Effect of Metacognitive Learning Approach on Students' Motivation to Learn Mathematics in Public Secondary Schools in Kitui County, Kenya

Kithinji Rugendo Wairambu*, Prof Nelson Jagero (PhD)

Chuka University, Kenya

**Correspondent Author*

Abstract: **The present study investigated the effect of the Metacognitive learning approach on students' motivation to learn mathematics based on the topic Formulae and Variation in mathematics. A Quasi-experimental design and in particular Solomon Four Design was employed for the study. A stratified random sampling technique was used to select four boys' and four girls'extra county participating secondary schools. Assignment of groups to either experimental or control group was done through simple random sampling. A sample size of 360 form three students was used in the study. Students in the experimental groups were taught Formulae and Variations using Metacognitive Learning Approach (MLA) while control groups were taught the same topic using Conventional Teaching Approach (CTA). The research instrument for data collection was Academic Motivation Scale (AMS). Data analysis was undertaken with the help of Statistical Package for Social Sciences (SPSS) version 25.0 software. The study showed that Metacognitive Learning Approach (MLA) resulted to higher levels of students' scores in motivation towards learning of mathematics. The study recommends that teacher training institutions, Kenya Curriculum (KICD) and mathematics teachers should enact MLA approach as a preferred mathematics learning approach in Kenyan secondary schools. The findings of the study form basis for future research on innovative teaching approaches in mathematics education.**

***Key Words*: Conventional Teaching Approach, Kitui County, Kenya, Mann- Whitney, Metacognitive learning Approach, Motivation, Public Secondary Schools.**

I. INTRODUCTION

Students' motivation play a critical role in metacognitive learning as a means of achieving desirable outcome and as means of enhancing holistic understanding. Holistic understanding enables learners to satisfy needs for competence and autonomy that deepens the meaning of learning. Thus, enables the transfer of new knowledge into new situations and apply it in unfamiliar contexts. Unfortunately, many students often do struggle to recognize and correct any specific difficulties because of lack of this motivation. Both cognitive and metacognitive approaches are necessary for enhancing motivation among learners by reducing uncertainty behaviour in the classroom. Motivation is a reason for students thinking in a given situation. The students are expected to collaborate, experience themselves as active participants in creating mathematical insights. Such students are intrinsically motivated which arouses, directs, and maintain behavior (Woolfolk, 2008). When a student has internal drive that arouses and direct him or her, he or she willingly participate in the activity because it is certainly interesting or enjoyable. When a student is extrinsically motivated, he or she undertake an activity because it leads to a successful outcome (Ryan & Deci, 2017). Students awareness of the distracting stimuli either internal or external can prompt them enjoy mathematics and put their focus on the completion of tasks, makes better use of appropriate learning strategies that enable learners to obtain better results (Penkrun *et a*l. 2017). Students who possess high academic intrinsic motivation are actively involved in the learning process

The motivation of individuals is related to their metacognitive beliefs. When students beliefs that they possess the skill and the ability to perform a task with confidence do affect their motivation (Voi et al., 2014). Relevant to the present study, student's motivation is related to a set of beliefs such as autonomy, competence and relatedness as concerns intrinsic motivation. Other important components believed to be important for individual development and integrated functioning are introjected, identified, integrated and external regulation. The constructs can make a learner develop internalized goals. Education 2030 agenda aims at providing quality education that equip teachers with required skills, provide well remunerated and motivated teachers (UNESCO, 2016). High qualified and motivated teachers will put a lot of effort to ensure all students acquire the necessary skills for learning.

Factors that do influence motivation among the students have been identified by D'Martino and Zani (2010) as fear to fail, anger, being bored and low perceived competence. Ozcan and Gumus (2019) established mathematics anxiety on mathematical problem solving is associated with motivation, self-efficacy and metacognition. Hanus and Fox (2015) found learners classroom activities and their perception of classmates do influence their motivation to learn. Hanin and Nieuwenhoven (2020) reported low levels of confidence while

solving the mathematical problem due to repeated failures. Another study reported students' negative perception and emotions on summarizing monitoring, and the need to know justification behind formulas (Radmehr & Drake, 2020), indicating students face a challenge even before igniting their thinking. Lack of metacognitive awareness (Anderson, 2012; Fakhr- Amaladari, 2016). Lack of of awareness makes students struggle to recognize and correct any specific difficulty they encounter. The motivational variables considered focused on learning and understanding mathematics concepts with aim of arriving at the correct solutions. Previous studies focused on learners characteristics as some of the factors that affect their motivation to learn. Instructional approaches used by the teacher can influence learner motivation. Therefore, teachers should focus on appropriate learning learning approaches that are likely to increase student motivation.

I.1 Objectives of the Study

To establish the effect of Metacognitive learning approach on Students Motivation to learn mathematics in secondary schools in Kitui County, Kenya.

1.2. Hypothesis of the Study

There is no statistically significant difference in students' motivation to learn mathematics among students taught through the metacognitive learning approach and those taught through conventional teaching approach.

1.3 Statement of the Problem

The success of learners over the years has been influenced by their ability to think about the core competence of learning to learn (Metacognition). However, teaching learners about their cognitive processes that help them to apply higher order-thinking concept is lowly accepted in the society. Learner-centered approaches such as the Metacognitive approach. IMPROVE Programme has been shown to improve learners motivation in other subjects. The metacognitive learning approach IMPROVE Programme is intended to give more insights for students on the needs of competency, autonomy and relatedness. Therefore, the present study sought to establish the effect of the Metacognitive Learning Approach (MLA) on students' motivation in mathematics in Kitui County.

II. LITERATURE REVIEW

A study that sought to establish the relationship between the constructs of intrinsic motivation and mathematics achievement was carried out in Portuguese secondary students by Maria, Monteirio and Peixoto (2012). The study had involved 869 boys and 850 girls as respondents. The instrument for data collection was intrinsic motivation inventory questionnaire. The results of the study revealed a positive association between student's motivation and attitude towards learning of mathematics. The results suggests that students possess positive feelings towards learning of mathematics. The researchers focused only on learners intrinsic motivation.

Tian et al. (2018) conducted a study on the effect of self-regulated learning on students' metacognitive knowledge in mathematics performance in China. A sample size of 569 students (245 males, 324 females) participated in the study. Both quantitative and qualitative data was obtained. The instrument used was divided into three sections. Section one contained items on metacognitive knowledge, section two had responses on self-efficacy and the section three covered items on academic motivation scale. The results of the study showed that self regulation predicted students metacognitive knowledge, self-efficacy and intrinsic motivation. Findings of Skaalvik et al. (2015) shows that students self-efficacy in mathematics learning do influence student's motivated actions such as efforts persistence and seeking for assistance when faced with difficulties.

A research study designed by Cruickshank et al. (2009) took place in Malang and Salama Districts in Malaysia. A total number of 400 secondary school students participated in the study. The results showed that majority of the students had low self motivation because when they were freely left to perform mathematical tasks with majority unable to complete the assignment. The students freedom enable them to be engaged in unnecessary behaviours rather than learning. Abdellah (2015) suggests that students should be controlled in order to prevent them from engaging an necessary behaviours. When students are motivated they tend to be engaged, persistent and such students have better performance outcome and perform better than other students in achievement test. The results revealed that motivation of learners is very crucial for learning. The results suggest that suitability of learning environment that is conducive learning is necessary for students to have meaningful learning. Such an environment can be supported by metacognitive learning approach IMPROVE programme.

Research work conducted by Mahasneh et al. (2014), in Jordan one of the Arabs Nation found out the low levels of motivation in academics as the major cause of failure of students. The study was carried in university of Jordan. The results showed that the academic achievement of students was low especially for the first year students. It was also established that these students were not using metacognitive strategies during the process of learning, such strategies like ability to listen carefully, making notes on what they hear and figuring out the right strategy to use were lacking. Teachers should adopt an appropriate instructional approach aimed at enabling learners to apply higher order thinking skills, and ability to perform mathematical tasks with confidence and develop internalized goals of their actions.

George (2012) in Uganda examined the extent of relationship between academic motivation, self- concept and academic achievement of students. The study adopted descriptive using correlational research design method. The participants of the

study were 311 secondary school students. The instrument of data collection was self-administered questionnaire. The study established among all the indicators of academic achievement such as mastery performance and social support had a significant negative relationship with academic motivation. The present study focused on teaching and learning approach and its relation on the various aspects of extrinsic motivation to learn mathematics.

Kasuni (2014) investigated the effect of human resource factors and motivation on students performance of mathematics in secondary schools in Kenya. The study was conducted in Public secondary schools in Makueni County, Kenya. The target population was 5505 students selected from 24 public secondary schools of Makueni County. The participants of the study was nine mathematics teachers, 552 students and nine head teachers. Questionnires and interview schedule were used as the instruments for data collection. The findings of the study showed most of the schools in Makueni County are well staffed with qualified and experienced teachers who had an experience of more than ten years. It was established that these teachers had low motivation since they had not taken in-service professional developments programmes to equip them with new skills. Motivated teachers are engaged in activities that create emotionally supportive environment and non-threatening learning environment conducive for learners. Research shows that teachers who are supportive, responsive and helpful to learners do enable learners to achieve more in mathematics (Ahmed et al. 2010). Therefore, teachers should carefully plan for the instructional approach to use in a classroom setting that has the potential of changing learners motivation. Such an approach proposed is the metacognitive learning approach.

The present study was based on self-determination theory (SDT) of Ryan and Deci (2017). The theory helped in the development of intervention program to a more autonomous student's motivation that consequently results to improved students confidence and academic achievement. The SDT was used in the study to understand student extrinsic motivation. The theory was applicable in the present study by showing that learner' autonomous extrinsic motivation leads to positive results among the students. The type of goals set by students do help them predict school outcomes. When learners' needs for competency, autonomy and relatedness were met, resulted to autonomous motivation. Metacognitive learning approach can result to greater extrinsic motivation and better adjustment outcomes.

III. RESEARCH METHODOLOGY

3.1 Research Design

The study adopted a quasi- experimental research design and in particular, Solomon's four non – equivalent control group designs suitable for pre-test and post-test studies (Shuttleworth, 2009). The Quasi-experimental chosen allows for the assessment of the causal effects of metacognitive teaching on students' post-learning achievements as well as on their motivation towards mathematics learning. The design is appropriate because once the students have been assigned classes in form one they remain intact groups and the school administration do not normally allow such classes to be split and regrouped for research purposes (Randolph, 2008). The approach enables the researcher to acquire the benefit of using pre-test while also allowing an assessment of pretest sensitization.

3.2 Sampling Procedure and Sample Size

The study sample was drawn from a population of all public secondary schools. The units of sampling were schools and not subjects. Stratified sampling was used to draw counties with desired characteristics. The desired characteristic was a low performance at KCSE in comparison to the National performance index. Through purposive sampling, one county was selected to participate in the study. Simple random sampling was then used to draw four boys-only and four girls-only schools. The desired characteristic was a school with more than forty-five students per stream, an approximate number of boys or girls per stream, and qualified mathematics teachers with experience of at least two years. Three hundred and sixty form three students in the sample schools participated in the study.

3. 3 Data Analysis

Data were analyzed using descriptive statistics mean ranks and inferential statistics (Mann-Whitney U test, Kruskal Wallis test, Post HOC analysis).

IV. RESULTS AND DISCUSSION

4.0.1 AMS Pre-test Mean Ranks and Mann-Whitney U Test on Experimental Group E1 and Control Group C1

The Mann-whitney test was used to understand whether the two groups contained learners with similar characteristics before administration of posttest AMS questionnaire. It was assumed that the distributions of the two independent variables do not have similar shape. Therefore, it was possible to compare test results on mean ranks of students' responses on a five-point Likert scale. To analyze the homogeneity of group E1 and C1, Mann-Whitney U test was run for the pre-test scores. The results were summarized in Table 1.

Table 1: Mann-Whitney Test of the Pre-Test of Academic Motivation on Experimental Group E1 and Control Group C1

Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	P-Value
E1	92	96.47	8875.00	4050.500	8515.500	0.746	0.455
C1	94	90.59	8515.50				
Total	186						

Table 1 results shows the mean rank of Experimental group E1 was 96.47, which was almost as same as that of Control group C1 that was 90.59. From the information in Table 1, the obtained value of (U=4050.0, p= 0.455) shows that the mean ranks of AMS pre-test were not statistically significant at alpha 0.05. The two groups contained students with comparable characteristics and therefore were suitable for the study.

4.0.2 AMS Post- test Mean Ranks and Mann-Whitney U Test on Experimental Group E1 and Control Group C1

To analyze whether students differed in the level of motivation when taught using metacognitive learning approach and conventional teaching approach, Mann-Whitney U test was run. Mann-Whitney U test was run between the experimental group E1 and control group (C1). AMS posttest scores and the posttest results were compared to the pre-test results. The results are presented in Table 2.

Table 2: Mann-Whitney Test of the Post- test of Academic Motivation on Experimental group E1 and Control group C1

Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	P-Value
E1	92	111.22	10232.00	2694.000	7159.000	4.444	0.000
C1	94	76.16	7159.00				
Total	186						

The Mann- Whitney U test results analysis Post- test mean ranks of AMS in Table 2 indicate that the mean rank of Experimental group E1 (111.22) was much more than that of Control group C1 (76.16). The Mann-Whitney U test value obtained was (U=2694.0, P=0.000). The obtained p- value was less than 0.05. This means that Experimental Post- test results in Table 2 reveals that students in the experimental group E1 were highly motivated to learn mathematics than their counterparts in Control group C1. This indicates that there is a statistically significant difference in the level of motivation to learn Mathematics between students exposed to the Metacognitive learning approach and those taught mathematics using the Conventional teaching approach.

4.0.3 AMS Post- test Mean Ranks and Mann-Whitney U Test on Experimental Group E2 and Control Group 2

To check for mean rank differences between experimental group E2 and control group C2 analysis of post- test was done using the Mann-Whitney U test. The findings are summarized in Table 3

Table 3: Mann-Whitney Test of the Post- test of Academic Motivation on Experimental group E2 and Control group C2

Group	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	P-Value
E2	85	101.34	8614.00	2606.000	6611.500	3.545	0.000
C2	89	74.28	6611.00				
Total	174						

Results in Table 3 indicate that the mean rank of Experimental group E2 was 101.34, which was much higher than that of Control, group C2 that was 74.28. This means that Experimental group E2 had a higher level of motivation than Control group C2. The Mann- Whitney U test result was found as (U=2606.0, p=0.000). A P-value of 0.000 is less than 0.005. The results reveals a statistical significant difference in the level of motivation to learn mathematics between students exposed to the Metacognitive learning approach and those exposed to conventional teaching approach.

4.0.4 Comparisons of Students Posttest AMS Scores for Experimental groups and Control groups

Further analysis using Kruskal- Wallis test was done in the four groups to check whether there is statistical significant difference between groups of an independent variable. The results of Post- tests AMS are presented in Table 4:

Table 4: Independent-Samples Kruskal-Wallis Test Summary of Post- test AMS for the Four Groups

Total N	Kruskal-Wallis H	Df	P-value
360	37.057	3	0.000

The results of the Kruskal-Wallis test indicate an H (3) =37.057, p=0.000 for motivation regarding motivation towards learning mathematics. The p-value obtained was less than 0.05 indicating a statistical significant difference in the level of motivation to learn mathematics. The null hypothesis that stated there is no statistically significant difference between students exposed to the Metacognitive learning approach and those exposed to the Conventional teaching approach on the level of motivation to learn mathematics was therefore rejected. Therefore, there is a statistical significant difference in motivation levels between students exposed to the Metacognitive learning approach and those exposed to the Conventional teaching approach.

The findings of the study are in harmony with the findings of another study by Founche and Lamport (2011). Founche and Lamport established that when learners are intrinsically motivated they actively accomplish tasks out of their preference in doing with or without any external returns .The findings of the study are inconsistent with the findings of Hofferber et al. (2016) who found that extrinsic motivation disappears when a reward has is achieved. In a study by Anderson (2012) established that students who are metacognitively aware are both intrinsically and extrinsically motivated. Such learners engage in reflecting upon their learning and they make conscious decisions about what they can do to solve mathematical problems. To establish which group this difference exists can best be observed by a Post hoc test analysis. Post-hoc tests using Bonferroni adjusted alpha levels were used to compare all pairs of groups the post hoc results are presented in Table 5.

Table 5: Pairwise Comparisons of Groups

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
C2- C1	17.770	15.338	1.155	.248	1.000
C2- E2	56.516	15.771	3.583	.000	.002
C2- E1	85.292	15.461	5.516	.000	.000
C1- E2	38.746	15.565	-2.5489	.0113	.047
C1-E1	67.522	15.251	4.427	.000	.000
E 2- E1	28.776	15.645	1.839	.066	.395

Each row tests assess the differences against the mean ranks in order to determine whether the Sample 1 and Sample 2 distributions are drawn from the same population.Table 5 shows the asymptotic significances (2-sided tests) at significance level is 0.05. Significance values obtained were adjusted using Bonferroni correction for multiple tests. Significant differences emerged for the individual intervention group on the students' academic motivation questionnaire. Significant difference was found between E1 and C1, E2 and C2. However, the insignificant differences exist between experimental or control groups that is (E1 and E2; C1 and C2). The results shows that the level of motivation to learn mathematics increased when students were allowed to learn through metacognitive learning approach.

The results obtained from the study indicate that students taught using MLA were motivated to learn mathematics than those taught using CTA. It can be argued that MLA enhances students' motivation to learn mathematics. The present study findings are in agreement with researchers that extrinsic motivation emphasizes the role played by external rewards, immediate positive feedback after the accomplishment of the task, and appreciation of the learners after performing well in a task. Harris (2010) found out that extrinsically motivated learner will put more effort to engage in a learning activity as a means to an end Classmates' perceptions and practices also influence the motivation of students (Hanus & Fox, 2015). Ayub (2010) confirms that individuals perceive behavior caused by forces outside their control and thus stop participating in learning activities. Through metacognitive learning approach, learners are motivated to improve their skills in learning. With metacognitive strategies, a learners is able to discover what they have already learned and still needs to learn.

The metacognitive learning approach enables learners to actively get involved in learning by participating in metacognitive activities. When teachers become less committed, the level of self-efficacy decreases, and students tend to switch to surface learning Guvendir (2016). Research work by Onyambu (2019) shows when students are motivated to learn more, teachers get motivated because good performance would result to recognition, potential for professional growth. This has a direct impact on students' achievement since such teachers can direct their effort to assist the students.

The present study findings are in line with other studies conducted by Afzal et al. (2016); Peklaj & Levpuscent, (2006) who found out that intrinsic and extrinsic motivation is positively correlated to academic motivation. The findings are also in agreement with another study by Cerasoli et al. (2014);

De Pasque and Tricomi (2015) who found out that intrinsically motivated individual develops a true interest in learning. In a similar study conducted by Lee et al. (2010) and Lee et al. (2012) found a strong correlation between intrinsic motivation and academic motivation. Metacognition is conceptualized as being aware and understanding of ones thinking. Unfortunately, many students often do not have this awareness and so struggle to recognize and correct any specific difficulties they encounter. A motivated individual has to pay attention to tasks and has to change ways of thinking to increase his or her self-efficacy. Student self-efficacy is important because it enables ones to put more effort in learning which ultimately results to a better outcome. The present study established metacognitive learning approach enhanced students' self-efficacy resulting to improved achievement in mathematics.

The present study established that students in treatment groups were able to reflect upon their learning and were able to correct mistakes made during solving a mathematical problems. These results are consistent with the results of Anderson (2012) who established that when learners become independent thinkers they make conscious decisions on ways of improving their performance by reflecting upon their process of learning. The findings of the study are in harmony with findings of another study by Smith (2017) who established that the level of motivation enables the learners either to be committed in learning and engage them in higher order thinking, become interested in learning and develop positive attitude during instructions by the teacher.

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The null hypothesis stated that there is no statistically significant difference in students' motivation to learn mathematics between students taught through the metacognitive learning approach and those taught through conventional teaching approach. From the non-parametric test results, Mann –Whitney results showed there were statistical significant difference in the level of motivation to learn mathematics between students taught using MLA and those taught through conventional teaching approach. The hypothesis was rejected at a 0.05 level of significance. The findings of the study indicate that students taught using MLA had a higher level of extrinsic motivation to learn mathematics than those taught using conventional teaching approach. The results of the study suggests that metacognition help students to develop self confidence, self autonomy and relatedness in learning. When an appropriate learning approach that enable learners to reflect on what they are learning is used, students' performance changes positively as well.

The findings indicated that students Metacognitive knowledge enhances motivation to learn Mathematics. Motivated learners plan for the task, think about the task and carefully undertake the task within the shortest period. Metacognitive Learning Approach is an appropriate tool that allows learners to be aware of their thinking process that results changes in their learning behavior.

5.2 Recommendations

The study established that metacognitive learning approach improves Students' motivation to learn mathematics in the topic formulae and variation. This learning approach has proved that when it is used in a classroom situation it makes the learners improve the understanding of the concepts in mathematics through metacognition and hence promote meaningful learning. Teachers should emphasize the importance of student choice and decisions in improving students' engagement and motivation on what students learn, how they learn, and what they know can make them develop confidence to express themselves individually. Teachers should acquire the understanding of enhancing students understanding of metacognitive knowledge by creating an enabling flexible environment for metacognitive learning.

REFERENCES

[1] Abdellah, R. (2015). Metacognitive awareness and its relation to the academic achievement and teaching performance of pre-service female teachersin Ajman University in UAE. Procardia – Social and Behavioural Sciencies 174 (2015), 560- 567.

[2] Afzal, H.; Ali, I.; Khan, M. A., & Hamid, K. (2010). A study of university students' motivation and its relationship with their academic performance. International Journal of Business and Management, 5(4), 80-89

[3] Ahmed, I., Nawaz, M., & Ahmad, Z (2010). Does quality affect students performance? Evidence from institute of Higher Learning. Journal of Business Management, 4, 2527 – 2533.

[4] Amrai, K., Motlagh, E., Azizi, S., & Parhoon, H. (2011). The Relationship between Academic Motivation and Academic Achievement Students. Procedia Social and Behavioral Sciences, 15: 399 – 402.

[5] Anderson, N. (2012). The Role Metacognition in Second/Foreign Language Teaching and Learning. Eric Digest. Psychology for Language Learning. Insights from Research, Theory, and Practice. 169- 187.

[6] Ayub, N. (2010). Effect of intrinsic and extrinsic motivation on academic performance. Journal of Education and Social Sciences Pakistan Business Review, 8, 363–372.

[7] Cerasoli, C., Nicklin, J., & Ford, M. (2014). Intrinsic Motivation and Extrinsic Incentives Jointly Predict Performance. A 40-year Meta- analysis. Psychological Buletin 140 (4), 980.

[8] Cruickshank, D., Jenkins, D., & Metcalf, K. (2009). The act of teaching (5th Ed). Boston:

[9] D' Martino, P., & Zan, R. (2010). Me and Maths'' Towards a Definition of Attitude Grounded on Students Narrratives. Journal of Mathematics Teacher Education 13 (1), 27 – 48.

[10] DePasque, S., & Tricomi. E. (2015). Effects of Intrinsic Motivation on Feedback Processing during Learning. Neuroimaging, 119, 175- 182.

[11] Founch, J., & Lamport, M. (2011). Do Metacognitive Strategies Improve Students Achievement in Secondary Science Classroom? Christian Perspective in Education, 4 (2)

[12] George, O. (2012). Academic motivation, self-concept and academic achievement in English and Mathematics at O level (Unpublished master's thesis). Makerere University, Kampala, Uganda.

[13] Hanin, V. & Nieuwenhoven, C . (2020). An Exploration of the Cognitive, Motivational, Emotional and Regulatory Behaviours of Elementary – School Novice and Expert Problem Solvers.

Canadian Journal of Science, Mathematics and Technology Education, 1- 30.
[14] Harris, A. (2010). Leading Systems Transformation. Journal of Social Leadership and Management. 30 (3), 197 – 207.
[15] Hofferber, N., Basten, M., GroBmann, N., & Wilde, M., (2016). The Effects of Autonomy Supportive and Controlling Teaching Behaviour in Biology Lessons with Primary and Secondary Experiences on Students' Intrinsic Motivation and Flow Experience. International. Journal. Science. Education. 38 (13), 2114- 2132.
[16] Hunus, M. & Fox, J., (2015). Assessing The Effects of Gamification in the Classroom; A Longitudinal Study on Intrinsic Motivation, Social Comparison, Satisfaction, Effort, and Academic Performance. Compute and Educ. 80, 152- 161.
[17] Kasuni, J. (2014). Human Resource Factors Affecting the Performance of Mathematics in Secondary School Students in Kenya.A case of Mbitini, Division, Makueni County, Kenya.
[18] Lee, H., Lim, K., & Grabowski, B. (2010). Improving Self-Regulation, Learning Strategy use, and Achievement with Metacognitive Feedback. Educational Technology Research and Development, 58(6), 629–648.
[19] Lee, N., Dekher, H., Krabbendam, L., & Boschloo, A. (2012). Academic Motivation Mediates the Influence of Temporal Discounting on Academic Achievement During Adolescence.Trends in Neuroscience and Education. 1(1), 43- 48.
[20] Maftoon, P., & Fakhr-Alamdari, E. (2016). Exploring the Effects of Metacognitive Strategy Instruction on Metacognitive Awareness and Listening Performance through a process-based approach. International Journal of Listening, 1 – 20.
[21] Mahasneh, A., Al-Zou'bi, Z., Mahasneh, A., Batayneh, O.& Al-Zou'bi A. (2014). Reasons for low GPA of the Hashemite University student's from the perspective of students, 10(3).74-101.
[22] Maria, M., Monteirio, V., & Peixoto, F. (2012). Attitudes Towards Mathematics. Effects of Individual, Motivational and Social Support Factors. Child Development Research. Retrieved https://doi.org/101155/2012/876028.
[23] Onyambu, C. (2019). Analysis of the effects of teacher motivation on KCSE performance. A case of Masimba Division, Masaba South District, Kenya. MED Thesis, Kenyatta University.
[24] Ozcan, & Gumus, A. (2019). A modeling study to explain mathematical problem-solving performance through metacognition, self-efficacy, motivation, and anxiety. Australian Journal of Education, 63(1), 116-134.
[25] Peklaj, C., & Levpušček, M. (2006). Student motivation and academic success in relation to the quality of individual and collaborative work during a course in educational psychology. Annual 31 the ATEE conference Association of Teacher Education in Europe, University of Ljubljana.
[26] Penkrun, R., Hall, N., Goetz, T., & Perry, R. (2017). Boredom and Academic Achievement: Testing a model of Reciprocal Causation. Journal.of Education. Psychology. 106, 696- 710.
[27] Radmehr, F., & Drake, M. (2020). Exploring Students' Metacognitive Knowledge: The Case of Integral Calculus. Education Sciences, 10(3), 55.
[28] Randolph, J. (2008). Multidisciplinary Methods in Educational Technology Research and Development. Julkaisuja. Hameenlina, Finland.
[29] Ryan, R., & Deci, E. (2017). Self Determination Theory. Basic Psychological Needs in Motivation, Development and Welfare. The needs in Motivation. Retrieved https://doi.org/10.1521/978
[30] Shuttleworth, M. (2009). Solomon four-group design. Retrieved on 11th march 2015 from http://www.experiment_resources.com/solomon-Four group-design.htm.
[31] Skaalvik, E., Federici, R & Klassen, R (2015). Mathematics achievement and self-efficacy: Relations with motivation for mathematics International Journal of Educational Research 72. 129-136
[32] Smith, V. (2017). Encouraging Students Autonomy through Higher Order Thinking Skills. Grand Canyon University.
[33] Taylor, B., Pearson, P., Peterson, D., & Rodriguez, M. (2000). Looking Inside Classroom. Reflecting on the "How" as well as the "What" in the Effective Reading Instruction. The Reading Teacher. 56 (3), 270- 279.
[34] Tian, Y., Fang, Y., & Jian, L. (2018). The Effects of Metacognitive Knowledge on Mathematics Performance in Self – regulated Learning Framework Multiple Mediation of Self – efficacy and Motivation, University of Houston, United States.
[35] UNESCO (2016). Global Education Monitoring Report Gender Review.
[36] Voi, V., Li,, R., Kornell, N., Pouget, A., & Cantlon, J. (2014). Young Children bet on their Numerical Skills. Metacognition in the Numerical Domain Psychological Science, 25 (9), 1712-1721.
[37] Woolfolk, A. (2008). Educational Psychology. Boston, MA: Allyn and Bacon.