International Journal of Humanities and Social Science Invention (IJHSSI)
ISSN (Online): 2319 – 7722, ISSN (Print): 2319 – 7714
www.ijhssi.org ||Volume 8 Issue 11 Ser. III || November2019 || PP38-45

Using ICT Mediated Cognitive Apprenticeship Model And The Effect On Mathematical Problem-Solving Ability Of Year Eight Students With Different Types Of Learning Styles For Urban And Rural Schools.

[1] Sofia Shireen N. K. Ali, [2] Dr (Mrs.) Flosy C. R. D'Souza
[1] Ph.D. Research Scholar, (Fiji), Mangalore University
[2] Associate Professor and Research Guide St. Ann's College of Education, (Autonomous) Mangalore India
Corresponding Author; Sofia Shireen N. K. Ali

ABSTRACT: *The learners of Mathematics need to obtain problem-solving proficiency, figuring out how to connect using Mathematics knowledge and ability, create Mathematical Cognitive thinking, to see the connection between Mathematics and other subjects, which is a worldwide confirmation among Mathematics teachers. Mathematical problem solving is a process that comprises a set of factors and tasks to get a well-defined objective. It is very challenging to learn and teach, as it depends on many skills and considerations. Difficulty in teaching Mathematical Problem Solving will arise if the teachers'have minimal understanding of the process.Thus for teachers, there is a great need to understand these factors and skills if they want the students to acquire this process.It is used to solve problems, and with the initiation of computer technology, it has helped in making social, economic,and technological advances, which were, at times, very impossible.*
Based on the above, this paper aims to examine the Mathematical Problem-Solving ability ofyear eight students. A sample of 160 year eight students (80 rural and 80 urban) was selected from two schools of Lautoka/Yasawa district in Fiji using the random sampling technique (lottery method). Experimental, 2x3 factorial design method applied. A standardized Mathematical Problem Solving Ability test (PSAT-D) by L.N.Dubey (1971) was used to do collect pretest and post-test data whereby Intelligence was kept as Covariate.Mean, standard deviation, 'and two-way ANCOVA was used to analyze the data with the help of SPSS. The analyzed data were tabulated and tested with the hypothesis. Finding shows there was a significant difference in Mathematical Problem Solving Ability of year eight, urban and rural schools, while they were taught with ICTCAM Instructional strategy compared to Conventional Instructional.

Keywords:*Mathematical Problem Solving Ability, Year Eight Students, ICTCAM-ICT mediated Cognitive Apprenticeship model, Urban and Rural Schools.*

Date of Submission: 04-11-2019 Date of acceptance: 22-11-2019

I. INTRODUCTION:

The teaching and learning of Mathematics are diverse because the study of "mathematics subjects develops the criticism of thought, rational reasoning, and knowledgeable and aesthetic contentment. "Mathematics is essential to all fields from K- Postgraduate and is also necessary for the evolution of science and technology in ones' country. It is difficult to survive without the use of fundamental processes of mathematics in everyday routine. The essential requirement of any human being is to acquire knowledge of mathematics to know its underlying procedures and the capacity to use them. Due to the nature of mathematics, there is a need to develop "reasoning and thinking powers" (Sidhu, 1995). It prepares the essence to be exploratory and gives the establishment of intelligent and thorough thinking. Education is a product of experiences.Development and operativeapplication of those involvements through interactive strategies with the community flourish an individual into a well-balanced person. Appropriateknowledge is indispensable for tuning the mind to develop the intellectual capability, creative and critical thinking, and manipulative strategies. Educating every citizen is the principalobligation of society. Indeed from the very foundation of education, children start with both language and mathematical skills.

According to Schoenfeld (1983), a problem is only a problem (as mathematicians use the word) if you don't know how to go about solving it. An issue that has no "surprises" in-store, and can be resolved comfortably by routine or simple procedures (no matter how difficult!) it is an exercise.

Mathematics, if taught well, subject brilliance and style, stimulating in its justification or coherence. The mathematics studied in schools and the way it is taught and learned by students schools should use different instructional strategies such as ICTCAM so that the students become good problem solvers as an outcome that moves beyond the "traditional goal of getting correct answers to mathematical exercises" (Seeley and Harold, 2004). Hardly ever, it is observed that students rise for mathematics classes with appreciation and eagerness to learn. Students must learn mathematics with understanding, enthusiastically constructing new information as a matter of fact and from prior knowledge. It is more useful to recognize how to mathematize than to see a lot of mathematics, andthey receive an excellentfoundation in mathematics.

Review of Related Studies:

Researchers have reported continuously that in the past few decades, students lack mathematical problem solving ability. Studies that were conducted in India and aboard have also exposed that knowledge in application of appropriate problem-solving strategies mathematics anxiety (Karasel et al., 2010), (Gallagher et al., 2000; and Johan, 2002), Krishnan, 1990; Dhillon, 2000;problem-solving accurateness (Krawec, 2014) evidenced presenting argument for lack of mathematical Problem-Solving Ability.

The experimental studies endeavored by the researchers in India and abroad were also shown that the following methods, such as teaching via problem solving (Erickson, 1993 and Ridgeway et al,, 2002), Polya's heuristic approach (Ayodhya, 2007 and Yalla and Ayodhya, 2010), multimedia and use of whiteboard (verbal and visual strategy instruction (Swanson, 2014), (Erdogan, 2015) and empirical mathematical reasoning (Papadopoulos, 2015) has enriched mathematical problem-solving ability when compared to CI of teaching and learning.

Significance of the Study:

Initiatives have been taken to restructure mathematics education over the last decades.Thus instead of learning abstract concepts and procedures in mathematics, a restructure has been to engage students in doing more concrete and problem-solving activities rather than textbook exercises only.The restructure, or transformation on the modeling of reality must change the learners from the passive captivation of knowledge to a constructive way of learning. Therefore the above will act against the apparent decline of interest of students in mathematics. Consequently, using the ICTCAM instructional strategy should be asignificant reason for assisting in helping out such substantialspeculation in learning and teaching mathematics and will propagate the requirements for mathematical skills and proficiency in the 21st-century society, which will also develop students who have low achievement in Mathematics.

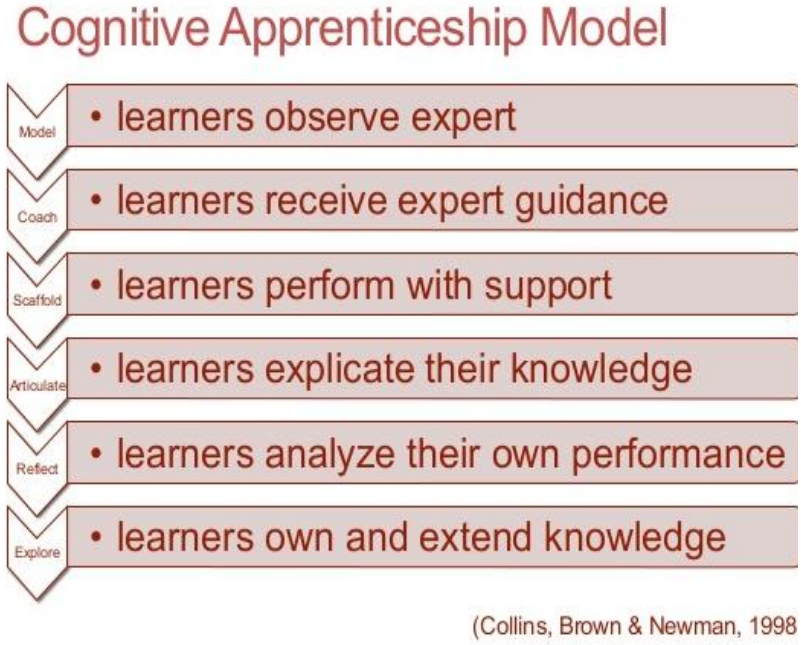
It is a fact that the study of mathematics develops imagination, trains in clear and logical thought, and challenges varieties of challenging ideas.The learning and teaching of mathematics have become a matter of the most significant concern and importance for everyone involvednot only in education but a concern to the nation.Mathematical competency has been recognized by the National Council of Teacher of Mathematics (2000)as one of the criticalskills necessary for personal self-actualization, active citizenship, social inclusion, and employability in this global society.

Making mathematical learning effective in developing problem solving ability is the energetic need and social obligation of the investigators in the area of research in the field of Mathematics.

Operational Definitions

Table 1.0 showing Operational Definitions

Information and Communication Technology (ICT)mediated Cognitive Apprenticeship Model (ICT Mediated CAM)	ICT is the acronym that stands for Information and Communications Technology: communication devise or application, which includes radio, television, cellular phones,Computer and network hardware and software, Satellite systems, etc. ICT in the context of this study will include digital technology that is computers, laptops, tablets, mobile phones, the **dynamic educational software** that can be used to **enhance the teaching and learning of Mathematics.** The use of ICT **Dynamic Geometry software – Geo Gebra** integrated into six instructional methods of the **Cognitive Apprenticeship Model** to teach the **content of Geometry** in Mathematics Integration of Technology, Pedagogy and Content Knowledge (TPACK) Mishra & Koehler's, 2006 in this study refers networked multimedia computers and software that is Dynamic Geometry software – Geo Gebra integrated into six instructional methods of the Cognitive Apprenticeship Model.

Dynamic Geometry software – Geo Gebra	Geogebra is an open-source, free software package for creating and manipulating geometric objects. It also allows for graphing of functions and managing the features in all sorts of exciting ways. It runs on the Java framework, which means if you have Java installed on your computer, you can run Geogebra, which makes it any Java-enabled operating system. This means the very same program will run on Windows, Mac, Linux, or Solaris, although the installer is different for each operating system.
Cognitive Apprenticeship model	
Types of learning style s (Audio, Visual and Kinesthetic Learners)	Types of learning style (Audio, Visual, and Kinesthetic Learners)helps us in understanding how our students learn, which is perhapsone of the most important tasks a teacher can undergo while teaching the students. And it allows teachers how to provide opportunities for learning through the use of these identified Learning preferences. Teachers often use their preferred learning styles as their primary mode of teaching, and if students do not share those same preferences, then learning can be challengingand frustrating. In this present study, the Learning style inventory wasadministered using the Learning Style Inventory LSI (Ali, Sofia, and D'Souza Flosy, 2017) constructedand developed by the researcher and validated by experts.This test was carried out to identify the three differentlearning styles, such as Visual, Audio, and Kinesthetic. Learners.
Conventional Instruction (CI)	is defined as the teaching method used by the regular Mathematics teacher in the upper primary Mathematics classes, in Fiji Context teaching of Geometry involves chalk and board, traditional method use of GeoBoard,mathematical set instruments Mathematics 4C exercise book, some models of shapes, cutting and pasting, etc.
Problem Solving	Is the framework or pattern within which thinking and reasoning take place. It is the ability to think and reason on given levels of complexity. Problem-solving is a process of overcoming difficulties that appear to interfere with the attainment of a goal. In the present study, the scores obtained by the students of year eight on Problem Solving Ability Test (PSAT), a standardized tool prepared by L.N.Dubey (1971), was considered as Problem Solving Ability of samples.

Objectives of the Study:

The present study by the investigator was based on the conceptual framework of early research work, and the following objectives were outlined.

1. To study the main and interaction effects of Instructional Strategies (ICT Mediated CAM and Conventional Instruction CI)and Types of Learning Styles (Audio, Visual, and Kinesthetic) on the Problem-Solving skills of year eight students of urban schools by taking Intelligence as Co-variate.
2. To study the main and interaction effects of Instructional Strategies (ICT Mediated CAM and Conventional Instruction CI) and Types of Learning Styles (Audio, Visual, and Kinesthetic) on the Problem-Solving skills of year eight students of rural schools by taking Intelligence as Co-variate.

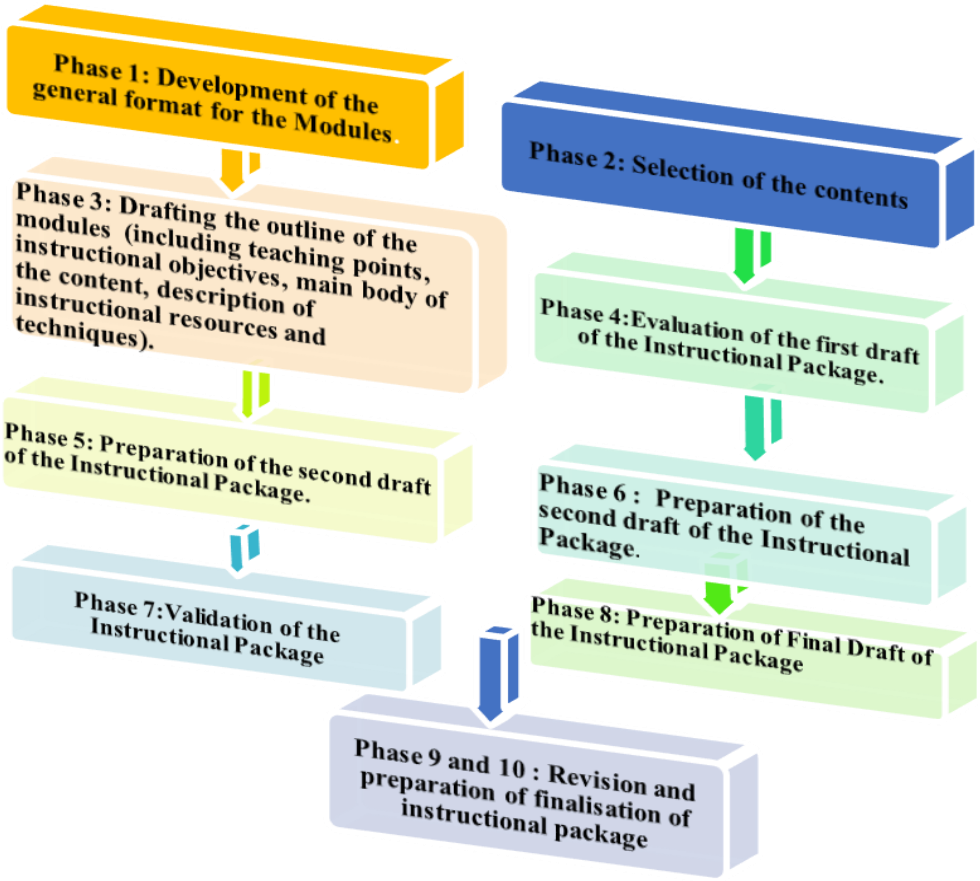
Hypothesis:

H_0(1.0)There is no significant difference in the main and interaction effects of Instructional Strategies (ICT Mediated CAM and Conventional Instruction CI) and Types of Learning Styles (Audio, Visual and Kinesthetic) on the Problem-Solving Skills of year eight students of urban schools by taking Intelligence as Co-variate.

H_0(2.0)There is no significant difference in the main and interaction effects of Instructional Strategies (ICT Mediated CAM and Conventional Instruction CI) and Types of Learning Styles (Audio, Visual and Kinesthetic) on the Problem-Solving Skills of year eight students of rural schools by taking Intelligence as Co-variate.

II. METHODS AND PROCEDURES:

Figure 1.0: Phases in the preparation of the instructional Material using ICTCAM



The procedure of Data Collection

The researcher conducted an experimental study to find the "Effectiveness of ICTCAM on the Problem-Solving Skills Mathematics of Upper Primary rural and urban School students In Fiji." The present study involved four phases:

- Phase 1: Pre Measurement
- Phase 2:Treatment
- Phase 3: Post Measurement
- Phase 4: Data Analysis

The Distribution of Sample size

Table 2.0 Showing the distribution of sample size

Types of Learning Styles	**Groups: Urban**		**Groups: Rural**		**Total**
	ICTMCAM Treatment	CI Conventional Instructional	ICTMCAM Treatment	CI Conventional Instructional	
Audio	10	10	10	10	40
Visual	20	20	20	20	80
Kinesthetic	10	10	10	40	40
Total For Each Group	**40**	**40**	**40**	**40**	**160**

The Evaluation Tools and Variables

Table 3.0: The details of the Evaluation tools used in the study for selected variables.

Tool No	Name of the Tool	Name of the Author of the Tool	Variables
1.	Group Test Of Intelligence	(GGTI-A)G.C.Ahuja (1971)Standardised Test.	Intelligence
2.	Learning Style Inventory (LSI-S)	Ali, Sofia & D'Souza, Flosy- (2017) Validated by experts	Types of learning styles
3	Problem Solving Ability Test (PSAT-D)	L.N.Dubey (1971) Standardised Test.	Problem Solving Skills
4	Instructional Material using ICT Mediated CAM and CI	Ali, Sofia &D'Souza, Flosy - (2017) validated by subject experts.	Lesson plans and worksheets based on ICTCAM and CI

III. ANALYSIS AND INTERPRETATION OF DATA.

Hypothesis Testing

H_0(1.0)There is no significant difference in the main and interaction effects of Instructional Strategies (ICT Mediated CAM and Conventional Instruction CI) and Types of Learning Styles (Audio, Visual, and Kinesthetic) on the Problem-Solving Skills of year eight students of urban schools by taking Intelligence as Co-variate.

Table 4.0 ANCOVA Summary of (IS) for Problem Solving Skills for Urban schools (Hypothesis tested at 0.05 level of significance) by taking Intelligence as Covariate

COMPONENT PSAT	SOURCE	Type III Sum of Squares	df	Mean Squares	F-ratio	p-ratio	Results
	Instructional Strategies (A)	11.586	1	11.586	7.180	.009	S
	Types of Learning styles (B)	5.545	2	2.727	2.914	.061	NS
	Instructional Strategies (A) x Types of learning styles(B) (A X B)	.385	2	.193	.206	.814	NS
	Error	68.322	73	.936			
	Total	121.000	80				

Table 5.0 Adjusted mean for Instructional Strategies: PSAT Intelligence as Covariate. For urban schools

COMPONENT: PROBLEM-SOLVING SKILLS (URBAN SCHOOLS)		
GROUP	Adjusted Mean	SD
ICTCAM	0.93	0.859
CI	0.55	1.085
TOTAL	0.74	0.972

IV. FINDINGS

Main Effect on Instructional Strategies for Urban Schools.

The instructional Strategies (ICTCAM and CI) differ significantly in developingthe Problem-Solving Skills of year eight students of urban schools after partialing out the effect of intelligence. ICTCAM is significantly effective than CI in developing the Problem-Solving Skills among year eight students of urban schools after partialing out the effect of intelligence.

Main Effect on Types of Learning Styles

There is no significant difference in the Types of Learning Styles (Audio, Visual, and Kinesthetic) of year eight students of urban schools on developing the Problem-Solving Skills after partialing out the effect of intelligence.

Interaction Effect between the Instructional Strategy and Types of Learning Styles.

Interaction of Instructional Strategies (ICTCAM and CI) and Types of Learning Styles (Audio, Visual, and Kinesthetic) has no significant effect on developing the Problem-Solving Skills of year eight students of **urban** schools after partialing out the effect of intelligence.

H_0(2.0)There is no significant difference in the main and interaction effects of Instructional Strategies (ICT Mediated CAM and Conventional Instruction CI) and Types of Learning Styles (Audio, Visual and Kinesthetic) on the Problem-Solving Skills of year eight students of **rural** schools by taking Intelligence as Co-variate.

Table 6.0: The ANCOVA Summary of (IS) for Problem Solving Skills for Rural schools (Hypothesis tested at 0.05 level of significance) by taking Intelligence as Covariate.

COMPONENTS PSAT	Source	Type III Sum of Squares	df	Mean Sum of Squares	F-ratio	p-ratio	Results
	Instructional Strategies (A)	11.586	1	11.586	7.180	.009	S
	Types of Learning styles (B)	6.616	2	3.308	2.050	.136	NS
	Instructional Strategies (A)x Types of learning styles(B) (A X B)	.380	2	.190	.118	.889	NS
	Error	117.802	73	1.614			
	Total	262.000	80				

Table7.0 **Adjusted mean for Instructional Strategies: PSAT Intelligence asCovariate for urban schools**

COMPONENT : PROBLEM SOLVING SKILLS (RURAL SCHOOLS)		
GROUP	Adjusted Mean	SD
ICTCAM	1.63	1.353
CI	0.88	1.181
TOTAL	1.25	1.317

Main Effect on Instructional Strategies for Rural Schools

The instructional Strategies (ICT mediated Cognitive Apprenticeship model) (ICTCAM and CI) differ significantly in developing the Problem-**Solving Skills** among year eight students of **rural schools** after partialing out the effect of intelligence.ICTCAM is significantly effective than CI concerningimproving the Problem-Solving Skills among year eight students of **rural schools** after partialing out the effect of intelligence.

Main Effect on Types of Learning Styles

There is no significant difference in the Types of Learning Styles (Audio, Visual, and Kinesthetic) of year eight students of **rural schools** on developing the **Problem-Solving Skills** after partialing out the effect of intelligence.

Interaction Effect between the Instructional Strategy and Types of Learning Styles.

Interaction of Instructional Strategies (ICTCAM and CI) and Types of Learning Styles (Audio, Visual, and Kinesthetic) has no significant effect on developing the **Problem-Solving Skills** among year eight students of **rural schools** after partialing out the effect of intelligence.

V. DISCUSSION:

From the above analyses and interpretation, this research investigation concerningcomparison has concluded with the following considerations. From the results, it can be declared that there is a significant difference in the instructional strategies (ICTCAM and CI) in developing the mathematical Problem-Solving skills of year eight students with different types of learning styles in both urban and rural schools.

Therefore the instructional strategy ICTCAM is very useful compared to CI.Thus this could be adopted in schools to teach mathematics in urban and rural schools.

Educational implications:

Mathematics is a critical key learning area throughout the world, because of its purposefulprominence to the individual and society in which problem-solving is anessential component. Through a problem-solving approach, practical aspects of Mathematics is developed. Problem-solving is a vehicle for learning new concepts and skills, or reinforcement and mathematics through problem-solving can create a framework that simulates real life.

Though mathematics curriculum is organized around Problem-Solving, it is recommended that due focus should be given in developing skills and the ability to apply these skills to unfamiliar situations, gathering, organizing, interpreting, communicating Mathematics information, verbalizing key questions, analyzing and conjecturing problems, defining problems and goals, determining patterns and connections, seeking out appropriate data, experimenting, transferring skills and strategies to new situations, developing curiosity, confidence, and open-mindedness. Teachers must also teach problems via a problem-solving approach and should make the students aware ofall strategies that can apply to solve a problem.

Hence, it is a challenge for teachers, at contends, to develop the process of Mathematical thinking together with the knowledge and to seek out changes to present even routine Mathematics tasks in problem-solving contexts.

VI. SUGGESTIONS AND RECOMMENDATIONS:

It is fair to suggest that the teaching styles and mathematical tasks should be planned to benefit the different learning styles of learners. There must be more than a balance in various forms of Mathematics concepts, that is, the integration of algebraic, verbal, and visual thinking should be included. However, it may be reasonable to note that the nature of many mathematical tasks indicates that students should cope well with systematic and intuitive thinking in the problem-solving situations. In fact, at the beginning of a solution, they need to think openly and then follow a routine step by step procedure to arrive at the necessary answer. Textbooks and current teaching methods of mathematics in schools and higher education institutions favor various ways of thinking.

The environment of students in which the learning of mathematics takes place must also be made effective and monitored continuously both by parents and teachers. Thus there is a need for significant continuous research in the area of Mathematics Education in the society and the world of technology enclosed with Mathematical thoughts and concepts.

VII. CONCLUSION

This research has presented a vibrant picture of the Mathematical problem-solving ability of year eight students of urban and rural schools. Already in the 80s, NCTM recommended: "problem solving be the focus of school mathematics" (1980, p. 1), later endorsing that problem solving to be the main focus of school mathematics (2000). In 2000 NCTM stated: Solving problems is not only a goal of learning mathematics but also an essential means of doing so.

By learning problem-solving in mathematics, students should acquire ways of thinking, habits of persistence and curiosity, and confidence in unfamiliar situations. (p. 52)

The mastery of problem-solving skills among the students is still at an inadequate level. Initiatives must be engaged to help students to practice problem-solving skills in Mathematics. Instructional Strategies such as ICTCAM can be planned and implemented in the classrooms, and the data generated by this research should contribute towards the progression of teaching and learning mathematics in Fiji and all the other countries.

REFERENCES:

[1]. Abdelkader.A. (n.d.). Skills Needed for Mathematical Problem Solving (1). Retrieved from https://www.analyzemath.com/math_problems/paper_1.html.

[2]. Ayodhya, P. (2007). Problem-solving skills-Effectiveness of conventional and Polya's heuristic approach. Edutracks, 7(3), 34-39.

[3]. Callejo, M. L., and Vila, A. (2009). Approaches to mathematical problem solving and students' belief systems: Two case studies. Educational Studies in Mathematics, 72(1), 111–126.

[4]. Chang,C.Y.,and Taipei,Y.H.(2000).Exploring Interrealtionalships between Problem-Solving Ability and Science Process Skills of Earth Sciences Students in Taiwan International Journal of Science Education,24(5),441-451.

[5]. Collins, A., Brown, J. S., & Holum, A. (1998).Cognitive Apprenticeship: Making Thinking Visible.American Educator:The Professional Journal of the American Federation of Teachers,15(3),6-11,38-46.

[6]. Davis, D. J. N. (1995). The relationship between reading and attitudes and mathematical, verbal problem-solving ability of introductory algebra college students. Dissertation Abstracts International, 568, 3039-A.

[7]. Dhillon, A.S. (2000). Individual Differences within Problem-Solving Strategies used in Mathematics. Science Education, 82(3), 379-405. In I-manager Publications, I manager publications, I-manager's http://www.imanagerpublications.com/viewarticles/7/752/JPSYVol11Iss2

[8]. Erdogan, A. (2015).Turkish Primary School Students' Strategies in Solving a Non-Routine Mathematical Problem and Some Implications for the Curriculum Design and Implementation. International Journal for Mathematics Teaching and Learning, 15, 414.

[9]. Erickson, D. K. (1993). Middle School Mathematics Teachers' Views of Mathematics and Mathematics Education, Their Planning and Classroom Instruction, and Student Beliefs and Achievement. Paper submitted at the Annual Meeting of the American Educational Research, Atlanta, GA. In i-manager Publications, manager Publications, i-manager's http://www.imanagerpublications.com/viewarticles/7/752/JPSYVol11Iss2

[10]. Fuchs, L. S., Fuchs, D., Stuebing, K., Fletcher, J. M., Hamlett, C. L., and Lambert, W. (2008). Problem-solving and computational skill: Are they shared or distinct aspects of mathematical cognition? Journal of Educational Psychology, 100(1), 30-47.

[11]. Fuchs, L. S., Fuchs, D., Prentice, K., Hamlett, C. L., Finelli, R., and Courey, S. J. (2004). Effect of Schema-based Instruction in Promoting Mathematical Problem-Solving. Journal of Educational Psychology, 96(4), 635–647.

[12]. Gallagher,A.M., DeLisi, R., Holst, P. C., McGillicuddy, A. V., Morely, M., and Cahalan, C. (2000). Gender differences in advanced mathematical problem-solving. Journal of Experimental Child Psychology, 75, 165-190. In i-manager Publications, manager Publications, i-manager's http://www.imanagerpublications.com/viewarticles/7/752/JPSYVol11Iss2.

[13]. H. Schoenfeld, "Learning to Think Mathematically: Problem Solving, Metacognition, and Sense-Making in Mathematics," Handbook for Research in Mathematics, Edited by D. D. Grouws, MacMillan, New York, 1992.

[14]. Mathematical Problem Solving Ability of Eleventh Standard https://files.eric.ed.gov/fulltext/EJ1169548.pdf.

[15]. The National Council of Teachers of Mathematics [NCTM]. (2000). Principles and standards for school mathematics. Reston, VA: Author.

Sofia Shireen N. K. Ali "Using ICT Mediated Cognitive Apprenticeship Model And The Effect On Mathematical Problem-Solving Ability Of Year Eight Students With Different Types Of Learning Styles For Urban And Rural Schools."International Journal of Humanities and Social Science Invention (IJHSSI), vol. 08, no. 11, 2019, pp. 38-45