability can be assessed best by problems that require the application of chemistry concepts to everyday problems.

Brunner (1957, 1963) argues that a creative individual should not see data as unique but as part of related sequence of events which the environment has been providing. Okere (1986) gives recognition of relationships scientific definition as generating hypothesis. For a student to be able to generate hypothesis he needs to have an understanding of scientific phenomena. According to Okere (1986) generating hypothesis involves;

3.2.1. Selecting a Correct Hypothesis from Given Alternatives

In this case the student should be able to select a correct hypothesis from given alternatives. This will require a student to first recognise relationships between particular chemistry concepts and the expected outcomes before selecting the correct hypothesis. The student should also give reasons for whatever choice they made.

3.2.2 Generating a Hypothesis from a Particular Topic Area

Here the student suggests causes of given physical phenomenon or described observations. This requires the student to generate a hypothesis based on particular topic and give reasons for deciding on the particular hypothesis.

3.2.3 Generating a Hypothesis from Many Topic Area

In this case the student should elicit many possible hypotheses from various science topics when explaining causes of observed phenomenon. In this study the focus will be on the assessment of the above skills among Form Three chemistry students in National schools.

3.3 Flexibility in Reasoning

This is defined as the ability to produce a great variety of ideas even when it is not necessary to do so (Guilford 1950; Barron, 1969; Kuhn, 1959). Hudson (1990) and Torrence (1990) give a case for flexibility, fluency and originality. According to Wilson (1954) there are two types of flexibility.

- Spontaneous flexibility, which is the ability to produce a great variety of ideas, with freedom from inertia.
- Adaptive flexibility which facilitates the solution of problems

Okere (1986) state that the ability can be assessed by problems that calls for reasoning so that students have the freedom to give all possible reasons. Alternatively it may be assessed by design problems that give room for various ways of solving a particular problem. The scientific definitions of flexibility are design of investigations where general statements are formulated and generating hypothesis.

3.4. Planning for Scientific Investigations

The ability to devise experiments to test hypotheses (Parnes, 1963; Hudson 1967 & Washton, 1966).This skill can be assessed by constructing problems that require the identification of control variables. It can be displayed in problems that require students to propose and devise experiments to test hypothesis. The scientific definition of planning is design for investigation. This involves;

3.4.1 Reformulating General Statements

In this case a student should be able to rephrase statements in such a way that they could be checked scientifically. This means that a student should first be able to identify the inadequacy of a given statement and also suggest an experiment that could be used to check the rephrased statement and state the control variables.

3.4.2 Criticising Experimental Procedures

In this case the student should be able to identify what is wrong with an experimental procedure. The student should be able to identify the variables that need to be controlled to make the results of the investigation fairer, and explain the need to control such variables.

3.4.3 Describing the Sequences of Investigation

Here the student should be able to describe a given experiment that would be used to investigate a particular problem. In doing this, a student describes the sequences of investigations and explains the criteria to be used in determining the dependent variables.

According to Okere (1986, 1996), the above psychological definitions of creativity and their scientific meanings or definitions are displayed in his model shown in Figure 3. This model will guide the development of Chemistry Scientific Creativity Test (CSCT) which will be used in this study to measure the level of scientific creativity in chemistry education of form three students.

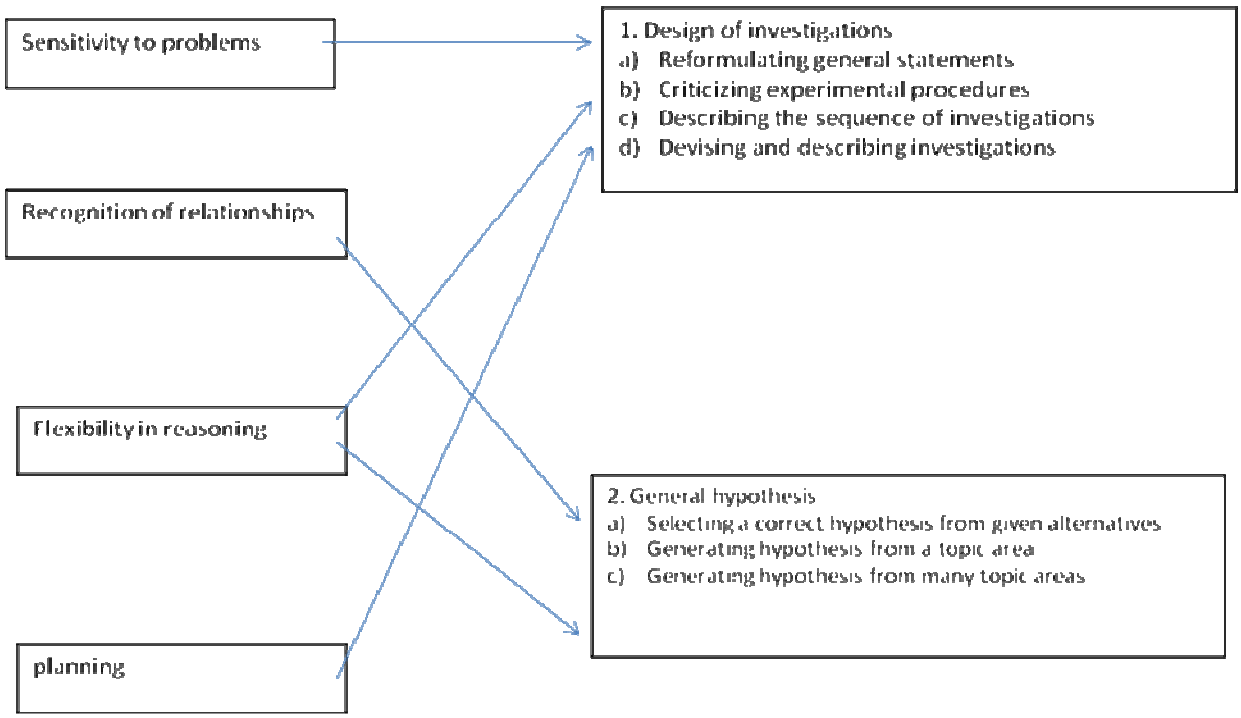

Figure 1: The mapping of psychological definitions of creativity onto scientific meaning (Okere, 1986)

4.0 SAMPLE ITEMS ON EACH ASPECT OF THE PSYCHOLOGICAL MEANINGS OF SCIENTIFIC CREATIVITY

1. **Sandra a form 3 student in Lions Secondary School has been given 5 bottles labelled P, Q, R, S and T with colourless liquids in them. She is told that 2 of the liquids are dilute acids, 1is an alkali and the other 2 are water. She also has a liquid indicator called phenolphthalein. This goes;**

   - **colourless in acids**
   - **red in alkali**
   - **colourless in water**

   Write some instructions for Sandra so that she can find out whether the liquid in each bottle is an alkali, acid or water. She is allowed to use a rank of test-tubes, the indicator and the liquids from the bottles P, Q, R, S and T. (10 Marks)

   NB: Make sure you say exactly what she must do so that when she has finished she can label the bottles 'Acid", 'Alkali", or 'Water".

This test question was testing 2 aspects of creativity namely planning and flexibility. 10 responses were required each scoring half a mark for score of 5 marks for planning and 5 marks for flexibility for a total score of 10 marks.

2. **Rehema complained of a burning sensation (hurt burn) along her food pipe (oesophagus) after lunch. Her chemistry teacher told her it was as a result of excessive production of hydrochloric acid in the stomach. She was advised to chew anti-acid tablets (actals). After a few minute the burning sensation stopped. Different parts of this question measured different aspects of creativity.**

   a) **Explain why the burning sensation stopped after taking anti-acid tablet. (2 marks)** This test item was measuring the recognition of relationship aspect of creativity.

   b) **Rehema attempted to determine the p^H of the actal tablets in the laboratory to prove the answer in (a) above. However she failed to get the p^H. Suggest as many as possible the mistakes Rehema did that made the experiment to fail. (10 marks)**

This test item was measuring two aspects of creativity sensitivity and flexibility. For every correct response given one mark was given for sensitivity and a mark for flexibility.

   c) **Describe to Rehema how she could determine the p^H of the ant-acid tablet (actal) in the laboratory. (10 marks)**

This test item was measuring two aspects of creativity, planning and flexibility. Planning aspect was measured by correct description of the steps in the procedure of measuring the pH of the tablet. 10 steps are used. Each correct step given ½ a mark in the correct sequence was awarded. Incorrect sequence was not awarded marks. Any wrong response in the sequence made the rest of the responses wrong because it would not have resulted in the determination of the Ph. The maximum score for this aspect of creativity (planning) was 5 marks.

Flexibility was measured by how many correct responses were given. For every correct response given ½ a mark was awarded. The maximum score on flexibility was 5 marks.

5.0 PILOTING

The test was piloted with 160 Form Three students in two schools (two National and two District school) with the same characteristics as the sample schools from Nakuru County. A specialist in scientific creativity and science education will moderate the CSCT items and the scoring key before and after piloting. Maximum score in CSCT was 100% while the minimum was 0%.

6.0 DATA ANALYSIS AND INTERPRETATION

Creativity in chemistry was measured by the Chemistry scientific creativity test (CSCT) while the chemistry achievement test (CAT) was used to measure achievement in chemistry. Learners' scores in the CSCT and CAT were expressed in percentages then used to calculate the mean scores which were then correlated. The SPSS programme was used to compute the Person Product Correlation Coefficients for the mean scores obtained from the two scores. The results are shown in Table I.

Mean scores in CAT and CSCT were correlated to establish whether there is a relationship between academic achievement in chemistry and scientific creativity in chemistry.

Table I

Person Product Correlation Coefficients for Learners' Scores on the Chemistry Scientific Creativity Test and Chemistry Achievement Test

	Mean	Std deviation	Scores on CAT	Scores on CSCT
Scores in CAT	28.47	17.37	1.00	0 .73**
Scores in CSCT	21.95	12.93	0 .73**	1.00

** Correlation is significant at the 0.05 level

The results in Table 1 show that the mean in CSCT was 21.95 with a standard deviation of 12.95 and CAT had a mean of 28.47 with a standard deviation of 17.37. The Person Product Correlation Coefficients for learners' scores on the chemistry scientific creativity test and chemistry achievement test scores r = 0.73, which was statistically significant at 0.05 level. This means that the means of CSCT and CAT are positively correlated and the correlation is significant. This implies that a good mastery of chemistry concepts is essential for development of scientific creativity in chemistry. Therefore, the null hypothesis is rejected.

7.0 DISCUSSION

The finding in Table 1 shows that there was a positive correlation between the learners' scores on the Chemistry achievement and the chemistry scientific creativity test and the correlations was statistically significant. This suggests that high achievement in chemistry which in turn means a good mastery of chemistry of chemistry concepts is essential for effective acquisition of chemistry scientific creativity. These findings are in agreement with findings of some researchers such as, Ai, (1999); Asha, (1980); Getzels & Jackson, (1962); Karimi, (2000); Marjoribanks, (1976); Murphy (1973); Yamamoto, (1964), Okere, (1986), (1988), Ndeke, (2012), Hungi, (2009) found that there is a relationship between creativity and academic achievement. Others like Weiner (2002) argues that the knowledge functions as a pre-requisite to creating anything while Dunbar (1999) in support to this suggests that knowledge is a pre-requisite for creative production in science.

8.0 IMPLICATIONS

The findings of this study indicate that student academic achievement in chemistry plays a significant role in developing or enhancing scientific creativity in chemistry. This is seen from the findings of this study which showed a positive correlation between learners' chemistry scientific creativity and chemistry academic achievement. Therefore, educational institutions should strive to improve students' academic achievement in chemistry as a strategy of posting or enhancing scientific creativity in chemistry.

9.0 CONCLUSIONS

There is a positive correlation between student's academic achievement in chemistry and their level of scientific creativity in chemistry. Students with in scores in chemistry academic achievement had high level of scientific creativity in chemistry. Therefore if teachers and educational institutions wish to enhance scientific creativity in chemistry education then they should ensure learners understand the chemistry concept taught in

the classroom. Knowledge in chemistry which can be shown by academic achievement in chemistry tests and examinations is a requirement or pre-requisite to creativity in chemistry education.

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