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Peer Instruction and Secondary School Students Problem Solving Ability in Mathematics; Bungoma County; Kenya.

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Abstract Most Educators Agree That Mathematics Should Be Taught In A Way To Enable Learners Acquire Problem Solving Ability. Thus The Focus In Teaching Mathematics Should Be On Problem Solving Situations Rather Than On Routine Computations. This Implies Active Learner Participation As Brought About By Student Centered Instruction. This Study Was Concerned That The Conventional Methods Of Instruction Were Not Facilitating Acquisition Of Problem Solving Skills Resulting In Mass Failure Of Students In National Examinations. The Study Investigated The Role Of Peer Instruction In Learners' Perception Of Their Problem Solving Ability In Mathematics. The Observation Learning Theory Was Used To Guide The Study. Previous Studies Indicated That Using Peer Instruction Enables Learners Acquire Skills Of Analysis, Synthesis And Evaluation That Facilitate Problem Solving. The Study Was Conducted In Bungoma County. Proportionate Sampling Was Used To Pick 300 Participants. The Study Used An Ex Post Facto Research Design. A Questionnaire Was Used To Collect Data. Both Descriptive And Inferential Statistics Were Used In Data Analysis. The Results Indicate That Majority Of Students Perceived Themselves Able To Solve Problems In Mathematics After Peer Instruction. The Study Therefore Recommends That Teachers Incorporate Peer Instruction In Their Teaching To Facilitate Learners Acquire Problem Solving Skills In Mathematics.

Key Words : *Peer Instruction, Problem Solving Ability.*

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I. INTRODUCTION

1.1 Background To The Study

There Is A Growing Consensus Among Educators That The Fundamental Role Of Teaching Mathematics Is To Enable Learners Acquire Problem Solvingability In Mathematics (Katundo,2004; Ngaro,2004; Wilson, Fernandez & Hadaway,2005). Problem Solving In Mathematics Requires Not Just Knowledge Of Mathematics Concepts But Also Experience In Using Particular Kinds Of Thinking Skills In Solving Mathematics Problems (Wilson, 1990). According To Damon And Phelps (2000), Peer Instruction Enables Learners To Sharpen Their Thinking Skills Because, In Using Peer Instruction, The Role Of Routine Computation Diminishes And The Focus Is More On Problem Solving Situations. Suffice To Say, Problem Solving Ability Can Be Achieved By Active Learning Within A Social Context As Opposed To Passive Learning.

The Kenya National Examination Council: (KNEC) Report Cites That Majority Of Students Leave Mathematics Problems Incomplete (KNEC, 2015). This Results In Mass Failure Of Students In Mathematics Examinations. KNEC Not Only Tests The Acquisition Of Mathematics Concepts, But Also Their Application To Problem Solving Situations. The Kenya Institute Of Curriculum Development (KICD) Syllabus, Spells Out That The Teaching Of Mathematics Should Be Done With Its Application To Problem Solving (KICD, 2012). This Is Because, Learning Problem Solving Improves The Learners' Ability To Select Appropriate Solution Strategies To Mathematics Problems And This May Enable Learners Excel In Mathematics Examinations.

Asurvey By Strengthening Mathematics And Science Education (SMASE), Indicates That The Teaching Of Mathematics In Secondary Schools Was Characterized By Lecturing And Giving Notes And That Learners' Were Mostly Passive (SMASE,2010). This Is Contrary To The Requirements Of The Syllabus Which Prescribes That Mathematics Lessons Should Mostly Be Student Centered And Characterized By Learning By Discovery (KICD, 2012). When Students Participate In Their Own Learning They Benefit From Intellectual Stimulation And Increased Understanding In The Field Of Study (Stones 1992). According To Wilson, Fernandez &Hadaway (2005), Successful Problem Solving, Involves Exploration, Pattern Finding And Organization Of Mathematics Knowledge. This May Be Brought About By Using Peer Instruction As It

Provides Learners With An Opportunity To Reflect On The Learning Activities In A Systematic And Constructive Way During The Learning Session.

1.2 Statement Of The Problem

Learning Problem Solving Is Central To Holistic Mathematics Education. This Is So Because Many Mathematics Applications Are Best Brought Out In Problem Solving. Educators Are Concerned That The Usual Methods Of Teaching Are Not Facilitating Learners Acquire Problem Solving Skills. Mass Failure Of Students In Mathematics In National Examinations Characterized By Inability To Solve Mathematics Problems Necessitated This Study.

1.3 Purpose Of The Study

This Study Investigated The Role Of Peer Instruction In Learners' Problem Solving Ability In Mathematics. It Was Hypothesized That 'There Is No Relationship Between The Use Of Peer Instruction And Learners Perception Of Their Ability To Solve Problems In Mathematics'.

1.4 Theoretical Framework

This Study Was Hinged On The Observational Learning Theory Proposed By Bandura (1977). In It, Learners Acquire New Skills By Observing A Model. In This Study Learners Acquire Problem Solving Ability Through Peer Teaching And Learning. Students Are The Preferred Models Because Learners Tend To Pay More Attention When The Model Is Similar To Them (Asch, 1956). Thus, The Actions Of An Individual Within The Peer Led Mathematics Learning Session, Captures And Elicits The Attention Of Peers Hence Facilitating Learning.

Studies Have Shown That The Amount Of Information Processing That Occurs When The Material Is Initially Encountered Is Central To Determining How Much Of The Information Is Retained.(Hougan, 2002; Too, 2004).Learning From Peers Ensures That The Learners Engage With The Material Reflect On Their Own Ideas And Support Each Other's Learning.

II. LITERATURE REVIEW

2.1 Peer Instruction Effectiveness

Peer Instruction Is A Form Of Cooperative Learning Where Students Begin At Roughly The Same Levels Of Competence To Solve Tasks Neither Could Previously Do (Andrimi, 2016). Astudy By Armstrong (2012), Investigating The Relationship Between Peer Instruction And Tutee Performance Found That Tutee Achievement After Peer Instruction Showed Marked Improvement. This Was Because Peer Instruction Provides Both Flexibility And Adaptability In The Learning Process. More So, The Diversity Of Learners' Problem Solving Experiences And The Collective Depth Of Knowledge Of Individual Learners Makes Peer Instruction A Very Rich Co-Learning Experience. Similarly A Study By Cohen And Kulik(1981),Reports That Both Tutees And Tutors Mathematics Achievement Improves When Using Peer Instruction. They Report That Tutees Improved More After Peer Intervention As Compared To When Teacher Directed Learning Activities Were Used. Both Studies Were Done In Remedial Situations While The Current Study's Focus Is In Teaching Situations.

It Has Been Ascertained That Teachers With Teaching Problems Could Best Be Assisted By Their Peers Rather Than Their Supervisors (Waseem, 2015). This Study Supposes That, In A Classroom Learning Situation, Learners Could Assist Each Other Improve Their Problem Solving Ability. Owiti (2000),Says, Students Whose Friends (Peers) Work Hard In Mathematics Are Also Likely To Work Hard In Mathematics. This May Be So Because Children Tend To Adhere To The Peer Group Expectations If They Have To Fit In With Their Peers.

Rashcke, Dedrick&Statheet Al, (1988) Investigated The Outcomes Of Peer Tutoring, And Reports That, Learners' Attitudes As Well As Motivation To Learn Mathematics Improved. This Results In Greater Achievement. Thus,Peer Instruction Provides The Best Training Ground For Problem Solving In Mathematics. Teachers Therefore, Should Encourage And Provide Learners With Opportunities To Relate To Each Other In Their Learning Experiences.

2.2 Peer Instruction And Problem Solving

Participation Is Essential To Any Quality Learning Experience And Peer Instruction Provides Opportunity For This Brady(2005). More So Because, During Group Sessions Everyone Has 'Talked' Two Or Three Times In Attempting To Solve The Problem. Constructivist Theories Suggest That The Learner Must Be Actively Involved In The Construction Of His/Her Own Knowledge Rather Than Passively Receiving It,Friedricksen (2007).Furthermore,Brant (1981) Says The Peer Group Provides Perhaps The Best Training Ground For Practicing Problem Solving. Suffice To Say, Peer Instruction Used In Problem Solving Enables

Learners Acquire Facts And Skills And Also Leads To Analysis, Synthesis And Evaluation Of Concepts Resulting In Holistic Learning.

III. RESEARCHMETHODS

3.1 Study Area

The Study Was Conducted In Bungomacounty Of Western Kenya. In This County We Have Boys Schools, Girls Schools And Co-Educational Schools. Despite Producing Remarkable Results In National Examinations In Other Subjects, Performance In Mathematics Has Remained Poor.

3.2 The Study Sample

The Study Was Conducted Among Form Three Students. Proportionate Sampling Was Used To Select 30 Schools In The Ratio Boys: Girls: Co- Educational From Each Stratum.Participating Schools Were Selected By Random Sampling And The Process Resulted In 300 Subjects Of Whom78 Were From Boys' Schools, 81 From Girls' Schoolsand 141 From Co-Educational Schools.

3.3 Research Design

The Study Used An Ex Post Facto Research Design. The Design Was Chosen Due To Its Suitability To The Study As The Variables Under Investigation Had Already Manifested In The Field.A Questionnaire Was Used To Collect Data From Students. The Questions Were Structured To Elicit Responses On The Relationship Between Peer Instruction And Problem Solving. The Questionnaire Used A Five Point Likert-Type Of Scale And Contained 20 Items. The Maximum Score A Learner Could Obtain Was 60.

Data Was Analyzed Using Descriptive And Inferential Statistics. A Table Of Frequencies Was Made. Grouped Responses Were Expressed As Percentages Of The Survey Sample. The Chi- Square Test Was Used To Accept Or Reject The Null Hypothesis. A Contingency Coefficient Was Used To Confirm The Magnitude Of Association Between The Variables.

IV. DATA ANALYSIS AND INTERPRETATION

The Study Investigated The Relationship Between Peer Instruction And Learners Problem Solving Ability In Mathematics. Percentages For Learners' Perception Of Their Problem Solving Ability After Peer Instruction Were Calculated And The Results Presented In Table 1.

Table 1: Percentages Of Learners' Problem Solving Ability.

	Using Peer Instruction	Using Conventional Instruction
Able To Solve	54%	22%
Not Able To Solve	11%	13%

The Results Indicate That The Majority Of Students (54%) Perceived That Theywere Able To Solve Problems In Mathematics After Peer Instruction. To Investigate This Implication, The Chi Square Test Was Run. This Was To Ascertain If There Was Any Relationship Between Using Peer Instruction And Learners Perception Of Their Ability To Solve Problems. The Results Are Presented In Table 2.

Table 2: Chi Square On Learners Ability To Solve Problems After Peer Instruction

	Using Peer Instruction	Using Conventional Instruction	Total
Able To Solve	161 (148)	67 (80)	228
Not Able To Solve	34 (47)	38 (25)	72
Total	195	105	300

χ^2 = 13.609 At α = 0.05Contingency Coefficient 0.208

Figures In Parenthesis Are Expected Frequencies

A Chi Square Value Of 13.609 Was Obtained At 0.05 Level Of Significance And 1 Degree Of Freedom. This Indicated That The Two Variables Were Not Independent Hence There Was A Relationship Between Peer Instruction And Problem Solving Ability. The Null Hypothesis 'There Is No Relationship Between The Use Of Peer Instruction And Learners Perception Of Their Ability To Solve Problems In Mathematics' Was Rejected.

4.2 Study Findings

The Results Show That There Was A Significant Relationship Between The Use Of Peer Instruction And The Learners' Perception Of Their Problem Solving Ability In Mathematics. These Findings Agree With Those Of Chamber And Rosemary(1989) Which Points Out That The Teaching Given By Children To Children Has The Same Importance As That Given By Adults To Children. Cohen And Kulik (2001), Also Say That When Using Peer Instruction Mathematics Achievement Effects Were Strong. They Established A Correlation Between Peer Instruction And Student Outcomes In Mathematics. Allan (2004) Says That Learning Discussions Such As Peer Instruction Should Be Considered One Of The Principal Forms Of Education. In A Study That Focused On The Outcomes Of Peer Instruction, Raschke Et Al (1988) Posit That Besides Improved Attitude Towards Subject Matter, Performance Also Improves.Suffice To Say, Peer Instruction Increases The Confidence Of Learners In Problem Solving In Mathematics.

This Study Therefore Concludes That Peer Instruction Is Instrumental In The Learners' Problem Solving Ability In Mathematics. The Study Recommends That Teachers Incorporate Peer Instruction In Their Teaching Programs For Increased Problem Solving Ability By Learners In Mathematics.

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