Jurnal Pendidikan Matematika (Kudus)
P-ISSN 2615-3939 | E-ISSN 2723-1186
https://journal.iainkudus.ac.id/index.php/jmtk
DOI: -
Volume 5, Number 1, June 2022, pp. 1-16

The Relationship between Critical Thinking Skills and Quantitative Reasoning among Junior Secondary School Students in Nigeria

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Abstract

Evidence suggests scarcity of investigations on the relationship between critical thinking (CT) and students' achievement in quantitative reasoning (QR) in Nigeria. This correlational study adopted a quantitative model to investigate critical thinking skills as correlates of achievement in quantitative reasoning among 1500 junior secondary school students in Lagos State, Nigeria. The study involved three research questions and two valid and reliable instruments {California Critical Thinking Skills Test-Form B (CCTST with KR-20=0.88 and the Quantitative Reasoning Achievement Test (QRAT with KR-20=0.92)} were used for data collection. Data collected were analysed by deploying the statistics of mean, standard deviation, Pearson product-moment correlation coefficient, and multiple regression analysis at 5% level of significance. The outcome of the study showed a prevalent shortfall of quantitative reasoning among the junior secondary school students in Lagos State. Results showed statistically weighty associations amid critical thinking and its gauges (analysis, deductive reasoning, inductive reasoning, evaluation, and inference) with students' quantitative reasoning achievement. In addition, the five gauges or indicators were weighty forecasters of quantitative reasoning achievement among the junior secondary school students. Based on the outcomes of this study, it was recommended that mathematics teachers should abstain from deploying teacher-centered pedagogies that are hostile to students' comprehension of mathematical concepts and critical thinking. In conclusion, mathematics teachers should endeavour to integrate everyday life experience of the students into the mathematics taught in the classroom to enable purposeful utilization of mathematics.

Keywords: Achievement; Critical Thinking; Junior Secondary School; Quantitative Reasoning

Abstrak

Bukti menunjukkan kelangkaan penyelidikan tentang hubungan antara berpikir kritis (CT) dan prestasi siswa dalam penalaran kuantitatif (QR) di Nigeria. Studi korelasional ini mengadopsi model kuantitatif untuk menyelidiki keterampilan

berpikir kritis sebagai korelasi prestasi dalam penalaran kuantitatif di antara 1500 siswa sekolah menengah pertama di Lagos State, Nigeria. Penelitian ini melibatkan tiga pertanyaan penelitian dan dua instrumen yang valid dan reliabel {California Critical Thinking Skills Test-Form B (CCTST dengan KR-20=0.88 dan Quantitative Reasoning Achievement Test (QRAT dengan KR-20=0.92)} digunakan untuk pengumpulan data Data yang terkumpul dianalisis dengan menggunakan statistik mean, standar deviasi, koefisien korelasi product-moment Pearson, dan analisis regresi berganda pada tingkat signifikansi 5%.Hasil penelitian menunjukkan kekurangan penalaran kuantitatif yang lazim di antara sekolah menengah pertama siswa di Negara Bagian Lagos Hasil menunjukkan asosiasi yang berbobot secara statistik di antara berpikir kritis dan pengukurnya (analisis, penalaran deduktif, penalaran induktif, evaluasi, dan inferensi) dengan pencapaian penalaran kuantitatif siswa. prestasi penalaran siswa SMP Berdasarkan hasil penelitian ini, Direkomendasikan bahwa guru matematika harus menjauhkan diri dari menyebarkan pedagogi yang berpusat pada guru yang memusuhi pemahaman siswa tentang konsep matematika dan pemikiran kritis. Kesimpulannya, guru matematika harus berusaha untuk mengintegrasikan pengalaman hidup sehari-hari siswa ke dalam matematika yang diajarkan di kelas untuk memungkinkan pemanfaatan matematika yang bertujuan.

Kata Kunci: Berpikir Kritis; Penalaran Kuantitatif; Pencapaian; Sekolah Menengah Pertama

Introduction

Universally, critical thinking (CT) is a generic skill viewed as an indispensable logical path for knowledge augmentation and utilization. CT skill is an essential implement for solving problem and resolving naughty issues in all human context. Consequently, it is beneficial that CT skills be cultured in educational settings for learners to gain expertise in them. Conventionally, not all learners can think critically thus making the retooling and development of critical thinking an indispensable didactic matter. In this context, CT is described as the logical, purposeful and fair investigation of truths and proof to make a ruling proficient at reducing primeval self-centeredness. As a precious product of any schooling programme, CT skill is projected to be integrated into the pedagogical process with instructors providing empowering approaches proficient at increasing its practical utilization by all learners. CT includes the achievement of investigation, cognitive strengthening, analysis, inference, conception, simplification, and appraisal (Cottrell, 2005; McGregor, 2007; Okunuga, Awofala & Osarenren, 2020). CT integrates the capability to form enquiries and questions, enunciates them vibrantly and correctly, accumulates and appraises vital evidence, exploits abstract ideas to interpret them commendably to accomplish flawless results and responses. It also comprises trying accessible proofs together with useful, dispassionate ethics and integrity in the system of fringe judgment, distinguishing and mediating their necessities, potentials, extrapolations, and proactive ingresses, and cooperating

fruitfully with others to track purposes for the complex problems (Paul & Elder, 2009).

Facione (1990) described CT as possessing both mental and emotional features. The mental feature of CT includes (1) understanding, (2) scrutiny, (3) assessment, (4) inference, and (5) self-regulation whereas the emotional or attitudinal feature of CT includes (1) proof-hunting, (2) inquisitiveness, (3) transparency, (4) scrutiny, (5) honesty, (6) methodical, and (7) self-assured. Consequently, the mental CT is regarded as an intensive, self-regulatory judgment that synthesizes elucidation, enquiry, assessment, and analysis of the evidentiary, hypothetical, ritual, conditional replications on which that judgement is beached (Facione, 1990). Critical thinking is significant as a tool of investigation, a liberating vitality in schooling, a powerful foundation in a person's idiosyncratic and public life, and a pervasive and individual-adjusting social consciousness.

A classical critical thinker according to Facione (1990) is regularly intrusive, well-informed of incidence, determined, approachable, pliable, unemotional in the assessment, candid in incrustation of idiosyncratic predetermined idea, sensible in synthesizing outcomes, and open to appraisal. More so, a classical critical thinker is immaculate about apprehensions, ordered in complex problems, meticulous in following relevant info, unbiassed in the assortment of standards, engrossed in enquiry, and persistent in chasing results which are as straightforward as the matter and the circumstances of investigation warrant (Facione, 1990). A critical thinker can be said to possess an internal locus of control based on their diligence and hard-work (Awofala, Awofala, Fatade, & Nneji, 2012) Generally, the teaching of earnest critical thinkers should note these qualities and fostering in them those dispositions that reliably yield useful insights that make a rational and democratic culture (Facione, Giancarlo, Facione, & Gainen, 1995). Nevertheless, a key worry of educationalists has been what education practices can be positioned to nurture the augmentation of CT skills in learners? This enquiry has elevated the confidence of educationalists in accelerating students' CT capabilities while bearing in mind the prospect of imbuing CT into an array of school programmes. At higher education pedestal, CT is presented either distinctly as a subject or as implanted in other educational courses so that academics can synthesis courses that are cognitive-skills-reliant (Noor, 2019; Ardiansyah, 2020).

Unfortunately, there is a scarcity of investigation concerning the efficacy of CT education in improving learners' educational outcome. Consequently, this is a motivation for relentless examination regarding the application of significant CT interventions linking resourceful educational forecasts to allow dynamic teachers to develop their learners' outcomes. A strong CT education that develops and nurtures

learners' understanding, capacities, and dispositions can grow learners' didactic achievement while advancing those competences obligatory for communication and expertise in the workplace. Globally, conventional pedagogy has proved abortive in nurturing in learners the intellectual capacities needed for personal and didactic success (Okunuga, Awofala & Osarenren, 2020; Awofala & Lawani, 2020).

Regularly, learners are imparted to engross in committal to memory of information via rote learning deprived of being trained on how to synthesise or query matters, and this has made them unskilled at making decisions and attacking complex life challenges (Awofala & Lawani, 2020). Substantiating this Sternberg (2003) upheld that globally, institutions of learning frequently engage learners in rote memorization, which needs ability to remember and duplication while CT requires skillful investigation, assessment, and illumination.

Generally, every person requires a strong knowledge base and this accumulation of info must be valuable for existence and educators must attempt to impart practical knowledge, which will produce students that are healthier citizens. In short, learners at the pre-tertiary level are taught only the elementary realm of remember, understand, and apply while the higher realm of evaluate, create and analyse are hardly imparted and this produces learners who are tremendously susceptible to the permit of rational misunderstandings. The reluctance to teach higher-order skills at pre-tertiary levels has made the growth of CT a tale thus making learners to act on their prejudices and doubts relatively than on coherent judgement. Positioning critical thinking in a course milieu may be a flawless way of learning and teaching it. However, quantitative reasoning (QR) is regarded as a course that requires critical thinking (Elrod & Park, 2020).

Quantitative reasoning is the functional use of basic numerical skills to the investigation and illumination of hands-on mathematical info in a subject to draw inferences that are applicable to the commonplace life involvement of the learners. QR is the ritual of an intellectual to ponder on the authority and limitations of numerical validation in the evaluation, formation, and declaration of intents in public, professional, and personal life. Prior to 2008 in Nigeria, QR was taught as a standalone course at the pre-secondary schools. The reformation and revising of the old primary and junior secondary schools' mathematics curricula into the new nine years basic education mathematics curriculum prompted the integration of QR into it. Therefore, beginning from 2008 till now in Nigeria quantitative reasoning is taught as an integrated course with mathematics at the pre-tertiary level. The 9-year basic education mathematics curriculum according to Awofala (2017) is required to make learners proficient in the mathematical skills obligatory to the promotion and nurturing of the capacities crucial to the changeable society.

One expectation of the integration of quantitative reasoning into junior secondary mathematics curriculum is that learning mathematics at that level would be made applied and tangible. Consequently, tutors are anticipated to enact student-centred, enthralling, practical and mental-building instructions to congeal and boost learners' knowledge of quantitative reasoning. Comprehensive education in QR in specific and mathematics, in overall (Allen, 2011), will arouse and cultivate in a learner independence, aptitudes, and fairness obligatory for equality and democracy to reign. The instruction in QR is expected to deliver a basic obligation and understanding of dynamic avenues that mathematical and statistical information are used in problem-solving situations. Consequently, QR offers five straightforward purposes of literateness; genuineness; pertinency; comprehension; and pragmatism. QR is comparable to a generation livelihood, as functioning QR is required for educational achievement as people and personal accomplishment. Individuals with strong QR embrace the aptitude to ponder and decode mathematical problems from an extensive choice of open circumstances and repetitive life situations. They understand and can synthesize elegant ideas strengthened by mathematical resilience (Awofala, 2021) and they can communicate those ideas in a variety of designs via graphs, mathematical calculations, words, and charts as appropriate.

Succinctly, QR is not only effective in communication, but that skill in conveying mathematical ideas allows people to infer and assess opinions and methodically judge evidence. Therefore, QR is interpreted as an expressed gauging review for applying mathematical expertise to solving problems that go outside the meagre attainment and recollection of honest info across various scenes. Quantitative reasoning according to Elrod (2014) is a powerful instrument for discerning unconventionally, evaluating and synthesizing sensible purposes, and enquiring and insistently challenging the established order. As QR only requires continuous exercise by people, the aptitude to ponder and exploit QR turns it into a routine of cognitions (Madison & Deville, 2014) with citadel of learning launching comprehensive programmes envisioned to accommodate the formation and practice of discerning and employing quantitative reasoning expertise (Madison & Deville, 2014). These programmes will not fail only if the training of candidates from the pre-tertiary levels is soundly conceived and implemented.

Evidence suggests (VanderMolen, 2016) that QR is perceived as a difficult aspect of mathematics and inadequate preparation in CT is regarded as the bane of learners' poor performance in QR (Awofala & Anyikwa, 2014). Several learners are lacking in the QR skills (Ancker & Abramson, 2012) needed for personal and job success with marginal learners displaying severe shortfall. This appallingly meagre

attainment of learners in QR is a major source of mathematics anxiety (Awofala, 2019; Awofala & Akinoso, 2017) amongst the Nigerian public with low QR looking serious in forecasting the slighter probability of being gainfully employed (Rivera-Batiz, 1992; Sopekan & Awofala, 2019). In essence, this anxiety inducing innumeracy is ubiquitous amongst refined and influential people with college graduates displaying deficiency in QR needed to habituate efficaciously in this high-tech-opulent numerical world. Quantitative reasoning is functional teaching of mathematics in context and very few citizens will hesitate that the sacramental teaching of mathematics out of context has plummeted with numerous college graduates displaying neither the QR resilience nor the mathematical proficiency required to function effectively in the current era of numerically linked society.

The existing works have exposed inconsistent outcomes regarding the relationship amid critical thinking and educational performance in which some researchers have revealed very robust association (Okunuga, Awofala & Osarenren, 2020; Ali & Awan, 2021; Kanbay, Işik, Aslan, Tektaş, & Kiliç, 2017; Kanwal, & Butt, 2021; Musa, 2020; Pozhhan, Goodarzi, & Roozbehani, 2019; Shirazi, & Heidari, 2019; Vierra, 2014; Ross, Leoffler, Schipper, Vandermeer, & Allan, 2013; Ghanizadeh, 2017) while other researchers have found no relationship (Doleck, Bazalais, Lemay, Saxena, & Basnet, 2017; Bakhshi & Ahanchian, 2013). In the context of Nigeria, there is a proof of little research done regarding the association amid scholastic performance and CT (Okunuga, Awofala & Osarenren, 2020; Chukwuyenum, 2013) notwithstanding the importance of CT in learners' performance in any course. The unreliable investigational interpretation and the lack of studies in Nigeria regarding the relationship betlifeween CT and educational outcome obliged and strengthened further investigation. Henceforth, this research examined the relationship amid QR achievement and pre-tertiary learners' CT skills. Objectively, this study would be significant as it would help in (1) determining the junior secondary school students' level of QR; (2) examining the association amid CT skills and achievement in QR, and (3) exploring the influence of CT skills in predicting achievement in QR. Corroborating the objectives of the study, three research questions were stated to include (1) What is junior secondary school students' level of QR? (2) What is the association amid CT skills and achievement in QR? (3) What is the influence of CT skills to the prediction of achievement in QR?.

Method

Research Design

This investigation was carried out using a descriptive survey of a correlational research design. The design affords the researchers the opportunity to evaluate two variables of interest, understand and assess the numerical relationship amid them and foreclosing unwarranted intrusion from any redundant inconstant. With this the researchers were able to explore the relationship amid QR achievement and junior secondary school students' CT skills.

Participants

This study took place in Lagos State, Nigeria and there are six education districts in the state and simple random sampling technique was used to pick education district III for the study. The education district III consisted of four zones which include: Lagos Island, Eti-Osa, Epe, and Ibeju-Lekki. Overall, there are 132 public junior secondary schools in Education District III and Epe zone was randomly selected. This zone contained twenty public junior secondary schools out of which 15 were randomly selected and the sample comprised 1500 junior secondary school year three students with the ratio of males to females being 1:1 in which 48% were Muslims and 52% were Christians. The sample age oscillated amid 12 and 15 years (Mean= 14yrs 3 mths, SD=1 year 2 mths).

Instruments

Two evaluative tools were deployed for the collection of data and they included: California Critical Thinking Skill Test (CCTST) adopted from Facione and Facione (1993) and Quantitative Reasoning Achievement Test (QRAT) developed by the researchers.

California Critical Thinking Skills Test (CCTST-B)

The assessing instrument implemented to compute the critical thinking skills of the learners was a routine test, termed California Critical Thinking Skills Test (CCTST). This instrument is a reliable, norm-referenced assessment that tests CT skills in honest problem-solving settings. Two versions of the CCTST are available but the Form B which contained 34 multiple choice items was adopted for the study and the following five skills were assessed: evaluation, deductive reasoning, inference, analysis, and inductive reasoning. The CCTST recognizes general school level knowledge and has a total score of 34. The questions vacillated from a simple

examination of the meaning of rulings to highly complex unification of CT skills. Higher scores on CCTST denote strong CT skills and can be completed within 45 minutes when administered. Prior works had confirmed the dependability and soundness of the CCTST (Aghajani & Gholamrezapour, 2019; Facione & Facione, 1997; Abbasi & Izadpanah, 2018). The present study used the Kuder-Richardson 20 to compute the reliabilities of the CCTST and its indicators and the following values were recorded: Inductive Reasoning, α=0.92; Deductive Reasoning, α=0.88, Analysis, α=0.84; Inference, α=0.86; Evaluation, α= 0.86, and CT, α=0.88 and these values were adjudged satisfactory.

Quantitative Reasoning Achievement Test (QRAT)

The QRAT was developed using a table of specification and it contained 40 items with options A to D culled from the new general mathematics textbook used for grade nine students. The items covered everyday statistics, number and numeration, algebraic processes and geometry and mensuration cutting across the higher realm of analysis, synthesis and evaluation. Item analysis (Akinsola & Awofala, 2009) was carried out and it was adjudged okay for the study. Kuder-Richardson 20 was deployed for the computation of the reliability coefficient of the QRAT and a value of 0.92 was computed. The overall time for completing the QRAT was one hour.

Procedure for Data Collection

15 research helpers and the researchers were involved in the administration of the QRAT and CCTST to target respondents in habitually planned lessons in the entire selected junior secondary schools.

Data Analysis

The collected data were coded on the SPSS version 24 and the research questions were answered using the mean, standard deviation, Pearson product-moment correlation and multiple regression analysis. All statistical tests were carried out at 5% level of significance.

Results

Research question one: what is the level of QR amongst junior secondary school students?

The maximum and minimum points achievable on the QRAT are 40 and 0, and a score of 20 lies in the middle. Consequently, scores below 20 stipulate a low

level of quantitative reasoning. In this study no student scored above 20 and none recorded a score that equaled 20. All the students recorded scores lower than 20 (M=15.21, SD=1.50, Minimum score=8, Maximum score= 18). This signifies low level of QR among the junior secondary school students in the study.

Research question two: what is the association amid junior secondary school students' CT skills and achievement in QR?

Table 1 unveiled the outcomes of the associations amid the CT and its subscales and QR achievement. As contained in Table 1 there were momentous positive association between QR achievement and analysis, evaluation, inference, deductive reasoning, inductive reasoning and total CT skills. The not too robust associations amongst the CT factors as exposed in Table 1 were predicted because they symbolize not the same expertise.

Table 1. Correlation Amid CT Factors and QR Achievement

	1	2	3	4	5	6	7
1. Achievement in QR	1						
2. Analysis	.436*	1					
3. Evaluation	.528*	.355*	1				
4. Inference	.181*	.247*	.433*	1			
5. Deductive Reasoning	.169*	.286*	.451*	.249*	1		
6. Inductive Reasoning	.202*	.193*	.326*	.314*	.182*	1	
7. Critical Thinking	.260*	.580*	.805*	.686*	.692*	.592*	1
Mean	15.21	3.83	3.53	3.86	3.58	3.64	15.45
SD	1.50	0.76	0.71	0.64	0.72	0.47	1.86
N	1500	1500	1500	1500	1500	1500	1500

*Relationship is momentous at the .01 level (2-tailed).

Research question three: what is the contribution of CT skills to the prediction of achievement in QR among junior secondary school students?

In Table 2 below, the R-value indicates the simple correlation and is 0.710, which suggests a high degree of association. Accordingly, the R^2 value represents how much of the total variance in the outcome variable (achievement in QR) could be explicated mutually by the CT factors. Afterward, 50.3% was explicated and this is regarded as middling and momentous at 5% level of significance. Table 2 displayed the relative influence of the predictors in forecasting the dependent factor. Consequently, evaluation was the greatest and strongest significant predictor of students' QR achievement. This was trailed by analysis that absolutely forecasted QR achievement. This was strictly shadowed by inductive reasoning that absolutely

predicted QR achievement. The inference showed the next constructive and expressive influence to the elucidation of alteration in QR achievement. Lastly, deductive reasoning showed the smallest momentous constructive forecast of QR achievement. The regression equation is illustrated by Quantitative reasoning$_{predicted}$=15.13 + .901 analysis + .548 inference +1.428 evaluation + .649 inductive reasoning + .412 deductive reasoning.

Table 2. Model Summary, Coefficient And T-Value of Multiple Regression Analysis of Critical Thinking Dimensions and Achievement in Quantitative Reasoning

Model	Unstandardized Coeff		Standardized Coeff.	t	Sig
	B	Std Error	Beta		
Constant	15.13	.207		68.312	.000
Analysis	.901	.057	.312	15.968	.000
Evaluation	1.428	.053	.664	29.743	.000
Inference	.548	.053	.275	12.759	.000
DR	.412	.047	.203	9.543	.000
IR	.649	.050	.293	14.492	.000

Model summary
Multiple R= .710; Multiple R^2= .503; Multiple R^2 (Adjusted)= .502
Standard Error Estimate= 1.062; F=302.903; p<.001; df1=5; df2=1494
DR**=** Deductive Reasoning; IR= Inductive Reasoning

Discussion

This research has exposed the low level of QR amongst the junior secondary school students. This result corroborated the findings of some researchers (Elrod & Park, 2020) that students displayed low level of QR. This deficiency in QR specifies a little level of resilience or proficiency in mathematical capabilities. The dearth of QR amongst the students reinforced the proclamation of researchers (Dingman & Madison, 2010) that learners originate from a context with smaller relational cognition, and very controlled cliques of discrete mathematical ideals. Steen (2001) observed that there is a widespread numerical knowledge slit in the United States of America as learners finished from colleges with deficiency in QR skills. According to Kabael and Akin (2018), learners with deficiency in QR could not comprehensibly and completely use numbers in problem definition. Accordingly, learners with seemingly deficient QR might need additional instruction in elementary quantitative and numerical science to achieve success. The deficiency in QR ostensible in the present study might be attributed to the prevalent conventional teaching space communication form in virtually all public schools in the country. The teaching space that fails to enhance student-dependent educational treatise will be unsuccessful in supplying the needed QR skills to enrich students' conceptual understanding and problem-solving outlook (Awofala, 2002; Awofala, 2017).

Normally, in Nigeria mathematics that integrates QR skills is imparted via drills and monotonous replication that nurture committal to memory and recital thus stopping learners from taking advantage of the supremacy intrinsic in constructivist instruction. In constructivist instruction learners learn to construct their notions and thoughts of the universe thus permitting dynamic contribution in all sides of instruction. This is underplayed in conventional instructions that are hostile to learners' comprehension of concepts and preclude them from engaging actively in class participation during instruction. Traditional instruction hampers the integration of QR skill into practical contexts and also disturbs learners' comprehension of concepts by thwarting and frustrating learners learning of QR in an interesting and demystifying manner. Insufficient comprehension of concepts might result in deficient QR, which might result in deficient CT as recorded in the present study. The low critical thinking among junior secondary school students in this study might be one reason for their poor QR skills. Students will succeed in QR tasks if the teaching of mathematics is accurately done by relating it to real-life context and students made to see the need for the study of mathematics. The absence of QR skills may cause irreparable damage to students' life by making them unfit as reasonable citizens of a democratic society. Therefore, it is important to design mathematics learning that relates to students' activities, culture, and daily environment (Auliya, 2019; Malasari, Herman, & Jupri, 2019; Bhoke, 2020; Richardo, 2020; Taskiyah & Widyastuti, 2021).

Besides, this study has shown that there was a positive and significant association amid QR achievement and CT skills amongst the study participants. This finding expressively concurred with the findings of some researchers (Okunuga, Awofala & Osarenren, 2020; Abbasi & Izadpanah, 2018; Ali & Awan, 2021; Kanbay, Işik, Aslan, Tektaş, & Kiliç, 2017; Kanwal, & Butt, 2021; Musa, 2020; Pozhhan, Goodarzi, & Roozbehani, 2019; Shirazi, & Heidari, 2019; Vierra, 2014; Ross, Leoffler, Schipper, Vandermeer, & Allan, 2013; Ghanizadeh, 2017; Jacob, 2012; Taghva, Rezaei, Ghaderi, & Taghva, 2014) that a significant relationship exists between critical thinking and educational performance. Nonetheless, this outcome disagreed with the results of others who had found no statistically momentous relationship between CT and educational outcome (Doleck, Bazalais, Lemay, Saxena, & Basnet, 2017; Bakhshi & Ahanchian, 2013). The momentous constructive connection between CT and QR achievement indicates that as CT rises, achievement in QR will rise. Accordingly, it is the duty of mathematics teachers to impart QR expressively to learners by deploying leaner-centred instructions like cooperative learning, differentiated instruction and problem-based learning (Awofala & Lawani, 2020; Ojaleye & Awofala, 2018; Olabiyi & Awofala, 2019), which might further concretize

their beliefs in mathematics (Awofala & Awolola, 2011) and make them more amenable to QR classroom transactions.

The present study revealed that CT is a momentous forecaster of QR achievement. This result agreed with the separate findings of Abbasi and Izadpanah (2018) and Okunuga et al. (2020) that CT was a strong predictor of students' achievement in the English language and mathematics respectively. The study revealed that the predictors (evaluation, inference, inductive reasoning, analysis, and deductive reasoning) influenced intensely the discrepancy in students' QR achievement. This result furthermore reveals the relationship between CT and QR. Consequently, no significant achievement in QR is possible without students resulting to ponder reflectively and critically. More so, QR aids in the acquisition of CT. Respectable students of mathematics must show proficiency in scrutiny, appraisal and making of extrapolation via inductive and logical reasoning to unravel commonplace practical problems. Learners who show deficiencies in these skills will not be able to participate in exact reasoning and dearth of exact reasoning may produce QR deficiency.

Conclusion

No significant growth and development can be reached in life at the expense of CT-a tool for honing and educating the mind. Nigerians need CT as a weapon for solving problems and climbing life hurdles. This investigation revealed a prevalent of QR skills shortfall among Nigerian students. The consequence of this result is that QR skills deficit will produce low logical inquisitiveness amongst learners and can stop them from attaining and comprehending concepts in mathematics. No school subject can be understood in this era of digitalism without an appreciable knowledge of quantitative reasoning-a harbinger of critical thinking.

More so, the outcome of a momentous constructive relationship amid CT and its subscales with QR achievement is commendable. Thus, a significant growth in CT will produce an equivalent significant growth in QR achievement. QR encapsulates an authorizing influence on the public and commercial security of people. The consequence of this is that learners' evaluation in QR in the country must continuously strengthen the acceptability of higher-realm thoughtful reasoning, lucid thinking, and reliable achievement instead of aligning learners to engross in lower-realm thought that strengthens regurgitation of facts and memorization education. The consequence of this line of argument is that students' CT can be deployed as a benchmark for gauging their success in QR as students with strong CT abilities will find it easy to make intelligible choices about issues of communal

solemnity and live together positively and adventurously in a democratic culture that is akin to Nigeria.

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