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Articles

The Relationship between Headmasters Instructional Leadership and Teachers Commitment

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Abstracts

The article attempts to examine the relationship between headmasters instructional leadership on teachers commitments in schools in Jagoi Zone in Bau District. Data are collected using questionnaires from 74 respondents teaching in various schools in the Jagoi Zone. Data are analysed using the Exploratory Factor Analysis (EFA) while the hypotheses are tested using Pearson Moment Correlation. The four elements used in the study to examine the relationship between headmasters' instructional leadership and teachers' commitment are the ability of the headmasters to articulate vision and values, understanding of pedagogy, understanding of development and maintenance, and strategic planning and ability to plan. The results of the study show that there is a positive correlation between a headmasters instructional leadership style and teachers commitment in these schools. All the headmasters in the schools adopt instructional leadership styles.

Keywords: Instruction leadership styles, teachers commitment

Introduction

The study on the relationship between headmasters' instructional leadership and teachers' commitment is conducted in the Jagoi Zone in the Bau District, Sarawak. The schools in Jagoi Zone are; Sekolah Kebangsaan (SK) Stass, SK Skibang, SK Sebobok, SK Serasot, SK Jagoi, and SK Serabak. SK Serasot and SK Jagoi are Grade A schools because schools have more than 150 students enrolment. The rest of the schools are Grade B schools. These schools are all rural schools and are situated more than 25 kilometers away from Bau town In terms of the school administration both SK Stass, SK Skibang, SK Sebobok are headed by a DGA32 headmaster. While SK Serasot and SK Jagoi are headed by DGA34 headmaster. On the other hand, SK Serabak is managed by a graduate headmaster on a DG44 scale. All these headmasters had experience managing schools for more than ten years. These headmasters are never being trained to become headmasters prior to their appointment as headmasters. However, their leadership style is based on their experience and some have gone through continuous informal education and short courses organised by the Education Department after their appointment as headmasters. All these schools have similar problems in terms of the physical condition of the schools. The buildings are old and do not have a constant supply of water. Their source of water is from the gravity feed connected from the village water pipe line. Besides that, some of these schools are connected by telephone because there is no infrastructure made available by the service provider.

Based on the 2010 UPSR results, it shows that the result varies from one school to another school ranging from 46.67% to 76.29% and only eleven students out of 153 students manage to get straight A's in their result. If headmasters had managed their respective schools by following the principles of instructional leadership, then their UPSR results would have shown a better result.

In Malaysian schools' today, the principal or the headmaster is the instructional leader in the school. As an instructional leader, the headmasters should be able to lead the team in the school not only academically, but, in all aspects. The teachers look upon the headmasters as leaders for encouragement, as they discharge their duties educating the young children.

The principal is expected to provide the appropriate leadership which will assist teachers in the efforts to provide quality and up-to-date education. According to Sergiovanni (2005) the knowledge about teaching and learning and ability to share these insights with teachers is a key factor in any good principal selection process. The principal must have a positive and strong relationship between effective instructional leadership behaviors exhibited by principals' and teacher commitment.

The National Education Philosophy (NEP) wants to produce a balanced outcome for the students after completing their schooling years in terms of physical, emotion, spiritual and intellect. Thus, this makes headmasters and teachers face a huge task in order to follow the principles of NEP. Therefore, the headmaster must possess a good leadership quality to ensure that teachers are committed to their jobs. Besides that, the NEP becomes the beacon to headmasters and teachers in ensuring that planning and implementing education policies is on track as outlined in the NEP.

Other problems faced by these schools are the number of teaching periods per week. Some teachers had to teach at least thirty periods per week and each period last half an hour. Some headmasters also teach more than eighteen periods per week besides having to do clerical work and also managing the schools. Besides that, some teachers

are teaching subjects that they are not trained for because there is a mismatch in all the schools compared to the real needs of the schools. Thus, all these problems could had an impact on the performance of the schools.

Literature Review

Instructional leadership consists of principal behaviors that set high expectations and clear goals for student and teacher performance, monitor and provide feedback regarding the technical core for teaching and learning in schools, provide and promote professional growth for all staff members, and help create and maintain a school climate of high academic press (Edmonds, 1979; Bossert, Dwyer, Rowan and Lee, 1982; Hallinger and Murphy, 1985; Murphy, 1990; Weber, 1997; Blasé and Blasé, 1999). Furthermore, Hoy and Hoy (2003, p.2) tell us "Above all, the principal must communicate a clear vision on instructional excellence and continuous professional development consistent with the goal of the improvement of teaching and learning"

Today's educational administrators must lead their schools so that their students can attain higher achievements. But at times, principals are busy with all the day-to-day responsibilities of running their schools that they do not seem to have enough time to practice instructional leadership. According to Smith (2009), Sheppard (2006) and Murphy (2007) "Instructional leadership is often conceived as a blend of supervision, staff development and curriculum development that facilitate school improvements and interactions between leaders and followers". Reitzug (1991) also listed few attributes of the principal, which constitute instructional leadership that provide staff development, encourage risk taking and require justification of practices. The ultimate goal of schooling is learning on the part of the students. The knowledge they learn, however, depends on the teachers' performance, which is a product of many factors, such as their commitment, professional growth, school environment, prevailing culture, and teachers' innovativeness. All these factors are either directly or indirectly linked with the principal's actions or inactions. According to Sheppard (2006) the most influential instructional leadership behavior at both the elementary and high

The role of instructional leader is a relatively new concept that emerged in the early 1980s, influenced largely by research that found effective schools usually had principals who stressed the importance of leadership. In the first half of the 1990s, attention to instructional leadership seemed to waver, displaced by discussions of school-based management and facilitative leadership (Lashway, 2008) Recently, however, instructional leadership has made a comeback with increasing importance placed on academic standards and the need for schools to be accountable.

In past few years, a number of researchers have developed theoretical frameworks of instructional leadership roles of school principals, contributing to the clearer conceptualizations of the term. The works of Bossert, Dwyer, Rowan, and Lee (1982) may be considered pioneering efforts directed toward a deeper understanding of instructional leadership roles of a school principal. These researchers emphasized that a school principal, through his or her activities, roles, and behaviors in managing school structures does not affect student achievement directly, in the ways the teachers do. However, classroom teaching may been impacted by principals' actions, such as setting and clearly communicating high expectations for all students, supervising teachers' instructional performance, evaluating student progress, and promoting a positive teaching and learning environment.

Over the past decades, several comprehensive reviews have been conducted of the literature on school administrators and their roles in schooling. The findings of these reviews will be presented chronologically, not by their importance. As the notion of educational leadership style evolved through the past decades, so did the research of the impact of the school leaders style on the school. At the time when the idea of instructional leadership became dominant, a number of researchers conducted empirical studies in an attempt to determine if the instructional leadership roles, behaviors, and activities practiced by school leaders may be correlated with school outcomes. The large wave of research on instructional leadership occurred in 1980s and 1990s.

While most would agree that instructional leadership is critical in the realization of effective schools, it is seldom prioritized. (Strodgill, 1974) stated that among the many tasks performed by principals, only one-tenth of their time is devoted to instructional Leadership. Among the reasons cited for giving less emphasis to instructional leadership are lack of in-depth training, lack of time, increased paperwork, and the community's perception of the principal's role as that of a manager (Fullan, 2005). Today, most school leaders seek a balance in their role as manager-administrator and instructional leader.

Instructional leadership differs from that of a school administrator or manager in a number of ways. Principals who pride themselves as administrators usually are too preoccupied in dealing with strictly managerial duties, while principals who are instructional leaders involve themselves in setting clear goals, allocating resources to instruction, managing the curriculum, monitoring lesson plans, and evaluating teachers.

Fullan (2005) in short stated that instructional leadership reflects those actions a principal takes to promote growth in student learning. The instructional leader makes instructional quality the top priority of the school and attempts to bring that vision to realization.

The definition of instructional leadership has been expanded to include deeper involvement in the core business of schooling, which is teaching and learning currently. DuFour, (2007) emphasized shifts from teaching to learning, some have proposed the term "learning leader" over "instructional leader".

The National Association of Elementary School Principals in USA (2001) defines instructional leadership as leading learning communities, in which staff members meet on a regular basis to discuss their work, collaborate to solve problems, reflect on their jobs, and take responsibility for what students learn. In a learning community, instructional leaders make adult learning a priority, set high expectations for performance, create a culture of continuous learning for adults, and get the community's support for school success.

According to Blase and Blase (1999) specific behaviors of instructional leadership, such as making suggestions, giving feedback, modeling effective instruction, soliciting opinions, supporting collaboration, providing professional develop providing professional development opportunities, and giving praise for effective teaching.

Methodology

The research instrument namely a questionnaire with multiple answers is used in this study which was modified from the pilot test study. The questionnaires are in English, contains statements on the headmasters' possible views and opinions of the variables in attempts to investigate the relationship between a headmaster's instructional leadership and teachers' commitment in schools in Bau District. A five point Likert scale

are used because it allows accurate assessment of opinions, which are often conceptualized in terms of gradation. This scale is commonly used to measure responses and allows respondents to express the degree of their opinion.

This questionnaire contains 42 items basically to obtain information on the respondent's demography such as gender, teaching experience, academic qualifications, tenure under the current headmaster and the respondent's age, instructional leadership of the headmaster and teachers commitments. Before the questionnaires were distributed, it was pilot tested. The results of the pilot test for articulating vision and values is 0.837, understanding of pedagogy is 0.880, understanding of development and maintenance is 0.760 and lastly strategic orientation to plan is 0.740. While for teachers commitments is 0.704. The results indicate that all the items in the five constructs are reliable and acceptable due to internal consistency.

The population consist of all the teachers and headmasters in the Jagoi Zone in Bau District comprising of six schools with a total of 95 teachers. However, for the purpose of this study only 74 teachers were selected which is equivalent to 75% of the population were selected as samples to response to the questionnaires. Only teachers who had served more than a year with their current headmaster are chosen. This is to ensure that teachers really understand their headmaster's leadership style.

Findings and Discussions

Headmasters' Instructional Leadership

This section elaborates the headmaster's instructional leadership. It is divided into four sub-topics and are described accordingly.

Articulating Vision and Values

The first element in headmasters'instructional leadership is articulating vision and values. Articulating vision and values is a major variable in instructional leadership. An exploratory factor analysis (EFA) was calculated to determine the validity and reliability of the items in the construct. The findings in Table 4.2 show that the variable exceeded the acceptable standard of Kaiser-Meyer Olkin's value at 0.836 which is greater than of 0.505 at two-tailed analysis for 95 percent confidence level. This is supported with significant level in Bartlett's test of Sphericity value at 270.74. Another test is Eigen value, which recorded larger than 1 at cumulative percentage of 75.45. Finally, the reliability factor recorded the Cronbach's Alpha at 0.918, which means a greater factor in determining the instructional leadership among respondents. From the findings, it can be inferred that all the items in the construct are reliable.

Table 1: EFA Result for Articulating Vision and Values

Construct	KMO	Bartlett Test of Sphericity	Eigen Value (Cum. %)	Cronbach's Alpha
Component for Articulating vision and values	0.836	270.74	75.45	0.918

Based on the statistic analysis, as shown in Table 4.3, the entire mean scored were higher than 3.5 for each statement in articulating vision and values element. This means

that the majority of the respondents are giving positive feedback to the given statement. For example, the statement saying *'The school's vision helps me to focus on my job'* recorded mean and standard deviation at 4.00 and .811. This finding illustrate that the school's vision is an important factor that can determine the success of the school in all fields. The statement that states *"The headmasters uses past examination results to plan future programme."* scored mean at 3.88 with almost two-third of them claimed either 'often' or 'always. Academic performance is very useful in setting goals and mission for the school because they are the product of the headmaster and teachers who trained the students for better achievement. The inability of the headmasters to articulate school's vision and values in the right direction, the school would not be having any real objectives to pursue and this could de-motivate teachers.

Table 2 : Distribution of Standard Deviation, Mean and Percentage of Articulating Vision and Values

Statement	SD	Mean	Percentage				
			Never	Seldom	Sometimes	Often	Always
6. The school's vision under my current headmaster is easy to understand.	0.867	3.96	1.4	1.4	27.0	40.5	29.7
7. The strategies to achieve the school's vision is clearly understood.	0.939	3.91	1.4	5.4	24.3	39.2	29.7
8. The school's vision helps me to focus on my job.	0.811	4.00	1.4	1.4	20.3	50.0	27.0
9. The headmaster uses past examination results to plan future programmes.	0.921	3.88	2.7	4.1	20.3	48.6	24.3
10.Theadmaster discusses with other teachers to evaluate school's programmes.	0.921	3.97	1.4	6.8	14.9	47.3	29.7

[N=74, Mean= 3.97 & SD=0.844]

Understanding of Pedagogy

The second element of the instructional leadership style is understanding of pedagogy. The EFA is used to determine the dominating factor in instructional leadership in Understanding the Pedagogy construct. The result of the analysis is shown in Table 4.4. The findings exceeded the acceptable standard of Kaiser-Meyer Olkin's value at 0.827 which is greater than of 0.5, while the Bartlett's test of Sphericity is at 264.22 and the Eigen value is at 75.09. Lastly, the reliability factor analysis a recorded Cronbach's Alpha value at 0.915. These indicate that understanding the pedagogy by the headmaster is part of the determinant factor in instructional leadership but at lower degree compared

to 'Articulating Vision and Values'. Based on the findings, it can be inferred that all the items in this construct are reliable.

Table: EFA Result for Understanding of Pedagogy

Construct	KMO	Bartlett Test of Sphericity	Eigen Value (Cum. %)	Cronbach Alpha
Component for Understanding of pedagogy	0.827	264.22	75.09	0.915

In addition, further analysis using the Mean and Standard Deviation shows that. *"Ensuring that the teacher's learning objective in class is in line with the academic objective"* has the highest mean score of 4.05 with a standard deviation of 0.874 and this is followed by *"Evaluate teacher's learning objective so that it is the same as the national curriculum"* which has a mean of 4.00 and a standard deviation of 0.891. (table 4.5)

Besides making sure that learning objective is in accordance with the national curriculum, a headmaster must also participate actively in maintaining that the teaching quality of teachers, playing an active role in selecting learning materials and also ensuring subject panels are functioning properly. All these statements has a mean of above 3.97 with a standard deviation of 0.799. A headmaster who understands pedagogy helps in the teaching process in class.

Table: **Distributions of Standard Deviations, Mean and Percentage on Understanding of Pedagogy**

Statement	SD	Mean	Percentage				
			Never	Seldom	Sometimes	Often	Always
11. Ensure that the teacher's learning objective in class is in line with the academic objective.	0.874	4.05	1.4	2.7	18.9	43.2	33.8
12. Evaluate teacher's learning objective so that it is the same as the national curriculum.	0.891	4.00	1.4	4.1	18.9	44.6	31.1
13. Observe teachers teaching in class consistently.	0.771	3.62	0	6.8	35.1	47.3	10.8
14. Play an active role in choosing learning materials.	0.939	3.54	2.7	9.5	32.4	41.9	13.5
15. Ensure that all subject panels function properly.	0.926	3.93	1.4	4.1	25.7	37.8	31.1

[N=74, Mean= 3.97 & SD=0.799]

Understanding and Development of Maintenance

Understanding of development and maintenance is the third element of instructional leadership. The results for the exploratory factor analysis for the third construct 'Understanding of Development and Maintenance', is shown in Table 4.6. The variable exceeded the acceptable standard of Kaiser-Meyer Olkin's value at lower compared to the mentioned earlier construct, at 0.786 however is higher than of 0.5. Meanwhile, the Bartlett's test of Sphericity is at 217.82 with Eigen value of 72.327. and the Cronbach's Alpha is at 0.741. Hence, it can be inferred that all the items under the construct of 'Understanding the Development' are reliable.

Table: EFA Result for Understanding of Development and Maintenance

Construct	KMO	Bartlett Test of Sphericity	Eigen Value (Cum. %)	Cronbach Alpha
Understanding of development and maintenance	0.786	217.82	72.327	0.741

The overall results of the Mean and Stand Deviation analysis of the construct on Understanding of Development and Maintenance is shown on Table 4.7. The mean score for this construct is recorded at 3.65 with a standard deviation of 0.691.The statement *"*

Support activities carried out by the teachers that contribute to the academic success of the school" has a mean of 4.16 with a standard deviation .861 and this is the highest score. This followed by *"State a high academic expectation to be achieved by the students"* which has a mean of 4.14 and a standard deviation of 0.849. *"Do not support teachers who performed excellently to get promoted for fear the school would loose their services"* has a mean of 2.34 and this is the lowest under this element. This could be because the statement is written in a negative form and in a positive form it shows headmasters the schools used in this study are very supportive if teachers in the school get promoted. The conclusion drawn is that in order for schools to improve academically, the development of staff and students is very important.

Table: Distribution of Standard Deviation, Mean and Percentage   Understanding of Development and Maintenance

Statement	SD	Mean	Percentage				
			Never	Seldom	Sometimes	Often	Always
16. Ensure that teacher's do their reflection at the end of each lesson.	0.856	4.08	1.4	1.4	20.3	41.9	35.1
17. Ensure that remedial and enrichment programmes that are given to students are based on the results of their test.	0.817	3.82	1.4	5.4	18.9	58.1	16.2
18. Give merits to teachers who are excellent in their work.	0.940	3.47	5.4	5.4	35.1	44.6	9.5
19. Do not support teacher's who performed excellently to get promoted for fear the school would loose their services.	1.327	2.34	40.5	12.2	28.4	10.8	8.1
20. Support activities carried out by the teachers that contribute to the academic success of the school.	0.861	4.16	0	4.1	17.6	36.5	41.9
21. State a high academic expectation to be achieved by the students.	0.849	4.14	1.4	0.0	21.6	37.8	39.2
22. Give merits to students who excel academically.	0.896	3.93	1.4	2.7	27.0	39.2	29.7

[N=74, Mean= 3.65 & SD=0.691]

Strategic Orientation and to Plan

Strategic orientation and planning is also an important element is instructional leadership. The results for exploratory factor anlysis for 'Strategic Orientation to Plan'. is shown in Table 4.8. The variable exceeded the acceptable standard of Kaiser-Meyer Olkin's value at slightly higher compared to 'Understanding of Development and Maintenance' at 0.808. Meanwhile, the Bartlett's test of Sphericity is at 164.64 with Eigen value at of 55.79 and Cronbach's Alpha value is at 0.793. The findings of this study shows that the 'Strategic Orientation to Plan' is also dominant factor, and therefore all the items in the construct is reliable and valid.

Table 4.8: EFA Result for Strategic Orientation to Plan

Construct	KMO	Bartlett Test of Sphericity	Eigen Value (Cum. %)	Cronbach Alpha
Component for Strategic orientation and to plan	0.808	164.64	55.79	0.793

Based on the results from Table 4.9 about strategic orientation and to plan, the mean score for the five statements is 3.65 with a standard deviation of 0.701. *"Inform all teachers, parents and students about school academic target"* has the highest mean score of 4.24 with a standard deviation of 0.873. This followed by *"set a higher academic target than the current achievement"* with a mean of 4.18 and a standard deviation of 0.834. Thus, a school would improve if headmasters disseminate information to all the concerned parties about the school's academic target. However, a headmaster must ensure that target plans are possible to achieve because the result shows some of the target plans are impossible to achieve when 39.2% of the respondents says target plans are impossible to achieve.

Table: Distribution of Standard Deviation, Mean and Percentage of Orientation and to Plan

Statement	D	ean	Percentage				
			Never	Seldom	Sometimes	Often	Always
Plans and implements all the curriculum programmes.	.899	.99	.4	.4	6.2	7.3	9.7
Set a higher academic target than the current achievement.	.834	.18	.4	.7	0.8	7.3	7.8
Ensure that the school academic is easily translated into the learning objectives in the classroom.	.751	.89	.4	.0	5.7	4.1	8.9
Inform all teachers, parents and students about the school academic target.	.873	.24	.4	.1	.1	1.9	4.6
Target plans are impossible to achieve.	.067	.11	0.8	2.2	9.2	1.1	.8

[N=74, Mean= 3.65 & SD=0.701]

4.3 Teachers' Commitments

The results for exploratory factor analysis for teachers' commitment is shown in Table 4.10 in which the Kaiser-Meyer Olkin's is 0.753 with the Bartlett's test of

Sphericity at 517.55 and the Eigen value is at of 55.79. The Cronbach's Alpha value is at 0.658. Based on the results we can infer that the items under teachers' commitment is reliable and valid

Table 4.10: EFA Result on Teachers Commitment

Construct	KMO	Bartlett Test of Sphericity	Eigen Value (Cum. %)	Cronbach Alpha
Teachers' Commitment	0..753	517.55	75.14	0.658

Table 4.11 shows the findings of the study on all the items on 'teachers commitment. The item on "I pledge my full commitment to the school's vision" has the highest mean score of 4.28 with a standard deviation of 0.580. This is followed by *I am proud to tell other people that I work in this school"* with a mean score of 4.23 and a standard deviation of 0.609. *"Working in this schoo*l *is really meaningful to me"* and "*I have a sense of belonging to this school"* has the same mean of 4.23 and a standard deviation of 0.609. The teachers who are respondents in this study are happy with their headmasters who are instructional leadership leaders.

Although respondents are happy with their present school they do not intend to teach in the school until they retire or do not want to stay late in the school frequently. That statement that shows this type of trend are *"I should not leave this school although I may gain something if I moved out"* which has a mean of 2.64 and a standard deviation of 0.837 and also *"I feel guilty if I ask for transfer from this school"* with a mean of 2.64 and a standard deviation of 0.945. *"Leaving this school is not a loss to me*" and this statement has the lowest mean of 2.045 and a standard deviation of 0.995. These shows that although they want to move out of their currently school they would still find something are missing in their lives.

Headmasters who adopts instructional leadership style will be able to enhance teacher's commitment and able to retain the teachers until they retire from the service.

Table: Distribution of Standard Deviation, Mean and Percentage on Teachers' Commitment.

Statement	SD	Mean	Percentage				
			Strongly Disagree	Disagree	Quite Agree	Agree	Strongly Agree
28. I feel this school as part of my family.	0.637	4.24			10.8	54.1	35.1
29. Working in this school is really meaningful to me.	0.609	4.23		1.4	5.4	62.2	31.1

30. I have a sense of belonging to this school.	0.609	4.23			9.5	58.1	32.4
31. I am proud to tell other people that I work in this school.	0.631	4.28		2.7	1.4	60.8	35.1
32. I am happy to work in this school until I retire.	1.162	3.51	5.4	16.2	21.6	35.1	21.6
33. I pledge my full commitment to the Headmaster.	0.809	3.95	1.4	4.1	14.9	58.1	21.6
34. I pledge my full commitment to achieve the school's vision.	0.580	4.34			5.4	55.4	39.2
35. I do not care what happens to this school if I am transferred out.	0.978	2.05	29.7	47.3	13.5	6.8	2.7
36. Leaving this school is not a loss to me.	0.995	2.45	13.5	45.9	28.4	6.8	5.4
37. Staying longer hours in school is a must that I like to do everyday.	0.905	3.05	2.7	25.7	39.2	28.4	4.1
38. Other schools might not give the benefits that I enjoy in this school now.	1.025	2.93	1.4	43.2	24.3	23.0	8.1
39. I do not have any sense of responsibility to this school	0.832	1.78	41.9	41.9	13.5	1.4	1.4
40. I should not leave this although I may gain something if I move out.	0.837	2.64	4.1	47.3	29.7	18.9	0.0
41. I feel guilty if I ask for transfer transfer from this school.	0.945	2.64	6.8	44.6	31.1	13.5	4.1
42. I like to attend courses realted to my work.	0.767	3.99		4.1	17.6	54.1	24.3

[N=74, Mean= 3.32 & SD=0.471]

4.4   Test Results of Research Hypotheses

There are four research hypotheses that will be tested in this study which had earlier been formulated in Chapter One. Pearson Correlation is employed to test for the research hypotheses which determine the relationship between the variables. The first hypothesis determines the relationship between the ability of headmasters to articulate the vision and values and teachers commitments

H_1: *There is a significant relationship in the ability of a headmaster to articulate vision and values on teachers' commitment.*

The results in Table 4.12 shows that the $r=0.126$ and $p=0.286$. These indicate that there is a significant difference between the ability of a headmaster to articulate vision and values with teachers' commitment. Thus, H_1 is accepted because the significant level of p>0.05 at 95 percent confidence level for two-tailed analysis. From the results of this hypotheses indicates that the teachers' commitment in school is determined by the headmasters' ability to articulate vision and values.

Table 4.12: Result for H_1: There is a significant relationship in the ability of a headmaster to articulate vision and values on teachers' commitment.

	Teachers' Commitment	Articulating Vision and Values
Teachers Commitment Pearson Correlation Sig. (2-tailed) N	1 74	0.126 0.286 74

The second hypothesis tested in the study is to determine the relationship between understanding of the pedagogy by headmasters in the Jagoi zone primary schools in Bau District and teachers commitments. The second hypothesis is:

H_2: *There is a significant relationship on the understanding of pedagogy by a headmaster on teachers' commitment.*

The results in Table 4.13 of the Pearson Correlation shows that r=0.082 and p=0.490 and the significant level is higher than 0.05 at 95 percent confident level. Therefore, H_2 have is accepted due to the significant level at p>0.05 at 95 percent confidence level for two-tailed analysis. The results of H_2 shows that teachers' commitment is influenced by the understanding of pedagogy by the headmaster, therefore the hypothesis can be accepted.

Table 4.13 : Result for H_2: There is a significant relationship on the understanding of pedagogy by a headmaster on teachers' commitment.

	Teachers' Commitment	Understanding of Pedagogy
Teachers Commitment Pearson Correlation Sig. (2-tailed) N	1 74	0.082 0.490 74

The third hypothesis which this research project wants to establish is the relationship between understanding and development and maintenance by the headmasters in the Jagoi zone in Bau District on teachers commitment. The third hypothesis is:

H_3: *There is a significant relationship in understanding development and maintenance by a headmaster on teachers' commitment.*

The results in Table 4.14 shows that r= 0.228 and p=0.05 at 95 percent confidence level for two-tailed analysis.H_3 is rejected because the p=0.05. The results show that teachers' commitment is not influenced by ability of headmasters in understanding development and maintenance. Therefore, the hypothesis can be rejected.

Table 4.14: Result for H_3: There is a significant relationship in understanding development and maintenance by a headmaster on teachers' commitment.

	Teachers' Commitment	Understanding of development and maintenance
Teachers Commitment Pearson Correlation Sig. (2-tailed)	1	0.228 0.05
N	74	74

The final hypothesis determines the relationship between the headmasters strategic planning and ability to plan on teachers' commitment. The hypothesis is:

H_4: *There is a significant relationship on a headmaster's strategic planning and ability to plan on teachers' commitment.*

The result in Table 4.15 shows that r=1.62 and p=0.167 and the p value is higher than 0.05 which means there is a significant relationship between headmaster's strategic planning and ability to plan with teachers' commitment. Thus, H_4 is accepted because the significant level of p>0.05 at 95 percent confidence level for two-tailed analysis. The results show that teachers' commitment is highly depending on strategic planning and ability of their headmasters.

Table 4.15 : Result for H_4: There is a significant relationship between headmaster's strategic planning and ability to plan with teachers' commitment.

	Teachers' Commitment	Strategic Orientation and to plan
Teachers Commitment Pearson Correlation Sig. (2-tailed)	1	0.162 0.167
N	74	74

4.5 Summary of the Hypotheses Test

Table 4.16 is a summary of the Pearson Correlation test for the four hypotheses. H_1, H_2 and H_4 are accepted because all these three hypotheses have a p value of more than 0.05. Only H_3 is rejected because p = 0.05. From the result, we can infer that there is a

relationship between a articulating vision and values, understanding of pedagogy by a headmaster, and a headmaster's strategic planning and ability to plan on teachers' commitment.

Table 4.16 : Summary of the Hypotheses Test

Hypotheses	r value	p value	Results
H$_1$: There is a significant relationship in the ability of a headmaster to articulate vision and values on teachers' commitment.	0.126	0.286 p >0.05	Accepted
H$_2$: There is a significant relationship on the understanding of pedagogy by a headmaster on teachers' commitment.	0.082	0.490 p>0.05	Accepted
H$_3$: There is a significant relationship in understanding development and maintenance by a headmaster on teachers' commitment.	0.228	0.05 p = 0.05	Rejected
H$_4$: There is a significant relationship between headmaster's strategic planning and ability to plan with teachers' commitment.	0.162	0.167 p > 0.05	Accepted

Conclusions

The findings of this study reveal that headmasters in the primary schools in the Jagoi Zone in Bau district do apply instructional leadership in managing their schools since all the elements in instructional leadership showed a mean of >3.60 with articulating vision and values and understanding of pedagogy has a mean of 3.97. Four hypotheses were tested to determine the relationship of the headmasters instructional leadership styles with teachers commitments. The findings of this study show that the headmaster who articulates the visions and values of the schools has significant relationship with teachers commitment. In addition, the headmasters' understanding of pedagogy and strategic orientation to plan also indicate a positive relationship on teachers commitment. Only one hypothesis that is "There is a significant relationship between understanding development and maintenance by a headmaster with teachers' commitment" was rejected because it has a p value of 0.05, which mean there is significant relationship respectively

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The Impact of Monetary Policy Measures on Bank Credit (1990 – 2010)

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Introduction

1.1   Background To The Study

Over the years, the objectives of monetary policy have remained the attachment of internal and external balance of payments.

However, emphasis on techniques/instruments to achieve those objectives have change over the years. There have been two major phrases in the pursuit of monetary policy, namely (Before and after 1986). The first phase placed emphasis on direct monetary controls, while second relies on market mechanism.

Analysis of institutional growth and structure indicates that the 'financial system' grew rapidly in the mid 1980s to 1990s.

The number of commercial banks rose from 29 in 1986 to 64 in 1996 and declined to 51 in 1998, while the number of merchant banks rose from only 12 in 1980 to 52 in 1991 and subsequently, declined to 38 in 1998. In terms of branch network, the combined commercial and merchant bank branches rose from 1,323 in 1985 to 2,549 in 1996. There was also substantial growth in the number of non-bank financial institutions, especially insurance companies.

The economic environment that guided monetary policy before 1986 was characterized by the dominance of the oil sector. In order to maintain price stability and a healthy balance of payment position, monetary management depended on the use of direct monetary instrument such as: credit control selective credit controls, administered interest and exchange rate as well as prescription of case reserve requirements and special deposits.

The most popular instrument of monetary policy was the issuance of 'credit rationing' guidelines which primarily set the rate of change for component and aggregate commercial bank and loan and advances to the private sector. The sectorial allocation of Bank in CBN guidelines was to stimulate the productive sectors and there by stem inflation pressures.

The fixing of interest rates at relatively low levels was due mainly to promote investment and growth. Occasionally, special deposits were imposed to reduced the amount of free reserves and credit creating capacity of the banks in the mid 1970s on the basis of their total deposit liabilities, but since such cash ration were usually lower than those voluntary maintained by banks, they forced less effective as restraint on their credit operations.

The structural adjustment programme (SAP) was adopted in July, 1986 against crash in international oil market and resultant deteriorating economic conditions in the country. It was designed to achieve fiscal viability by altering and restructuring the production and consumption patterns of the economy, eliminating price distortions, reducing the heavy dependence on crude oil exports and consumer goods imports enhancing the non oil export base and achieving substantial growth.

In line with the general philosophy of economic management under SAP., monetary policy was aimed at inducing the emergence of a market oriented financial system for effective mobilization of financial savings and efficient resource allocation. The main instrument of a market based framework is the open market operation, complimented by reserve requirements and discount window operations.

Effective against 1990, the use of stabilization securities for the purpose of reducing and buldging size of excess liquidity in banks was re-introduced. Commercial banks Cash reserve Requirements was increased in 1989, 1990, 1992, 1996 and 1999.

By way of inducing efficiency and encouraging a good measure of flexibility in 'bank credit operations', the regulatory environment was improved. Consequently, the sector-specific credit allocation targets were compressed into four sectors in 1986 and to only two in 1987. From October, 1996, all mandatory credit allocation mechanism were abolished. The commercial and merchant banks were subjected to equal treatments since their operations were fund to produce similar effect on the monetary process. The liquidity effect of large deficits financed mainly by the bank led to loan acceleration of 'monetary and credit' aggregates in 1998 relative to stipulated targets and performance in the preceding year. Outflow of funds through CBN weekly foreign exchange transition at the Autonomous Foreign Exchange Market (AFEM) and, to a lesser extent of open market operation (OMO) exerted some moderating effect.

1.2   Statement of Problem

From the mid 1970's, it became increasingly difficult to achieve aims of monetary policy measures, leading to unpredictable fluctuations in the level of bank credit. Generally, monetary policy aggregates government fiscal deficit, GDP growth rate, inflation rate and balance of payment position moved to undesirable directions.

Compliance by bank with prudential credit guidelines was less than satisfactory, this led to the enactment of several other guidelines, agencies, institutions, all in a bid to savage the situation.

The way or source of problem which was the nature of monetary control framework, relied heavily on credit ceilings and selective credit controls which increasingly failed to achieve monetary targets and implementation less effective with time.

The major source of problem in monetary management were the nature of monetary control framework, the interest rate regime and non-harmonization of fiscal and monetary policies. The main thrust of this study shall be to evaluate the effectiveness of CBN's monetary policy over the years. This would go a long way in assessing the extent to which the monetary policies have impacted on the growth process of Nigeria using 'bank credit' as a yardstick.

1.3   Objective of the Study

The main objective of the study is to empirically assess the impact of monetary policy measures on bank credit in Nigeria.

The specific objective of this study are to:

I.   examine the relationship between monetary policy and bank credit in Nigeria

II.   examine how effective the various monetary policies have been in the Nigerian financial system.

III.   critically examine if there is a direct-relationship between monetary policy and bank credit in Nigeria.

IV.   assess the overall effect of monetary policy on economic development in Nigeria

1.4 Research Questions

1. Is there a relationship between monetary policy and bank credit in Nigeria?
2. How effective are the various monetary policies in the Nigerian financial system?
3. Is there a direct relationship between monetary policy and bank credit in Nigeria?
4. How has the effect of monetary policies affected economic development in Nigeria?

1.5 Statement of Hypotheses

The research hypotheses that would be tested in the cause of this research work will include the following:

Hypothesis 1

Ho: Monetary policy instruments do not have a direct relationship with bank credit.

Hi: Monetary policy instruments have a direct relationship with bank credit.

1.6 Significance of the Study

The significance of the study to the academic environment includes:

The study would provide an economic basis upon which to examine the impact of monetary policy measures on bank credit.

It would provide an objective view of the impact of monetary policy measures on bank credit and economic growth.

The study will emphasize the crucial role of monetary policy measures on flow of credit in the economy among others.

1.7 Methodology of the Study

The econometric method be employed was the ordinary least square (OLS), the choice of statistical data analysis would be the regression analysis.

The model to capture the impact of monetary policy on bank credit will be stated in the course of the research work with the independent variables as: Reserve requirement, interest rate and credit control. While the independent variable will be the bank credit (loan and advances).

The study will rely on secondary data, serves as analysis for the relevant data shall be collected majorly from the Central Bank of Nigeria including relevant publications and the National Bureau of Statistic.

1.8 Scope and Limitation

The economy is a large component with a lot of diverse and sometimes complex parts, therefore the study will only consider some of the monetary policy measures.

The scope of this study covers between 1990-2010, within this limit the objectives of the study will be achieved.

The research work will consequently be limited to 1990-2010 and reliability of data acquired from Central Bank of Nigeria.

1.9   Plan of the Study

This research work will be categorized into five chapters:

Chapter One, The Introduction will give a brief detail insight and brief historical background into the operation of monetary policy and how it has affected bank credit in Nigeria.

Chapter Two, The Literature Review will include detail historical background of the study, past and most recent changes made by the monetary authorities in Nigeria. It will also include conceptual, theoretical and empirical framework.

Chapter Three, The Research Methodology entails the formulation and statement of the model to be used in the research work.

Chapter Four, Data Presentation and Analysis will involve detailed analysis by making use of a multiple regression model to ascertain the extent to which monetary policy affect bank credit.

Finally Chapter Five will entail the Summary, Findings, Conclusion and Recommendations of the research work.

1.9 Definition of Terms

Monetary Policy: Policy designed to control the volume, cost and direction of money and money supply in the economy

Interest Rate: Rates set by the Central bank that guides the giving out of loan and advances.

Reserve Requirements: Central Bank of Nigeria may require deposit money from banks to hold a fraction of their deposit or deposit with the CBN

Credit Control: Are guidelines that set the rate of change for aggregate bank loan and advances.

Bank Credit: Refers to the amount/quantity of liquid cash that commercial banks deposit money banking institutions have at their disposal to grant out loans and advances to customers and leaders.

2. Literature Review

2.1   Historical Background of the Study

The CBN has since 2002 adopted a medium term monetary policy framework to free monetary policy implementation from the problem of time inconsistency and minimize over-reaction due to temporary shocks. However, periodic amendments are made to take policy guidelines in the light of development in the financial   market and performance of the economy during the period under review. Thus, in 2005 some new

reforms were introduced as 'amendments and addendum' to the 2004/2005 monetary policy circular no 37.

Under the West African Monetary Zone Exchange Rate Mechanism (ERM) arrangements, member countries are required to maintain a band of +/-10.06. however, given the appreciate level of external reserves and the nature stability of the naira exchange rate which are achieved in 2004: the CBN seek to maintain a narrower a narrower band of +/-3.0% during the curse of 2005. The band is intended to anchor expectations and to enable investors and end users of forex to plan and to minimize transaction cost.

Interest Rate Policy

Over the years, the spread between bank deposit and lending rates has remained unacceptably wide with adverse implications for savings mobilization and investment. Promotion with the declining trend in the rate of inflation, there is no justification why the MRR should be currently fixed at 15.0%, when the year on year inflation rate for December 2004 was about 9.5%. The CBN is moving to a regime of more active monetary policy, with decision on interest rate regime reviewed every quarter.

The CBN shall henceforth anchor its Minimum Rediscount Rate (MMR) on the year-on-year inflation rate adjusted for seasonality which reflect the current fundamental policy changes in the economy; as opposed to the traditional practice of anchoring the MRR on the 12 month moving average rate of inflation which reflect both current rate of inflation which reflect both current and past policy errors. Accordingly, the MRR has been reduced to 13% in the first quarter of 2005.

Whole Sale Dutch Auction Forex Market (Das)

In order to deepen the foreign exchange market and ensure sustained exchange rate stability, the CBN will establish a framework and guidelines for the introduction of a wholesale Dutch Auction System after the successful completion of the recapitalization and consolidation of banking industry by the end of December, 2005. Also the CBN will ensure installation of requisite infrastructure to monitor banks open position for the effective implementation of DAS. The DAS will not only deepen the forex market but will also assist in convergence of the DAS and the interbank exchange rate and eliminate rate to seeking behavior by the authorized dealers

National Savings Certificate

To enhance liquidity management and ensure monetary stability, the national savings certificate (NSC) was launched in 2005.

It's expected that the issuance of NSC would encourage the growth of domestic savings as well as address the problem of excess liquidity in the economy on a more sustainable basis.

Cash Reserve Requirement
(Two Weeks Maintenance Period)

The CRR will compliment OMO in ensuring that excess liquidity in the banking system is minimized. The maintenance period of CRR averaged 8 weeks in 2004. Consequently, it did not effectively serve the purpose for which it was intended. The existing ratios of 9.9% remained in force in 2005.

However, the maintenance period shall be two weeks. The computation of CRR would be based on each banks total deposit liabilities (i.e. demand, savings, and time deposit of both private and public entities), corporate of deposit, and promissory notes held by non-bank public and other deposit items.

Public Sector Deposit

Consistent with its traditional functions as the barrier to the federal government, the withdrawal of public sector funds from deposit money banks to CBN was initiated in 2004 to address the problem of excess liquidity in the banking system, and to encourage the banks to mobilize savings from traditional sources other than the public sector. Its brief implementation proved very effective liquidity management.

However, this measure was suspended because of apparent mixed signals which it conveyed to the public at the beginning of the banking system recapitalization.

Settlement/Cleaning Banks

Seven (7) banks that met the requirements for maintaining settlement account with the CBN were appointed and designated as 'settlement banks' to perform clearing and settlement functions for other banks with effect from 1st April, 2004.

Cognizant to the need to provide collateral commensurate with the volume and value of cleared items and the need to further enhance the settlement and clearing systems of banking industry, the guidelines were reviewed in 2005.

2.2   Concept of Monetary Policy Framework

Over the past two decades, the shift in the approach of economic management from direct government control to market-based policies has gained momentum, both in the industrial and developing countries. The driving force has been the desire for enhanced efficiency in the mobilisation and utilisation of resources. In this context, an increasing number of countries have embarked on comprehensive adjustment programmes designed to promote a stable macroeconomic environment and provide versatile institutional arrangements necessary for a free market economy. An important element of this adjustment process is the financial sector reform, which helps to establish a solid foundation for effective implementation of the market-based monetary policy.

There are various transmission channels and mechanisms through which monetary policy has affected economic activities by different schools of thought. The transmissions mechanisms of monetary policy have been broadly examined under the monetarist and Keynesian schools of thought.

The monetarist transmission mechanism postulates that changes in the money supply lead directly and without going through the financial market, to a change in the real magnitude of money. Friedman and Schwartz (2003) described this transmission. In their view, an increase in open market operations by the Central Bank increases stock of money, which also leads to an increase in Commercial Bank reserves and ability to create credit and hence increase money supply through the multiplier effect. In order to reduce the quantity of money in their portfolios, the bank and non-bank seller would in the initial stance purchase securities with characteristics equivalent to the ones sold to the Central Bank. The increase in demand bid up to price of such securities. Thus through this mechanism, the initial increase in money supply, involving the open market operations stimulates activities in the real sector. On the other hand, the Keynesian view of monetary

transmission is centered on the ability of changes in money supply to influence the cost of capital through changes in short term interest rates. In this transmission, changes in the money supply work through the financial market to affect the level of economic activities.

According to Modigliani (1993), he analyzed credit availability theory by stating that "interest rates charged to borrower by financial intermediaries are largely controlled by institutional forces and should adjust slowly at best; and that the demand for funds is accordingly limited not by lender's willingness to lend or more precisely, by the funds available to them to be rationed out among would-be borrowers". Thus monetary expansion includes banks to relax credit rationing and this result to an increase in income from increase investment and consumption, while savings could rise sustaining further investment through increasing the availability of loanable fund. The transmission mechanism acts through increase in money stock, which in turn increases effective demand, mainly investment partly because of short term reduction in the cost of capital and partly because of reduction in credit rationing and subsequently through flow of financial savings.

Tobin's (1998) view of transmission mechanism, which involves portfolio adjustment, is similar to that of the monetarists but which influences the cost of capital. He pointed out that an increase in money supply leads to assets substitution between corporate bonds, equities, commercial paper and banks deposits. He also indicated that monetary policy affects the economy through liquidity constraints and credit control. During periods of tight monetary policy characterized by high and rising interest rates, which also reduce bank's ability to lend, loan administration favours prime customers and business firms who in the process displace mortgage and consumer applicants. This development he says is strong enough to reduce investment and consumer expenditure.

Oliner and Rudebush (2005) analyze the use of bank and non-bank debt instruments in response to monetary policy contraction and fund that there was little change in the use of either. In which case, monetary contractions do not reduce the supply of bank debt instrument relative to other sources of business funds. Rather, they find that large firms crowd out small forms from credit market during periods of contractions in monetary policy.

Borio (2006) investigated the credit channel of monetary policy by examining the structure of credit to the non-government sector in fourteen industrialised countries and factors influencing it. He found out that the structure of credit was largely determined by interest rate and factors affecting the availability of credit such as collateral value and rationing, defined as "refusal to grant as much credit as is demanded on the observed interest and non-interest terms".

Gertler and Gilchrist (1991) established the existence of the lending channel by studying the response of small manufacturing firms to changes in monetary policy. The results of their analysis indicated that, in periods of contractionary monetary policy, (i) lending to small firms declines, (ii) small firms react more to changes in bank-related aggregate (e.g. broad money) than large firms.

Benji Onyido (2007) defined monetary policy as the action taken by the monetary authorities usually the Central Bank to affect monetary and other financial conditions through influence over the availability and cost of credit in pursuit of the broad objectives of sustainable growth of output, price stability and a healthy balance of payments

position. The discretionary control of the money stock to him involves the expansion or contraction of money and influencing interest rate to make money cheaper or more expensive depending on the prevailing economic conditions and thrust of policy. He went further by classifying the instruments of monetary control into two broad categories - direct and indirect instruments. Under a system of direct monetary control, the Central Bank uses some criteria to determine monetary, credit and interest rate targets that would achieve the goals of economic policy. In a regime of indirect monetary control, the monetary base (specifically bank reserves) is managed while the market is left to determine interest rates and credit allocation.

In the words of Whittlesey (1940), "monetary controls work much more through restructuring the availability of credit than through increasing its cost, much more through restraints on lenders than through reactions of borrowers." To him it is possible to curtail spending significantly by limiting the availability of bank reserves without raising significantly market rate of interest Also that monetary restriction will curtail aggregate demand if the most extreme skepticism about interest rate elasticity of borrowing and spending are justified.

According to Alan Griffths and Stuart Hall (1984), monetary policy refer to the actions undertaken by the government in order to affect macroeconomic variables such as output, employment and inflation, that is, they involve controlling the quantity of money in existence or its rate of growth either by controlling the supply of money or the demand for money via the interest rate.

Shaw (1973) defined monetary policy as 'any conscious action undertake b_y the monetary authority to change the quality and availability or cost of money', while Einzig (1952) defined it as the attitude of the political authority towards the monetary system of the committees under its control.

According to Duncan and Sidrauski (1971) they said that government monetary policy directly affect only the assets market given the assumption that savings are insensitive to interest rate. While to William Gibson and George Kanfinan (1980), monetary policy is view as Federal reserve actions designed to affect the tightness and easiness of credit conditions and the behaviour of total money supply and money substitution, that is bank deposits and other liquid instruments.

In the words of Anna Schwartz (1910), monetary tends to be counter-cyclical - rates typically rise during business cycle expansion and fall during contraction but measured by money growth, monetary policy tends to be pro-cyclical - money growth tends to rise during expansion and fall during contraction and she went further by saving that the Federal appears to pursue a counter cyclical monetary policy.

Poole (1988) also went further by stating his own major instrument of monetary policy, which are open market operation, discount window and reserve requirement. His own economy was viewed from the American economy. He also gave what is known as 'Defensive Open Market Operation' - which are Federal purchases and sales of government securities to offset unwanted effects on bank reserves of a host of factors that may change reserves and by changing reserves affect interest rate.

Vermon (1988) went further by giving another instrument known as Open Month Operations'- The Federal attempts to influence the economy through policy announcement, exhortations and sometimes extra legal pressure. And this has been use especially for difficult circumstance of high inflation and high interest rate. But for Carter

(1989), he asked Central Bank to impose credit controls to put restriction on the use of credit to buy cars and other items commonly purchased with borrowed funds.

In the words of Kim Jokomba and Kola Fasanu (1998), monetary policy was refer to as the combination of measures designed to regulate the value, supply and cost of money in an economy in consonance with the level of economic activity. They went further by saving that it is difficult to link monetary policy actions directly with overall economic performance not only because of the lags between actions and the outcomes but also because of the effects of other economic policies; fiscal and income policy measures.

According to Robert Rosa (2003), monetary controls to aid economic growth work much more through restricting the availability of credit than through increasing its cost, much more through restraints on lenders than through reactions of borrowers. According to his theory, it is possible to curtail spending significantly by limiting the availability of bank reserves without raising significantly market rates of interest. Although there is bound to be upward pressure on rates but he said that it is largely incidental and that one cannot judge the impact of a monetary restriction by the height to which it pushes rate of interest. He also included in his theory that at any given interest rates, the demand to hold government bonds relative to other assets will be higher if the interest rate is increasing.

According to Wrightsman (1976), monetary policy is a deliberate effort by the monetary authorities (Central Bank) to control the money supply and the credit conditions for the purpose of achieving certain broad economic objectives.

According to Ackley (1978), one of the objectives of the monetary policy, which is the attainment of a high rate of or full employment, does not mean zero unemployment since there is always a certain amount of frictional, voluntary or seasonal unemployment.

Culbertson (1961) gave two types of conflicts in the attainment of policy objectives, which are: (i) Necessary Conflict; (ii) Policy Conflict. The necessary conflict exists when the attainment of one objective precludes the attainment of the other that is when the objectives are inherently incompatible. For example, full employment may also conflict with rapid economic growth, which is dependent on the acceptance of innovation and changes, if maintenance of full employment encourages reliance on the status quo. While the policy conflict arises when monetary policy has difficulty in pursuing both goals simultaneously. For example, an easy monetary policy designed to stimulate economic growth will lower the rate of interest and may generate higher inflation if the growth is not sufficient enough to inhibit it.

According to Brunner and Meltzer (1969) under the monetary policy indicatives, the indicator of monetary policy provides a scale that permits policy makers to compare the thrust of monetary policy on economic activity, that is to characterize one policy as more expensive than another or to characterise policies as more or less expensive than before.

According to Ufodiama (1999) monetary policy, which includes financial policy, refers to the deliberate action of the monetary authority to control the money supply and general credit available in the economic system. There are two major control mechanisms of monetary policy used by Central Banks at any point in time and this control mechanism are usually referred to as tools/instruments of monetary policy and they have effects on the proximate targets. Monetary instruments can be direct or indirect. The direct instruments include aggregate credit ceilings, deposit ceiling, exchange control,

restriction on the placement of public deposit, special deposits and stabilisation securities while indirect instruments include Open Market Operation (OMO), cash reserve requirement, liquidity ratio, minimum discount rate and selective credit policies. Monetary policy has vital roles in the short-run i.e. it is used for counter-cyclical output stabilisation, while in the long run, it is used to achieve the macro-economic goals of full employment, price stability, rapid economic growth and balance   of payments equilibrium. Under SAP, monetary and financial policies were programmed to play a dual role. For economic growth and stabilisation purposes, there was to be tight monetary policy to complement a more disciplined fiscal policy in order to reduce domestic demand and reduce inflationary pressures.

2.3   Instrument of Monetary Policy
Various instruments are usually utilized by the monetary authorizes in Nigeria but generally, they can be classified under two major headings:

Direct Monetary Policy: These policies used by the government directed towards specific sectors of the economy for example moral suasion.

Indirect Monetary Policy: These are used generally by the government to proffer solution to the emerging economic problems without giving preference to various sectors of the economy for example open market operations (OMO).

2.4   Monetary are Credit Development
In a CBN circular to all commercial and merchant banks, the maximum lending rate for all banks was pegged at 21 percent per annum as from January, 1991. Accordingly, minimum savings deposit rate was also fixed at 13.5 percent per annum while minimum rediscount rate was also fixed at 15.5 percent per annum.

While the inflation rate plummeted from 48.3 percent in January, 1990 to 7.5 percent in December, 1990, interest rate on savings deposits and prime lending remained high throughout the year. The savings deposits rate actually fluctuated from a low of 17.8 percent in January to a peak of 19.3 percent in June and ended at 18.7 percent in December, 1990. Prime lending rate showed a similar trend as it ranged from 25.4 percent in December to 27.5 percent in the months of April and July, 1990.

An aggregate credit ceiling fall types of credit of 13.2 percent in 1991 is allowed for loans to the private sector by both commercial and merchant banks. The CBN also gives the sectoral percentage distribution for the 1991 fiscal year.

For 1991, the base for calculating case reserve requirement (CRR) was redefined to include demand, savings and time deposits instead of the former base which was only demand deposit liabilities. Thus, CRR has been defined as the ratio of a bank's cash reserve deposited with the CBN to its total deposit liabilities. A minimum CRR (as now defined) of 3 percent has to be maintained by both commercial and merchant banks at the end of every month.

The minimum liquidity ratio for both commercial and merchant banks is fixed at 30 percent. All compulsory deposits in whatever form with the CBN and cash deposit to meet CRR are excluded in the calculation of the ratio.

Growth in money supply was substantial during the review period. Monetary supply, MI and M2 grew rapidly from 16.3 and 19.4 percent   in 1995 to 48.1 and 62.2

percent in 2000, respectively (CBN, 2003). These rates were consistently above their projected targets.

The growth in monetary aggregates was due to factors such as; rapid monetization of oil inflows, minimum wage adjustments, and the financing of government's fiscal deficits through the banking system. Credit to the private sector, by contrast, declined sharply form 48.0 percent in 1995 to 23.9 percent in 1997 and thereafter increased gradually to 30.9 percent in 2000 (CBN, 2003). However, it stayed within the prescribed limits in only three (3) out of the six-year (1995-2000) time frame of the post-control regime analysis.

At N1,668.5 billion, Reserve Money (RM) grew by 7.7 percent, relative to the level at the end of December, 2008. At this level, RM exceeded the indicative benchmark of N1,604.8 billion for 2009 by 4.0 percent. The growth in monetary base was accounted for by the growth in both currency-in-circulation (CIC) and DMB's reserves at the CBN.

Broad money supply grew by 17.1 percent at the end of December 2009 to N10,730.8 billion, compared with the indicative benchmark growth of 20.8 percent for 2009 and the 57.8 percent growth at the end of the preceding year. The movement in M_2 was largely driven by the expansion in domestic credit (net) of the banking system, particularly credit to the private. Correspondingly, on the liabilities side, the growth in M_2 was driven by the expansion in both narrow money and quasi money.

Credit to the domestic economy (net) grew by 59.0 percent at end-December, 2009 lower than the indicative benchmark of 66.0 per cent and the growth of 84.2 percent at end December, 2008. The development reflected largely the growth of 26.0 percent in credit to the private sector, which was however, lower than the 59.4 percent growth at end-December, 2008. Net domestic credit to the economy constituted 73.4 percent of the total monetary assets (M_2) at end of December, 2009.

Net credit to the Federal Government (CG) fell by 26.6 percent, compared with the indicative benchmark of negative 41.9 percent for 2009 and the decline of 31.2 percent at end of December, 2008. The Federal Government maintained its status as net creditor to the banking system at the end of December, 2009, as in the preceding year, with its deposits with the banking system exceeding the credit extended to it.

Credit to the private sector (including state and local government and non-financial public enterprise, grew by 26.0 percent, which was lower than the 59.4 percent recorded at the end of December, 2008. Credit to the core private sector (excluding state and local governments) grew by 24.5 percent.

2.5 Trend and Structure of Nigerian Monetary Policy Since 1960 to Date the Exchange Rate Targeting Regime (1959-1973)

The conduct of monetary policy in Nigeria under the colonial government was largely dictated by the prevailing economic conditions in Britain. The instrument of monetary policy at that time was the exchange rate, which was fixed at par between the Nigerian pound and the British pound. This was very convenient, as fixing the exchange rate provided a more effective mechanism for the maintenance of balance of payments viability and for control over inflation in the Nigerian economy. This fixed parity lasted until 1957, when the British pound was devalued.

Owing to the civil war in the later part of this period, the monetary authorities did not consider it expedient to devalue the Nigerian pound in sympathy with the British

pound. Two major reasons accounted for this. First, a considerable proportion of the country's resources was being diverted to finance the war. Second, there was the apprehension that the devaluation of the Nigerian pound would only raise the domestic price of imports without any appreciable impact on exports, which were largely primary products. Rather than devalue, the monetary authorities decided to peg the Nigerian currency to the US dollar, but imposed severe restrictions on imports via strict administrative controls on foreign exchange.

Following the international financial crisis of the early 1970s, which led to the devaluation of the US dollar, Nigeria abandoned the dollar peg and once again kept faith with the pound until 1973, when the Nigerian currency was once again pegged to the US dollar.

With these developments, the severe drawbacks in pegging the Nigerian currency (Naira) to a single currency became obvious. A clear case was that the naira had to undergo a de facto devaluation in sympathy with the dollar when the economic fundamentals dictated otherwise, in 1973 and 1975 respectively. It was against this backdrop that the need to independently manage the exchange rate of the naira was firmly established. Hence, in 197& Nigeria pegged her currency to a basket of 12 currencies of her major trading partners.

Monetary Targeting Regime (1974 To Date)

From 1970, the economy witnessed a major structural change that affected the conduct of monetary policy. Oil dominated the export basket, constituting 57.6 per cent *of* total export in 1970 and over 96 percent from 1980 While non-oil exports (mostly agriculture) declined rapidly from 42.4 percent in 1970 to 16.9 per cent in 1973. As a result of the increased revenue accruing to government from oil, the imbalance in the balance of payments and low external reserves became things of the past. Indeed, Nigeria's external reserves rose rapidly by over 1000 per cent in 1975 from about N100 million in the late sixties to approximately N3.4 billion in 1975. The need to finance post-war developments also led to a considerable growth in public expenditure, thus intensifying inflationary pressures. Under the circumstances, the monetary authorities adopted a new monetary policy framework. This development marked the beginning of monetary targeting in Nigeria, which involved the use of market (indirect) and non-market (direct) instruments. Consequently, the major focus of monetary policy was predicated on controlling the monetary aggregates, a policy stance which was largely based on the belief that inflation is essentially a monetary phenomenon.

Direct Control (1974-1992)

The major objective of monetary policy during this period was to promote rapid and sustainable economic growth. Consequently, the monetary authority imposed quantitative interest rate and credit ceilings on the deposit money of banks, and prescribed sectoral credit allocation to the various sectors of the economy. Overall, the "preferred" sectors, such as agriculture, manufacturing and construction, were singled out for the most favoured treatment, in terms of generous credit allocation and a below market lending rate (Ojo, 1992).

The most important instrument of monetary control the CBN relied upon was the setting of targets for aggregate credit to the domestic economy and the prescription of low interest rates. With these instruments, the monetary authority hoped to direct the flow of

loanable funds with a view to promoting rapid development through the provision of finance to the preferred sectors of the economy.

The level and structure of interest rates were administratively determined by the CBN. Both deposit and lending rates were fixed in order to achieve by fiat, the social optimum in resource allocation, promote the orderly growth of the financial market, contain inflation and lessen the burden of internal debt servicing on the government. In implementing the policy, the sectors were classified into three categories: (1) 'preferred' (agriculture, manufacturing, and residential housing; (2) 'less preferred' (imports and general commerce); and (3) 'others'. This classification enabled the monetary authorities to direct financial resources at concessionary rates to sectors considered as priority areas. These rates were typically below the CBN-determined minimum rediscount rate (MRR) which itself was low and not determined by market forces. The imposition of special deposits compelled banks to deposit, at the CBN, any shortfall in the allocation of credit to the designated preferred sectors of the economy.

Empirical evidence during the control regime era revealed that the flow of credit to the priority sectors did not meet the prescribed targets and failed to impact positively on investment, output and domestic price level. Overall, banks tended to practice adverse selection in their credit allocation, For instance between 1972 and 1985, banks' aggregate loans to the productive sector averaged 40.7 per cent of total credit, about 8.7 percentage points lower than the stipulated target of 49.4 per cent. A major factor, which impaired the effectiveness of monetary policy during the era of control regime, was the lack of instrument autonomy by the Central Bank (Ojo, 1992). During this period, monetary policies were dictated by the Ministry of Finance and as such, were influenced by short-term political considerations. Beginning from mid-1981, crude oil prices took a downturn as prices fell from the peak of US$40 per barrel to US$14.85 in 1986. This led to severe external sector imbalance. The emerging economic development made Nigeria adopt the Structural Adjustment Programme (SAP), as a policy option to put the economy back on the path of sustainable growth.

In broad terms*,* the SAP strategy involved both structural and sectoral policy reforms. The reforms included the deregulation of the financial system to accomplish a market-oriented financial system that would support efficient financial intermediation. The programme, thus, entailed reforming and dismantling the control regime which was characterized by a system of fixed credit allocations, a subsidized and regulated interest rate regime, exchange controls and import licensing. Overall, the emergence of SAP ushered in a regime of financial sector reforms characterised by the free entry and free exit of banks and the use of indirect instruments for monetary controls.

The strategy therefore was to introduce measures that would increase competition, strengthen the supervisory and regulatory capacity of the CBN, improve the financial structure and redress the financial repression already identified (Oke, 1995). This led to the introduction of the regime of indirect monetary control. Nevertheless, owing to the exigencies of emerging economic developments, some direct control measures were maintained and new ones introduced to contain excess liquidity during the period of indirect control. For instance, Stabilisation Securities were introduced in 1990 as a temporary measure and later abolished in the last quarter of 1998. Similarly, Special Treasury Bills (STBs) were also introduced in April 1999 and discontinued before the end of 2000.

Indirect Monetary Control (1993 to Date)

Beginning from September 1993, the CBN embarked on a selective removal of all credit ceilings for banks that met some pre-set criteria under the Basel Committee's prescribed prudential guidelines (Odozi, 1995). While the Ministry of Finance continued to exert an influence on the conduct of monetary policy, efforts were made by the political leadership to strengthen the Central Bank's Act, in order to render the Bank less dependent on the Ministry of Finance. The first of such laws was the CBN Decree 24 of 1991 and the Banks and Other Financial Institutions Decree (BOFID) 25, also of 1991. This was followed by the CBN (Amendment) Decree Number 37 of 1998 and the Banks and Other Financial Institutions, BOFI (Amendment) Decree Number 38 of 1998. Overall, the CBN's amended Act granted the Bank more discretion and autonomy in the conduct of monetary policy. Consequently, the focus of monetary, policy during this period shifted significantly from growth and developmental objectives to price stability.

The operational framework for indirect monetary policy management involved the use of market (indirect) instruments to regulate the growth of major monetary aggregates. Under this framework, only the operating variables, the monetary base or its components are targeted, while the market is left to determine the interest rates and allocate credit. Essentially, the regime involves an econometric exercise, which estimates (ex ante) the optimal monetary stock, which is deemed consistent with the assumed targets for GDP growth, the inflation rate and external reserves. Thereafter, market instruments are used to limit banks' reserve balances as well as their credit creating capacity.

Instruments of Monetary Policy Under the Regime

The major instrument of indirect monetary control in Nigeria is the Open Market Operations (OMO). To date this instrument has been complemented by reserve requirements, CBN securities, as well as moral suasion.

Open Market Operations

The OMO was introduced at the end of June 1993 and is conducted wholly on Nigerian Treasury Bills (NTBs), including repurchase agreements (repos). The OMO entails the sale or purchase of eligible bills or securities in the open market by the CBN for the purpose of influencing deposit money, banks' reserve balances, the level of base money and consequently the overall level of monetary and financial conditions. In this transaction, banks subscribing to the offer, through the discount houses, draw on their reserve balances at the CBN thereby reducing the overall liquidity of the banking system and the banks' ability to create money via credit.

In implementing the OMO, the Research Department of the CBN advises the trading desk at the Banking Operations Department, also of the CBN, on the level of excess or shortfall in bank reserves (Odozi, 1995). Thereafter, the trading desk decides on the type, rate and tenor of the securities to be offered and notifies the discount houses 48 hours ahead of the bid date. The highest bid price (lowest discount rate quoted) for sales and the lowest price offered (highest discount offer) for purchases, with the desired size or volume, is then accepted by the CBN. The amount of securities sold at the OMO weekly sessions since the inception of the indirect monetary policy in 1993 has risen over a hundred-fold to N0.2 billion in 1994 (CBN, 2003). Even though a slump in sales was recorded in 1995, statistics for 1996 show an increase of 45.5 per cent in the amount sold at OMO over the 1995 sales. Activities at the OMO have been on the increase ever since,

with average OMO sales increasing by over 300 percentage points to N7.73 billion in 2000 (CBN, 2003).

Reserve Requirement

The CBN complements the use of OMO with a reserve requirement. In this connection, the reserve requirement is an instrument for liquidity management and for prudential regulation. The reserve requirements are the Cash Reserve Ratio (CRR) and the Liquidity Ratio (LR). While the former is defined as a proportion of the total demand, savings and time deposits which banks are expected to keep as deposits with the CBN, the latter refers to the proportion of banks' liquid assets to their total deposit liabilities. The CRR has been progressively increased from 6 per cent in 1995 to 8 per cent in 1997 and then to 12.5 per cent in April 2001. Similarly, the liquidity ratio has been increased from 30 per cent in 1998 to 40 per cent in April 2001 (CBN, 2003).

Discount Window Operations

The CBN discount window facilities were established strictly in line with the "lender of last resort" role, that the Bank is expected to play. Accordingly, it has continued to provide loans of a short-term nature (overnight) to banks in need of liquidity (Odozi, 1995). The facilities are collateralised by the borrowing institution's holding of government debt instruments and any other instrument approved by the CBN and subject to a maximum quota. The Minimum Rediscount Rate (MRR) is the nominal anchor, which influences the level and direction of other interest rates in the domestic money market.

Its movements are generally intended to signal to market operators the monetary policy stance of the CBN. It was recently reviewed upwards from 16.5 per cent to 18.5 per cent in June 2001 in order to contain the rapid monetary expansion arising from an expansionary fiscal policy.

Moral Suasion

The CBN adopts this approach as a means of establishing two-way communication with the banks, thereby creating a better environment for the effectiveness of monetary policy. The main avenue of contact is the Bankers' Committee, which meets two-monthly. This dialogue with banks was further expanded in November 2000 to include other stakeholders comprising key government officials, financial market operators, academics, etc, under the umbrella of the Monetary Policy Forum.

The objective of the Forum is to enhance the transparency of the Bank's monetary policy-making process.

3. Research Methodology

3.1 Introduction

Research methodology covers such areas as research design, population of study – sample size and sampling techniques, instruments of data collection and its procedure. It is a medium used for data collection in order to ensure valid conclusions made at the end.

This chapter also aims at investigating the methods that will be used to determine the effectiveness of monetary policy and its impacts on bank credit in Nigeria. It invariably serves as a prelude to chapter 4 where the data is presented and well analyzed.

The methodology adopted in this study is the linear regression employing the technique of ordinary least square (OLS). The choice of OLS is guided by the fact that it has optimal properties which include linearity, neutrality, and sufficient least variance and mean square error.

3.2   Research Design
The original least square method of the classical linear regression model is the econometric technique adopted in this study which covers a period of (1990 – 2010) the preference of the use of this model is because of certain assumption underlying the classical linear regression model.

Assumptions
I.   The relationship between the regressor and the regress is linear.
II.   The expected mean value of ui is zero. That is $\sum (ui/xi) = 0$.
III.   Homoscedasticity or equal variance of ui given the value of x, the value of ui is the same for all observation.
IV.   The error term is normally distributed.
V.   There is no perfect linear relationship among the explanatory variables.
Base on the above assumption, the estimator BLUE

i   the estimate are symmetrically unbiased

ii   the estimate are consistent i.e as sample size increase the B approaches it true value

iii   the estimators are efficient i.e among a group of unbiased consistent estimate Bs have the smallest variance.

iv   the estimator are linearly and normally distributed.

On the above four basis assumption and properties lies the justification for the

procedure.

3.3   Institutional Consideration
In general, economic research is concerned with the measurement of parameters of economic relationship with the prediction (by means of these parameters) of the values of economic variables (Koutsoyiannis, 1977).

Based on this, econometric methodology is adopted for the study in order to establish a simple accurate model. The choice of this econometric method is necessary since the work measures the quantity of money supplied and its impacts towards the economic real gross domestic growth.

3.4   Estimation Procedure
The procedure for estimation adopted in this study is the ordinary least square (OLS) single equation method. This was used to estimate the model under study. This method attributed to Carl fired- rich causes, a German mathematician is preferred because it is easy to understand, sample in its computational procedure plus its parameter estimates, which have some optional properties of linearity, unbiasedness and minimum

variance among a class of unbiased estimator. Thus, the OLS estimator possesses the BLUE properties of best linear unbiased estimators, which are consistent and sufficient.

The ordinary least square techniques is relatively simple to use and there are also readily available software packages for use like the MS Excel, PcGives, Eviews, SPSS that are user friendly. Data requirement are also minimal and it is also easier to understand by non-experts in econometric methodology. The Eviews econometric package was adopted for this analysis.

However, the following are some of the assumptions underlying OLS according to the Gaussian classical linear regression model (CLRM) which is the cornerstone of most econometric theory, Gujarati (1995).

3.5 Restatement of Hypothesis

The hypothesis tested in this study is:

H_0: There is no significant impact of monetary policy on bank credit.

H_1: There is a significant impact of monetary policy on bank credit.

3.6 Model Specification

Specification of econometric model is based on economic theory and on any valuable information relating to the phenomenon being studied.

In order word to test our working hypothesis, there is need to specify the appropriate relationship between the dependent and independent variables. This is because it is the relationship of economic theory which can be measured with one or other econometric techniques as casual, that is they are in relationship in which some variables are postulated to be causes of the variables of the other variables thus, the relationship between bank credit and monetary variables can be presented as follows:

BC = F (MS, INT, EXR, MRR) …………………………………………… (1)

Where

BC = bank credit

MS = money supply

INT = interest rate

EXR = exchange rate

MRR = minimum rediscount rate

The econometric model can be specified as shown below in equation two.

$BC = \beta 0 + \beta_1 MS + \beta_2 INT + \beta_3 EXR + \beta_4 MRR + \mu i$ …………………… (2)

Where

$\beta 0$ = Constant

$\beta 1, \beta 2, \beta 3, \beta 4$ are constant of the parameter

μi = error term.

Apriori Criteria

This refers to the supposed relationship between and or among the dependent or independent variables of the model as determined by the postulations of economic theory. The result or parameter estimates of the models will be interpreted on the basis of the

supposed signs of the parameters as established by economic theory put differently, the parameter estimates of the model will be checked to find out whether they conform to the postulations of economic theory.

The relationship between money supply and bank credit is expected to be positive because an increase in money supply will lead to an increase in bank credit to the economy, and vice visa ($\beta_1 > 0$).

Bank credit and interest rate are expected to be positively related because an increase interest rate, increase the bank credit, while a decrease in interest rate will lead to a decrease in bank credit ($\beta_2 > 0$).

Bank credit and exchange rate are also expected to be positively related because an increase exchange rate, increase the bank credit, while a decrease in exchange rate will lead to a decrease in bank credit ($\beta_3 > 0$).

The relationship between minimum rediscount rate and bank credit is expected to be negative because an increase in minimum rediscount rate will lead to an increase in bank credit to the economy, and vice visa.

3.7 Method Of Evaluation

Having specified and estimated the parameters of the model, the researcher would proceed with the evaluation of the results of the calculation; that is, with the determination of the reliability of these results. The evaluation consists of deciding whether the estimates of the parameters are theoretically meaningful, statistically satisfactory. The signs and magnitude of the parameters estimates will be examined to know whether they are in conformity with their apriori expectation. Economic apriori criterion will help the researcher to know when they are deviating from what is actually required.

In view of this, the researcher will evaluate the estimated parameters using the following criteria;

1)   The adjusted R^{-2} test.
2)   The student t – test.
3)   The F – test.
4)   The Durbin – Watson test.

1) The Adjusted R^{-2}

This is also called co-efficient of multiple determinations. It measures the percentage of the total variation of the dependent variable (BC) explained by the regression plane, that is, by changes in explanatory variables (MS, INT, EXC, MRR). The value of R^{-2} lies between 0 and 1.The higher the R^{-2}, the better the goodness of fit of the regression plane to the sample observations and the closer the R^{-2} to zero, the worse the fit (Gujarati, 2004).

2) The Student t-test

It is used to test the statistical significance of individual estimated parameter. In this research, t-statistics is chosen because the population variance is known and the sample size is less than 30 ($n < 30$).

Decision Rule

Reject the null hypothesis if the calculated value of t is greater than the tabulated value of t (i.e. t*>t tab) with N-k degree of freedom at the chosen level of significance, otherwise accept the alternative hypothesis, meaning that the parameter is significant. In this study the chosen level of significance will be 5 percent (5%).

3) The f-test

This is used to test for the overall significance of regression plane (model). The test aims to find out whether the joint influence of the explanatory variables on the dependent variable is statistically significant.

Decision Rule

If F calculated (F*) is greater than F-tabulated (i.e. F* >Ftab), with the chosen level of significance with k-1 and N-k degree of freedom, we reject the null hypothesis, that is, we accept that the regression model is significant. But if F* > tabs, we accept null hypothesis, that is we accept that the regression model is not significant with k-1 and N-k degree of freedom. The chosen level of significance in this test is 5 percent (5%).

4) Durbin - Watson

It is determined by the theory of econometrics. It is used to test for the percentage of first auto-correlation. The level of significance used is 5 percent (5%).

Decision Rule

Accept the null hypothesis if $du < d^* < (4 - du)$, that is there is presence of first order autocorrelation, or reject the null hypothesis if $d^* < du$ or $d^* > (4 - du)$, that is, there is no autocorrelation of first order. These are the guiding principles throughout the study.

3.8   Source of Data

The data used in this research work are secondary data sources from the Central Bank of Nigeria Statistical Bulletin. For the dependent variables, bank credit. The independent variables are money supply, exchange rate, interest rate, minimum rediscount rate. All these data are annual estimate staring from 1990 to 2010, a period of 20 years.

Reference

Gujarati, D. N. (2004). *Basic Econometrics*. New York: Tata McGraw Hill Publications.

4. Presentation and Analysis of Results

4.1 Introduction

The result of the original least square regression are presented below as stipulated in the previous chapter, the OLS and the result of our model was estimated using a computer software package E – view 7.0.

The empirical result is presented in a table. The table shows the estimated parameters, their t – statistics and other diagnostic test of equation. The result obtained from the estimation techniques are presented in the table below.

4.2 Presentation of Regression Results

Variable	Coefficient	Std error	T–statistic	Prob.
C	15.53751	23.21789	0.669201	0.5129
M2	0.42219	0.304295	1.387200	0.1844
INT	2.572834	1.536009	1.675013	0.1134
EXR	0.013709	0.083405	0.164361	0.8715
MRR	-2.726425	1.475755	-1.847478	0.0833

Source: Data Analysis.

This model has the following result

R^2 = 0.318247

F = (4, 15) = 1.867230

D* = 2.632251

Where

R2 = coefficient of multiple determination

D* = Durbin – Watson statistic

Result is shown in appendix II

4.3 Evaluation of Results

4.3.1 Evaluation Based On Eonomic Criteria

Constant

The sign of the constant is positive which conform to a prior expectation as specified in the model. It stipulates that holding all other variable constant, bank credit (BC) will raise by 15.53751.

Money Supply

The sign of saving conform to economic theory. The results stipulate that a percentage increase in the availability of money supply will lead to 0.42219 percent in bank credit.

Interest Rate

The coefficient of interest rate was found to be positive in the estimation. This agreed with theoretical postulation that with high interest rate banks are willing to give out loans, in the form of credit.

Exchange Rate

Exchange rate follows a prior sign. According to Jingan(2008), exchange rate and bank credit have positive relationship. The coefficient of EXR (0.013709) measure the rate in which bank rate increases. It indicates that over the period of study, holding other variables constant the partial elasticity of RGDP with respect of EXR IS 1.370 implying that, there is a 1.37 percentage increase in bank rate as a result of a unit absolute increase in exchange rate.

Minimum Rediscount Rate

The coefficient of minimum rediscount rate is -2.726425. This conforms to aprior expectation of negative relationship between MRR and bank credit. According to Jhingan (2008), when there is inflation, the central bank increases the bank rate. Borrowing by commercial banks from the central bank becomes costly and this discourages borrowing from the central bank. The commercial banks in turn increase their lending rate to customers. This reduces credit and money available in the economy. This then reduces the rate of inflation in the country. Also, the negative sign indicates money supply is university related to Real Gross Domestic Product.

4.4   Statistical Criterial (1st Order Test)

We shall apply the student t test, R^2 and F test to determine the statistical reliability of the estimated parameter.

The value of R^2 is 0.318247. This implies that 31% of the variation in bank credit is explained by independent variables which are money supply, interest rate, exchange rate, and minimum rediscount rate. This indicates that the goodness of the model is not a good fit.

4.4.2 The Student T Test

Evaluation is carried out to ascertain if the independent variables are individually significant. If the calculated t is greater than the critical t at 0.05 level of significant then reject the null hypothesis H_o, otherwise accept the alternative hypothesis H_1.

From the statistical table, critical t 0.025 is 2.086. The result of the evaluation is summarized in the table below.

Variable	T value	T – tab	Decision	Conclusion
M2	1.387200	2.086	Accept	Insignific

				Ho	ant
INT	1.675013	2.086	Accept Ho	Insignific ant
EXR	0.164361	2.086	Accept Ho	Insignific ant
MRR	- 1.847478	2.086	Accept Ho	Insignific ant

From the table above β_1 (MS), β_2 (INT), β_3 (EXR) and β_4 (MRR) are not statistically significant. We conclude that β_1, β_2, β_3 and β_4 have no significant effect on bank credit in Nigeria in the period under review.

4.4.3   The F – Statistics Test

This evaluation is carried out to determine, if the independent variables in the model are simultaneously significant or not. If F* is greater than critical F at 0.05 level of significant, then reject the null hypothesis H0 and accept the alternative hypothesis.

Decision Rule

Reject H0 if F- cal > F0.05 (V1/V2)

VI = K – 1 (numerator)

V2 = N – K (denominator)

From the result in the model, F cal = 1.867230. From the F table F0.05 (4/15) =3.13. Since F–table of F0.05 (3.06)> F-cal (1.867230), we accept H_0 and conclude that the independent variables in the model are not significant.

4.4   Econometrics Test of Second Order Test

This test will be based on whether the assumptions of the classical linear regression model are satisfied or not. The assumptions underlying the statistic are:

I.   The regression model include intercept term
II. The regressor or explanatory variables are non-stochastic of fixed in repeated sample
III. The error term is assumed to be normally distributed
IV. The regression model does not include the lagged value of the dependent variable as one of the explanatory variables.
V.   There are missing observations in the data.

When these assumptions are not satisfied it is customary to re-specify the model. For instance, one may introduce new variable or omit some, transform the original variable, so as to produce a new form that will satisfy these assumption.

4.4.1   Auto Correlation Test

We will adopt the Durbin Watson (d – statistic) to test the randomness of the residuals. Based on this we state our hypothesis as thus

H0:   P = 0 (No positive first order autocorrelation)

H1:   P = 0 (positive first order autocorrelation)

Decision Rule

Reject Ho if d* < du or d* > 4 -du

Accept Ho If d*> du or d* < 4 -du

Where:

d* = estimated Durbin – Watson

du = Upper Unit Durbin - Watson

from the Dw d table

du = 1.66 (n= 15, k = 4) at 5% level of significant. And d* = 2.632251

since our d* = 2.632251is greater then du = 1.66,we conclude that there is no evidence of positive autocorrelation in the regression result.

4.5   Summary of Finding

i. The relationship between money supply and bank credit is positive and conformed with the a priori expectation but is statistically insignificant.

ii. The result indicates a positive relationship between interest rate and bank credit which conform to the apriori expectation but is statistically insignificant.

iii. The relationship between exchange rate and bank credit is positive which conform to the apriori expectation but is statistically insignificant.

iv. The relationship between minimum rediscount rate and bank credit is negative which conform to the apriori expectation but is statistically insignificant.

The above shows the performance of monetary policy as an instrument to improve bank credit in Nigeria. The null hypothesis of this study posits that the use of monetary policy measures in promoting bank credit in Nigeria is not efficient. This proves true as monetary policy variables (interest rate, money supply, exchange rate and minimum rediscount rate) do not show statistical significant relationship between them and bank credit.

5. Summary, Conclusion and Recommendation

5.1   Summary

An issue which has occupied the minds of government for decades is the effectiveness of monetary on influencing economic variables.

In the course of the research work, certain monetary policy variables were employed to critically evaluate the effect of monetary policy on banks credit and the results proved significantly that   the effect could be positive or negative depending on the variables adopted.

In Nigeria between (1990-2010), different in monetary policy variables were adopted to respond to the various upheaval in the economy, the   study made use of

secondary data which were obtained primarily from the CBN and the Federal Bureau of Statistics.

The monetary policy variables adopted were interest rate, money supply, exchange rate on each of this variables from (1990-2010) and tested at a 5% level of significance.

The result obtained during the course of the study showed that in the last two decades all the monetary policy variables adopted had positive relationship on the level of bank credit with the exception of the minimum rediscount rate.

The monetary policy variables used do not show statistical significant relationship between them and bank credit, but current institutional arrangement and operational modalities in which the monetary policy is formulated and implemented allows the banks sufficient operational attitude to respond swiftly and decisively to financial and economic upheavals in the system.

The CBN for instance will change the official interest rate in an attempt to influence the overall level of expenditure in the economy, the same goes for the exchange rate and money supply.

5.2 Conclusion

In the light of the Nigerian experience, it is essential that responsibility should always be matched with authority. Such operational arrangement would help to define the parents and responsibilities of major players and enhance accountability and professionalism.

Given the magnitude of human capital at his disposal the CBN can surely make swift and decision responses to the nations financial environment there by contribute effectively towards financial stability, if and only if it is endowed with instrument independence.

A continuous and direct approach to monetary policy will ensure a sustainable and economically viable level of bank credit facilities to both commercial and private enterprises.

Based on the findings and the unstable nature of the Nigerian economy, these strategy adopted in implementing the research work the monetary variables considered in this research should be streamlined in accordance with the rising needs of the economy. For instance when the motive is to curb inflation gaps, the minimum rediscount rate can be adopted, consequently leading to a decrease in the level of bank credit.

5.3 Recommendation

As earlier stated in the literature review, monetary policy is an important level of power at the same time a tool. In this process, the following recommendation has been suggested for onward performance in ensuring financial stability in Nigeria with the optimum level of bank credit.

a. A gradualist approach to monetary policy believing that a serves of small movement in interests is a more effective strategy rather than sharp and unexpected jumps in the cost of borrowing money.

b. Monetary policies in Nigeria should be designed to be proactive and forward looking because changes in interest rates always take time to work through the economy. The

reaction of business and consumers to interest rate movement is uncertain as are the time lays involved.

c. The CBN should familiarize itself with certain data, the economic data's to be considered on a monetary basis should include:

    I. GDP growth rule and spare capacity

    II. Bank lending and consumer credit figures

    III. Equity markets (share price) and house process

    IV. Unemployment's figures

    V. Trends in global foreign exchange markets

a. Monetary Policy requires experts knowledge on its successful prosecution

b. The state of the country's infrastructure is another critical factor which must be put right for monetary policy to be effective while the economy needs an effective Central Bank to work, the Central Bank will also depend on a conducive environment to be effective.

Effects of Specific Imagery and Autogenic Relaxation Combined Intervention on Soccer Skill Performance of Young Athletes in Turkey

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Abstract

The aim of this study was to investigate the impact of a 14-week specific imagery and autogenic relaxation combined intervention on 10–12 year-old novice boys' soccer skills performance in Turkey. A repeated measures pre-post design was used to examine changes in performance by group (experimental, control). Participants (aged 10-12 years) were randomly assigned to either an experimental group (imagery and autogenic relaxation) or control group. Participants' performance tests assess shooting accuracy, ball control with head, ball control with feet, and short passing tests. The experimental group was instructed to use imagery and autogenic relaxation which comprised 10 minute mental training sessions, three days a week on non-consecutive days for 14 weeks. Post-test results indicated that the intervention group demonstrated greater improvement in shooting, ball control with head, ball control with feet, and short passing tests. Mental imagery and autogenic relaxation combined with physical practice may have positive effect on soccer skills enhancement in 10-12 year-old novice boys.

*Keywords***:** Specific imagery, autogenic relaxation, soccer, young athletes.

Introduction

Soccer, as it is around the world, is the leading sports in Turkey with the amount of participation and audience it attracts. Turkish Football Federation (2010) aims at training children under 13 years of age with correct movement form and football education through school and club football activities so that they can join youth leagues with proper preparation. The ultimate goal of these trainings is acquisition of football technique and tactic skills along with mental, psychomotor, social and emotional development (TFF – Basic Principles of School Football, 2010). However, a closer look at the training processes demonstrates that physical trainings geared towards technical competencies are supported with tactic acquisition and those mental training techniques are disregarded. Studies show that mental training techniques positively affect the motor skill acquisition in early ages (Wrisberg et al., 1989; Li-Wei et al., 1992; Caliari, 2008; Hemayattalab & Movahedi, 2010; Hidayat, 2011). Imagery, a form of mental training, has been shown to be an important mental skill for children (Li-Wei et al., 1992; Munroe-Chandler et al., 2005). Imagery method use in young athletes has been proved to affect motor skill acquisition (Zhang et al., 1992; Mammasis & Doganis, 2004; Hidayat, 2011; Veraksa & Gorovaya, 2011; Munroe-Chandler ve diğ., 2012), self-esteem level (Munroe-Chandler ve diğ., 2008), and tactic development (Munroe-Chandler et al., 2005) in a positive manner. Imagery can be developed in conjunction with autogenic relaxation, as relaxation techniques prepare players in order that imagination is effective. There are only a few studies examining the effect of relaxation techniques on young athletes (Lohaus and Hessling, 2001; Lohaus and Hessling, 2003; Hashim et al., 2011).

Though researchers have emphasized the importance of mental skills training for young athletes (Orlick & Zitzelsberger, 1996; Weinberg et al., 2003; Munroe-Chandler et al., 2012); there is a paucity of research on the effects of implementation of both imagery and autogenic relaxation approach in technical skills acquisition in soccer for children who newly start. Therefore, further evaluation of the effects of mental training techniques in children's soccer skills performance is warranted, especially in Turkey where child football is newly being studied, and no studies have evaluated the impact of mental training on technical skill acquisition.

The aim of the present study was to investigate the effects of 14-week specific imagery and autogenic relaxation combined with standard physical training on soccer skill performance in novice boys aged 10-12 years. It was hypothesized that the technical skills of children who employed specific imagery and autogenic relaxation techniques would improve significantly more than the children in the control group, performing regular trainings but not receiving mental training treatment. The primary outcome of the study was the effects of specific imagery and autogenic relaxation techniques on soccer skill performance in novice boys aged 10-12 years.

Methods

Participants

Twenty nine healthy boys, who previously applied to the Sanliurfa Soccer Training Center, have participated in this study. They were aged between 10-12 years and had not played soccer formally; and they were not previously trained to use the techniques used in this study. The study measurements were performed between April and July of 2010; after approvals of the Harran University Ethic Board and Soccer Federation of Turkey Provincial Representation Office of Sanliurfa were received. As the participants were under 18 years of age, participants along with their parents and coaches were provided information about the study.

Study procedures

Participants were tested individually and out of sight of the remaining athletes being tested on the task. This ensured that no observational learning occurred between participants. Shooting, ball control with the head, ball control with the feet and short passing techniques as recommended by the Soccer Federation and frequently reported in the literature (Ali, 2011; Ali et al., 2007; Rösch et al., 2000) have been tested in open air in the field, without giving any specific commands.

The participants were randomly allocated either into the control group or the mental training group.

Control Group: Participants allocated to the control group (n = 15; mean (SD) age = 11.2 (0.6) years) did not receive any psychological skills training or contacted with the researchers during the course of the study period. They performed their routine physical trainings. Skill measurements were performed twice with an interval of 14 weeks.

Mental Training Group: The mental training group (n = 14; mean (SD) age 11 (0.7) years) received a mental training program involving specific imagery and autogenic relaxation techniques in addition to the standard physical training program. The mental training was planned as 10-minute mental training sessions, non-consecutive days and three days a week for 14 weeks. Skill measurements were performed before and after 14 weeks of mental training.

The purposes of the mental training program were (a) to educate children about autogenic relaxation and specific imagery, without an extensive commitment to training or time period, (b) to reduce anxiety through autogenic relaxation and attention control, (c) to improve skill performance through task specific imagery practice. The researcher informed children that it may take time for the mental skills training to have an effect on their soccer skills performance and encouraged them to use all of their mental skills. It was assumed that the participants would use both of the interventions. There was no direct measure showing that each individual performed all interventions.

Mental Training

Specific Imagery (imagery of skills): In each session, children were instructed to imagine one of the soccer sport skills (shooting, ball control with head, ball control with feet, and short passing) (Table 1). According to previous research, the use of a written script, orally delivered to the athlete, has been the most widely used technique for administering imagery interventions (Perry & Morris, 1995).

Autogenic Relaxation: In accordance with the principles of autogenic relaxation, children were instructed to tense and relax specific muscle groups (Table 2). Since relaxation instructions were limited to 5 minutes each, the number of body parts included was smaller than in the original version of the training, designed by Lohaus and Hessling (2001). The muscle groups, which were successively addressed, were muscles in the hand, arms, forehead, cheeks, chest, shoulders, stomach and thighs.

Skills Evaluation Procedures

The experimental design involved three phases:

Phase 1: A baseline stage where the researcher collected skill scores in two days.

Phase 2: The intervention phase, lasting fourteen weeks for the mental training groups; no intervention was provided to the control group.

Phase 3: The post-intervention stage, where the researcher collected skill scores in two days.

Skill Tests

Skill 1 - Shooting Accuracy: The clear aim of a soccer match is to score more goals than the opposing team. Therefore, one of the most highly valued and important skill elements within the game is the ability to score goals (Jinshen et al., 1991). Goal-shooting tests are usually part of a battery of skill tests designed to assess overall soccer playing performance (Reilly & Holmes, 1983; Rösch et al., 2000; Haaland & Hoff, 2003). Therefore, shooting test has been selected. For the test, the whole goal (2.44 x 7.32 m (8x27 feet)) has been divided into 6 sections with tape strip of 5 cm. (Figure 1). Target points have been shown and it was explained to them that they would earn 4 points in case the ball hits section A, 3 points in case the ball hits section B, and 1 point in case the ball hits section C. The ball has been placed in middle point which is 10 meters away from the goal. No instruction has been given for shooting speed and child stops it. Children were allowed to approach the ball by running.

Children made 5 kicks on a dead ball, and took a rest of 1-minute between kicks. Two referees scored the kicks made. Balls that hit the goalpost or tapes were excluded from the evaluation.

Skill 2 - Ball Control with the Head: Children were told to control the ball without allowing it hit the ground, provided that they repeatedly head the ball within a 9x9 m square area. Only the kicks made with the head without allowing the ball hit the ground have been accepted and the head hits were counted. If the ball hit the ground, or the child stepped outside of the square, or he/she touched the ball with any body part other than the head, then the counting was stopped.

Skill 3 - Ball Control with the Feet: Children were told to control the ball without allowing the ball hit the ground, provided that child only kicks up the ball with his feet within a 9x9 m square area. Only the kicks made with his feet without allowing the ball hit the ground has been accepted, and the kicks were counted. If the ball hit the ground, the child stepped beyond the square or touched the ball with any other body part than his feet, and then the counting was stopped.

Skill 4 - Short Passing: This was an assessment of accuracy and coordination in passing a moving ball. The player dribbled the ball within a marked rectangle up until a line and from there passed the ball into a hockey goal 11 meters away. The examiner

measured a total of five attempts, scoring 3 points if the ball goes into the goal and 1 point if the ball hits the crossbar or goalpost.

Data Analysis

All statistical analyses were performed using SPSS version 16.0 (SPSS, SPSS Inc, Chicago, IL, USA) software. All values of variables were expressed as mean and standard deviation (SD). In order to determine whether the intervention influenced the time taken to perform the soccer skills, data were analyzed 2 (group) x 2 (time) repeated measures ANOVA. Groups served as between-subjects independent variables, while test (pre, post) served as the within-subjects independent variable, and the time taken to complete the soccer skills was the dependent variable.

All variables were matched pair-wise (before - after intervention) and statistical significance was accepted at $p < 0.05$. The results were presented in tables.

Results

Kolmogorov-Smirnov and Shapiro-Wilk tests showed that the assumption of normality was met within each group.

Means (SD) scores and change in scores in 14 weeks for all tasks for each group (control and experimental) are presented in Table 3. Significant increase in all skill scores were observed in the experimental group following mental training, while no difference was found in the control group.

Upon one-way ANOVA the first measurement scores were not significantly different between groups in all four skills (shooting [$F(1,28)=0.001$; $p=0.97$], ball control with head [$F(1,28)=1.262$; $p=0.27$], ball control with feet [$F(1, 28)=0.062$; $p=0.80$] and in the short pass test [$F(1,28)=0.06$; $p=0.93$]).

In order to determine whether the mental training intervention influenced the time taken to perform the soccer skill tasks, a repeated measures-ANOVA was conducted, and paired t-test Bonferroni correction was utilized to prevent a type I error.

ANOVA results for shooting test for time effect and group by time effect were significant [$F(1,27)= 28.349$, $p < 0.05$, $\eta^2=0.512$, power= 0.999 and $F(1,27)=7.261$, $p < 0.05$, $\eta^2=0.212$, power=0.738, respectively] (Fig. 2).

Ball control with head skill ANOVA results for time and group by time effect were also significant [$F(1,27)=23.066$; $p < 0.05$, $\eta^2=0.461$, power=0.996) and $F(1,27)=9.102$; $p < 0.05$, $\eta^2=0.252$, power=0.828, respectively] (Fig. 3).

Ball control with feet also yielded significant ANOVA results for time [$F(1,27)=23.772$; $p < 0.05$, $\eta^2=0.468$, power=0.997] and for group by time effect [$F(1,27)=14.548$; $p < 0.05$, $\eta^2=0.350$, power=0.957] (Fig. 4).

However, for the passing test, the time effect was significant [$F(1,27)=19.667$; $p < 0.05$, $\eta^2=0.421$, power=0.990], but the group by time interaction effect was not [$F(1,27)=3.890$; $p=0.059$, $\eta^2=0.126$, power= 0.477] (Fig. 5).

Discussion

The purpose of the study was to assess the effects of specific imagery and autogenic relaxation intervention combined with standard physical practice on soccer skill performance of young athletes. It was hypothesized that boys receiving the specific imagery and autogenic relaxation intervention would perform better (increased accuracy)

on the soccer task from pre to post testing than those in the control condition who received standard physical practice. Compared to the identical physical training regimen without mental imagery and autogenic relaxation training, we found that 14 weeks of mental imagery and autogenic relaxation training targeting the soccer skills performance resulted in significant increases among 10-12 year-old boys. The results of this study support previous findings (Hidayat, 2011; Callow et al., 2006; Peluso et al., 2005; Thelwell & Maynard, 2003; Li-Wei et al, 1992; Munroe-Chandler et al., 2012). Findings of Martin et al. (1999), in their Applied Model of Imagery Use, support this finding. They suggest that the function of imagery employed should be dependent on the intended outcome for the imagery use. Therefore, given the goal was to increase the speed with which the athletes completed the soccer task (i.e., completing a series of soccer skills), Martin et al. (1999) would state that CS imagery is the most pertinent function to use. This result also supports the evidence that the combination of mental training with physical training leads to better result than separate trainings (Hidayat, 2011; Hall et al., 1998; Bar-Eli et al., 2002; and Cumming et al., 2004). This may be explained by the fact that children know their body well and they understand the importance of focusing on the techniques they will implement. Children also know how they can mentally focus on techniques they want to improve, how they can effectively use their body, and they can list their aims for success. Children who implement the imagination and autogenic relaxation were left alone during their technical learning. The pupils who experienced mental imagery training felt as if they had exercised twice, firstly in their minds and secondly in reality. According to Abbott & Collins (2004), for an athlete to progress from one stage of development to another, the ability to use self-regulatory learning strategies (e.g. imagery) is vital. When a soccer player progresses from novice to junior, she or he will have to learn several new skills in a short period of time. Technical, physical, and mental demands increase markedly in a short time, and soccer players are introduced to a regular psychological skills training program. If some of the mental training skills were to be implemented earlier in the soccer players' careers (i.e. when they are novices), they would be better prepared to progress to junior level. When Munroe-Chandler et al. (2012), studied the effects of a cognitive specific (CS) imagery intervention on the soccer skill performance of young athletes aged 7-14 years and determined if performance varied with age, they found that younger children were more willing to use mental imagery techniques, which is an important finding from an applied perspective. They recommend that "mental skills such as imagery should be introduced to athletes more willing to embrace these skills and use them to their benefit" (Munroe-Chandler et al., 2012). This study also emphasizes the importance of implementing mental imagery and autogenic relaxation combined training in motor skill learning process. It is based on several functional and practical reasons: (1) as a supplemental training before and after routine training, even in spare time while waiting to return to exercise, especially if the class is abundant of pupils; (2) as a device to enhance the cognitive skill of pupils; (3) as a device to accelerate the process of motor skill acquisition and more accurate motor response formation; and (4) to create an influence to improve psychological aspects according to some studies (Hidayat, 2011).

Although the findings of this study are informative, there are several limitations to note. First, as the study was a cross-sectional study, one cannot imply causation. A longitudinal study assessing mental training use across age and competitive groups would provide insight to determine what causes changes in soccer skills. Similarly, social influences (parents, peers, siblings, coaches, sporting heroes, sport psychologists, etc.)

can all influence the acquisition of mental skills. Thus, there is a need for further research in this field. Finally, by using only 10-12 aged novice children as participants, our results have generalization limitation, and thus application of the findings to other sports needs to be done with caution.

Conclusion

Overall, the current findings reveal that mental practice is effective for the preparation of the action. Furthermore, learning instructions on the movement effect related to the movement technique are more effective than a more distant effect. The results of the present study may have important implications for optimizing instructions for motor performance and motor learning in young athletes.

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Table 1. Imagination skill instructions list (Morris et al, 2005; Smith, 1999) used in this study

1. Close your eyes and take a deep breath.

2. Slowly exhale and relax. Let all the tension flow from the body.

3. Dream that you are walking at soccer field. Imagine field lines, grass, goal, your friends and ball.

4. Take a deep breath and say to yourself that you will be successful.

5. Imagine that you are preparing to technique. You are full of self-confidence, calm and you know that you can do.

6. Take a deep breath and relax.

7. Imagine that you approached the ball, think the point you put your supportive foot, motion of the foot you kicked and your kick. Watch where ball goes to. Your timing, balance and kick is perfect. Everything is as it should be.

8. Review different points of technical implementation. You are calm and balanced and full of self-confidence.

9. Your trainer and friends liked your technical implementation. Imagine that they congratulate you.

10. Focus again on your breathing. Take a deep breath and slowly exhale.

11. Slowly open your eyes, stretch, and feel confident of your upcoming performance.

Table 2. Autogenic relaxation technique (Morris et al, 2005; Smith, 1999) used in this study

1. Get in a comfortable position, such as sitting in a chair or on a couch and place both feet on the floor.

2. Close your eyes and relax.

3. Inhale through your nose and exhale through your mouth.

4. Take a good deep breath so your lungs are completely filled.

5. Do not hold your breath.

6. Exhale the air through your mouth so you can hear a soft whispering sound.

7. Keep your thoughts on your breathing.

8. As you continue to breathe in and out let your body relax… just let go of any tension you may be feeling.

9. You are now going to focus on relaxing your body. Starting at your head, you are going to scan the muscles of your body for areas of tension.

10. When you find a tense area, acknowledge it and then release it and let that tension go.

11. Allow those tense areas to just relax. Focus first on your head and face and perform a scan… and release any areas of tension.

12. Continue down to your neck and shoulders.. searching for any areas of tension.. if you find an area, just let that tension go.

13. Breathe in…Breath out. Move onto your right arm all the way down to your fingers.. stop at each muscle group and release any tense areas.

14. Breathe in….Breathe out. Move onto your left arm…searching for those tense muscles as you move down into your fingers.

15. Breathe in…. Breathe out. Scan your upper and then lower back...when you find tension acknowledge it and let it go.

16. Breathe in…Breath out. Continue to move onto your gluteus and hips….they should all be completely relaxed.

17. Breathe in filling your lungs with fresh, clean air…Breathe out releasing the toxins from within…. Scan down into your right leg all the way to your toes…stopping at each muscle group and allowing it to relax.

18. Scan your left leg…when you find tension just let it go. Rescan your body for any areas that are still tense, if you feel tension anywhere, just let it go. Allow your body to continue to relax and your mind to be calm. Breathe in…Breathe out.

19. You are now going to perform the task of spine boarding. You are going to imagine the steps. You are going to be successful.

20. A similar procedure can be performed at the soccer field. Before perform a skill, just focus on your breathing. Take a deep breath through your nose. Do not hold your breath, but exhale through your mouth. You are now relaxed and ready to perform.

Table 3. Pre- and post-test scores for each skill of control and experimental groups

	Control					Experimental				
	First measurement (mean (SD)	Second measurement (mean (SD)[a]	Change Mean Difference	SEM	P value [b]	Pre-intervention (mean (SD)	Post-intervention (mean (SD)[a]	Change Mean Difference	SEM	P value [b]
Shooting	7.2 (0.9)	8.0 (1.6)	0.86	0.45	0.06	7.2 (1.2)	9.9 (1.5)	2.64	0.474	0.001
Ball control (head)	7.7 (2.5)	9.2 (4.0)	1.53	1.19	0.21	8.6 (1.6)	15.3 (4.7)	6.71	1.235	0.001
Ball control (feet)	29.1 (14.0)	31.6 (12.0)	2.60	3.40	0.45	30.2 (12.3)	51.5 (21.0)	21.86	3.523	0.001
Short passing	3.2 (0.5)	3.6 (0.8)	0.46	0.26	0.08	3.2 (0.4)	4.4 (0.7)	1.214	0.273	0.01

[a]There are 14 weeks between the two measurements
[b]Paired t-test with Bonferroni correction.
SD: standard deviation; SEM: Standard error of mean

Legend of the Figures

Figure 1. Goal point

Figure 2. Shooting test scores for each group from first to second measurements

Figure 3. Ball control with head scores for each group from first to second measurements.

Figure 4. Ball control with feet scores for each group from first to second measurements.

Figure 5. Short passing scores for each group from first to second measurements.

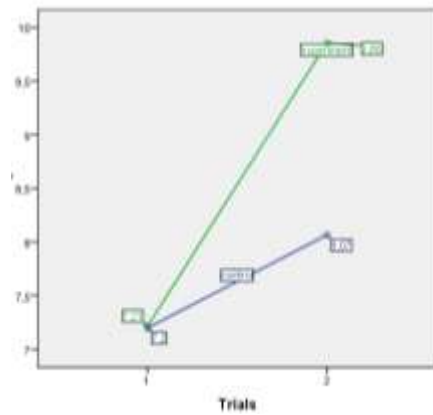**Figure 1**

A	C	A
4 point	1 point	4 point
B	**C**	**B**
3 point	1 point	3 point

A=1.5 m x 1.22 m

B=1.5 m x 1.22 m

C= 4.32 m x 1.22 m
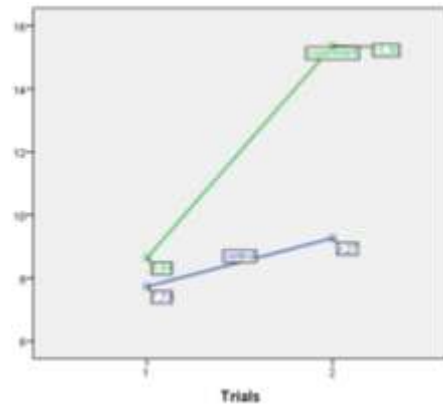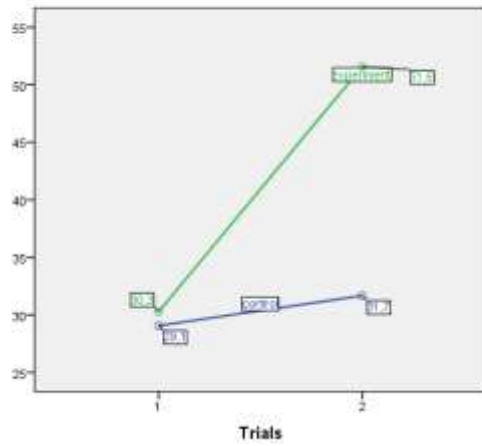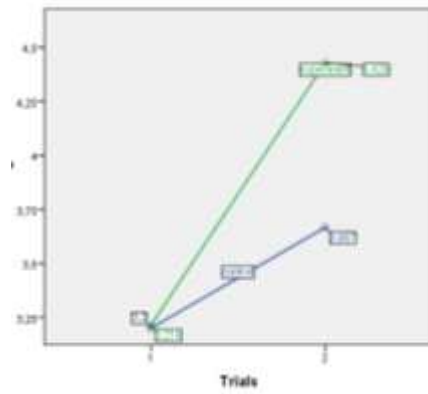
Figure 2

Figure 3

Figure 4

Figure 5

Barriers to Effective Use of Information Technology in Higher Education at Yanbu, Kingdom of Saudi Arabia

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Abstract

As information technology becomes ubiquitous in classroom, teachers will be asked to utilise new technologies in their pedagogy. This is important for them to provide opportunities for students to learn to operate in an information age. This study examined the barriers to use of information technology (IT) in higher education at Yanbu district in Saudi Arabia. Sub-domains investigated included: infrastructure and resources, policy and support, teachers' personal beliefs, and staff development. This study uses a survey which shows common barriers encountered by the teachers. Demographic data enabled description of teachers based on similarities and differences of gender, training, years of teaching experience, and age. Teachers rated the barriers limiting their use of technology in teaching on a scale ranging from 0 (does not limit) to 3 (greatly limits). We present results which showed that all four domains were highly significant barriers: infrastructure and resources (M = 1.33); staff development (M = 0.82); policy and support (M = 0.94); and teachers' personal beliefs regarding technology (M =0.94).

The most top two barriers are no computerised text books for most of college's curriculums and the architecture of classrooms is not suitable enough to use IT. To minimize the impact of these barriers and consequently improve the level of integration of information technology in higher education in Saudi Arabia, a well-conceived strategic vision, adequate integration of IT in text books and curriculum; and sufficient IT architecture plan are of great importance.

Introduction and Related Research

For the last few decades, technology has been revolutionizing every aspect of a person's life. Information and communication technology (ICT) has become an important part of most organizations and business nowadays (Zhang and Aimang, 2007). Computers began to be placed in higher education in the early 1980s, and researchers suggest that ICT will be an important part of education for the next generation too. Modern technology offers many means of improving teaching and learning in the classroom (Lefebvre, Deaudelin & Loiselle,2006).

Saudi Arabia has responded to the technological expansion in most areas, including education and in a tremendous transitional stage in its movement towards integration of IT. According to the sub-areas in the main areas of the National Plan for Information Technology; utilization of IT in education and computer literacy is optimized at all levels of education - general, technical, vocational, graduate, post- graduate, and continuous education (Ministry of Communications and Information Technology, Saudi Arabia, 2003). Through the use of information technology and the Internet, information is now more accessible than ever before. In the 1960s and 1970s, the term information technology (IT) was a little known phrase that was used by those who worked in places like banks and hospitals to describe the processes they used to store information. With the paradigm shift to computing technology and "paperless" workplaces, information technology has come to be a household phrase. It defines an industry that uses computers, networking, software programming, and other equipment and processes to store, process, retrieve, transmit, and protect information.

Information technologies today significantly affect every society in the world, especially in the field of education. The World Wide Web makes our world so small that it increasingly resembles a small village. Internet users tend to know what is going on in their cyber-neighbors' lives; even when that neighbor is often living on the other side of the world! According to Becta (2003) and Samman (2003), new technologies might improve our lives in two ways: a) by enabling us to do things better, and b) by enabling us to do better things.

Although technology is everywhere, its development and application are still lacking with problems for both users and designers. In higher education, technology has become an important apparatus in the teaching and learning process. Universities around the world have made significant investments in educational technologies. Higher Education instruction needs to prepare professionals who are competent in the design and the use of current and emerging computer technologies. Even though computers are becoming available worldwide, some faculty members have not yet begun to use computers for personal, professional, or instructional purposes (Downs, 2006). In order for higher educators to become more technologically savvy, the barriers must be removed. The fewer barriers facing them, the more likely they will be open and motivated to incorporate technology into their curriculums. Whereas technology usage by faculty has become commonplace over the past two decades in the most highly developed countries, many higher education institutions in

other nations have not yet experienced a similar adoption of instructional technology (Iyamu & Ogiegbaen, 2006; Monsef, 2005).

Institutional leaders are concerned about providing a competitive education in their respective disciplines, but they may not be ready to invest the resources necessary for maximizing the benefits of instructional technology on their campuses (Berge, Muilenburg, & Haneghan, 2006).While technology usage by faculty is expected at well- resourced institutions, there has been little focus on the barriers which persist in keeping faculty of universities in less-developed countries from joining their technologically proficient colleagues (Gall, 2005; Iyamu & Ogiegbaen, 2004; Vrasidas, 2002).Faculty members who have had little instruction in using technology may not feel prepared for the demands of using technology in their teaching (Groves & Zemel, 2006). In order to use technology in teaching, Groves and Zemel concluded that faculty wanted accessible hardware, training, and discipline specific media that is easy to use. Despite the fact that the number of faculty adopting these new technologies has been increasing, still many remain cautious to adopt new technologies (Jacobsen, 2005). Universities are currently in a position where there is unplanned agenda for the adoption of educational technology, and many are searching for ways to promote its use for instruction.

Appropriate integration of technology constitutes a major change in faculty lives; technology integration is a complex phenomenon that involves understanding faculty motivations, perceptions, and beliefs about learning and technology. Universities should strive to construct a strong vision grounded on technology integration and offer appropriate professional development programs that support teachers experimenting with new educational technologies. Since still faculty members with adequate access and skills are not integrating technology into their teaching. Many factors are restraining faculty in terms of adopting new technologies:

First, resistance is common from faculty members who are comfortable with their current instructional methodology and do not want to learn "new" approaches to educational methods. Even some of the best faculty members are reluctant to use technology. Some faculty fear that increases in technology will decrease the human relationship between instructors and students, thereby influencing the students' motivation to learn and affecting the students' attitude toward the content area (Powers, Anderson & Love, 2005). Second, some reluctance is also based on self-efficacy. If a faculty feels that they possess the skills needed for technology integration, they are more likely to do so (Milbrath & Kinzie, 2006). In regards to technology, faculty self-efficacy is associated with higher levels of proficiency and higher commitment when faced with tasks of increasing difficulty. Third, some of the resistance is also based on the teaching style of the faculty. Even if teachers acquire the needed skills and access, they will only use the computer in a way that fits with their pedagogical style (Fulton & Sibely, 2005). Fourth, the perceived quality of the content and its value to instruction are one of these concerns to faculty. Regardless of how innovative the faculty may be, and regardless of what concerns they bring, all faculty development must begin and end with emphasis upon the enhancement of teaching effectiveness. Professional development programs must offer faculty tangible benefits before they will embrace new approaches (Harrsch, 2005). Fifth, faculty must understand that the use of technologies will serve to enhance their effectiveness as instructors. Faculty must understand that the integration of technologies is not a pathway to the elimination of human instructors, but rather an opportunity to enhance instruction. Sixth, leadership and support at all levels must be centered firmly upon the improvement of the teaching and learning process, making the student the focus of instruction, not the technology. Identifying areas that can be considered as troubling and providing the necessary information to address those concerns will promote a clear institutional vision that will be reassuring to faculty.

Seventh, faculty members are often doubtful to board on technology integration because the attitude of their institution toward such integration is unknown. Equally important is effective institutional management of the entire change process"(Thompson, 2003, p.2). Eighth, he posits that change is viewed as a process not an event, and is discussed based on the motivations, perceptions and attitudes of the group in question.

According to Ertmer (2007), the root causes of lack of effective technology integration have been linked to two types of barriers, first order barriers that are extrinsic to teachers and include lack of access to computers and software, insufficient time to plan instruction, and inadequate technical and administrative support and second barriers that are intrinsic to teachers and include beliefs about teaching pedagogy, beliefs about computers or technology, established classroom practices, and unwillingness to change.

According to Nielsen, 2007, students must be taught skills that will allow them to be successful in their future endeavors, regardless of what they may be. The technology that exists today will not be the technology of the future. Students should acquire a set of generic skills and knowledge they could utilize in the decision-making process and other academic and occupational pursuits. Although there is some benefit in teaching kids skills they can apply immediately, there's more value in teaching them deeper concepts that will benefit them forever, regardless of changes in specific applications (Nielsen, 2007). Educators need to find stronger themes, around which they can coordinate big ideas (Cavanagh, 2006). This allows students to make deeper connections with academic material. These themes can successfully be developed with the integration

of current technology. Technology has the ability not only to develop these skills but also to present material to students in a manner to which they are accustomed. These computer literate students have been "programmed" to learn through digital technology. In order to be effective in teaching, teachers need to incorporate not only problem solving skills, but incorporate appropriate technology training as well. If students learn problem solving skills, how to analyze data, and how to apply new knowledge to novel situations they will be prepared to tackle any task they may encounter in their future. Because technology is embedded in so many aspects of a student's life, students need to learn skills that will allow them to effectively use this technology. These include creating hypertext, computer-supported presentation skills, and basic usability guidelines. In addition, students should be able to analyze the validity of data received digitally and assess the value of the material they obtain. There is increasing recognition that the end result of computer literacy is not only knowing how to operate computers but also using technology as a tool for organization, communication, and problem solving (Johnson, D. & Eisenberg, M., 2002).

Khalid, Abdullah (2009), said that the barriers related to accessibility of new technologies for teachers are widespread and differ from country to country. Empirica's (2006) European found that lack of access and infrastructure of IT in a classroom are also amongst the largest barriers to using IT in teaching by teachers. Similarly Khalid (2009, p240) also found that in European higher education there are some infrastructure barriers such as broadband access not yet available. He also concluded that four of the top ten barriers were related to infrastructure and accessibility of CT. These barriers were insufficient numbers of computers, insufficient peripherals, insufficient numbers of copies of software, and insufficient simultaneous Internet access.

Successful integration and/or adoption of information technology in Higher Education as well as its rejection depend on several factors. These factors could vary from one place to another depending on the environment where the technology is introduced as well as the purpose and timing of this study. Several studies have been conducted on this regard.

The purpose of this study was to examine the barriers that prevent teachers from Yanbu University College (YUC) in Saudi Arabia from using information technology in their teaching. This study investigated the barriers to its use in their daily teaching activities.

What are the unique barriers encountered by educators in the transition to IT-facilitated education? This study outlined an investigation into the barriers that prevent effective use of IT in day-to-day teaching activities in Saudi Arabia, specifically drawing from the perspectives of teachers in YUC. Two research questions were considered:

1. Do teachers encounter common barriers that prevent them from making effective use of IT in day-to-day teaching activities at YUC in Saudi Arabia? and
2. Do teachers encounter unique barriers (other than the common barriers identified in the first research question) that may prevent them from making effective use of IT in day-to-day teaching activities at YUC in Saudi Arabia?

The chapter is organized as follows. In Section 2 we introduce our methodology which provides procedure to collect our data and shows the findings regarding barriers of IT education in Yanbu. In Section 3 we present the limitation of our analysis method. In Section 4 we present results and discussions. Finally, we summarize the chapter with future discussion and recommendations.

Methodology

The study was conducted in Yanbu district in Saudi Arabia. The research designs used were descriptive, and comparative. Both male and female teachers at YUC were asked on their use of IT in the classroom. Comparisons of their survey responses were made. The relationship between demographic information and teachers' computer experience to their attitudes toward computers was also determined.

The study examined and identified the barriers that hinder the inclusion of IT in higher education in Saudi Arabia.

Based on the findings from a preliminary focus group of 74 teachers in YUC, common barriers to IT adoption were identified and used to design the survey instrument.

Variables

The demographic variables came from questions included in the final segment of the survey. These questions include: a) participant's gender, (b) his/her years of teaching experience, (c) pre-service IT training, (d) in-service IT training, and (e) age.

The independent variables focused on four categories of barriers. Each category contained statements designed to test the frequency of the teachers' responses to determine whether or not it should be considered a barrier. The four groups were: (a) infrastructure and resources, (b) policy and support, (c) teachers' personal beliefs, and (d) staff development. Participants were asked to add any other barriers they considered important that were not mentioned in the instrument.

Survey Instrument

The survey consisted of two main parts. The first part investigated barriers to implementing IT in YUC, Saudi Arabia. The second part focused on demographic factors.

The first part of the instrument consisted of four sections :(a) infrastructure and resources, (b) policy and support, (c) teachers' beliefs, and (d) staff development. It also included barriers not previously mentioned in the instrument but added by study participants in response to an open-ended question. Participants evaluated each barrier and rated it according to the values defined in Table 1.

Des	
Does Not Limit	
Slightly Limits	
Somewhat Limit	
Greatly Limits	

Table 1: Limitations of Technology Scale

The second part of the survey contained 12 elements of demographic information. They included: (a) gender, (b) years of teaching experience, (c) training, (d) age, (e) grade levels taught, (f) number of classes taught weekly, (g) highest educational degree and year earned, (h) presence of a computer in their home or university, (j) where computers were used (at home or university), (k) where access to the Internet was available (at home or university), and (l) number of computers available in teachers' classrooms andin computer laboratories in university.

Participants/Respondents

The participants are teachers of all departments in YUC. Survey questionnaires were sent to all departments at YUC to all male and female teachers who volunteered to participate in the study. Only 74 questionnaires were returned back.

Statistical Methods

The first research question asked was "Do teachers encounter common barriers that prevent them from effectively using IT in their day-to-day pedagogy?" The null hypothesis for this question is: Teachers do not encounter common barriers that prevent them from effectively using IT at YUC district in Saudi Arabia.

This was tested using the comparative study. The domains were tested individually which include: (a) infrastructure and resources, (b) policy and support, (c) teachers' personal beliefs, and (d) staff development.

The average of all participants in every domain was derived. Arranged by perceived importance, the participants reported that most barriers were associated with infrastructure and resources, staff development, policy and support, and the teachers' personal beliefs. EXCEL spreadsheet was used to calculate the analytical statistic and its significance at .05 level.

The second research question asked was, "Do teachers encounter unique barriers (other than explicit barriers listed in the second research question) that may preventthem from effectively using IT in YUC Saudi Arabia?" All anticipated major barriers that may prevent teachers from using IT were explicitly included in the survey. Acknowledging that important barriers may have been overlooked, an open-ended question was included to let the participants express their opinions and thoughts about barriers not mentioned in the survey. Analysis of their answers was conducted by calculating how many times each new barrier mentioned was repeated.

Limitation of study

This study was focused only on teachers from only one higher education in Saudi Arabia in Academic Year 2009-2010. Aspects of IT implementation can change over time. Based on the continuous evolutionary development of the computer industry, the degree of technology use this year may be different from that of next year.

This research was limited to a specific region in Saudi Arabia, the Yanbu district. It is hoped that these results could be generalized due to the inclusion of feedback from across Saudi Arabia which was used in the development of the survey instrument. However, one limiting factor of this research is that the results may not be generalized to other teachers. The barriers to the application of IT in other higher education may be different from those in YUC.

Experimetal Results and Discussions

Barriers to IT Integration

Results of a comparison analysis for all these subdomains of barriers to IT integration are reported in Table 2. The subdomain *Infrastructure and Resources* is less than .05 indicating that this subdomain is the most common barriers preventing teachers from effectively using YUC in Saudi Arabia.

Sub-domain	Overall Mean	SD	Limitations of Technology Usage
Infrastructure and Resources	1.33	0.63	Between 'Slightly Limit' and 'Some-what Limits'
Policy and Support	0.94	0.78	Almost to 'Slightly Limit'

Teachers' personal belief	0.58	0.68	More than 'Does Not Limit'
Staff Development	0.94	0.80	Almost to 'Slightly Limit'

Table 2: Limitations of Technology Scale

*Significant at .05 level of significance

Top ten barriers To discern trends, specific common barriers were examined in terms of frequency of occurrence. Table 3 shows the top 10 barriers by frequency of response, respectively.

#	Barrier	Mean	Std. Dev	Sub-Domain
1	No computerised text books for most of college's curriculums	1.77	1.16	IR
2	The architecture of classrooms is not suitable enough to use IT.	1.75	1.16	IR
3	The college curriculum is not designed to be used electronically	1.62	1.11	IR
4	Students do not have adequate access to IT outside of the college	1.59	1.11	IR
5	Lack of access to instructional support in using IT (e.g. to incorporate technology into teaching)	1.58	1.06	IR
6	Internet connection isn't fast enough for use while teaching	1.47	1.14	IR
8	College curriculums' content are full of activities and experiments that demand a lot of time to finish them and find an extra time to apply technology	1.39	1.12	IR
8	If I want relevant software, I have to purchase it myself	1.37	1.20	IR
9	No access to Internet during college time	1.36	1.16	IR
10	I don't know the IT training opportunities	1.34	1.15	SD

Table 3: Top Ten Barriers that limit the Use of IT in YUC at Yanbu, KSA

Note: Scale runs from "doecn't limit" (0) to "greatly limits". N = 176. Where

IR = Infrastructure and Resources

PS = Policy and Support

TPB = Teachers' Personal Beliefs

SD = Staff Development

Conclusion and Future Research

This study has found barriers that prevent teachers from making effective use of information technology in higher education in Yanbu, Saudi Arabia. Identifying the fundamental barriers encountered by the teachers in integrating IT into the classroom is the first step towards a solution to the problem. Two related barriers are greatly limiting which are as follows:

1. No computerised text books for most of college's curriculums; and

2. The architecture of classrooms is not suitable enough to use IT.

The barriers could be minimized by providing more text books which have integration of IT. This study was not the first to identify these barriers. This finding is similar to that of author (Cragun 2007) mentioned that computerized textbooks need to support the knowledge that is required for a course of study, but they need to do so in a way that allows today's students to effectively interact with this material. Textbooks should be marginal in courses, while debates, discussions, computer-based presentations, and other forms of communication should be the main focus of the classroom. Textbooks should be chosen based on their ability to incorporate problem-solving skills, use real-life situations to support concepts, link material to broader understandings, and incorporate computer technology. Modern technology has allowed textbooks to be interactive by accompanying

traditional texts with CD's as well as having companion websites. There are also now electronic textbooks that are exclusively online and that are written collaboratively using wikis. These textbooks are unique in that they can be accessed and edited by anyone on the internet. Cragun further explains that electronic textbooks can present animation and sound and provide links to several items and suggest associations among ideas. Providing links to other websites allows students to learn about topics in more detail by reading additional articles, participating in online activities, and even watching movies. This allows the students to interact with the material in a way that the traditional textbook does not. With the new technology of wikis, students themselves are able to take part in writing part of their textbook. This enables them to learn about a specific topic in detail, write about it, and then post it on the internet for anyone to read. When students do this, they take more responsibility and ownership in learning about the topic (Cragun, 2007).

The top most barrier 'No computerised text books for most of college's curriculums' has also some bearings to how students learn today. Today's students are computer savvy. They have grown up in a digital world that has allowed them access to information at unprecedented rates.

According to Prensky (2001), today's students are no longer the people our educational system was designed to teach. Today's students are comprised of the first generation to have grown up in a world of technology. Email, the Internet, cell phones, PDI's, instant messaging, and computer games are integral parts of their lives (Prensky, 2006). These digital natives are vastly different from the students who our current educational system was designed to teach. They have been networked most of all their lives. Today's students will spend hours on My Space and Facebook, while they find it difficult to focus on book work for any duration of time. They have little patience for lectures, step-by-step logic, and "tell-test" instruction (Prensky). To design engaging learning experiences for these digital natives, the digital immigrants (those who have not grown up in a digital world) must be well trained in technology and understand its potential (Burke, 2000). Those who have grown up surrounded by digital technology communicate differently and use different problem solving methods (Pasteur, 2007). They prefer receiving information very quickly, parallel processing and multi-tasking, and working with graphics and hypertext over text. Another researcher also aid that students thrive on instant gratification and frequent rewards, and they prefer games to "serious" work (Prensky). Games embody well-established principles and models of learning. For instance, games are effective partly because the learning takes place within a meaningful (to the game) context (Van Eck, 2006). Research has consistently found that games promote learning and/or reduce instructional time across multiple disciplines and ages (Van Eck).

Khalid (2009) from his studies have also concurred that the architecture of classrooms is also important for the IT to be utilized during a teaching process. He also concluded that four of the top ten barriers were related to infrastructure and accessibility of ICT. These barriers were insufficient numbers of computers, insufficient peripherals, insufficient numbers of copies of software, and insufficient simultaneous Internet access. These barriers are all related to the architecture of IT in a classroom.

Further research and investigation in finding successful solutions to the barriers for the faculty's continued use of technology in their pedagogy would be beneficial to creating sustainable technology infusion in higher education.

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Determinants of Risk Aversion among Cassava Based Farmers in Osun State Agricultural Zones, Osun State, Nigeria.

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The study examined the effect of risk aversion of the cassava based farming in Osun State Agricultural Zones. Specifically, the study attempts to identify the socio-economic characteristics of the cassava based farmers, describe the risk involved, different strategies used by cassava farmers in coping with risk and factors that determines the risk attitudes in the cassava based farming. A multi-stage random sampling techniques was employed to select one hundred and eighty (180) cassava based farmers from the three Agricultural Zones of Osun State. These are Osogbo, Iwo and Ife/Ijesha. Data were collected through the use of structured questionnaire. Data obtained were processed using descriptive and inferential statistics. It was found that substantial numbers of farmers were risk averse which is mostly determined by experience and education.

Key words: Risk aversion; coping; attitudes; uncertainty

Introduction

Though the literature on risk and risk attitude is quite diverse, not much has been done in the area of investigating the effect of risk on farmers' performance measurement. Farmers' principal external sources of capital are gifts and inheritance on the one hand, and loan or credit on the other hand. Gifts and short-term loans are of considerable importance within the extended family, providing a basis for transferring income from one person to another in regular succession of crisis and need. However, family sources are often inadequate and farmers have to borrow from other sources. Investment is a function of risk and returns. Farmers like other people are risk avoiders; they are prepared to forget a certain amount of income every year in order to avoid occasional large losses. The choice between profit maximization and security is particularly obvious where it is possible to insure against risk. By such insurance a private company or state organization guarantees to pay a substantial sum in the event of a major catastrophe in return for a relatively small annual premium.

Moreover, resource-use efficiency in the developing countries such as Nigeria is faced with problem of underutilization of capacity for resources such as land, labour, capital and management which leads to low return. According to Ogunfowora and Olayide (1981), resources are not efficiently utilized or allocated under the small scale farming which is mainly traditional in style. The kinds and qualities of resources used in farming activities are of crude form, very simple and farmers make use of old techniques of farming.

Labour in the small holding farms are not fully utilized because adequate tools and farming techniques are not supplied, which can improve production of crops thereby causing low productivity in the farm. Anthony *et al* (1995) pointed out that land fragmentation is a constraint in the optimal utilization of land in tropical agriculture. The cost of borrowing or buying land is very high for the smallholder farmer to afford.

The purpose of this study is therefore to ascertain farmers' attitudes towards risk, as well as examine the drivers of attitudes towards risk in cassava based farming in the study area. In addition, the research attempts to shed lights on what the production activities, risk involved and different coping strategies of risk used by farmers are in the study area.

Nigeria is now concentrating on cassava production having known its importance in satisfying the local and international demand. There must be tremendous increase in its production to cater for its demand. This research is significant in that it seeks to know the attitude of farmers to risk involved in the production of cassava. This will help to determine the risk involved in the production of cassava and revealed how to overcome the risks involved.

Materials and methods

Galbraith (1977) noted that, the term risk aversion refers to evolutions of risk attitude at specific monetary outcome. He also noted that most comparisons of risk attitude among decision makers are valid only at this outcome, that is, one decision maker may be more risk averse than others at one monetary values, but not another. Upton (1997) stated that, risk is a measure of the effect of uncertainty on the decision maker. There are differences of opinions as to how risk should be measured. Some argued that it is variation or instability of income, while others claimed that, it is possibility disaster or turn. The estimation of utility functions of individual farmers, in order to measure their attitudes to risk is based on farmers interview in which the respondents is asking to choose between alternative hypothetical gambles, with different sets of prizes or different probabilities.

Binswanger (1990) developed an experimental method of measuring the risk attitude of about 350 farmers. Financial compensation added realism to the gambling situation by establishing incentives for the respondent to protect and increase their wealth. King and Robins (1981) argued that the direct elicitation of utility method (1) EU is not accurate enough to measure utility function

and they proposed an interval measure of risk attitude. Hood *et al* (2001) used direct elicitation of utility function that involves direct contact with decision makers to specify their risk attitude. This method has a lot of variations in which risk includes Von-Neumann Morgenstern (VN) method, the modified VN method and the Rainsey method.

This study however applied the indirect approach as used by Moscardi and de Janvry

Method of Data Collection

Primary data were collected for the study with the aid of a structured questionnaire to obtain information from the respondents about the major aspects of the study including values of inputs and outputs, socio-economic characteristics and production constraints of cassava farmers.

Sampling Procedure and Sample Size

The multi-stage random sampling technique was used for the selection of the representative samples. The first stage involved random selection of five Local Government Areas from each zone. The second stage involved random selection of two villages from each Local Government Area. The third stage involved random selection of six farmers from each village making a total of one hundred and eighty cassava farmers.

Measurement of Variables

The variables are socio-economic characteristics, which include age (yrs), educational level (yrs), primary occupation, secondary occupation, experience of farmers (yrs) and household size. Other variables include fertilizer (kg), pesticides (Lit), herbicides (Lit), family labour (man-days), hired labour (man-days), farm size (hec.) and seeds/cuttings/yam setts (value).

Method of Data Analysis

Descriptive Statistics

Statistical tools like frequency distribution, percentage were used to analyze the socio-economic characteristics of the respondents. The descriptive statistics were used to obtain the frequency of occurrence of some selected variables such as age, sex, educational status, family size and so on.

Regression Analysis

The study was based on two major assumptions namely; the randomness of cassava production and the relationship between cassava output and the input (inputs-output relationship) as represented by Cobb-Douglas production techniques;

The postulated relationship is:

$$Y = A_s X_i^{bi} u^e \quad ....(v)$$

Where

Y= Cassava (tonnes)

i =1,2,3,4,5,6,7

X_1 = Fertilizer (kg)

X_2 = Pesticides (Litre)

X_3 = Herbicides (Litre)

X_4 = Family Labour (man-days)

X_5 = Hired Labour (man-days)

X_6 = Farm size (hectare)

X_7 = Seed/cuttings/yam setts (value)

$$K_s = \frac{1}{Y}\left[1 - \frac{P_i X_i}{Pf_i Ny_i}\right] \quad \text{..}(vi)$$

$K_{(s)}$ = Risk Aversion

Y = Coefficient of variation in cassava output in tonnes

P_i = Wage rate of labourers (man-days)

X_i = Average labour use per respondents

P = Mean of cassava output

f_i = Elasticity of production with respect to labour

Ny_i = Average crop yield

$$K_{(s)} = f\left(V_1, V_2, \text{..................................}V_6\right) \quad \text{..}(vii)$$

Where

V_1 = Age of farmers (years)

V_2 = Educational level (years)

V_3 = Primary occupation

V_4 = Secondary occupation

V_5 = Experience of farmers (years)

V_6 = Household size

Results and discussion

Socio-Economic Characteristics of the Respondents

Table 1 showed the socio-economic characteristics of the respondents. The factors considered were sex, age of the respondents, household composition size, level of education, primary occupation, secondary occupation and farming experience. It is observed from the table that there were more male than female in all categories. There were 160 male farm household heads among 180 sampled households for this study. This implied that about ninety percent (90%) of the respondents were male farmers while about eleven percent (11%) of the respondents were female. This indicated that males constituted majority of cassava farmers in the areas of study. This is in conformity with Ejembi and Ejembi (2006) who stated that an indication that the traditionally "visible" human input in the agricultural sector is the male contribution. The mean age of the respondents was 54.83 years. Majority of the respondents fell within the age range of (50-59) years represented 38.9 percent. This indicated that the respondents have agility and vigor to carry out farming activities. The respondents that fell between 40-49 years represented 28.2 percent. The respondents that fell between 60-69 years of age represented 27.9 percent. While age 70 years and above were five percent. This indicated that the highest percentage of the respondents of this study were between the age of 50-59 years.

The average household size was 8. About 7.8 percent of the farmers had household size between 1 and 4 members(s). Fifty percent had household size between 5 and 8 members, over 41 percent had household size between 9 and 12 members. About 1 percent had 12 members and above. The family size seems high and this is likely to be an incentive for engaging in income generating activities in order to meet the obligation of the family. The reason for maintaining large family size in the various households sampled may be to ensure adequate supply of family labour for their farm and non-farm activities. This indicated that large families appeared to be more efficient than small families.

About 39 percent of the respondents had no formal education, over 35 percent had primary school education, 6.1 percent had post-primary education while over 19 percent had tertiary school education. Majority of the respondents were literate. This implied that level of education would improve technical efficiency. This is in line with the study of Clark and Akinbode (1998) who observed that education helps in learning process and also help in adoption of new technology.

About 84 percent of the respondents were into crop production. About 1 percent were into fisheries, 1.7 percent were into agricultural business, 10 percent engaged in public sector employment,

3.3 percent of the respondents were artisans while 0.6 percent were in other business. This implied that the respondents may have access to the food directly from their farms. Over 71 percent of the respondents did not engage in any secondary occupation, 0.6 percent were into trading, 2.2 percent were into driving while 26.1 percent were into other activities. This indicated that larger proportion of the respondents did not have secondary occupation.

The average farming experience was 20.49. Over 8 percent of the respondents have been into farming for between 1 to 5 year(s), 17.7 percent have been into farming for between 6 to 10 years, 3.9 percent have been into farming for between 11 to 15 years, 28.9 percent have been into farming for between 16 to 20 years, 2.34 percent have been into farming for between 26 to 30 years, 7.2 percent have been into farming for between 31 to 35 years while 0.6 percent have been into farming for between 36 to 40 years. This implied that majority of the respondents had more than a decade farming experience and this is an indicator of a person's commitment to agriculture and also in line with a study by Awudu and Richard (2001) that farming experience contributes positively to production efficiency.

Table 1: Frequency and Percentage Distribution of the Socio-Economic Characteristics of the Respondents.

Variables	Frequency	Percentage (%)
Sex		
Male	160	88.9
Female	20	11.1
Total	180	100
Age (years)		
40-49	51	28.2
50-59	70	38.9
60-69	50	27.9
70 and above	09	5.0
Total	180	100
Household Size		
1-4	14	7.80
5-8	90	50.00
9-12	74	41.10
>12	02	1.10
Total	180	100
Primary Occupation		
Crop Production	151	83.90
Fisheries	01	0.60
Agricultural Trading Business	03	1.70
Public Sector Employment	18	10.00
Artisan	06	3.30
Others	01	0.60
Total	180	100
Secondary Occupation		
None	128	71.1
Trading	01	0.6
Driving	04	2.2
Others	47	26.1
Total	180	100
Education		

No formal Education	70	38.9
Primary	64	35.6
Post-Primary	11	6.1
Tertiary	35	19.4
Total	180	100

Source: Field Survey,

2010.

Variables	Frequency	Percentage (%)
Experience (yrs)		
1-5	15	8.3
6-10	32	17.7
11-15	07	3.9
16-20	52	28.9
21-25	18	10.0
26-30	42	23.4
31-35	13	7.2
36-40	01	0.6
Total	180	100

Source: Author's computation

Production Activities, Risk Involved and Strategies used in Coping with Risk Problem in Cassava based Farms.

Table 2 showed the production activities, risk involved and strategies used in coping with risk problem in cassava based farms. This involves sources of farmland, size of farmland, size of farmland for each crop involved, source of planting materials, risks involved, and strategies used in coping with risk problems in cassava based farm.

Majority of the respondents obtained their land through family inheritance. Over 13 percent of the respondents obtained their land through lease, 5.6 percent obtained their land through purchase while about 9 percent obtained their land through gifts. This implied that there would be tenure security for the majority of the respondents.

The average farm size was 3.19. About 19 percent of the respondents fell into land size ranging from 1 to 2 hectare(s). About 79 percent fell into size ranging from 3 to 4 hectares of land while 2.7 percent of the respondents fell into land size ranging from 5 hectares and above. This implied that majority of the respondents are small scale farmers.

The average farm size for cassava production was 1.41. About 60 percent of the respondents cultivated size of land ranging from 0 to 1 hectare for the production of cassava, 40.6 percent cultivated size of land ranging from 2 to 3 hectares while 0.5 percent of the respondent cultivated size of land ranging from 4 hectares and above for cassava production. This indicated that majority of the respondents cultivated the size of land ranging from 0 to 1 hectare for the production of cassava.

The average farm size for maize production was 0.62. About 99 percent of the respondents cultivated land size ranging from 0 to 1 hectare for maize production while 1.67 percent of the respondents cultivated land size ranging from 2 to 3 hectares and above. This implied that higher proportion of the respondents cultivated 0 to 1 hectare of land for maize production.

About 44 percent of the respondents cultivated between 0 to 0.5 hectare of land for yam production while over 56 percent of the respondents cultivated between 1 hectare and above. This indicated that majority of the respondents cultivated between 1 hectare and above for the production of yam. Over 47 percent of the respondents cultivated less than 1 hectare of land for cowpea production, 51.6 percent cultivated between 1 to 2 hectares(s) of land while 0.55 percent of the respondents cultivated 3 hectares and above. This indicated that majority of the respondents cultivated between 1 to 2 hectare(s) of land for cowpea production.

Majority of the respondents obtained their planting materials from their previous production. About 6 percent of the respondents obtained their planting materials from contact farmers, 15 percent obtained their planting materials from International Institute of Tropical Agriculture (IITA) while over 2 percent obtained their stems, seeds and yam setts from other sources. This implied that the stems and seeds the respondents obtained from their previous production are viable and this will reduce the cost of obtaining them from other sources.

Majority of the respondents faced the problem of poor soil and erosion (production risk) in the process of farming. About 24 percent of the respondents faced the problem of drought and bush fire (natural risk), over 26 percent of the respondents faced the problem associates with labour and management functions in farming (human risk) while about 14 percent of the respondents faced the problem of price fluctuation in inputs and saleable outputs (economic risk). This implied that the major risk problem encountered by the respondents is the production risk. Over 17 percent of the respondents did not use strategy to cope with risk. About 36 percent of the respondents used fertilizer to cope with the problem of risk, about 24 percent used pesticides to cope with risk, over 22 percent of the respondent used planting of improved varieties to cope with risk while over 1 percent of the respondents used other means to cope with risk. This implied that majority of the respondents used fertilizer to cope with risk problem.

Table 2:   Frequency and Percentage Distribution of Production Activities, Risk involved and the Strategies used in Coping with Risk in Cassava based Farms.

Variables	Frequency	Percentage (%)
Sources of Farmland		
Family	130	72.2
Lease	24	13.3
Purchase	10	5.6
Gifts	16	8.9
Total	180	100
Farm Size (ha)		
1-2	34	18.9
3-4	141	78.4
5 and above	05	2.7
Total	180	100
Size of Land for Cassava Production (ha)		
0-1	106	59.0
2-3	73	78.4
4 and above	01	2.7
Total	180	100
Size of Land for Maize Production		
0.1	177	98.33
2-3	03	1.67
Total	180	100
Size of Land for Yam Production (ha)		
0-0.5	79	42.89
1 and above	101	56.11
Total	180	100
Size of Land for Cowpea Production (ha)		
< 1	86	47.80
1-2	93	51.65
3 and above	01	0.55
Total	180	100

Sources of Planting Materials		
IITA	27	15.0
Contact Farmers	10	5.6
Previous Production	129	77.2
Others	04	2.2
Total	180	100

Variables	Frequency	Percentage (%)
Types of Risk Involved	65	36.11
Production Risk	43	23.88
Natural Risk	47	26.12
Human Risk	25	13.89
Economic Risk	180	100
Total		
Strategies Used in Preventing Risk Problems		
None	31	17.22
Use of fertilizer	64	35.56
Use of Pesticides	43	23.89
Planting of Improved Varieties	04	22.22
Other	02	1.11
Total	180	100

Source: Author's computation

Risk Averse Group and the Mean Efficiency of the Cassava based Farms

Table 3 showed the frequency distribution of the cassava based farms based on their risk averse group. About 4 percent of the respondents were risk preferers while 6.67 percent of the respondents were risk neutral and 88.89 percent of the respondents were risk averters. This implies that majority of the sampled farmers do not like taking risk. Efforts were made to look at the determinants of risk using tobit regression as shown in table 4

Table 3: Frequency Distribution of Risk Averse Group and the Mean Technical Efficiency of the Cassava based Farms.

Risk Averse Group		Freque ncy	Percentage (%)
Risk prefers (0<K<0.4)		08	4.44
Risk neutral (0.4≤K≤1.2)		12	6.67
Risk averters (1.2≤K≤2)		160	88.89
Total		**180**	**100**

Source: Author's computation.

All the variables considered had significant effects on the risk aversion of the cassava based farmers. These are age which had a positive coefficient of 1.5338 and a t-value of 6.345 and is significant at 1 percent level. The results means that a unit increase in farmers age would result in an 1.534% increase in the level of risk aversion. Primary occupation had a negative coefficient of -1.0962 and a t-value of -2.579 and is significant at 1 percent level. Experience is significant at 1 percent level with a coefficient of -1.4599 and a t-value of -6.6.83. This result means that as the experience increases by one year, the level of risk aversion reduces by 1.4599%. Education is statistically significant at 1 percent level with a coefficient of 2.04 and a t-value of 2.888. This implied that as the respondents' education increase their level of risk aversion increase by 2.04%. Source of land had a coefficient of -14.1634 and a t-value of -7.620 and this is significant at 1 percent level. Farm size is significant at 1 percent level with a coefficient of 7.3653 and a t-value of 3.079. This implied that as the farm size increases by one hectare, the risk aversion of the cassava based farmers increases by 7.365%.

Table 4: Regression estimates of determinants of risk in Cassava based Farms.

Variables	Coefficient s	t-values	p-values
Constant	-61.6053	-4.275	0.0000
Age	1.5338	6.345	0.0000***
Primary	-1.0962	-2.579	0.0099***
Occupation	- 1.4599	-6.683	0.0000***
Experience	2.0400	2.888	0.0039***
Education	-14.1634	-7.620	0.0000***
Source of land	7.3653	3.079	0.0021***
Farm size			

Source: Data Analysis, 2010.

*** Significant at the 1 percent level.

Conclusion

The study had empirically examined the risk aversion and its determinants among the cassava based farmers in Osun state. It was found that majority of the farmers are risk aversed and socio-economics characteristics like age, experience and education are crucial determinants of attitudes of the farmers' towards risk. Therefore, any intervention in strengthening risk taking, especially in adoption of new technologies should focused more on the experienced and educated while adequate training should be encouraged among the non-literate farmers

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Understanding Dyadics and Their Applications in Mechanical Engineering

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Abstract

First author, who has been teaching on subjects related to advanced dynamics and vibrations for many years, observed that his students have always found it difficult to understand concepts on "dyads" and "dyadics". Based on his observation, in this article the authors present information and formulae gathered from different resources, on dyads and dyadics along with proofs so that the subject can be better understood easily by a larger population in the scientific field.

Keywords: Dyads; dyadics; basic operations on dyadics; applications in mechanical engineering

1. Introduction

The first author has been giving the courses "Dynamics of Mechanical Systems" and "Advanced Mechanical Vibrations" at the postgraduate level for many years. During this period he has observed that the students had difficulties in grasping the concepts of dyads and dyadics. This observation has led authors to compile the formulae and examples mostly given briefly in the appendices of various books on this topic. This paper is the result of this work and aims to help the students and possibly to some instructors to understand this subject better.

2. Definition of a dyad and dyadic

In the symbolic representation, vector notation is not sufficient to treat second-order or higher-order tensor quantities, such as stress and strain. Dyadic symbols represent second-order quantities, just as vector symbols are for first-order tensor quantities.

In this text, a dyadic symbol is indicated by a two sided arrow over a letter as in Reddy, (2002). A *dyad* is defined as two vectors standing side by side and acting as a unit (Reddy, 2002):

$$\vec{\phi} = \mathbf{ab} . \tag{1}$$

The quantity $\mathbf{ab}$ has meaning only when it operates on other quantities (Arya, 1998).

A linear combination of dyads is called a *dyadic*. Any dyad can be written in the form of a dyadic by expressing any of the vectors $\mathbf{a}$ and $\mathbf{b}$, or both, in terms of their components along the cartesian axes x, y, z multiplied by the corresponding unit vectors $\mathbf{i}$, $\mathbf{j}$, $\mathbf{k}$, or generally by a set of independent unit vectors $\mathbf{e}_i$ (i =1, 2,3):

$$\mathbf{a} = \sum_i a_i \mathbf{e}_i = a_1 \mathbf{e}_1 + a_2 \mathbf{e}_2 + a_3 \mathbf{e}_3,$$
$$\mathbf{b} = \sum_j b_j \mathbf{e}_j = b_1 \mathbf{e}_1 + b_2 \mathbf{e}_2 + b_3 \mathbf{e}_3. \tag{2}$$

Then:

$$\vec{\phi} = \mathbf{ab} = \sum_{i,j} a_i b_j \mathbf{e}_i \mathbf{e}_j = \sum_{i,j} \phi_{ij} \mathbf{e}_i \mathbf{e}_j$$
$$= a_1 b_1 \mathbf{e}_1 \mathbf{e}_1 + a_1 b_2 \mathbf{e}_1 \mathbf{e}_2 + a_1 b_3 \mathbf{e}_1 \mathbf{e}_3$$
$$+ a_2 b_1 \mathbf{e}_2 \mathbf{e}_1 + a_2 b_2 \mathbf{e}_2 \mathbf{e}_2 + a_2 b_3 \mathbf{e}_2 \mathbf{e}_3 \tag{3}$$
$$+ a_3 b_1 \mathbf{e}_3 \mathbf{e}_1 + a_3 b_2 \mathbf{e}_3 \mathbf{e}_2 + a_3 b_3 \mathbf{e}_3 \mathbf{e}_3.$$

The first vector $\mathbf{a}$ in (3) is called the *antecedent* and the second vector $\mathbf{b}$ is the *consequent*. Further, expression 3 is called as the *nonion* form of the dyadic $\vec{\phi}$.

3. Various definitions on dyadics

Conjugate (transpose) dyadic

A conjugate or transpose dyadic is formed by interchanging the vectors of each dyad. $\vec{\phi}$ is symmetric if the dyadic $\vec{\phi}$ is equal to its transpose:

$$\vec{\phi} = \vec{\phi}^T , \tag{4}$$

leading to $\phi_{ij} = \phi_{ji}$.

An example of a symmetric dyadic is the inertia dyadic $\vec{\mathbf{I}}$, as can be shown easily:

$$\ddot{\mathbf{I}} = I_{xx}\mathbf{ii} + I_{xy}\mathbf{ij} + I_{xz}\mathbf{ik}$$
$$+I_{yx}\mathbf{ji} + I_{yy}\mathbf{jj} + I_{yz}\mathbf{jk} \qquad (5)$$
$$+I_{zx}\mathbf{ki} + I_{zy}\mathbf{kj} + I_{zz}\mathbf{kk}.$$

Its transpose is :

$$\ddot{\mathbf{I}}^T = I_{xx}\mathbf{ii} + I_{xy}\mathbf{ji} + I_{xz}\mathbf{ki}$$
$$+I_{xy}\mathbf{ij} + I_{yy}\mathbf{jj} + I_{yz}\mathbf{kj} \qquad (6)$$
$$+I_{zx}\mathbf{ik} + I_{zy}\mathbf{jk} + I_{zz}\mathbf{kk}.$$

Recognizing that $I_{ij} = I_{ji}$ (i.e., $I_{xy} = I_{yx}$, $I_{xz} = I_{zx}$, $I_{yz} = I_{zy}$), it is seen that

$$\ddot{\mathbf{I}} = \ddot{\mathbf{I}}^T . \qquad (7)$$

Unit dyadic
The unit dyadic is defined as

$$\ddot{\mathbf{U}} = \mathbf{ii} + \mathbf{jj} + \mathbf{kk} . \qquad (8)$$

4. Dyadic operations

4.1 The sum of dyadics
The sum of two dyadics $\ddot{\phi}_1$ and $\ddot{\phi}_2$ is a dyadic obtained by adding the corresponding elements:

$$\ddot{\phi} = \ddot{\phi}_1 + \ddot{\phi}_2 , \qquad (9)$$

where

$$\phi_{ij} = \phi_{1ij} + \phi_{2ij} . \qquad (10)$$

4.2 Dot product of a dyadic and a vector
The dot product of a dyadic and a vector is a vector which, in general, differs in magnitude and direction from the original vector. If $\ddot{\phi} = \mathbf{ab}$, and $\mathbf{c}$ is a vector, then

$$\ddot{\phi} \cdot \mathbf{c} = \mathbf{ab} \cdot \mathbf{c} = \mathbf{a}(\mathbf{b} \cdot \mathbf{c}), \qquad (11)$$

which is a vector having the direction of $\mathbf{a}$. Here, the dyadic $\ddot{\phi}$ acts as a prefactor. The general rule is that the vector products (dot or cross) between a vector and a dyadic are always made between the vector and the adjacent vector in the dyadic (Chou and Pagano, 1967).

$$\mathbf{c} \cdot \ddot{\phi} = \mathbf{c} \cdot \mathbf{ab} = (\mathbf{c} \cdot \mathbf{a})\mathbf{b} \qquad (12)$$

is a vector having the direction of the vector **b**. Here, the dyadic $\ddot{\phi}$ acts as a postfactor. Hence, post- and premultiplying of a dyadic by a vector gives different results! (Mase, 1970).

For a symmetric dyadic, however, "The order of taking the dot product with a vector does not matter."

Example

Dot product of the inertia dyadic and the angular velocity vector

The inertia dyadic $\ddot{I}$ of a rigid body was given in (5). The angular velocity vector is written as

$$\omega = \omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k}. \tag{13}$$

Let us calculate $\ddot{I} \cdot \omega$.

$$
\begin{aligned}
\ddot{I} \cdot \omega = & I_{xx} \mathbf{i} \left[\mathbf{i} \cdot \left(\omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k} \right) \right] \\
& + I_{xy} \mathbf{i} \left[\mathbf{j} \cdot \left(\omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k} \right) \right] \\
& + I_{xz} \mathbf{i} \left[\mathbf{k} \cdot \left(\omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k} \right) \right] \\
& + I_{yx} \mathbf{j} \left[\mathbf{i} \cdot \left(\omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k} \right) \right] \\
& + I_{yy} \mathbf{j} \left[\mathbf{j} \cdot \left(\omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k} \right) \right] \\
& + I_{yz} \mathbf{j} \left[\mathbf{k} \cdot \left(\omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k} \right) \right] \\
& + I_{zx} \mathbf{k} \left[\mathbf{i} \cdot \left(\omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k} \right) \right] \\
& + I_{zy} \mathbf{k} \left[\mathbf{j} \cdot \left(\omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k} \right) \right] \\
& + I_{zz} \mathbf{k} \left[\mathbf{k} \cdot \left(\omega_x \mathbf{i} + \omega_y \mathbf{j} + \omega_z \mathbf{k} \right) \right] \\
= & I_{xx} \omega_x \mathbf{i} + I_{xy} \omega_y \mathbf{i} + I_{xz} \omega_z \mathbf{i} \\
& + I_{yx} \omega_x \mathbf{j} + I_{yy} \omega_y \mathbf{j} + I_{yz} \omega_z \mathbf{j} \\
& + I_{zx} \omega_x \mathbf{k} + I_{zy} \omega_y \mathbf{k} + I_{zz} \omega_z \mathbf{k}.
\end{aligned} \tag{14}
$$

The calculations for $\omega \cdot \ddot{I}$ lead in the same manner to:

$$
\begin{aligned}
\omega \cdot \ddot{I} = & \left(I_{xx} \omega_x + I_{xy} \omega_y + I_{xz} \omega_z \right) \mathbf{i} \\
& + \left(I_{xy} \omega_x + I_{yy} \omega_y + I_{zy} \omega_z \right) \mathbf{j} \\
& + \left(I_{xz} \omega_x + I_{yz} \omega_y + I_{zz} \omega_z \right) \mathbf{k}
\end{aligned} \tag{15}
$$

which results in (14), considering that $I_{xy} = I_{yx}$, $I_{xz} = I_{zx}$ and $I_{yz} = I_{zy}$.

Hence,

$$\ddot{I} \cdot \vec{\omega} = \vec{\omega} \cdot \ddot{I}. \tag{16}$$

Recognizing, that the right side of (14) (or 15) represents the angular momentum **H** (Meirovitch, 2003), expression in (16) can be written in the form

$$\mathbf{H} = \bar{\mathbf{I}} \cdot \omega = \omega \cdot \bar{\mathbf{I}} = \sum \sum I_{ij} \omega_j \mathbf{e}_i . \tag{17}$$

It is evident that subscripts i, j (=1, 2, 3) on I_{ij} correspond to x, y, z and $\mathbf{e}_i$ (i = 1, 2, 3) to **i**, **j**, and **k**.

Unit dyadic

A particularly simple symmetric dyadic which, in fact, leaves an arbitrary vector **a** unchanged upon dot multiplication is the unit dyadic, defined in (8).

Proof

Let

$$\mathbf{a} = a_x \mathbf{i} + a_y \mathbf{j} + a_z \mathbf{k} \tag{18}$$

be an arbitrary vector. Then:

$$\begin{aligned}
\overline{\mathbf{U}} \cdot \mathbf{a} &= (\mathbf{ii} + \mathbf{jj} + \mathbf{kk}) \cdot (a_x \mathbf{i} + a_y \mathbf{j} + a_z \mathbf{k}) \\
&= \mathbf{i} \left[\mathbf{i} \cdot (a_x \mathbf{i} + a_y \mathbf{j} + a_z \mathbf{k}) \right] \\
&+ \mathbf{j} \left[\mathbf{j} \cdot (a_x \mathbf{i} + a_y \mathbf{j} + a_z \mathbf{k}) \right] \\
&+ \mathbf{k} \left[\mathbf{k} \cdot (a_x \mathbf{i} + a_y \mathbf{j} + a_z \mathbf{k}) \right] \\
&= a_x \mathbf{i} + a_y \mathbf{j} + a_z \mathbf{k} = \mathbf{a}.
\end{aligned} \tag{19}$$

Now

$$\begin{aligned}
\mathbf{a} \cdot \overline{\mathbf{U}} &= (a_x \mathbf{i} + a_y \mathbf{j} + a_z \mathbf{k}) \cdot (\mathbf{ii} + \mathbf{jj} + \mathbf{kk}) \\
&= a_x \mathbf{i} \cdot (\mathbf{ii} + \mathbf{jj} + \mathbf{kk}) \\
&+ a_y \mathbf{j} \cdot (\mathbf{ii} + \mathbf{jj} + \mathbf{kk}) \\
&+ a_z \mathbf{k} \cdot (\mathbf{ii} + \mathbf{jj} + \mathbf{kk}) \\
&= a_x \left[(\mathbf{i} \cdot \mathbf{i}) \mathbf{i} + 0\mathbf{j} + 0\mathbf{k} \right] \\
&+ a_y \left[0\mathbf{i} + (\mathbf{j} \cdot \mathbf{j}) \mathbf{j} + 0\mathbf{k} \right] \\
&+ a_z \left[0\mathbf{i} + 0\mathbf{j} + (\mathbf{k} \cdot \mathbf{k}) \mathbf{k} \right] \\
&= a_x \mathbf{i} + a_y \mathbf{j} + a_z \mathbf{k} = \mathbf{a}.
\end{aligned} \tag{20}$$

Hence:

$$\overline{\mathbf{U}} \cdot \mathbf{a} = \mathbf{a} \cdot \overline{\mathbf{U}} = \mathbf{a} . \tag{21}$$

4.3 Dot product of two dyadics

Dot product of two dyadics

$$\overline{\mathbf{A}} = \mathbf{a}_1 \mathbf{b}_1 + \mathbf{a}_2 \mathbf{b}_2 + \cdots + \mathbf{a}_n \mathbf{b}_n , \tag{22}$$

$$\overline{\mathbf{D}} = \mathbf{c}_1 \mathbf{d}_1 + \mathbf{c}_2 \mathbf{d}_2 + \cdots + \mathbf{c}_n \mathbf{d}_n \tag{23}$$

is defined as the dyadic:

$$\bar{\mathbf{A}} \cdot \bar{\mathbf{D}} = (\mathbf{b}_1 \cdot \mathbf{c}_1) \mathbf{a}_1 \mathbf{d}_1 + (\mathbf{b}_2 \cdot \mathbf{c}_2) \mathbf{a}_2 \mathbf{d}_2 + \cdots + (\mathbf{b}_n \cdot \mathbf{c}_n) \mathbf{a}_n \mathbf{d}_n. \tag{24}$$

4.4 Double dot product of two dyads

Double dot product of two dyads **ab** and **cd** is defined as

$$\mathbf{ab} : \mathbf{cd} = (\mathbf{a} \cdot \mathbf{c})(\mathbf{b} \cdot \mathbf{d}) = \lambda, \tag{25}$$

the scalar λ being

$$\lambda = (a_x c_x + a_y c_y + a_z c_z)(b_x d_x + b_y d_y + b_z d_z). \tag{26}$$

It can be shown that (25) can also be written as

$$\mathbf{ab} : \mathbf{cd} = \mathbf{c} \cdot \mathbf{ab} \cdot \mathbf{d} \tag{27}$$

as given in Goldstein, (1974).

It is to be noted that the definition of the double dot product of two dyads given in Reddy, (2002) is different from (25), namely

$$\mathbf{ab} : \mathbf{cd} = (\mathbf{b} \cdot \mathbf{c})(\mathbf{a} \cdot \mathbf{d}). \tag{28}$$

4.5 Double dot and cross products of two dyads

Double dot and cross products of the dyads **ab** and **cd** are defined as:

$$\mathbf{ab} \times \mathbf{cd} = (\mathbf{ac})(\mathbf{b} \wedge \mathbf{d}) = \text{a vector } \mathbf{g}, \tag{29}$$

$$\mathbf{ab} \times \mathbf{cd} = (\mathbf{a} \wedge \mathbf{c})(\mathbf{b} \cdot \mathbf{d}) = \text{a vector } \mathbf{h}, \tag{30}$$

$$\mathbf{ab} \overset{\times}{\times} \mathbf{cd} = (\mathbf{a} \wedge \mathbf{c})(\mathbf{b} \wedge \mathbf{d}) = \text{a dyad } \mathbf{uw}. \tag{31}$$

4.6 Cross product of a dyadic and a vector

The cross product of a dyadic and a vector is a dyadic. The order of multiplication is important:

$$\mathbf{c} \wedge \bar{\boldsymbol{\phi}} \neq \bar{\boldsymbol{\phi}} \wedge \mathbf{c}. \tag{32}$$

As an example, consider the cross product $\boldsymbol{\omega} \wedge \bar{\mathbf{I}}$ i.e., the cross product of the angular velocity vector and the inertia dyadic given in (13) and (5), respectively.

The inertia dyadic in (5) can be written in compact from as:

$$\bar{\mathbf{I}} = \sum_i \sum_j I_{ij} \mathbf{e}_i \mathbf{e}_j. \tag{33}$$

Then,

$$\boldsymbol{\omega} \wedge \bar{\mathbf{I}} = \boldsymbol{\omega} \wedge \left(\sum_i \sum_j I_{ij} \mathbf{e}_i \mathbf{e}_j \right) = \sum_i \sum_j I_{ij} (\boldsymbol{\omega} \wedge \mathbf{e}_i) \mathbf{e}_j \tag{34}$$

is a dyadic.

Let us follow the procedure in Greenwood, (1988) and postmultiply the left side of (34) by $\boldsymbol{\omega}$, using the dot product. Considering (17), it can be written:

$$\omega \wedge \bar{\bar{\mathbf{I}}} \cdot \omega = \omega \wedge \mathbf{H} = \omega \wedge \left(\sum_i \sum_j I_{ij} \omega_j \mathbf{e}_i \right)$$
$$= \sum_i \sum_j I_{ij} \omega_j (\omega \wedge \mathbf{e}_i). \tag{35}$$

In doing so, it is tacitly assumed that

$$\left(\omega \wedge \bar{\bar{\mathbf{I}}} \right) \cdot \omega = \omega \wedge \left(\bar{\bar{\mathbf{I}}} \cdot \omega \right). \tag{36}$$

Actually, we had to calculate $\left(\omega \wedge \bar{\bar{\mathbf{I}}} \right) \cdot \omega$. Starting with (34), the following can be written:

$$\left(\omega \wedge \bar{\bar{\mathbf{I}}} \right) \cdot \omega = \left(\sum_i \sum_j I_{ij} (\omega \wedge \mathbf{e}_i) \mathbf{e}_j \right) \cdot \omega$$
$$= \sum_i \sum_j I_{ij} \underbrace{(\omega \wedge \mathbf{e}_i) \mathbf{e}_j}_{\text{dyad}} \cdot \omega$$
$$= \sum_i \sum_j I_{ij} (\omega \wedge \mathbf{e}_i) \underbrace{(\mathbf{e}_j \cdot \omega)}_{\omega_j}$$
$$= \sum_i \sum_j I_{ij} \omega_j (\omega \wedge \mathbf{e}_i). \tag{37}$$

It is seen that this is the same result as given in (35). Hence, this observation can be generalized as follows:

For a symmetric dyadic $\bar{\bar{\phi}}$ and for an arbitrary vector **a** the following relation holds:

$$\left(\mathbf{a} \wedge \bar{\bar{\phi}} \right) \cdot \mathbf{a} = \mathbf{a} \wedge \left(\bar{\bar{\phi}} \cdot \mathbf{a} \right). \tag{38}$$

It is worth noting that (38) is not given elsewhere.

4.7 Time derivative of a dyadic

Following Greenwood, (1988), the time derivative of dyadic is illustrated by differentiating (33), i.e. the inertia dyadic $\bar{\bar{\mathbf{I}}}$ with the result

$$\dot{\bar{\bar{\mathbf{I}}}} = \sum_i \sum_j \left(\dot{I}_{ij} \mathbf{e}_i \mathbf{e}_j + I_{ij} \dot{\mathbf{e}}_i \mathbf{e}_j + I_{ij} \mathbf{e}_i \dot{\mathbf{e}}_j \right). \tag{39}$$

Assuming a body-fixed coordinate system in which the moment of inertia are constant, i.e., $\dot{I}_{ij} = 0$, and noting that

$$\dot{\mathbf{e}}_i = \omega \wedge \mathbf{e}_i, \qquad \dot{\mathbf{e}}_j = \omega \wedge \mathbf{e}_j = -\mathbf{e}_j \wedge \omega, \tag{40}$$

it is easy to show that (39) leads to

$$\dot{\bar{\bar{\mathbf{I}}}} = \omega \wedge \bar{\bar{\mathbf{I}}} - \bar{\bar{\mathbf{I}}} \wedge \omega. \tag{41}$$
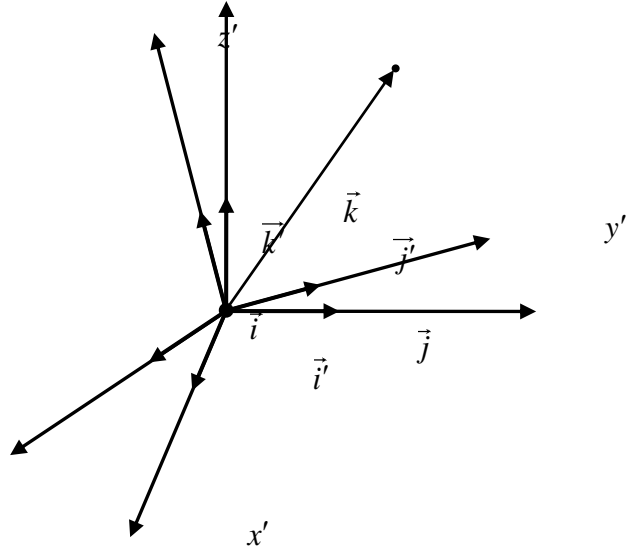
5. Applications

5.1 Rotation dyadic

In Figure 1 two coordinate axis frames xyz and $x'y'z'$ with the common origin O are shown. As is known, the relationship between the expressions of the position vector $\overrightarrow{OP}$ in the xyz and $x'y'z'$ reference systems is as follows:

$$\mathbf{r}' = \mathbf{A}^T \mathbf{r}, \tag{42}$$

where **A** is the so called *rotation matrix* (or matrix of direction cosines) (Nikravesh, 1988):

$$A = \begin{vmatrix} \cos(\vec{i},\vec{i}') & \cos(\vec{i},\vec{j}') & \cos(\vec{i},\vec{k}') \\ \cos(\vec{j},\vec{i}') & \cos(\vec{j},\vec{j}') & \cos(\vec{j},\vec{k}') \\ \cos(\vec{k},\vec{i}') & \cos(\vec{k},\vec{j}') & \cos(\vec{k},\vec{k}') \end{vmatrix}. \tag{43}$$

Figure 1: Primed and unprimed reference systems with the common origin O.

Let us denote the transpose of **A** as **C**. The matrix **C** can be written as:

$$\mathbf{C} = \begin{bmatrix} c_{x'x} & c_{x'y} & c_{x'z} \\ c_{y'x} & c_{y'y} & c_{y'z} \\ c_{z'x} & c_{z'y} & c_{z'z} \end{bmatrix}, \tag{44}$$

where

$$c_{x'x} = \cos(\vec{i}',\vec{i}), \quad c_{x'y} = \cos(\vec{i}',\vec{j}), \quad c_{x'z} = \cos(\vec{i}',\vec{k}), \dots \tag{45}$$

Now the rotation dyadic is defined as:

$$\begin{aligned}
\vec{C} = {}& c_{x'x}\mathbf{i}'\mathbf{i} + c_{x'y}\mathbf{i}'\mathbf{j} + c_{x'z}\mathbf{i}'\mathbf{k} \\
& + c_{y'x}\mathbf{j}'\mathbf{i} + c_{y'y}\mathbf{j}'\mathbf{j} + c_{y'z}\mathbf{j}'\mathbf{k} \\
& + c_{z'x}\mathbf{k}'\mathbf{i} + c_{z'y}\mathbf{k}'\mathbf{j} + c_{z'z}\mathbf{k}'\mathbf{k}.
\end{aligned} \tag{46}$$

Let

$$\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}, \qquad \mathbf{r}' = x'\mathbf{i}' + y'\mathbf{j}' + z'\mathbf{k}'. \tag{47}$$

It can be shown that

$$\mathbf{r}' = \vec{C} \cdot \mathbf{r}. \tag{48}$$

which is the counterpart of (42) in dyadic notation (Greenwood, 2003).

Proof

The following can easily be obtained:

$$\overline{\mathbf{C}} \cdot \mathbf{r} = x\left(c_{x'x}\mathbf{i}' + c_{y'x}\mathbf{j}' + c_{z'x}\mathbf{k}'\right)$$
$$+ y\left(c_{x'y}\mathbf{i}' + c_{y'y}\mathbf{j}' + c_{z'y}\mathbf{k}'\right) \tag{49}$$
$$+ z\left(c_{x'z}\mathbf{i}' + c_{y'z}\mathbf{j}' + c_{z'z}\mathbf{k}'\right),$$

which can be rearranged as:

$$\overline{\mathbf{C}} \cdot \mathbf{r} = \left(c_{x'x}x + c_{x'y}y + c_{x'z}z\right)\mathbf{i}'$$
$$+ \left(c_{y'x}x + c_{y'y}y + c_{y'z}z\right)\mathbf{j}' \tag{50}$$
$$+ \left(c_{z'x}x + c_{z'y}y + c_{z'z}z\right)\mathbf{k}'.$$

Recognizing from (47):

$$x' = c_{x'x}x + c_{x'y}y + c_{x'z}z,$$
$$y' = c_{y'x}x + c_{y'y}y + c_{y'z}z, \tag{51}$$
$$z' = c_{z'x}x + c_{z'y}y + c_{z'z}z,$$

one is led to:

$$\overline{\mathbf{C}} \cdot \mathbf{r} = x'\mathbf{i}' + y'\mathbf{j}' + z'\mathbf{k}' = \mathbf{r}'. \tag{52}$$

Hence, (48) is obtained.

Following a similar approach as above,

$$\mathbf{r} = \overline{\mathbf{C}}^T \cdot \mathbf{r}' \tag{53}$$

can be proven, as well.

5.2 Useful relationships on rotation dyadic

The following relationships are taken from Greenwood, (2003). But, additionally, their proofs are given here.

1)
$$\overline{\mathbf{C}}^T \cdot \overline{\mathbf{C}} = \overline{\mathbf{U}} \tag{54}$$

Proof

The following can be written, after some rearrangements:

$$\overline{\mathbf{C}}^T \cdot \overline{\mathbf{C}} = \left(c_{xx'}c_{x'x} + c_{xy'}c_{y'x} + c_{xz'}c_{z'x}\right)\mathbf{ii}$$
$$+ \left(c_{yx'}c_{x'y} + c_{yy'}c_{y'y} + c_{yz'}c_{z'y}\right)\mathbf{jj}$$
$$+ \left(c_{zx'}c_{x'z} + c_{zy'}c_{y'z} + c_{zz'}c_{z'z}\right)\mathbf{kk}$$
$$+ \left(c_{yx'}c_{x'x} + c_{yy'}c_{y'x} + c_{yz'}c_{z'x}\right)\mathbf{ji}$$
$$+ \left(c_{zx'}c_{x'x} + c_{zy'}c_{y'x} + c_{zz'}c_{z'x}\right)\mathbf{ki} \tag{55}$$
$$+ \left(c_{xx'}c_{x'y} + c_{xy'}c_{y'y} + c_{xz'}c_{z'y}\right)\mathbf{ij}$$
$$+ \left(c_{zx'}c_{x'y} + c_{zy'}c_{y'y} + c_{zz'}c_{z'y}\right)\mathbf{kj}$$
$$+ \left(c_{xx'}c_{x'z} + c_{xy'}c_{y'z} + c_{xz'}c_{z'z}\right)\mathbf{ik}$$
$$+ \left(c_{yx'}c_{x'z} + c_{yy'}c_{y'z} + c_{yz'}c_{z'z}\right)\mathbf{jk}.$$

Recognizing that

$$c_{ij} = c_{ji} \qquad (i, j \triangleq x, y, z),$$ (56)

And comparing the expressions in the parentheses with the formulae in the Appendix, one is led to:

$$\vec{C}^T \cdot \vec{C} = \mathbf{ii} + \mathbf{jj} + \mathbf{kk} = \overline{\mathbf{U}},$$ (57)

which completes the proof of (54). One can prove in a similar manner that

2) $$\vec{C} \cdot \vec{C}^T = \overline{\mathbf{U}}' = \mathbf{i'i'} + \mathbf{j'j'} + \mathbf{k'k'}.$$ (58)

3) $$\vec{C} \cdot \overline{\mathbf{U}} \cdot \vec{C}^T = \overline{\mathbf{U}}'$$ (59)

Proof

It is easy to obtain

$$\vec{C} \cdot \overline{\mathbf{U}} = c_{x'x} \mathbf{i'i} + c_{y'x} \mathbf{j'i} + c_{z'x} \mathbf{k'i}$$
$$+ c_{x'y} \mathbf{i'j} + c_{y'y} \mathbf{j'j} + c_{z'y} \mathbf{k'j}$$ (60)
$$+ c_{x'z} \mathbf{i'k} + c_{y'z} \mathbf{j'k} + c_{z'z} \mathbf{k'k}.$$

Then, the following can be written after some calculations:

$$\vec{C} \cdot \overline{\mathbf{U}} \cdot \vec{C}^T = \left(c_{x'x}^2 + c_{x'y}^2 + c_{x'z}^2 \right) \mathbf{i'i'}$$
$$+ \left(c_{y'x}^2 + c_{y'y}^2 + c_{y'z}^2 \right) \mathbf{j'j'}$$
$$+ \left(c_{z'x}^2 + c_{z'y}^2 + c_{z'z}^2 \right) \mathbf{k'k'}$$
$$+ \left(c_{y'x}c_{xx'} + c_{y'y}c_{yx'} + c_{y'z}c_{zx'} \right) \mathbf{j'i'}$$
$$+ \left(c_{z'x}c_{xx'} + c_{z'y}c_{yx'} + c_{z'z}c_{zx'} \right) \mathbf{k'i'}$$ (61)
$$+ \left(c_{x'x}c_{xy'} + c_{x'y}c_{yy'} + c_{x'z}c_{zy'} \right) \mathbf{i'j'}$$
$$+ \left(c_{x'x}c_{xz'} + c_{x'y}c_{yz'} + c_{x'z}c_{zz'} \right) \mathbf{i'k'}$$
$$+ \left(c_{z'x}c_{xy'} + c_{z'y}c_{yy'} + c_{z'z}c_{zy'} \right) \mathbf{k'j'}$$
$$+ \left(c_{y'x}c_{xz'} + c_{y'y}c_{yz'} + c_{y'z}c_{zz'} \right) \mathbf{j'k'}.$$

$$\vec{C}\cdot\overline{U}\cdot\vec{C}^T = \left(c_{x'x}^2 + c_{x'y}^2 + c_{x'z}^2\right)\mathbf{i'i'}$$
$$+\left(c_{y'x}^2 + c_{y'y}^2 + c_{y'z}^2\right)\mathbf{j'j'}$$
$$+\left(c_{z'x}^2 + c_{z'y}^2 + c_{z'z}^2\right)\mathbf{k'k'}$$
$$+\left(c_{y'x}c_{xx'} + c_{y'y}c_{yx'} + c_{y'z}c_{zx'}\right)\mathbf{j'i'}$$
$$+\left(c_{z'x}c_{xx'} + c_{z'y}c_{yx'} + c_{z'z}c_{zx'}\right)\mathbf{k'i'} \qquad (61)$$
$$+\left(c_{x'x}c_{xy'} + c_{x'y}c_{yy'} + c_{x'z}c_{zy'}\right)\mathbf{i'j'}$$
$$+\left(c_{x'x}c_{xz'} + c_{x'y}c_{yz'} + c_{x'z}c_{zz'}\right)\mathbf{i'k'}$$
$$+\left(c_{z'x}c_{xy'} + c_{z'y}c_{yy'} + c_{z'z}c_{zy'}\right)\mathbf{k'j'}$$
$$+\left(c_{y'x}c_{xz'} + c_{y'y}c_{yz'} + c_{yz'}c_{zz'}\right)\mathbf{j'k'}.$$

Considering equations in (56) and comparing the expressions in parentheses with equations in the Appendix, one is led to:

$$\overline{C}\cdot\overline{U}\cdot\overline{C}^T = \mathbf{i'i'} + \mathbf{j'j'} + \mathbf{k'k'} = \overline{U}', \qquad (62)$$

which is the relationship given in (59). It can be proven in the same manner that

4) $$\overline{C}^T\cdot\overline{U}'\cdot\overline{C} = \mathbf{ii} + \mathbf{jj} + \mathbf{kk} = \overline{U}. \qquad (63)$$

5.3 Inertia dyadic

The inertia dyadic $\ddot{\mathbf{I}}$ given in (5) is repeated here for the sake of completeness:

$$\ddot{\mathbf{I}} = I_{xx}\mathbf{ii} + I_{xy}\mathbf{ij} + I_{xz}\mathbf{ik} + I_{yx}\mathbf{ji} + I_{yy}\mathbf{jj} + I_{yz}\mathbf{jk} + I_{zx}\mathbf{ki} + I_{zy}\mathbf{kj} + I_{zz}\mathbf{kk}. \qquad (64)$$

The mass moments of inertia I_{xx}, I_{yy}, and I_{zz} are defined as follows (Greenwood, 2003):

$$I_{xx} = \int_V \rho^*\left(y^2 + z^2\right)dV, \quad I_{yy} = \int_V \rho^*\left(z^2 + x^2\right)dV, \quad I_{zz} = \int_V \rho^*\left(x^2 + y^2\right)dV, \qquad (65)$$

where ρ^* is the mass density and dV is a volume element of the rigid body. The products of inertia, also referred to as *deviation moments*, are defined as

$$I_{xy} = I_{yx} = -\int_V \rho^* xy\,dV, \quad I_{xz} = I_{zx} = -\int_V \rho^* xz\,dV, \quad I_{yz} = I_{zy} = -\int_V \rho^* yz\,dV. \qquad (66)$$
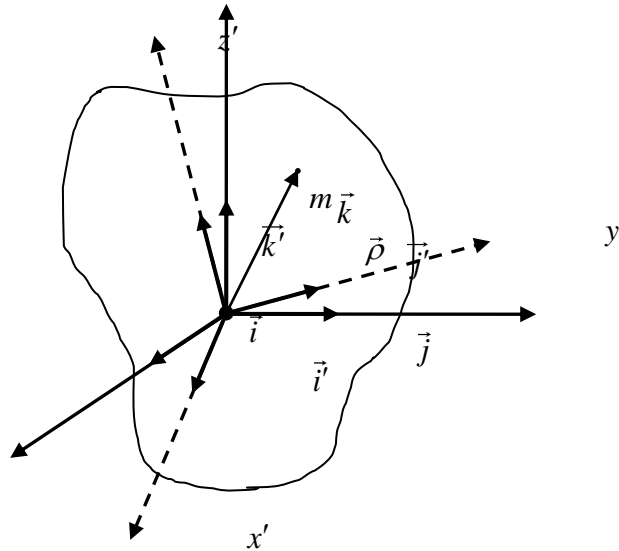
First, we want to prove that the inertia dyadic $\ddot{\mathbf{I}}$ in Equation (64) can be represented in the following compact form (Greenwood, 2003):

$$\ddot{\mathbf{I}} = \int_V \left[(\boldsymbol{\rho}\cdot\boldsymbol{\rho})\overline{U} - \boldsymbol{\rho}\boldsymbol{\rho}\right]\rho^* dV. \qquad (67)$$

Proof

In the above formula, $\boldsymbol{\rho}$ denotes the position vector of a typical mass element $dm = \rho^* dV$, as can be seen from Figure 2. It can be represented in the *Oxyz* reference system as

$$\boldsymbol{\rho} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k} . \tag{68}$$

Figure 2: Expressing the position vector of an infitesimal mass *dm* in the primed and unprimed reference frames.

The first term of integrand can easily be written as:

$$(\boldsymbol{\rho}\cdot\boldsymbol{\rho})\overline{\mathbf{U}} = \left(x^2 + y^2 + z^2\right)\mathbf{ii} + \left(x^2 + y^2 + z^2\right)\mathbf{jj} + \left(x^2 + y^2 + z^2\right)\mathbf{kk} . \tag{69}$$

The second term gives the following dyadic:

$$\begin{aligned}
\boldsymbol{\rho}\boldsymbol{\rho} = {}& x^2\mathbf{ii} + xy\mathbf{ij} + xz\mathbf{ik} \\
& + yx\mathbf{ji} + y^2\mathbf{jj} + yz\mathbf{jk} \\
& + zx\mathbf{ki} + zy\mathbf{kj} + z^2\mathbf{kk}.
\end{aligned} \tag{70}$$

Then:

$$\begin{aligned}
\int_V \left[(\boldsymbol{\rho}\cdot\boldsymbol{\rho})\overline{\mathbf{U}} - \boldsymbol{\rho}\boldsymbol{\rho} \right] \rho^* dV = {}& \left(\int_V \left(y^2 + z^2\right)\rho^* dV \right)\mathbf{ii} + \left(-\int_V xy\rho^* dV \right)\mathbf{ij} + \left(-\int_V xz\rho^* dV \right)\mathbf{ik} \\
& + \left(-\int_V yx\rho^* dV \right)\mathbf{ji} + \left(\int_V \left(x^2 + z^2\right)\rho^* dV \right)\mathbf{jj} + \left(-\int_V yz\rho^* dV \right)\mathbf{jk} + \left(-\int_V zx\rho^* dV \right)\mathbf{ki} \\
& + \left(-\int_V zy\rho^* dV \right)\mathbf{kj} + \left(\int_V \left(x^2 + y^2\right)\rho^* dV \right)\mathbf{kk}.
\end{aligned} \tag{71}$$

Now, considering (66) and then (67), one obtains:

$$\begin{aligned}
\int_V \left[(\boldsymbol{\rho}\cdot\boldsymbol{\rho})\overline{\mathbf{U}} - \boldsymbol{\rho}\boldsymbol{\rho} \right] \rho^* dV = {}& I_{xx}\mathbf{ii} + I_{xy}\mathbf{ij} + I_{xz}\mathbf{ik} + I_{yx}\mathbf{ji} + I_{yy}\mathbf{jj} + I_{yz}\mathbf{jk} + I_{zx}\mathbf{ki} + I_{zy}\mathbf{kj} + I_{zz}\mathbf{kk} \\
& = \overline{\mathbf{I}},
\end{aligned} \tag{72}$$

completing the proof of expression in (67).

5.4 Transformation rules for the inertia dyadic

The transformation equation relating the inertia dyadic of a rigid body with respect to primed and unprimed reference frames in Figure 2 is given by (Greenwood, 2003):

$$\vec{I}' = \vec{C} \cdot \vec{I} \cdot \vec{C}^T . \tag{73}$$

Proof

The expression of the inertia dyadic with respect to the primed reference system in Fig.2 is

$$\vec{I}' = \int_V \left[(\rho' \cdot \rho') \vec{U}' - \rho' \rho' \right] \rho^* dV , \tag{74}$$

where ρ' and $\vec{U}'$ denote the position vector of the mass element and unit dyadic written in the primed system, i.e.,

$$\rho' = x' \mathbf{i}' + y' \mathbf{j}' + z' \mathbf{k}' , \tag{75}$$

$$\vec{U}' = \mathbf{i}' \mathbf{i}' + \mathbf{j}' \mathbf{j}' + \mathbf{k}' \mathbf{k}' . \tag{76}$$

The dot product of (67) by the rotation dyadic $\vec{C}$ from the left yields

$$\vec{C} \cdot \vec{I} = \int_V \left[(\rho' \cdot \rho') \vec{C} \cdot \vec{U} - \vec{C} \cdot \rho \rho \right] \rho^* dV , \tag{77}$$

where use is made of the obvious expression

$$\rho \cdot \rho = \rho' \cdot \rho' . \tag{78}$$

The dot multiplication of (77) by $\vec{C}^T$ results in

$$\vec{C} \cdot \vec{I} \cdot \vec{C}^T = \int_V \left[(\rho' \cdot \rho') \vec{C} \cdot \vec{U} \cdot \vec{C}^T - \vec{C} \cdot \rho \rho \cdot \vec{C}^T \right] \rho^* dV . \tag{79}$$

Recalling (62), the above equation can be written as:

$$\vec{C} \cdot \vec{I} \cdot \vec{C}^T = \int_V \left[(\rho' \cdot \rho') \vec{U}' - (\vec{C} \cdot \rho)(\rho \cdot \vec{C}^T) \right] \rho^* dV . \tag{80}$$

Considering (52),

$$\vec{C} \cdot \rho = \rho' \tag{81}$$

can be written.

It remains to show that the last parenthesis can be expressed as ρ'. To this end, we start with

$$\rho = \rho' \cdot \vec{C} \tag{82}$$

which can easily be obtained. If this is dot multiplied by $\vec{C}^T$ from the right,

$$\rho \cdot \vec{C}^T = \rho' \cdot \vec{C} \cdot \vec{C}^T \tag{83}$$

is obtained. The consideration of (58) and then (21), leads to

$$\rho \cdot \vec{C}^T = \rho' . \tag{84}$$

Now, taking into account the (81) and (83), the expression in (80) can be brought into the form:

$$\bar{\bar{C}} \cdot \bar{\bar{I}} \cdot \bar{\bar{C}}^T = \int_V \left[(\rho' \cdot \rho') \bar{\bar{U}} - \rho' \rho' \right] \rho^* dV . \tag{85}$$

As can be seen from (74), the right side of the above equation represents the inertia dyadic of the rigid body, with respect to the primed reference system $Ox'y'z'$. Thus,

$$\bar{\bar{C}} \cdot \bar{\bar{I}} \cdot \bar{\bar{C}}^T = \bar{\bar{I}}', \tag{86}$$

is obtained, as claimed in (73).

5.5 Rotational kinetic energy

As is known, the rotational kinetic energy of a rigid body, i.e., its kinetic energy due to the rotation about the center of mass, is (Meirovitch, 2003):

$$T_{\text{rot}} = \frac{1}{2} \omega \cdot H , \tag{87}$$

ω and H being the angular velocity vector of the body and angular momentum with respect to the center of mass. The dot between ω and H denotes the classical dot product of two vector resulting a scalar.

Considering (13) and (14), the above equation leads to

$$T_{\text{rot}} = \frac{1}{2} \left(I_{xx} \omega_x^2 + I_{yy} \omega_y^2 + I_{zz} \omega_z^2 \right) + I_{xy} \omega_x \omega_y + I_{xz} \omega_x \omega_z + I_{yz} \omega_y \omega_z , \tag{88}$$

when recalling $I_{xy} = I_{yx}, I_{xz} = I_{zx}$ and $I_{yz} = I_{zy}$. Now, we want to prove that (88) can be represented in a compact form as

$$T_{\text{rot}} = \frac{1}{2} \omega \cdot H = \frac{1}{2} \omega \cdot \bar{\bar{I}} \cdot \omega , \tag{89}$$

using the inertia dyadic $\bar{\bar{I}}$ (Greenwood, 2003).

Proof

Let us start with the symbolic representation of the angular momentum in (17):

$$H = \bar{\bar{I}} \cdot \omega = \sum_i \sum_j I_{ij} \omega_j \mathbf{e}_i . \tag{90}$$

Dot multiplication of the above equation by $1/2\omega$ from the left yields

$$\frac{1}{2} \omega \cdot \bar{\bar{I}} \cdot \omega = \frac{1}{2} \sum_i \sum_j I_{ij} \omega_j \omega \cdot \mathbf{e}_i . \tag{91}$$

Recognizing

$$\omega = \omega_1 \mathbf{e}_1 + \omega_2 \mathbf{e}_2 + \omega_3 \mathbf{e}_3 \tag{92}$$

and, hence, $\omega \cdot \mathbf{e}_i = \omega_i$, one obtains

$$\frac{1}{2} \omega \cdot \bar{\bar{I}} \cdot \omega = \frac{1}{2} \sum_i \sum_j I_{ij} \omega_i \omega_j . \tag{93}$$

The right side of the above equation is nothing else but the symbolic representation of the right side of (88), leading to the fact claimed by (89).

6. Conclusions

According to the observation of the first author, who has been teaching subjects related to advanced dynamics and vibrations for many years, his students had always difficulties in understanding the concepts of dyads and dyadics. Based on his observations, in the present article, the authors compiled information and formulae gathered from various books on this topic along with proofs, so that the dyadics can be better understood by students and possibly a larger population in the scientific community.

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Appendix

Here, formulas regarding the direction cosines between the coordinate frames xyz and $x'y'z'$ are collected (Budo, 1980). The direction cosines are represented symbolically in the following small table:

	x'	y'	z'
x	$c_{x'x}$	$c_{y'x}$	$c_{z'x}$
y	$c_{x'y}$	$c_{y'y}$	$c_{z'y}$
z	$c_{x'z}$	$c_{y'z}$	$c_{z'z}$

$$c_{x'x}^2 + c_{x'y}^2 + c_{x'z}^2 = 1$$

$$c_{y'x}^2 + c_{y'y}^2 + c_{y'z}^2 = 1$$

$$c_{z'x}^2 + c_{z'y}^2 + c_{z'z}^2 = 1$$

$$c_{x'x}c_{y'x} + c_{x'y}c_{y'y} + c_{x'z}c_{y'z} = 0$$

$$c_{y'x}c_{z'x} + c_{y'y}c_{z'y} + c_{y'z}c_{z'z} = 0$$

$$c_{z'x}c_{x'x} + c_{z'y}c_{x'y} + c_{z'z}c_{x'z} = 0$$

$$c_{x'x}^2 + c_{y'x}^2 + c_{z'x}^2 = 1$$

$$c_{x'y}^2 + c_{y'y}^2 + c_{z'y}^2 = 1$$

$$c_{x'z}^2 + c_{y'z}^2 + c_{z'z}^2 = 1$$

$$c_{x'x}c_{x'y} + c_{y'x}c_{y'y} + c_{z'x}c_{z'y} = 0$$

$$c_{x'x}c_{x'z} + c_{y'x}c_{y'z} + c_{z'x}c_{z'z} = 0$$

$$c_{x'y}c_{x'z} + c_{y'y}c_{y'z} + c_{z'y}c_{z'z} = 0$$

Is Malaysian Terrace Housing an outdated planning concept?

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Abstract:
Housing is not a mere accumulation of houses. At certain point of urban development, it starts to build up community. Ages prior to industrialization, community was almost a bi-product of housing. Theorists argue that it was due to ample social interaction that was enhanced by pedestrian activities inside neighborhoods. However, industrial revolution changed the scenario. Houses for migrated working class people did not reflect that kind of community one dreamt of. Utopian garden city concepts tried to restore that kind of social interaction through walkable communities outside the bustling urban areas. Then the motor age came, which redefined the concept of neighborhood with the invasion of cars inside adapting the grid iron planning concept. Pedestrian activities were relegated to secondary, and social interaction started to become extinct resulting social decay and gentrification. To retrieve that utopian community was once again in the agenda. Planners tried for solutions where pedestrians can enjoy the same old walkable environment while not sacrificing the car access. Radburn concept was revisited as it was the first one to separate car with pedestrians. It was followed by more contemporary concepts such as loops, Fused Grids, Woonerfs, Shared Routes etc. They were accepted at various parts of the world as the solution to recover community. Malaysia experienced rapid urban development in recent decades. However, it started to follow the grid iron pattern in residential development fitted into the local context, though this concept was already started to be rejected in the developed world. In this study, several universal and local issues related to community development in current terrace housing in Malaysia were carefully scrutinized through literature survey and careful observation. It was found that they do not satisfy most of these issues. Therefore, considering the huge bulk of these housings, the question arises whether they are already outdated enough to be continued further.

Keyword: Terrace Housing, Community, Radburn, Grid iron pattern, Malaysia

Introduction: We need community, not just houses

Housing is not a mere accumulation of shelter. Especially at certain point in urban development, it starts to make impact on the society, culture, economy and the environment. In Malaysia probably that point has come when there is need to rethink what housing should offer (Rasdi 2007).

1. History of urban housing

1.1 Housing in New towns after Industrial Revolution:

After industrial revolution, the world saw a different kind of housing development in the urban areas in the form of dense shelters serving mainly as night time refuge for factory workers who had migrated from the countryside to these new industrial towns in search for better income. Eventually many other kinds of jobs evolved, and urban population rapidly increased, for which the towns were not prepared to provide enough housing. Many cities in Europe experienced hastily built cheap houses for factory workers. They were located close to the factory so that workers could walk to work. In terms of planning concept, they can be considered very primitive. Usually they were double-row houses back-to-back with an open sewer running in the middle of the front street which was already very narrow. People used to throw rubbish in the sewer. There were no backyards, no front window. These new towns were dirty and unhealthy, and a perfect breeding grounds for diseases (Peacock 2007).

1.2 Garden City Movement: pre-automobile era

However, the new towns grew immediate concerns among town planners. There was a rising consciousness about the utopia that was about to be lost. This utopia was about a home being a peaceful, enjoyable and secure place blended with nature that had been experienced in countryside houses throughout history (Christensen 1986). There was no alternative to the new towns, but the planners were looking for solutions how the houses can still sustain that sort of image. Sir Ebenezer Howard's Garden City has just provided that kind of solution (Figure 1). It combined the good points of both countryside and urban life, and proposed a new kind of town planning which could bring the good points of both together. The result was a separation of residential and industrial zones by a green belt, where the travel distance was covered by train. According to the concept, people could stay in the countryside as before inside a pedestrianized community, and could commute by train everyday to the town for work (Howard 1902). However, due to manifold practical problems related to local topography, management, local politics, many of the features could never be implemented as it was anticipated. Gradually, the concept started to evolve, and more concepts followed as automobiles started to become an integral part of people's lives (Schuyler 2002).
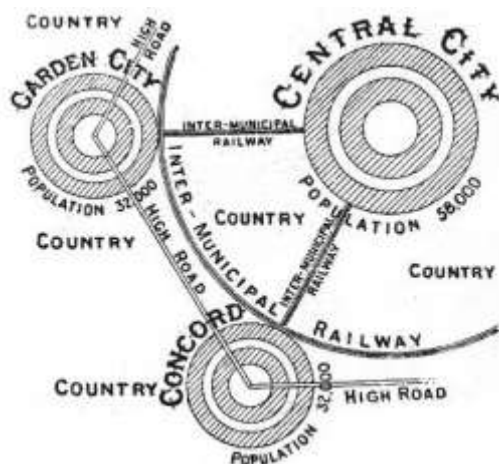
Figure 1: Concept of Garden City (Howard 1902)

1.3 Motor Age:

Introduction to motor age brought in newer issues. Automobiles became the mainstay in urban life. For the first time in history, walking was relegated to secondary as cities became wider and wider, travel distances became longer, and there was no alternate for motorized vehicles. Depending on the scale of public transport, different cities experienced different kind of vehicular dependency. Those with highly efficient public transport could still boast of some pedestrian activity, while those which were totally dependent on private car driven transportation, gradually started to lose the essence of walkable communities. Mumford (1961), in particular, severely criticized the emptiness of the concept with respect to the lack of hierarchy between main streets and residential streets. Debate continued to generate whether to speedy motorized vehicles should be given priority over traditional pedestrian activity.

At the beginning of motor age, automobiles were seen as not only a more convenient medium of transport but also as a status symbol. Therefore, in planning principles, easy car accessibility and high speed connections to major roads were given more attention, which tradition grid-iron street pattern could provide a good solution (Figure 2). That brought concerns from people like Architect Clarence Stein quoting Aristotle that cities started to lack security and happiness. At certain point it was felt that a community that lacks pedestrian activity can be deprived of safety, interaction and the enjoyment of a utopian city that was sought after by the garden city movements. However, there was no way back to sacrifice motorized transportation. Therefore, the challenge was to find a balanced concept that could prioritize pedestrian activity without sacrificing car dependency. Going back to Clarence Stein and Henry Wright's Radburn developed in late 1920s, planners rediscovered a concept seemed to provide exactly that sort of solution (Parson 1998).
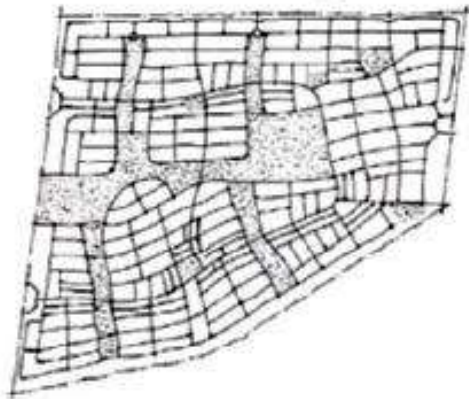
Figure 2: Traditional Grid-iron systme neighborhoods (Residential Street Pattern Design 2002)

1.4 Radburn: Prioritizing Pedestrian over Automobiles

The primary aim of Radburn was to separate the pedestrian and the vehicular traffic. Radburn theory replaced grid iron street patterns with superblocks. A super block is a large piece of land containing a cluster of houses surrounded by a feeder road that can be a main road or a peripheral road. The houses are grouped around small cul-de-sacs, each of which has access from the feeder road. Each house had two separate entrances. The front one is from the cul-de-sac, and the back one opening up to a pedestrian road, which connect to the green areas and community parks, that are considered as the key generator of human interaction. Therefore, the pedestrian ways are totally free from vehicular traffic. In order to achieve that, underpass and overpasses were also necessary with necessary landscaping. Since going back to pedestrian priority was the goal, this concept is often regarded as the

American version of British Garden Cit (Lee and Ahn 2003). From this general concept Martin (2001) states that addressing both vehicular and pedestrian is a logical way to achieve that utopian image from a contemporary perspective rather than trying to create a totally car free pre-automobile town design proposed by neo-urbanists. To him, a pre-automobile town can be an inspiration, but not the ultimate solution. But most importantly, Radburn was successful to bring back that strong 'community focus', that was about to be lost due to the rise of the automobiles. In Europe, and especially in the American new towns of the 1960s followed the concept. Though Martin (2001) argues that due to some pressure from neo-urbanists, there were many occasions where particular Radburn concepts were abandoned, still it was considered as the future of contemporary community planning (Figure 3).

Figure 3: Concept of Radburn superblock (Southworth and Ben-Joseph 2003)

1.5 Flaws of Radburn:

However, Radburn concept did not go without flaws. After years of inhabitation, a government report in Britain in 2002 summarized the limitations of Radburn (Lavalle 2012). Among them the most important ones were:

- the disconnectedness at dead-ends,
- the lack of natural surveillance in the pedestrian walkways,
- lack of effective management due to complicated organic layout, and
- profusion of un-adopted routes.

Due to lack of security, primary residents usually lost interest to live there, which is followed by silent gentrification with less privileged people, thus generating ghettos, and consequently increasing the chance of more social violence and crime. Several experiments were taken in order to 'uplift' Radburn estates. Some of the strategies include:

- reconfiguring the layouts in order to create natural surveillance,

- infill or de-concentrate at strategic points in order to minimize number of dead-ends etc.
   User satisfaction surveys later on showed approval for the works.

1.6 Radburn Modified: Contemporary Concepts

Therefore, some of the lessons taken from the studies are that:

- layouts should be simpler as possible for the sake of natural surveillance in the pedestrian streets,
- an effective management system must be enforced in order to supplement the security issues, and
- dead-ends should not be too far away from the feeder road (Lee and Stabin-Nesmith 2008).

For the first point, layouts were encouraged to be more in straight line, as it can remove the factor of being disoriented. The second point was learnt through experience in both dense cities and deserted cities. In order to achieve the last one, several other concepts were introduced. One of the most highlighted ones was the concept of 'shared routes' where pedestrians and cars are integrated with pedestrian getting legal priority (Ecotown 2012). Loops, Fused Grid (Grammenos and Pidgeon 2005), Woonerf (or Residential Yard), Home zones and Shared Spaces are some examples of this concept (Figure 4). However, they still need a high level of concerns from car drivers, as one single mishap could destroy the image of the whole concept.

Figure 4: Example of Woonerf (Wikipedia 2012) and Shared Routes (The Dings 2012)

Both Radburn and Shared Routes can produce pleasant pedestrian environment, but the success depends on housing density and the ratio of car journeys to foot journeys. Studies show that where density is low, pedestrian ways will always be deserted, thus Radburn fails. If most journeys are by car, resulting from a long distance between housing lots and the community facilities inside the neighborhoods such as shops, religious facilities, and communal facilities, Radburn also fails. Again, if the density is very high, too much pedestrian can jeopardize the car journeys in shared routes. Moreover, if the behavior of motor drivers is not studied carefully, pedestrians are always in danger in the shared routes.

1.7 Identify Universal issues

Rasdy (2007) have highlighted several universal issues that any neighborhood needs to build up a community. That sort of community used to be developed automatically during pre-automobile era as with the absence of any speedy vehicle. Pedestrians interacted by default. This traditional concept was temporarily jolted by the invasion of motor age. However, it seems that the concerns have been back and the search for effective planning concepts that does not fail to give importance to cars, but at that same time keep the community intact by prioritizing pedestrian activities, has gained momentum. However, that jolt in the middle taught some good lessons. When car prioritized neighborhood isolated the houses from each other, security was the first issue that had been felt. Since

neighbors seldom interacted, there was nobody to help in case of emergency such as burglary, social violence etc. The grid-iron layouts also do not offer natural surveillance unless presence of monitoring at nodes. In addition to the security issue, some other concerns were also seriously felt. Since there were no communal facilities at walkable distance, or even though there was, it was not easy to access them as they were crisscrossed by vehicular roads with constant traffic, it virtually prevented children or elderly people to spontaneously enjoy them, and left them virtually captivated inside the house unless someone carried them by car. There were questions about natural physical and mental growth of children who are confined inside their houses. For elderly people, it is virtually just waiting for their final call of nature. And for adults, car oriented movements also deprived them from physical movements necessary to maintain normal healthy body.

All these concerns appeared to be universal issues generated from post-automobile age in urban neighborhoods all over the world. These can be summarized as follows:

i. Degree of Car dependency
ii. Degree of pedestrian movement
iii. Security
iv. Degree of natural Surveillance
v. Degree of car dependence to reach communal facilities (Availability of alternate medium)
vi. Responsiveness to children's natural growth (availability of natural playground)
vii. Traffic free walkways (Children friendliness)
viii. Disable friendly walkways (Elderly friendly)
ix. Health issues generated from car dependency

The movements such as Radburn and shared routes are among those which tried to solve these universal issues. However, if concentrating on the particular context of urban Malaysia, several other issues were identified.

1.8 Lessons learnt:

Combining the universal issues from literature, several probable lessons can be learnt responding to each issue respectively those are essential to consider in any housing model:

i. Security is the first thing that is likely to be lost in a car-dependent neighborhood. When security is lost, gentrification is imminent, and ghettos are created, that raises more security issues. Therefore, there must be alternate movement other than cars.
ii. Enhancing pedestrian activities is the proven method to overcome security. However, the significance of car accessibility cannot be sacrificed. Therefore, Radburn or shared routes can be solution. However, Radburn seems to be the more acceptable approach than Shared Routes in denser context. If Radburn cannot be implemented totally, other methods may be mixed with Radburn to solve tricky cases.
iii. Therefore, security can be restored in two ways: enhancing pedestrian activity, and improve natural surveillance.
iv. For natural surveillance, there are two ways: firstly, designing non-face-to-face blocks to increase visual angle from each house, and secondly, to create activity at strategic nodes or locations
v. The communal facilities should not be accessible only through cars. There are two ways to do that: firstly, to decentralized them, so that they come within walking distance. Secondly, to create alternate route (example: bicycle route) that is not only health conscious approach, but also environmental friendly as it minimizes car journeys.
vi. There must be children's playground within walking distance to each house, so that they are not stuck in indoors, or need to travel by car to reach there.

vii.   The playground should not only be in walkable distance, but the route from each house needs to be traffic free to ensure parents'

viii.   All pedestrian walkways must be disabled friendly, so that wheelchairs can also have freedom to move.

ix.   Alternates to car journeys to playground and communal facilities increase natural body movement, and therefore offers a more healthy solution.

2. Malaysian context:

Malaysia's rise to rapid urban development started during the eighties that eventually created demand for a huge number of housing. Prototype Terrace houses (Single or Double story row houses) became very popular to the developers as it offered quicker construction time at a cheaper rate because of the batch construction methods, and also offers maximum number of houses per unit area. Most importantly perhaps, they proved to be a desirable upgrade from traditional 'kampong' or country houses (Ghazali 2007).
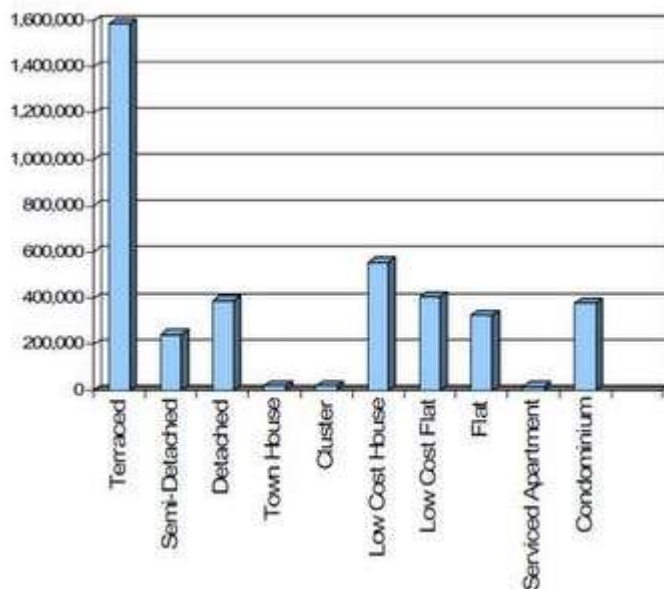

Figure 5: Summary of Supply of Residential Units by Type in Malaysia – Existing Stock (NAPIC 2007)

Though imported from Western world, the basic concept of terrace houses can still be considered as 'efficient' in the tropical context of Malaysia. The setbacks and the sectional details allowed penetration of natural lighting, ventilation. The front yard provided space for considerations of local culture besides the much needed parking space (Rasdi 2003).

However, in terms of planning i.e. designing the neighborhood, it adopted the car priority grid-iron street patterns apparently superficially molded to the Malaysian topography with the pedestrians being relegated to secondary. Lot sizes ranged from 16' X 50' to 24' X 100', with the most common ones being around 22' X 70'. The number of row-houses was limited to a range of eight to sixteen to allow firebreaks. Backlanes provided ample space for sewage system to run. Therefore, a lot of perforation by vehicular streets dominated the neighborhood planning. Moreover, linear face-to-face blocks did not allow much space for developing social activities and natural surveillance. Thereafter, a whole generation of estates comprising terrace houses has generated a kind of car dependent non-interactive unsecure neighborhood, with people isolated from each other, just the way the American and the Europeans faced before the 1960s (Ghazali 2007).

There were factors that lead to the development of such housing models and there were factors that were not considered during the development. Section 2.1 scrutinizes the former, and section 2.2 and 2.3 do the same for the latter.

2.1 Building regulations and Universal issues

In addition to the universal issues imported with the car-dependent model, there are other local issues related to the context of Malaysia. The first one was the building and planning regulations.

2.1.1   Compulsory Communal Facilities inside neighborhoods

According to Federal Constitution (Part IV), basic amenities and services should be provided for the local population and create job opportunities for them to get involved in their own area. The land and space allocations for a prototype model that consists of the required commercial, communal and recreational facilities to serve the residential area was thus calculated from the number of households that it serves (Nurdalila 2012).

2.1.2   Compulsory Green space as playground inside clusters

Moreover, the Town and Country Planning Act 1976 (act 172) stresses on environmental pollution control, and preservation of natural surroundings (TCPA 1976). As a result a mandatory minimum of 10% natural green area has been maintained as the playground inside each cluster (Figure 5).

2.1.3   Ground Coverage and Density control

The maximum ground coverage rule initiated the concept of backlane as built forms can only take up certain percentage of land. However, as a bonus, the backlane was supposed to provide safe sanitation, garbage control, and fire safety regulations. In addition, the Street, Drainage and Building Act 1974 (act 133) also fixed minimum surface area of roads in order to have easy access to all houses (SDBA 1974). Backlanes accumulate up to achieve that number.

2.1.4   Connectors

The concept of connectors mainly comes from fire-fighting regulations. Its job was to break the length of the block in order to give easy access to each house for fire-fighting trucks. The idea was that fire-fighting trucks should reach the back side of each house accessing through the connectors turning to the backlane. However, interviews with selected government high officials revealed that this concept is already obsolete as new technology has been introduced both in firefighting and in sewerage control. Therefore, the whole street network not only followed the perforated grid iron pattern, but also imposed an extra set of streets in the form of backlanes and connectors which do not serve any significant purpose any more.

2.1.5   Summary: The reality in Malaysia

Summarizing the facts, the question raised here was that whether the building regulations are responding to the lessons that are learnt through the nine universal issues in urban housing accumulated from literature. It seems mostly not. Here is the discussion on the 9 universal issues determined earlier from literature.

i.   As expected, the imported grid-iron model of terrace housing gives highest priority to car-dependency in Malaysian terrace housings.

ii. As an universal consequence, pedestrian movement is relegated to secondary, and often neglected. In addition to the main access road, backlanes and connectors create more perforation to the cluster, and discourage any sort of pedestrian activity. There are even no distinct pedestrian walkways. They have to walk on the road along with the car with no legal priority given to pedestrian safety.

iii. Security is under scrutiny. There are instances that social violence, burglary are occurring. For example, the much circulated case of the kidnapping of eight year old girl Nurin Jazlin can be traced back (The Star, 2007)

iv. The layout of blocks are linear and face-to-face, thus they do not offer much natural surveillance.

v. A neighborhood is divided into several clusters, and each cluster has a green field supposed to be used as playground, which is very much positive. However, the location is not well-planned as many such playgrounds are located at a corner of the cluster, thereby creating unequal journey from all part of the cluster.

vi. Moreover, the playgrounds are not at walking distance from each house of the cluster from children's perspective. Children under 12 years of age may not get permission by parent to travel by themselves if they have to make a long journey, with questionable security already around.

vii. Even more, these playgrounds are not accessible without crossing car roads. Therefore it neglects the lesson learnt from literature that a traffic free route is necessary to for community build up.

viii. There are no proper pedestrian walkways. Therefore, the issue to be elderly friendly is totally extinct.

ix. Communal facilities are not within walking distance from most of the houses in the neighborhood. There are not other alternate than cars. So health issues are neglected.

As a result, there is no pedestrian activity, the playgrounds continue to be deserted, and people need to take their car to reach to the communal places for any trivial issues. Tropical climate do not allow comfortable walking during daytime, unless they are shaded. However, where there is no option for walking safely, let alone the expectation of a comfortable walkway.

2.2 Climatic Issues

As a tropical country in the Northern Hemisphere, the sunlight and its direction is a major consideration. Being close to the sea, wind direction also becomes a major issue for cross ventilation. Natural cooling by planting trees strategically can also play a big role on these issues. However, the blocks of terrace houses and the overall landscaping do not seem to respect any of these issues, and they are arranged probably only one thing in the mind of the developers, that is, how to maximize the number of houses (Ghazali 2007).

Figure 6: A playground is a mandatory part in each cluster, though the location can vary. In this same cluster, different blocks can be oriented differently. Example Balok Perdana, Pahang (Source: Google Earth)

2.3 Socio-cultural issues

2.3.1   Route to Surau

As a predominant Muslim country, Mosques/Surau is an essential part of any neighborhood. According to Hadith (Tirmidhi 2012), Muslims should walk towards the mosque/surau. When the mosques/suraus are reachable only by car, that Hadith loses its value significantly. This study included an empirical observation of over 100 neighborhoods in Malaysia, but failed to find a definite separate route to surau in any of them that provide alternate journey other than car from all possible locations inside the neighborhood.

2.3.2   Ceremonial Occasions

Following local culture, Malaysians like to celebrate big occasions (ex. Wedding) in front of their own premise. They like to share the event with their neighbors as well. However, in those cases, empirical observation shows that occupying the car roads becomes the only option to arrange the temporary pavilions, which by some way reduces the advantage of accessibility to the houses of themselves as well as of neighbors for several days.

Figure 7: Temporary Pavilions are common practices in case of ceremonial occasions (Source: Author)

3.3.3. Temporary Street Food Vendors

Temporary street food vendors are popular inside neighborhoods in Malaysia. They may be used as natural surveillance points. There are regulations for protecting street vendors, and licensed vendors also get facilities from the state. However selection of locations and determining numbers in neighborhoods are not conclusive (Rane 2011).

Figure 8: A typical street food vendor inside neighborhoods (Source: Author)

3.3.4   Privacy Issues

For Islamic point of view, two face-to-face blocks unmistakably reduces the privacy of neighbors. From multi-cultural perspective, it may not be a big issue, but since Muslims dominate in numbers, houses should have different options to choose from, as long as visual privacy is concerned. However, there is no such trend probably because face-to-face blocks can maximize the number of houses and therefore more profitable for developers (Rasdi 2007).

2.4 Other issues

Malaysia is aiming towards being developed country. There are political goals that to achieve within limited time frame. Therefore, there is an urgency to reach that goal. Sometimes urgency leads to hasty conclusions or blind copying from existing success stories. It may not be same for all sectors, but for housing, it seems to be just like that. There is the goodwill to provide better housing for all, there are necessary resources to do that, but the one thing missing is the sensibility (Rasdi 2003).

2.5 Summary of issues, lessons learnt, and the reality

Therefore, it can be summarized that the imported car-friendly grid-iron model of housing estates not only bring in the universal problems, but also add more local problems to hinder community development. Table 1 shows the lists the issues, the lessons learnt and the actual reality:

Table 1: tabular format of issues, lessons learnt, and the reality

l. no	Issues	Lessons Learnt	Reality
.	Climatic concerns should be a major design consideration as sun orientation and natural wind flow are two dominant forces in the tropical climate of Malaysia	In terms of climate responsive planning of blocks, the orientation of blocks should be more carefully sorted out.	Climate has not been considered in terms of planning. In one single cluster, blocks with different orientation are found to co-exist, which raises the sensibility of the designer.
.	Journey to surau is an important consideration as from religious perspective in this Muslim dominating society, walking could have been the best option.	There must be alternate route to surau other than by cars.	There are no obvious alternate routes to surau.
.	There should be spaces that can hold occasional ceremonial events. To make it more effective it can be multipurpose, such as children's playground in rest of the time	There must be spaces to hold occasional ceremonial events rather than occupying part of busy inner streets.	There are no spaces that can hold occasional ceremonial events. As a result, people occupy the access road for days creating discomfort to neighbors.
.	Strategic points can be located for temporary vendors and sitting areas because they can create natural surveillance inside neighborhoods	Non-face-to-face blocks are not the best solutions in terms of privacy issues, which mostly related to Muslim residents.	There are no other options widely practiced than the linear face-to-face blocks which create privacy issues, especially among Muslim community.
.	Privacy issues related to Islamic culture could be more carefully reflected in designing block patterns especially as neighborhoods are dominated by Muslim Malays. Linear blocks may not be the only solution.	Temporary vendor points can be located around the neighborhood in order to increase natural surveillance.	Though street food vendors are licensed, and therefore can be controlled, however, locating vendors inside deep into neighborhoods may not be a good idea as long as total security is not ensured. In this case property management can play a significant role into each neighborhood.

Conclusion:

From the study, fourteen issues were identified those are considered crucial for a housing to be able to buildup a community. Among them nine of them can be considered as universal, and the rest five as contextual to Malaysia. One can expect that when the current model of terrace housing was being implemented, regulations would address all these issues very carefully. Unfortunately, this study finds only one has been satisfied (playground inside clusters), and the rest are totally ignored. At a certain point in the history i.e. at the rise of the motor age, it might not raise too much concern as the whole world was carried away by the power of speedy vehicles at that time. But situation has changed since then. Therefore the question lies whether an outdated model is followed by Malaysia. In fact, several alternate planning principles have been proposed during the past few years. For example, honeycomb cul-de-sac housing by Ghazali (2012) has negotiated with several of these contextual issues of Malaysia and claimed to be one affordable alternative to terrace housing. However, the question is why the old model of terrace housing is still being practiced. If it were about a small scale issue, one may have ignored it. But, as this model dominates the whole of urban Malaysia, it is the time to rethink before large scale social and economic damage is done in near future.

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Correlation between Scientific Reasoning Skill Level and Lecturers' Teaching Style among Mathematics Undergraduates

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Abstract

This survey research aimed to determine the scientific reasoning skill level among the mathematics undergraduates in Universiti Pendidikan Sultan Idris (UPSI), to identify the dominant lecturers' teaching style according to students' perceptions, and to determine the correlation between the level of scientific reasoning skill and the dominant lecturers' teaching style. A total of 74 early year undergraduates (semesters three and four) and 162 final year undergraduates (semesters five and eight) were involved in this study. Two instruments were used in the study namely the Scientific Reasoning Skills Test and the Lecturers' Teaching Style Survey. Descriptive statistics such as frequency, percentage and central tendencies and inferential statistics such as the t-test, multivariate analysis of variance and Pearson correlation were used to analyze the data. Findings of the study showed that most undergraduates had concrete level of scientific reasoning skills. The final year undergraduates had higher level of scientific reasoning skills as compared to the early year undergraduates. However, no significance mean differences in skills were established between undergraduates in the early and final years. The expert and delegator were dominant lecturers' teaching styles according to students' perception. In addition, it was found that there is no significant correlation between lecturers' teaching style and the level of scientific reasoning skill. This study could be used as a benchmark for mathematics undergraduates' level of scientific reasoning skill in UPSI. Specific strategies need to be integrated in the teaching, learning and assessment in higher education to ensure that students gain the skill to help them cope better with their study, university life and future life. Thus, as the university curricula continuously undergo improvement, the development of this skill needs to be incorporated and emphasized further.

Keywords: Scientific Reasoning Skill, Teaching Style.

1. Introduction

Educational reforms stress the need for a prepared 21st century workforce, which translates into students learning not only the content, but also acquiring advanced transferable reasoning skills (Bybee & Fuchs, 2006). The development of these skills will better enable students to handle open-ended novel situations and design their own investigations to solve scientific, engineering, and social problems in real world (Bao et al., 2009; Iyengar et al., 2008). An important component of these abilities is scientific reasoning, which broadly defined, includes the thinking and reasoning skills involved in inquiry, experimentation, evidence evaluation, inference and argumentation that support the formation and modification of concepts and theories about the natural and social world (Zimmerman, 2007). Scientific reasoning is a general ability and methodology that is critical in enabling the successful management of real-world situations in professions beyond the classroom.

Fostering critical thinking skills and creativity, logical and higher order thinking skills are the main emphases in Malaysian mathematics curriculum. High-level mathematical concepts involve abstracts ideas and require formal reasoning. According to the study done by Syed Anwar and Merza (2000), many students have not attained the higher-order thinking skills. This provides an indication that the students actually work at lower reasoning level than the level of reasoning required in the mathematics syllabus provided. This phenomenon means that the achievement level of students' reasoning for most of the secondary school students is far from the recommended goal of mathematics education.

Scientific reasoning skills, not only affect students' achievement at secondary school level but this skill also required at tertiary level and in the working world. If the secondary school students still do not achieve a proper level of reasoning, it seems likely that at higher education level of their skill level is still the same as before, or perhaps their reasoning skills will increase. However, is the learning experience in higher education can help students develop scientific reasoning skills? Therefore, this study is to explore this phenomenon by determining the level of scientific reasoning skills owned by the students at an early stage and then in the final stages of their undergraduate studies.

In K-12 education, the development of scientific reasoning skills has been shown to have a long-term impact on student academic achievement (Adel & Shayer, 1994). Positive correlations between student scientific reasoning abilities and measures of students' gains in learning science content have been reported (Coletta & Phillips, 2005). These findings support the consensus of the science education community on the need for K-12 students to develop an adequate level of scientific reasoning skills along with a solid foundation of content knowledge.

Traditionally, it is often expected that rigorous content learning in science and mathematics will help develop students' scientific reasoning abilities; however, recent studies have shown that the traditional style of STEM education has little impact on the development of students' scientific reasoning abilities (Bao et al., 2009). It is not what we teach but rather how we teach that makes a difference in student learning of higher order abilities such as scientific reasoning.

Scientific reasoning is a valuable attribute that should be owned by students at the university. A lot of effort by the government of Malaysia has been planned and are being implemented to improve the softskills of the graduates of Institute of Higher Learning including their scientific reasoning skills. However, this area has not been extensively tested and not much evidence has been reported on in-depth in Malaysia to measure this attribute among the undergraduates (Nor'ain et al., 2012). Therefore, this study was done particularly in the onset of the new policy of the Ministry of Higher Education on the concerted implementation of soft skills development and Outcome Based Learning development throughout all the institutes of higher learning in Malaysia. The finding of this study can be used as a

baseline for the measurement of the effectiveness of the policy after its implementation for at least one cycle of students.

2. Objectives and Research Questions

The objectives of this study are: (a) to determine the level of scientific reasoning skills (SRS) among mathematics students, (b) to identify the teaching styles of lecturers according to mathematics students' perceptions, and (c) to determine the correlation between lecturers' teaching styles according to mathematics students' perception and their level of SRS. The following are the research questions:

a) What is the SRS level of early year, final year and all mathematics students at UPSI?
b) Is there a difference between early and final year mathematics students in the overall SRS level and each SRS level?
c) What is the dominant lecturers' teaching style according to early year, final year and all mathematics students' perceptions?
d) Is there a difference between the early and final year on lecturers' teaching styles according to their perceptions
e) Is there a correlation between the SRS level with the lecturers' teaching style according to early year, final year and all mathematics students' perception?

3. Methodology

This study employed the quantitative survey data-gathering method. A total of 74 early year mathematics undergraduates (semester three) and 162 final year mathematics undergraduates (semesters five and eight) from Mathematics Program, Sultan Idris Education University (UPSI) were involved in the study.

Two instruments were used in the study, namely the Scientific Reasoning Skills Test (SRST) and the Lecturers' Teaching Style Survey (LTSS). The SRST is based on the modified version of the Lawson's Test of Scientific Reasoning (1978, 2000). This test focuses on a set of basic reasoning skills that are commonly needed for students to systematically conduct scientific inquiry, which includes exploring a problem, formulating and testing hypotheses, manipulating and isolating variables, and observing and evaluating the consequences. It provides a solid starting point for assessing scientific reasoning skills. The test is designed to examine a small set of dimensions including (1) conservation of matter and volume, (2) proportional reasoning, (3) control of variables, (4) probability reasoning, (5) correlation reasoning, and (6) hypothetical-deductive reasoning. These skills are important components of the broadly defined scientific reasoning ability. The SRST is a two-tier multiple-choice diagnostic instrument, consists of 12 items, and each item contains two tiers. The first tier is for choosing the answer, and second tier for using the thinking ability mentioned above. Students need to answer both tiers correctly in order to receive one point, so the highest score is 12. Scoring scheme proposed by Lawson (2000) in determining the level of SRS is as shown in Table 1.

Table 1: Scoring Scheme Reasoning Skills Level

Score	SRS Skills Level
0 - 4	Concrete Operations
5 - 8	Transitional Operations
9 - 12	Formal Operations

The LTSS was adapted from Teaching Styles Inventory (Grasha, 1996) to measure students' perception on lecturers' teaching style. It is a 40-item questionnaire that uses a Likert-type scale for responses. The questions are designed to categorise the various teaching styles. Grasha described five teaching styles: (a) expert (transmit information), (b) formal authority (structured instruction), (c)

personal model (teach by example), (d) facilitator (consultant, guides students), and (e) delegator (assigns task, teacher as a resource). The instrument was chosen because it reflects the fluidity of teaching style and does not categorize a teacher with only one teaching style. Score for the LTSS is categorized into three categories as suggested by Grasha (1996) as shown in Table 2 below.

Table 2: The Range Score for Teaching Styles

Teaching Style	Score		
	Low	Medium	High
Expert	1.0 – 2.3	2.4 – 3.4	3.5 – 5.0
Formal Authority	1.0 – 2.9	3.0 – 3.9	4.0 – 5.0
Personal Model	1.0 – 3.1	3.2 – 4.1	4.2 – 5.0
Facilitator	1.0 – 2.6	2.7 – 3.8	3.9 – 5.0
Delegator	1.0 – 1.9	2.0 – 3.0	3.1 – 5.0

The computed alpha reliability coefficients for both instruments, SRST and LTSS were 0.70 and 0.88 respectively. Descriptive statistics such as frequencies and central tendencies were used to characterize the data. Comparative analyses using t-test and ANOVA were used to explain differences exist in students' SRS based on year. The MANOVA was used to explain differences exist in lectures' teaching styles based on year. In addition, the Pearson correlation was used to establish relationship between lecturers' teaching styles and their level of SRS.

4. Findings

The findings are organized based on the objectives of the study. Firstly, the SRS levels of mathematics students are discussed. Further, the discussion highlights the teaching styles of lecturers according to mathematics students' perceptions, and. Finally, the discussion ends with the correlation between lecturers' teaching styles according to mathematics students' perception and their level of SRS.

4.1. The Level of Scientific Reasoning Skills

The overall mean level of SRS for mathematics students were shown in Table 2. The overall mean level of the SRS was 3.49. Specifically, 73.3% of the students achieved level 1 with a mean of 2.63, 25% of students obtained level 2 and the mean level was 5.63, and only 1.7% of students reached level 3 with a mean of 9.00. Findings indicated that UPSI mathematics students have concrete operational level of SRS.

Table 3: Level of Scientific Reasoning Skill

SRS Level	No. of Students(%)	Mean
1	173 (73.3)	2.63
2	59 (25)	5.63
3	4 (1.7)	9.00
Total	236(100)	3.49

The early and final year mathematics students' scores in SRS were shown in Table 4. The mean score for SRS level of early year mathematics students was 3.22, while the final year students' mean score was 3.61. Two-way ANOVA showed that there were no significant differences in each SRS level between the early year and final year students, $F (2, 230) = 0.036, p> 0.05$. This means both groups of students

have the same SRS for each level. In addition, t-test analysis showed that there was no significant difference in the overall level of SRS between the early and final year students, t(234)=-1.573, P > 0.05. These indicated that both early year and final year students have about the same SRS level i.e. is the concrete operational.

Table 4: Level of Scientific Reasoning Skill of Early and Final Year Students

SRS Level	No. of Students (%)		Mean	
	Early Year	Final Year	Early Year	Final Year
1	60(81.1)	113(69.8)	2.53	2.68
2	13(17.6)	46(28.4))	5.92	5.54
3	1 (1.4)	3 (1.9)	9.00	9.00
Total	74 (100)	162 (100)	3.22	3.61

4.2. The Dominant Lecturers' Teaching Style

Table 5 presented the scores on students' perception of mathematics lecturers' teaching style. In general, the dominant lecturers' teaching styles according to students' perception were expert (mean=3.92) and delegator (mean=3.59). Formal authority (mean=3.74) and personal model (mean=3.94) were the lowest teaching styles perceived by students. This provides an indication that the mathematics students at UPSI considered their lecturers' teaching style as an expert by displaying detailed knowledge and by challenging students to enhance their competence. It is also concerned with transmitting information and insuring that students are well prepared. Further, they also perceive their lecturers as delegators such that they concern with developing students' capacity to function in an autonomous fashion and students work independently on projects or as part of autonomous teams and they are available at the request of students as a resource person.

Table 5: Scores on Students' Perception of Mathematics Lecturers' Teaching Style

Teaching Styles		Score Range			Total/ Overall Mean
		Low	Medium	High	
Expert	No. of students (%)	0 (0.0	16 (6.8	220 (93.2	236
	Mean	-	3.19	3.98	3.92
Formal Authority	No. of students (%)	5 (2.1	165 (69.9)	66 (28.0	236
	Mean	2.78	3.58	4.22	3.74
Personal Model	No. of students (%)	12 (5.1)	157 (66.5)	67 (28.4)	236
	Mean	2.98	3.79	4.49	3.94
Facilitator	No. of	5 (2.1)	149 (63.1)	82 (34.7)	236

	students (%)				
	Mean	2.50	3.48	4.32	3.75
Pemberi Kuasa	Bilangan pelajar (%)	0 (0.0%)	24 (10.2%)	212 (89.8%)	236
	Min	-	2.83	3.67	3.59

Table 6 showed the scores for students' perceptions on lecturers' teaching styles based on early and final year. Based on the table above, there were no differences in lecturers' teaching styles according to students' perceptions between the early and final year students. More than 88% of early and final year students have the perception that their lecturers' teaching styles were expert and delegator. There was a decrease in percentage of students for final year students for both teaching styles: two percent (94.6% - 92.6%) for the expert style and three percent (91.9% - 88.9%) for the delegator style. For formal authority teaching style, personal model and facilitator, a significant decline in the proportion can be seen for final year students with a decrease of 12.4%, 27.5% and 34.0% respectively.

Table 6: Scores for Students' Perceptions on Lecturers' Teaching Styles Based on

Early and Final Year

Teaching Style	Year		Score Range		
			Low	Medium	High
Expert	Early	No. of Students (%)	0 (0)	4 (5.4)	70 (94.6)
		Mean	-	3.22	4.06
	Final	No. of Students (%)	0 (0)	12 (7.4)	150 (92.6)
		Mean	-	3.18	3.94
Formal Authority	Early	No. of Students (%)	1 (1.4)	46 (62.2)	27 (36.5)
		Mean	2.88	3.64	4.30
	Final	No. of Students (%)	4 (2.5)	119 (73.5)	39 (24.1)
		Mean	2.75	3.56	4.17
Personal Model	Early	No. of Students (%)	1 (1.4)	38 (51.4)	35 (47.3)
		Mean	3.13	3.85	4.54
	Final	No. of Students (%)	11 (6.8)	35 (73.5)	32 (19.8)
		Mean	2.97	3.77	4.43
Facilitator	Early	No. of Students (%)	0 (0)	31 (41.9)	43 (58.1)
		Mean	-	3.55	4.38
	Final	No. of Students (%)	5 (3.1)	118 (72.8)	39 (24.1)
		Mean	2.50	3.46	4.25
Delegator	Early	No. of Students (%)	0 (0)	6 (8.1)	68 (91.9)
		Mean	-	2.85	3.76
	Final	No. of Students (%)	0 (0)	18 (11.1)	144 (88.9)
		Mean	-	2.81	3.63

The mean scores for overall perception of lecturers' teaching styles based on early and final year students were shown in Table 7. Different colors indicated the different levels for each style according to Grasha (1996). The mean scores for overall perception of lecturers' teaching styles based on early year students were greater than the final year students. Further, the MANOVA was conducted to

explain the differences in lecturers' teaching styles between the early and final year students. Results showed that there were significant differences between the mean scores of each lecturers' teaching styles according to the early and final year students accept for the delegator teaching style (For expert style, $F(1, 234) = 7.052$, $p <0.01$; formal authority style , $F(1, 234) =11.221$ $p <0.01$; personal model style, $F(1, 234) = 29.258$, $p <0.01$; facilitator style, $F(1, 234) = 34.284$, $p <0.01$, and delegator style, $F(1, 234) = 6.328$, $p >0.01$). These indicated that the final year students were more critical in perceiving their lecturers' teaching style as they had more learning experiences as compared to the early year students.

Table 7: Mean Scores for Overall Perception of Lecturers' Teaching Styles based on Early and Final Year Students

Students	No. of Students	Mean scores of perception on lecturers' teaching style				
		Expert	Formal Authority	Personal Model	Facilitator	Delegator
Early year	74	4.02	3.87	4.17	4.03	3.69
Final year	162	3.88	3.68	3.84	3.62	3.54
Total	236	3.92	3.74	3.94	3.75	3.59

	Low level
	Medium level
	High level

4.3. The Correlation between Lecturers' Teaching Style and Level of Scientific Reasoning Skill

Table 8 illustrated the correlation between early year students' perception towards lecturers' teaching style and the SRS level. The findings indicated that there was no relationship between both variables, early year students' perception towards lecturers' teaching style and SRS level. There was negatively weak correlation between the variables where the r values were close to 0, $r_{expert} = -0064$, $r_{formal\ authority} =-0095$, $r_{personal\ model} = -0.003$, $r_{facilitator} = -0.079$ and $r_{delegator} = -0.106$. This provides an indication that the early year students' SRS do not have a relationship with the teaching styles that are owned by their lecturers.

Table 8: Correlation between early students' perception towards lecturers' teaching style and SRS level

	SRS	Lecturers' Teaching Styles				
		Expert	Formal Authority	Personal Model	Facilitator	Delegator
Mean	3.22	4.02	3.87	4.17	4.03	3.69
Pearson Correlation		-0.064	-0.095	-0.003	-0.079	-0.106
Sig (2-tailed)		0.590	0.418	0.980	0.503	0.367

Table 9 below showed the correlation between final year students 'perception of lecturers' teaching styles with the SRS level. It was found that there was no relationship between students

'perceptions of lecturers' teaching styles with SRS acquired. The correlation coefficient were r_{expert} = 0.050, $r_{formal\ authority}$ = -0.048, $r_{personal\ model}$ = 0.019, $r_{facilitator}$ = -0.039 dan $r_{delegator}$ = 0.065.

Table 9: Correlation between Final Year Students' Perception towards Lecturers' Teaching Style and SRS Level

| | SRS | Lecturers' Teaching Styles | | | | |
		Expert	Formal Authority	Personal Model	Facilitator	Delegator
Mean	3.49	3.92	3.74	3.94	3.75	3.59
Pearson Correlation		0.050	-0.048	0.019	-0.039	0.065
Sig (2-tailed)		0.527	0.546	0.813	0.626	0.410

Table 10 presented the correlation analysis between overall students' perceptions on lecturers' teaching style and the SRS level. Findings showed that there was no significant relationship between the students 'perceptions of expert, formal authority, personal model, facilitator and delegator teaching styles and the SRS level obtained. The correlation coefficient values were close to 0 (r_{expert} = -0.007, $r_{formal\ authority}$ = -0.083, $r_{personal\ model}$ = -0.023, $r_{facilitator}$ = -0.085 and $r_{delegator}$ = -0.009). This means that the SRS level do not have a relationship with the teaching style shown by their lecturers.

Table 9: Correlation between Overall Students' Perception towards Lecturers' Teaching Style and SRS Level

| | SRS | Lecturers' Teaching Styles | | | | |
		Expert	Formal Authority	Personal Model	Facilitator	Delegator
Mean	3.49	3.92	3.74	3.94	3.75	3.59
Pearson Correlation		-0.007	-0.083	-0.023	-0.085	-0.009
Sig(2-tailed)		0.914	0.203	0.723	0.195	0.894

5. Discussion

The results obtained in this study were parallel with several other findings in Malaysia where most Malaysian students whether they are at school or university level, they are less capable in scientific reasoning skill. For example, a study by Cheah (1984) on the upper secondary school students found that the majority of the students are in the early stages of concrete and formal thinking. Only 8.9% of the students reached the final stage of formal thought. In addition, a study conducted by Syed Anwar and Merza (2000) showed that 75% of Malaysia Certificate of Education graduates are still below the level of reasoning required by the Higher Educational Institutions. According to Syed Anwar and Merza (2000) again, the results of its review of the 19-year-old student matriculation at a local university found that 19% of students have a high level of scientific reasoning, while 66% had a moderate level of reasoning and 15% had low-level reasoning . For local university year two students majoring in science between the ages of 20-21 years, 12.77% of the students showed high levels of scientific reasoning, 56.38% of the students were at medium level and 30.85% were at a low level.

Based on these findings and also the results of other studies in Malaysia, it is reasonable to say that Malaysian students are less able in scientific reasoning skills than students in the United States.

For example, Lawson et al. (1991) in his study reported that students in the age of 16 years, 22% of the sample had high levels of scientific reasoning level, 59% were at moderate level and 19% at low levels. In the study by Chiappetta (1974) and Lawson (1992) to freshman students found that 25% of the students maintain the level of formal operations, while 50% are in the transition to the formal and the remainders are still at the level of concrete reasoning. This situation is further reinforced by a study conducted by Douglas and Wong (1977). The study was carried out on Chinese students and the findings show that students are less capable of scientific reasoning compared with students in America. This situation could be due to cultural differences and ways of teaching and learning between students in China with students in America. Therefore, this study indirectly shows that there exists relationship between the development of formal thinking with cultural differences. Furthermore, Douglas and Wong (1977) concluded that the culture in China is very autocratic and thus limiting the climate of intellectual development of students.

In Malaysia, the teaching system based on Bloom's taxonomy has blocked the development of high-level scientific reasoning skills, as reported in a study by Syed Anwar (2000). Students are able to use hypothetical-deductive thinking is restrained in a system that emphasizes empirical-deductive thinking. Methods and practices of teaching and learning is seen to be less effective in developing students' reasoning level to high-level reasoning. This is because the education system in Malaysia is more oriented to the objectivist approach in which it only produces students who can gather knowledge and information but is unable to develop the brain power. This is consistent with those proposed by Wilson, Teslow and Taylor (1999) that the objectivist approach ignores the need to focus on how the students think.

Early Years students aged 19-20 years and final year students aged 21-22 years in Malaysia should already have a level of formal operations of SRS. This is consistent with the study of Lawson (1995), at the age of 11 years and above, students should have begun to enter the formal operational level and then complete their intellectual development at the age of 15. At this stage of formal operations, students are able to think logically about abstract submission and test hypotheses systematically. In addition, they also become aware of the ideological problems, the future and also the hypotheses. This fact is supported by Piaget's Theory of Cognitive Development such that a 16-year-old student should have a formal operational level. At this stage of formal operations, one is able to do things like reasoning about mass or weight maintenance (conservational) which is the skill to recognize that the quantities given are remain unchanged despite the change in size, shape, configuration or context.

In this study, students do not achieve a proper level of SRS as they should have at the age of 19 years to 22 years. There are many factors that influence the level of this SRS. Among them is the knowledge based on experience or experienced (experiential) owned. According to Adey and Shayer (1990) states that this experiential knowledge base that leads to a high level skemata (higher order schemata) in mind and this is what allows the understanding to be obtained faster and produce higher levels of SRS. The study by Adey and Shayer (1990), Lawson (1995) and Marek and Cavallo (1997), stated that there are a lot of documentation to show that inquiry teaching can improve reasoning skills. Therefore, the inquiry approach is recommended to be implemented at secondary school and university level.

Grasha (1994) found that teaching is a matter of style. He identified the five styles of teaching as expert, formal authority, personal model, facilitator, and delegator. Each style, along with its advantages and disadvantages is defined by Grasha (1996; Grasha and Reichmann, 2006). Grasha (1996) viewed that the pattern of lecturers' teaching style is influenced by certain factors such as learning objectives, courses, class size, learning time, the norms of learning institutions and academic disciplines. The two dominant lecturers' teaching styles according to students' perception are the expert and delegator styles. The findings give an indication that students in this study felt that majority

of their lecturers really care about mastery of facts, concepts and principles in teaching. In fact, the students also felt that their lecturers have extensive and in-depth knowledge, high skills and focus on teaching to the transmission of information. In addition, they also act as a lecturer of resources personnel when needed. Lecturers are also confident that students are able to perform tasks with minimal guidance.

The results of this study is consistent with the results of the study at Universiti Kebangsaan Malaysia (Jawatankuasa Anugerah Cemerlang, 2004) in which the dominant lecturers' teaching style are expert, facilitator and delegator styles. They also found that science and professional lecturers had higher mean for expert teaching style. On the other hand, the social science lecturers had higher mean for facilitator and personal model teaching styles. In another study by Norzila, Fuaziah and Parilah (2007) on English for Specific Purposes (ESP) students found that three dominant lecturers' teaching style were the experts, followed by personal style and the delegator style. Even though, the sample of the study was not among mathematics undergraduates, the findings were consistent with this study. The three teaching styles most prevalent among the English language lecturers were expert, personal model and delegator styles. Expert and personal model teaching styles are teacher-centered in nature. Meanwhile, the most preferred teaching style stated by the students was facilitator style which is very much student-centered in nature and the formal authority is the less preferred teaching style.

Schaefer and Zyqmont (2003) in their study at the Nursing Faculty, gave indications that the lecturers expressed their perceptions of teacher-centered teaching in line with their own philosophical perspective. However, the lecturers of the faculty recognized that student-centered environment is needed, but they have difficulties in terms of implementation. The expert, personal model and delegator teaching styles that were perceived by the students in this study were more teacher-centered. Thus, not only the mathematics area but area such as nursing also revealed the same findings. However, these findings differ from the findings of a study conducted by Zamri, Nik Mohd Rahimi and Juliawati (2009). Their findings on the comparison of their teaching Malay and English shows that the dominant teaching style is personal style and the style expert model is the teaching style of the least dominant in language teaching and learning. This occurs may be due to several factors. Among them is the academic proficiency of students, student class standing and student proficiency level.

In addition, the findings of this study also showed that there was no correlation between lecturers' teaching style and the level of scientific reasoning skill. Many studies have shown that the constructivist teaching methods are effective in improving the conceptual understanding and develop scientific reasoning skills compared with traditional lecture teaching method (Howard & Miskowski, 2005; Spiro & Knisely, 2008; Minner, Levy, & Century , 2009; Rissing & Cogan, 2009; Jensen & Lawson, 2011). The strong relationship between a specific teaching style with the SRS will give some indications to educators about the importance of specific method of teaching that may enhance the reasoning skills. The findings of this study did not show a positive outcome where this study cannot correlate the lecturers' teaching style to the level of SRS. Nevertheless, this study gave some indications that the expert and delegator teaching styles were not contributed to the development of students' scientific reasoning skills. Therefore, this study opens the space to other researchers to explore in greater depth in this field.

6. Conclusion

In effort to achieve 2020 vision, one of the main challenges is to establish a scientific, progressive and innovative society. Mastery of knowledge and proficiency in science, mathematics and technology is an increasingly critical need in creating a powerful scientific community forward. Based on the results of this study, the SRS of the mathematics students in UPSI is still at the stage of concrete operational level. Precisely, this skill need to be nurtured from the beginning namely transformations should be made to the elementary curriculum by adding one more proficiency skill namely the reasoning skill other than the three proficiency principles (read, write and think). This is so to establish and enhance students thinking to align with their stage of cognitive development.

Educators in particular the lecturers play a crucial role in realizing the desired 2020 vision since the quality of education received will determine the quality graduates. Thus, teaching and learning approaches need to form an impressive proficiency in helping to foster scientific reasoning skill. Educators need to change the tradition of teaching that is not concentrated to the mastery of content but merely teaching should be focused towards the development of knowledge and skills at the higher thinking level.

This study can be used as a benchmark for mathematics undergraduates' level of scientific reasoning skill in UPSI. Specific strategies need to be integrated in the teaching, learning and assessment in higher education to ensure that students gain the skill to help them cope better with their study, university life and future life. Thus, as the university curricula continuously undergo improvement, the development of this skill needs to be incorporated and emphasized further.

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Does Job Satisfaction Mediate the Relationship between Leaders and Academic Staffs' Commitment to Service Quality at the Malaysian Universities?

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Abstract

This paper discussed the mediating effect of job satisfaction on the relationship between perceived transformational leadership style and commitment to service quality among academic staff in Malaysian Universities. Total useable questionnaires were 387 with a response rate of 36 percent from both private and public universities. The result revealed that job satisfaction only partially mediates the relationship between transformational leadership and academic staffs' commitment to service quality. This study implies to the policy makers and academic leaders at the universities that there is a need to focus in developing their academic staff, by tapping their potentials, inspiring them, promoting collaboration, motivating and reinforcing positive attitudes towards commitment to service quality. Future study should consider inclusion of other the mediating variables, alternative modes of enquires and a nationwide survey covering samples from the whole population of the higher institutions of learning in Malaysia that would be more significant in making generalizations.

Introduction

Malaysia's economy has undergone a transformation from that of a production based to that of a knowledge-based economy (k-economy). There has also been a call for some restructuring to tackle critical issues such as demand for more professional and skilled labour to manage the capital intensive, high technology and knowledge based industries (Mustapha & Abidin, 2008). By the end of 2010, Malaysia will need both policy makers' with partnership with the universities' community to materialize this transformational plan. Only through solid education and training systems can this transformation process into becoming a developed nation become a reality (Mohamad, 1991). However, there is an acute shortage of qualified academicians and high turnover especially with those with doctoral qualification. The turnover rate among doctorate holders at the Private Higher Education Institutes (PHEIs) in Malaysia was reported at 12 percent (National Higher Education Research Institutions, 2004). Huge investments in both the public and private universities have been carried out mainly to attract foreign students and retaining nationals but how do they prevent the academic staff from leaving. To encourage retention and eventually attained a high level of performance, especially for academic staff, it is important that academic leaders understand the aspects of professional job satisfaction that the academician would have derived from their duties and responsibilities at the university (Kuska, 2003). Nevertheless, past studies conducted on job satisfaction have been varied in terms of subject matter and also in the research frameworks (Tsai, 2008). For instance, there is a dearth in the past findings on the relationship between job satisfaction and commitment to service quality.

Past researchers were seen to adopt an attitude that displayed affective commitment to organisation as synonym to commitment to service quality. However, there have been some disagreements among scholars on how best to describe these relationships. Porter, Steers, and Boulian (1973) were convinced that organizational commitment is interrelated to job satisfaction but they have asserted that job satisfaction had to come first. Recent finding by Silva (2006) is in agreement with Porter, Steers, and Boulian's (1974) proposition that job satisfaction is interrelated to organisational commitment. Huang and Hsiao (2007) on the other hand, accepted that the relationship between job satisfaction and organisational commitment was reciprocally related. Studies on commitment to service quality are important and necessary but unfortunately there is still little research progress in this area despite past researches have also suggested that some universities in Malaysia were losing students because their standard of service quality was not up to the expectation of the students (Jain, Abu, Akhbar & Sapuan, 2004; Firdaus, 2006; Latif, Sungsri & Bahroom, 2009). However, what really motivates commitment to service quality among academic staff at the universities remains unanswered. Past leadership literatures have associated transformational leader to organizational commitment, such as to service quality delivery (Jabnoun & Rasasi, 2005); building relationships with customers (Liao & Chuang, 2007); students' engagement with schools (Leithwood & Jantzi,1999) and towards school reforms (Geijsel, Sleegers, Leithwood & Jantzi, 2003). Some of the benefits of transformational leadership style based on job satisfaction have been realised, such as the reduction in work environment pressures and stress that is the cause of low turnover (Berson & Linton, 2005; Nielsen, Yarker, Randall, & Munir, 2009).

Only of recent, researchers have begun to be aware of the missing mediating links between leadership styles and organizational outcomes. For example, Politis (2006); Griffith (2003); Yousef (2002) have reported the existence of a possible mediator, such as job satisfaction that may account for the significant linked between leadership styles, organizational behaviour, commitment and performance. Although empirical findings have advanced the understanding of these links, little is known about the mediating role of job satisfaction in the relationship between leadership styles of transformational leadership on the academic staff commitment to service quality. However, there still exists a vague support that indicates a direct relationship between the variables. The question of whether the transformational leadership style as perceived by the academic staff would directly or

indirectly affect their job satisfaction which eventually will lead to the commitment to service quality remains unanswered. Given the salience of this issue, more evidence is required. Therefore, the main purpose of this study is to elucidate information on the mediating effect of job satisfaction on the relationship between perceived transformational leadership style and commitment to service quality of the academic staff in their respective universities.

Literature Review

Commitment to Service Quality

Studies on the commitment to service quality in education literatures follow the same footpath as the general definition of affective commitment. Affective commitment is defined by Meyer and Allen (1991) as "an employee's emotional attachment to, identification with and involvement in the organization". Commitment to service quality is defined and understood as "conformity to a specification" (Martin 1986; Witt & Steward, 1996; O'Neil & Palmer, 2004) and in achieving "excellence" (Peters & Waterman, 1982). It is also about commitment to meet the students' needs and their expectations (Witt & Steward, 1996), and about building relationships between a customer and the organisation (Kandampully, 2002). Accordingly, the most important basis for the assessment of quality is the individual's experience of a service that comes from the internal quality service of the internal customer (all the organization's employees). Their commitment and willingness to serve is in the best interest of the customers, which incidentally is a prerequisite for achieving service quality (Kandampully, 2002). Clark, Hartline and Jones (2009) defined commitment to service quality as "dedication of employees to render service quality and the willingness to go beyond what is expected of them".

Past findings have also established that employees who are committed to the organization will remain loyal and are inversely related to turnover (Hartline, Maxham & McKee, 2000; Clark, Hartline, & Jones, 2009; Elmadag, Ellinger, & Franke, 2008). In such conditions, employees were known to spend more time and energy in assisting the organization realize its goals and they also put their own self interest aside (Porter, Steers & Boulian, 1973; Tsai, 2008; Sohail & Shaikh, 2004; Yiing & Ahmad, 2008). They would subscribe to the idea of being a citizen of the organisation and be fully committed to the goals of the organisation (Rashid, Sambasivan, & Johari, 2003). O'Neil (2000) in his study in higher education concurred on the importance of internal customer commitment to service quality as a means of gaining competitive advantage. Satisfied external customers, for example the students, were reported to spread by "word of mouth recommendations", which is a powerful tool in marketing (Cuthbert, 1996). Commitment of the highest level would mean emotional attachment to the organisational and this bondage is synonymous to "partnership" with superiors and colleague who would tender the academic staff's intention to continue their tenures at the university (Narimawati, 2007; Rego & eCunha, 2008).

Transformational Leadership

Leaderships can be of many facets and visages and they differ in effectiveness in terms of consequences of their actions towards internal and external stakeholders. Since organizations today are faced with many challenges, especially with the constant changes in technology, economic, social, political and legal conditions and internal processes, flexibility is required in resource utilization and in the promotion of continuous learning (Horner, 1997; Christie, 2002; Hashim & Mohmood, 2011).Therefore, there is a need for leaders in organizations to contribute not only in terms of knowledge or ideas but also in making right the decisions and responding to the changes. According to Bass and Avolio (1990), transformational leaders will focus on developing their followers by tapping them of their potentials, inspiring them, promoting collaboration, motivating them and by reinforcing positive behaviours. Bass (1990) argued that transformational leaders were pertinent especially during

turbulent times when rapid changes and globalization takes place. Barnett, McCormick & Conners (2001), Antonakis, Avolio & Sivasubramanian (2003) and Kirkbride (2006) preferred to delineate transformational leadership based on five factors, which is an adoption from Bass and Avolio's (1995, 1997) studies. The five components as suggested by Barnett, McCormick and Conners (2001), Antonakis, Avolio and Sivasubramanian (2003) and Kirkbride (2006) are: individualized considerations, intellectual stimulation, inspirational motivation, idealized influence (attributes) and idealized influence (behaviour). Other authors like Kent, Crotts and Aziz (2001), and Nemanich and Keller (2007) preferred to characterize transformational leadership into four factors based on the original studies by Bass (1985a, 1985b). The difference lies in the idealized influence factor that is being theorized into the dual theory consisting of behaviour and attributes (Barnett, McCormick, & Conners 2001; Antonakis, Avolio & Sivasubramanian, 2003).

Transformational leaders in the education industry were also seen to be responsible for laying the foundation for changes in the organizational culture, strategies and even structures that are similar to any other corporate setting (Yu & Jantzi, 2002). Strategies may include development of employees to attain a higher professional level that will directly increase their capabilities, innovativeness and give more empowerment to their subordinates to shape initiatives that will bring about the much needed changes (Clark, Hartline & Jones, 2009). It is also interesting to note that in his study, Leithwood (1994) indicated the importance of transformational leadership that indirectly promoted students' achievements through their leaders' abilities to promote the school vision, and provide the much needed intellectual stimulation through the introduction of the best educational practices which fostered a high performance culture. Bess and Golman (2001) who studied leadership in American universities also supported the notion that transformational leaders are not likely to be found at universities where the heavy emphasis is on teaching and decentralization of authority. However, in this turbulent and ever changing environment, transformational leaders are much needed, especially the educational leaders who experience threats of mergers or a total collapse and in need of drastic changes in order to survive.

Job Satisfaction

Job satisfaction has been defined as a single globe concept referring to the overall satisfaction levels (Ying & Ahmad, 2009) or a multiple dimensional concept that refers to the psychological or sociological factors. Multiple dimensional concepts have been applied to discover how employees are affected by for examples, intrinsic and extrinsic elements of their jobs (Ssesanga & Garret, 2005; Lacy & Sheehan, 1997). Generally, academic researchers would prefer to define job satisfaction based on the dual theory of Herzberg et al. (Lacy & Sheehan, 1997; Ssesanga & Garret, 2005; Rad & Yarmohammadin, 2006). As such, job satisfaction studies were based on the notion that the academicians' source of satisfaction comes from intrinsic factors which are related to job content and extrinsic factors that are associated with the working environment

Previous studies have indicated that the link between job satisfaction and leadership styles has not been consistent (Tsai, 2008; Nemanich & Keller, 2007). One such finding by Evans (2001) has reported that there is no direct link between the academicians and their leaders' motivational support in ensuring that their subordinates' were satisfied with their jobs. To a certain degree, the study revealed that the academician's nature of job, such as academic freedom, being independent and generally low in accountability has to a certain extent resulted in such outcomes. Later study by Griffith (2004) had resulted in similar observations and concurred that job satisfaction had an indirect relationship with transformational leadership style in speculating staff performance and turnover in schools. However, reviews of past studies have also demonstrated some support on the link between leadership styles and job satisfaction. Nielsen, Yarker, Randall and Munir (2009) for example, conceptualised the importance of health care providers in serving senior citizens in a pressured

environment and leaders especially transformational leaders were seen to have a direct link to the employees' job satisfaction and their well being.

Therefore, due to the inconsistency in the result of the findings, it has lead to some researchers to suggest that a strong indirect link through job satisfaction exists between the leadership styles which in turn influences an array of other variables such as school performance, organizational commitment, team performance, organizational citizenship behaviour and work outcomes,(Yousef, 2002; Griffith, 2003; Cheung, Wu, Chan & Wong, 2008; Chui & Chen, 2005). Chui and Chen (2005) for example presented a strong case of the mediating effects of job satisfaction in twenty four electronic companies in Taiwan, and have found that intrinsic satisfaction mediates the relationship between job varieties, job significance and organizational citizenship behaviour. However, the study did not find any support for extrinsic satisfaction but it was known to have important managerial implication. Another review of literature which linked the role stresses variable and organizational commitment indirectly through job satisfaction was conducted by Yousef (2002). He was concerned about the mediating effect of job satisfaction on role stresses particularly the role conflict and role ambiguity among employees in various organizations in United Arab Emirates. However, the findings indicate that job satisfaction mediates the influence of role conflict and role ambiguity on both affective and normative commitment with the exception of continuance commitment. The result indicates that employees were less willing to remain in the organization if they perceived they are less satisfied with their jobs because of the high level of job stress that they have to face. The lack of opportunities to move due to the scarcity of jobs was the only the reason for them to remain in the organization.

Politis (2006) conducted a study in Australia among the manufacturing organizations with the objective of testing the mediating effects of job satisfaction in relationship to self leadership and team performance. By using a structural equations modelling, the study provides full support for job satisfaction through the effects of self leadership behavioural-focused strategies which is based on team performance. Another study by Lok and Crawford (2004) obtained a totally different result. They concluded that job satisfaction only partially mediated the effects of leadership styles, organizational cultures and subcultures on commitment among nurses in seven large hospitals in Australia. Similarly, research in the school setting has also produced the similar results which pointed out the importance of indirect effects of job satisfaction on organisational commitment and citizenship behaviour (Nguni,Sleegers, & Denessen, 2006). On the other hand, studies by Salam, Cox and Sims (1996) reported that leadership according to transformational and authoritarian styles are related to team anti-citizenship, which is fully mediated by job satisfaction in a large defence firm located in mid-Atlantic United States. This study does not seem to be consistent with past studies such as those by Podsakoff, MacKenzie and Bommer (1996) who found a significant relationship between transformational leadership behaviour and citizenship behaviour through mere trust and job satisfaction. Given that most of these studies were conducted in affluent societies and that there are inconsistencies in the findings which may be due to the context, conducting more empirical studies and tests will provide more insights into the mediating variables of job satisfaction on the relationship between perceived transformational leadership style and the academic staffs' commitment to service quality in a developing country such as Malaysia.

Methodology and Research Design

This study was based on a descriptive correlation research design and cross sectional survey methodology. The target population for this study consisted of academic staff from two public universities and four private universities. Their perception of their immediate superiors such as the deans or heads of department or heads of schools were closely studied to identify their commitment to service quality. Using a 5-Point Likert-type scale, the respondent indicated their intensity of agreement anchored by 1, "strongly disagree" through to 5, "strongly agree" with items phrased. For this study,

the researcher adapted a later version of MLQ instrument commonly known as MLQ 5x-short-forms to rate transformational leadership. Although the factors that measure transformational leadership styles were distinctive, (5 factors measuring transformational leaders) in this study a single dimensional construct for transformational style was adopted. This is in line with past empirical studies by Walumbwa, Wang, Lawler and Shi (2004) and Walumbwa, Orwa,Wang and Lawler (2005) on transformational leadership construct. A recent modified version by Clark, Hartline and Jones (2009) was adapted in this study with slight modifications make in order to complement the study context for measures for commitment to service quality items. Finally, the instrument to measure the mediating variable of job satisfaction components was adapted from Ssesanga and Garrett (2005) and Mertler (2001). For this study a combination of on-line and self administered questionnaires were distributed to collect individual data on the respondents. Overall the response rate was 36 percent which was slightly better than what was reported generally in the Malaysian context (Othman, Ghani, & Arshad, 2001).

Discussion of Findings

A total of 387 academic staff participated in this study. The sample indicates that female respondents represented a slightly higher percentage of total samples (59%) when compared to the male respondents (41%). The majority of the respondents possessed Master degrees or others of similar level (71%) while 29 percent had completed their doctorate degree. Majority of the respondents were middle age of between 30 to 40 years of age (43%) followed by those between 40 to 50 years old (25%). About 18 percent of the academicians were from the younger group age of between 20-30 years. With reference to their experience in teaching, the sample showed a balance between those who had teaching experience of between 1 to 5 years (33%), 5 to 10 years (28%) followed by 10 to 15 years (17%) and above 20 years (14%). More than 47 percent of the respondents were from business faculty followed by faculty of information technology (12 %).

Table 1 below presents the mean and standard deviation of all the variables understudy. All the variables were measured on a five (5) interval scale. All the variable means were higher than three (3). It ranged from 3.36 to 4.04. This suggests that the perceived leadership style of the transformational, job satisfaction and academic staff commitment to service quality were at moderate to high levels in importance. All the standard deviations were below one (1) which indicates the variability in the data (Sekaran, 2005). Results of the correlation analysis indicate no violation of the assumption as the absolute value is between the ranges of 0.43 to 0.55 which is lower than the acceptable cut-off value of 0.8 (Benny & Feldman, 1985). Commitment to service quality was found to have a moderate positive correlation with the variable of transformational leadership ($r = 0.430$, $p<0.001$) and a strong positive correlation related to job satisfaction variable ($r = 0.551$, $p <0.001$). For transformational leadership, strong positive correlations were also observed with job satisfaction ($r = 0.533$, $p<0.001$). The variables for this study were also reported to have an excellent reliability with a coefficient of more than 0.7 (Nunnally & Berstein, 1994; Nunnally, 1978). For this study none of the item- to-total correlations values were removed since they have values of above 0.3 (Tabachnick & Fidell, 2001).

Table 1: Means, Standard Deviations and Intercorrelations of Variables of Interest

Variables	CSQ	TLF	M	SD	Reliability coefficient
Commitment Service Quality (CSQ)	1		4.038	0.509	0.846
Transformational Leadership (TLF)	0.430***	1	3.356	0.714	0.96
Job Satisfaction (JS)	0.551***	0.533***	3.607	0.592	0.911

To investigate the mediating effect of job satisfaction on the relationship between perceived transformational leadership styles on the academic staff's commitment to service quality, Multiple Linear Regression (MLR) assumptions were conducted and were reported to have no serious violations. The tolerance statistics revealed that the entire variables understudy were in an acceptable range (cut off of .10 as suggested by Tabanchnick and Fidell, 2001). The stepwise regression analysis was then employed and the three guidelines for the mediation analyses established by Baron and Kenny (1986) procedures were followed. The guidelines that must be upheld are: i) the independent (predictor) variable should make significant contribution to the dependent (criterion) variable; ii) the independent variable should make significant contribution to the mediating variable; iii) the mediator should make a significant contributions to dependent variable. Perfect mediation holds when the independent variable no longer relates to the dependent variable after mediator is included and regression coefficient is reduced to non significant (near zero) level. Partial mediation is when the beta coefficient of the independent variables value is reduced but still statistically significant after the inclusion of the mediator (Lok & Crawford, 2004).

Table 2 below reports the results of the analysis that was carried out. In Step 1, perceived transformational leadership style was used to predict the mediator variable of job satisfaction and was found to be significant at $p<0.001$, ($r^2 = 0.284$) contributing 28 percent of variance in job satisfaction. Therefore, condition one was supported where perceived transformational leadership was positively and significantly correlated to commitment to service quality ($\beta=0.533$; t= 12.35; $p<0.001$). In the second step, the mediating variable of job satisfaction was entered to predict the level of commitment to service quality. The result revealed it to be significant at ($\beta=0.551$; t= 12.94; $p<0.001$) which in turn supports the second condition. 30 percent of the variance in commitment to service quality is contributed by job satisfaction. The results also revealed that before the inclusion of the mediator, as indicated in Model one, the R –Squared was at 0.185 which was significant at 0.001 level. Previously, it was found to be significantly correlated at ($\beta=0.430$, t= 9.334, $p<0.001$). However, in the third step, after the inclusion of the mediator variable of job satisfaction, as shown in Model Two, the previous significant relationship does not reveal any insignificant relationship to account for the third support for the perfect mediator. The strength of relationship indicated a decrease ($\beta=0.190$, t= 3.853; $p<0.001$). The R –Squared was 0.329 significant at 0.001 level. When the mediator was included, the equation for R-Squared revealed a significant (F change = 0.001) increase from 0.185 to 0.329, indicating an improvement of 14 percent in the variance of the commitment to service quality (r^2 change =0.144). As indicated, the beta coefficient of the independent variable value was reduced but still was statistically significant after the inclusion of the mediator. Therefore, it can be concluded that job satisfaction only partially mediates the transformational leadership and commitment to service quality relationship.

Table 2: Transformational Leadership Style and Commitment to Service Quality Mediated By Job Satisfaction

	Variables	r²	β	t	Sig	F-value	Sig F change	Tolerance
	Transf L	0.284	0.533	12.35	0.001***	152.533	0.001	1
	Job Satis	0.303	0.551	12.94	0.001***	167.441	0.001	1
Model 1	Transf L	0.185	0.43	9.334	0.001***	87.118	0.001	1
Model 2	Transf L	0.329	0.19	3.853	0.001***	94.152	0.001	0.716
	Job Satis		0.449	9.094	0.001***			0.716

***p<0.001, **p<0.01, *p<0.05 DV: Commitment to Service Quality, Transf L: Transformational Leadership, Job Satis: Job Satisfaction

The finding indicates job satisfaction as being partially mediated the relationship between perceived transformational leadership on commitment to service is a step forward in uncovering the process through which both this leadership style influence one's commitment to service quality. This finding seems to complement other relevant research as that been conducted in non educational settings (Lok & Crawford, 2004) and in school settings (Nguni,Sleegers, & Denessen, 2006) which demonstrates how leadership behaviour indirectly influences its followers' organizational commitment through job satisfaction. Based on the present findings, there seems to be some confirmation that the academic leaders may have an indirect effect via job satisfaction on the attitudes of academic staff such as commitment to service quality.Thus, with the paucity and inconsistency in past findings which may be due to the context of the study, it is hoped that this study will provide sufficient support and insights into the mediating variables of job satisfaction on the relationship between perceived leadership styles of transformational leaders and the academic staff's commitment to service quality in a developing country such as Malaysia.

Conclusion and Implications

This research has its theoretical implications on the key area related to addition of new knowledge in integrating two disciplines which are: organizational behaviour and service quality management in education in Malaysia. Although empirical findings have advanced on the mediating role of job satisfaction, little is known about employing this mediating role of job satisfaction into the relationship between transformational leadership style and commitment of the academic staff towards service quality. The results from the findings have revealed that the outcome of the study was further enhanced by the mediating factor of job satisfaction. Therefore, this study provides more support theoretically of its importance in the education industry. Ignoring tits importance may have an impact on the degree of the academic staff's commitment to service quality. From the managerial perspective, this study implies to the policy makers and academic leaders at the universities that they need to focus in developing their academic staff, by tapping their potentials, inspiring them, promoting collaboration, motivating and reinforcing positive attitudes towards commitment to service quality. They should also seriously consider benchmarking their compensation system and practices with the best practices of other educational institutions or with other service industries. This study also has its share of limitation in the sampling frame which only considers a particular group of institutions of higher education (selected universities only) and therefore the results cannot be generalized to the whole education industry. Future studies should also consider inclusion of other variables such as conducive climate that supports research and development, creative thinking and goal clarity emphasis or elements of trust as the mediating effect so as to gain better insights. Future studies should also consider alternative modes of enquires such as employing the longitudinal method of data collection design (e.g. experiments, archival data, observations or interviews) and a nationwide survey covering samples from the whole population of the higher institutions of learning in Malaysia.

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Women in Management: A Growing Need for a New Type of Leadership in Nigerian Universities

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Abstract

In Nigeria, women in early 70s and late 80s were under represented due to two important factors. Firstly, girl child education was not taking seriously as a result of the belief that the outcome of the education will be taken to her husband's house and she will not be of any benefit to her father. The second factor was hinged on religious beliefs of each region in the country. Over the years significant numbers of women have entered managerial positions. However, women are still noticeably absent from the top levels of today's academic circles especially the universities. The study aimed at assessing the effect of gender imbalance in the Nigerian universities on quality of education. The entire 116 (federal, state and private) universities in the country are the study population. The country was divided into six geo-political zones and the universities were randomly selected. Ten universities were selected from each zone representing federal, state and privately owned. The findings revealed that in most universities very few women professors are available to compete with their male counterparts when it comes to elective positions such as Head of Department, Dean of Faculty, Provost of Colleges and Vice-Chancellor; in all only five universities had female Vice-Chancellors, that is two from both federal and privately owned and one from the state. This was attributed to earlier marginalization of women from the work force of the ivory towers. It was discovered that qualified females were recently just crossing from secondary schools and research institutes to the universities. Although, findings revealed that promotional criteria are the same between the male and female lecturers in the universities, the women were highly disadvantaged as their own extra roles (housewife and mother) prevented them from competing favorably in both research and administrative aspect of their career. It was recommended that the government should create conducive environment to allow equal entry for qualified women into the university employment which will serve as catalyst for quality education in the country.

Keywords: University, Women, Nigeria, Management and Leadership

Introduction

Nigeria as in other third world under-developed nations, education of girl child was never taking seriously which later cumulated to having fewer women in the workforce in early 70s and late 80s. This under representation of women in managerial level did not come as a matter of choice for the women but was occasioned by what tradition, social and religious beliefs thrust on them. Factors that seem to be responsible for this scenario include, women seeming inferior position in male-dominated culture of the Nigeria people.

Woman is the pivot around whom so many activities revolve, so strategic is her position in society that take her away and the rest one-half society will not stand. In the light of this, women contributions to the development of society be it agriculturally, economically, educationally and socially should have received more attention, however, they are portrayed in subordinate roles and in low status jobs as mothers, wives (to be seen and not to be heard), nurses, receptionists or clerical staff, while men are portrayed as chief executives.

The questions that are consistently begging for answer are: have Nigerian women in academics witness significant improvement in their working conditions nationwide in the last twenty years? Has various policies and measures put forward by the government been effective in promoting the course of women in our ivory towers?

Against this backdrop, this paper focuses on women in management which will engender new type of leadership in Nigerian universities. This paper concluded with the assertion that there is need for gender mainstreaming in top management in our ivory towers for rapid development, effective and efficient performance.

Historical and cultural limitations of women in Nigeria

Historically, the traditional and socially approved roles of Nigerian women have been child bearing, housekeeping and sustenance agricultural activities. Those roles started a course of modification only after the establishment of the first girl's school (that is Methodist Girls High School, Lagos) and the subsequent entry of Nigerian women into labour markets (Fafunwa, 1974, Awe, 1990). Another factor that has contributed in fostering gender imbalance is directly an offshoot of the first factor. That is, the imbalance in educational attainment. Educational attainment to a large extent determines the supply of women to the labour market. This has definitely lagged behind that of men. For some of those who have made it into the workforce, the heavy burden they have to bear as a result of the unbalanced sexual, division of labour saps their energy and limit the time they have to engage in political issues.

Alile-Williams (1988) observed that they are still largely confined by traditional roles and have not been encouraged to contribute significantly to national building. They are excluded from crucial economic decision making and lack of equal access to, and control over various means of production.

According to Abama and Mangvwat (2002), many policies and mounted educational programmes to enable women fulfill their roles as full members of the society have not really helped the women much, it only re-endorsed the stereotype – that is, the notion of teaching women how to become better wives, cook, mothers and further still better moral and religious knowledge which is considered sufficient for them. This notion was strongly advocated by Parsons (1959) who insists that women should content themselves with their natural role of providing comfort, security, and warmth for their children and husbands. This according to him is consistent with biological divisions of labour, which ensures the smooth functioning and stability of the society.

It was generally believed that men make better managers because they are more assertive, women are less committed to organizational careers because of family considerations, or men are less sensitive to the feelings of others and this are better able to make tough decisions.

Culturally, the Nigerian woman is of no serious consequences in her community except for reproductive role. Under-enrolment of women around the world is not surprising why only few women can and do come to limelight (Newswatch, 1995). In spite of all the misgiving about efficiency and productive capability of women, there is ample evidence to show that women have the potentials to perform creditably in top management positions, whether in the academic, business, the civil service, or even politics (Ogbu, 1999).

According to Idowu (2004), there are uncountable numbers of women doctors and professors in every country of the world. She further stated that the tenure of Professor Grace Alile-Williams as the Vice-Chancellor of the University of Benin witnessed firm and visionary leadership even in turbulent situations, so also was that of Professor Jadesola Akande who was appointed as the Vice-Chancellor of Lagos State University and Dr Gambo Laraba Abdullahi of University of Abuja. Professor Bolanle Awe also comes readily to mind when one thinks of distinguished women of note who had justified the confidence reposed in them by performing very well in their leadership jobs.

Problems confronting women in leadership position in Nigeria

In most organization whether for profit or non-profit women are discriminated against when it comes to recruitment and appointment. More emphasizes are laid on their physical appearance as pre-requisites for placement in certain positions. Hence, sexual attraction is made the sole criterion rather than their professional competences. However, this is not the case in the university employment as women physical attraction does not serve as added advantage for placement. The only snag on university employment criterion is that as a woman applicant you have to be extraordinarily/exceptionally brilliant to be seen as appointable. Even when women make efforts to physically enter these fields the gender imbalance continues in the form of dominant male perspectives.

The negative perception of women capacity to work translates into limited opportunities open to them for professional advancement such as training opportunities, attendance of international seminars and conferences etc. in most cases the most affected are the married lecturers who have other pressing roles (children, home and husbands) jostling for their attentions. Most of the times they have to forgo both local and international workshops and fellowships because their husbands will not grant necessary permission to go and if they do, it may be for short courses which may not benefit them due to the duration of the courses. For this reason, women at the top have to work twice as hard as their men counterparts before they gain promotion, recognition and respect deserve as successful women in their own right. It should be noted that women put in more in term of efforts into promotional qualifications as they are forced to combine other things such as administration, teaching, research, house-keeping and child caring duties that are more demanding.

In Nigeria educated and skilled women are found in significant numbers in good profession such as justice/magistrate, lawyers, medical doctors, educationists that is, Vice-Chancellors, professors, lecturers head teachers, principals and provosts, accountants, banks senior executives, permanent secretaries and directors in Federal and State Ministries, architects among others. However, very few, in fact less than 1% are found involved in power sharing. Weighted against the number of women in academics, those in power sharing and decision making are a concern.

Women are attaining greater heights in academic positions such as professors in arts and sciences. However, the analysis of academic staff by sex in the Nigerian Universities from 1980 – 2011 have shown gradual increase but not as remarkable as their male counterparts. Equally the number of those at the top management levels such as Head of Department, Deans of Faculty, Provost of Colleges and Vice-Chancellor were so insignificant given their current number.

According to Bozimo, (2000) the unjustified sorry state of educated women in economic participation – business world, power sharing and decision making – all very vital concepts in nation

building has led to the formation of credible societies of professional groups and development plans all looking for strategies for the improvement of women. One of those cooperative societies that advance women in the universities through networking and leadership training initiatives is the National Association of Women Academics (NAWACS). They emphasized role-modeling and mentoring amongst the women in academics, that is new entrants (young female lecturers), to be properly integrated and guided on how to conduct organized researches from older colleagues who can be a senior, associate professor or professor in their departments. Awareness workshops and orientation sessions are becoming more popular to help young female lecturers to become acclimated and productive as quickly as possible.

Having recognized the fact that university employment can be stressful if a new entrant is not given adequate/proper procedures and behaviour expected of a lecturer, each chapter of NAWACS is expected to hold regular leadership workshops in their respective campuses where junior less experienced female lecturers are encouraged to learn from experienced senior colleagues on how to prioritize their activities (time management), conduct research, and publication. This had gone a long way to influence and help to develop mentoring relationship in their career progression. This is in line with Ivancevich et al (2008) view on importance of mentoring which stated that, through mentoring new employees can obtain valuable career and psychosocial influences from a variety of individuals – managers, peers, trainers, and personal friends.

Methodology

The study aimed at assessing the effect of gender imbalance in the Nigerian universities on quality of education. The entire 116 (federal, state and private) universities in the country are the study population. The country was divided into six geo-political zones and the universities were randomly selected. Ten (10) universities were randomly selected from each zone representing federal, state and privately owned. Structured questionnaire were distributed among female lecturers in the selected institutions and at least two (2) male lecturers in each of the universities were sampled to give room for balanced opinion about their view on women leadership roles in the universities.

Discussion of Findings

The findings revealed that in most universities very few women professors are available to compete with their male counterparts when it comes to elective positions such as Head of Department, Dean of Faculty, Provost of Colleges and Vice-Chancellor; in all only six universities had female Vice-Chancellors, that is two from the federal, three from the privately owned and one from the state (see appendix). Also in the universities visited, the total sum revealed that only about (25%) of the women had ever become Head of Departments, (3%) Dean of Faculties/Deputy Dean of Faculties and (1%) Provost of Colleges. This was attributed to earlier marginalization of women from the work force of the ivory towers. It was discovered that qualified females were recently just crossing from secondary schools and research institutes to the universities.

The result further revealed that the top-most positions in the universities are elective post which many women on their own may not be able to get enough votes to win due to their inability to campaign and their male counterparts bias to having women as leaders. It is instructive to know that where there is vacancy for the top position, such as Vice-Chancellor or University Librarian the committee (executive search) appointed to search for competent highly qualified candidates who can be enticed from their present positions by the right offer, (asides from public advertorial in the newspapers) never consider female professors available during their search. This is not surprising as males will constitute the members of the search parties; moreover, it is one of the ways by which the males in the academics normally view appointment into the universities top positions.

On their own part women out of fear of non-acceptance will fail to put themselves up for elective positions even if they are the most qualified candidate. All mud-slinging and the expenses

associated with campaigns will also prevent them from going all out to campaign for the job, but only wait for selection instead of election into top positions. Until this is overcome by the women, lopsided filling of top positions will continue in our ivory towers.

Although, findings revealed that promotional criteria are the same between the male and female lecturers in the universities, the women were highly disadvantaged as their own extra roles (housewife and mother) prevented them from competing favorably in both research and administrative aspect of their career.

In the developed countries women at times take time off work to care for their babies and sick relations, but here in Nigeria, women only take mandatory three (3) months maternity leave and continue with teaching and research. This shows that child bearing does not serve as an impediment when it comes to higher responsibilities. Moreover, by the time a woman in academics will get to the position of a professor she might have stop child bearing and her children will be out of the way.

Although, ratio of women's to men's wages and remuneration may differ in other professions across the country, but the reverse is the case in Nigerian universities as all academicians earn the same salary except in some allowances such as child and dependant allowance (women are not allowed to claim for child support and dependants except they are able to state that they are wholly responsible for them). However, they may not likely earn allowances allowable to those top managerial positions if they fail to get there.

One of the reasons for not allowing female lecturers to get to the top in their profession was discovered that women leaders can be too bossy and also too assertive in their day-to-day activities, giving little room for contributions from others especially the male under them. To some male lecturers (some of the respondents), this is not a good leadership trait (autocratic type of leadership), which they view as a form of inferiority complex or defense mechanism for inadequacy on their part. However, the single most important factor related to managerial level and performance was the manager's supervisory ability – that is, his or her skill in using supervisory methods appropriate to the particular situation. It should be noted that intelligence, initiative, and self-assurance would be a hallmark of successful leaders which will enhance their performance. Also effective leadership does not depend on a particular set of trait or gender, but on how well the leader's traits match the requirements of the situation. Although, women are still less likely than men to emerge as leaders, they are leaders, they are just as effective when they do. Even though an increasing number of people believe in equality of ability and opportunity, persistent, often unconscious, sexual stereotyping continues to hamper the recognition of women as potential leaders.

Another area where the women in the universities have been of great assistance is in the area of monitoring and serving as role model to female students on campus. The issue of indecent dressing has become so rampant and disturbing to the management of various institutions, but the female academics have been using both persuasion and mentoring of those students to reduce to the barest minimum their love for scanty and revealing dresses, and by so doing reduced sexual harassments from both male students and lecturers alike.

The study also revealed that in departments where the head is a woman, the students are less militant and more physiologically stable. The students' academic performances were also enhanced as they received motherly touch to both academic and administrative needs during their tenure.

Conclusion and Recommendations

Leadership positions in organizations has been an exclusive preserved for men as women roles are to bring forth children, tend homes, however, several laudable steps in re-emphasizing and acknowledging the significant role of women have gained prominence in Nigeria. One of such efforts

is the adoption of the draft copy of the National Policy on Women to ensure equality of opportunity for the deprived female gender in Nigeria. Specifically, programmes and project-specific interventions aimed at enhancing the potential roles of women in the pursuit of sustained economic growth and development have been advanced. So far, efforts in this direction are largely sporadic.

The study have emphasized the roles culture, religion, tradition, and socio-economy singly or combined play in problems faced by women in management and more especially women in academic in Nigeria.

In most universities sampled, women had never got to the position of a Vice-Chancellor except in six universities (3 private, 2 Federal and 1 State). In the 80s and early 90s, there was one Vice-Chancellor apiece for both Federal and State University. If one should consider this progression it may be said that women are coming up gradually, however, on the second thought, the number of universities in the country vis-a-vis the number of women in top managerial position in the universities – it can be deduced that women in the academics are yet to get there.

There are female Ministers, Speakers of House of Representatives and State House, Acting Governor, Deputy Governors, Permanent Secretaries, Senators, Commissioners, members of Federal and State House of Assemblies, Local Government Chairperson and Councilors, top position in both State and Federal Civil Services. When compared to the time of the likes of Margaret Ekpo, Gambo Sawaba and Fumilayo Kuti etc there has been a paradigm shift in term of women participation in both political and economic activities in the country.

Substantially, Nigerian women had pushed ahead in term of improvement of their socio-economic, political and leadership status in recent time. However, in the ivory towers there is still need for improvement, the government needs to allow the clause of equality to be extended into the universities so as to prevent lopsided occupancy of the top positions.

Knowing that the prosperity of any nation depends on the efficient utilization of all factors of production, land, capital, and labour; there should be total elimination of practices of discrimination against the employment of women in both public and private sectors especially in the some engineering related departments in the universities, and to make conditions of employment as conducive as possible to attract other women that are still working outside to come in and contribute their own quota to educational development of the nation. Government policies should include sanctions against non/full utilization of women in the development of human resources and nation building.

Women should help other women (and men also) by way of mentoring to understand themselves and their changing roles in this new era. Women should not run each other down, but rather strive to complement efforts of other women and work as a collective force.

Women, who do become leaders however, not only perform as well as male leaders according to objective measures, but also are generally perceived as equally effective by their employees. In view of this men should not find it difficult to be subjected to the rule of women even though they are still African inspite of western education.

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Appendix

Current Serving Women Vice-Chancellor In Nigeria

/NO	NAMES	UNIVERSITY	TYPE
	Professor E.I. Braidu	Federal University, Lafia Nassarawa	Federal
.	Professor Sidi. Osho	Afe Babalola University, Ado-Ekiti	Private
.	Professor Aize Obayan	Covenant University, Ota	Private
.	Professor Comfort M Ekpo	University of Uyo, Uyo	Federal
.	Professor Charity A Angya	Benue State University, Makurdi	State
.	Professor Margee M Ensign	American University of Nigeria, Yola	Private