

On Vital Role of Mathematics for Inculcating Good Behaviors/Values towards Curbing Corrupt Tendencies among Nigeria Students

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Abstract

This paper discussed that mathematics is a valuable subject, as such, it is vital in inculcating good and acceptable behaviors and values among different categories of students in Nigeria. Since corruption is not a good behavior and there is the need to avoid and prevent it in the society, it was argued that with effective mathematics teaching and learning, students will acquire the knowledge and inherent values of mathematics towards cultivating good and acceptable behaviors. This will help Nigeria to produce well-behaved citizens and to develop in a healthy manner. Some vital concepts in mathematics through which good and acceptable behaviors and values can be inculcated in students were discussed in the paper including the critical roles of formulas, logic and mathematical games. The paper concluded with ardent emphasis that besides the acquisition of knowledge, mathematics is useful in cultivating good behaviors in students for good living in the society. For this reason, all mathematics teachers are urged to teach the subject very well through the use of practical examples so as to make the learning simple, realistic and interesting for students. Also, in the course of teaching, they need to give examples of how specific aspects of mathematics can be used to help in molding the behaviors of students positively.

Keywords: Mathematics, Corruption, Values, Character, Education, Students, Teachers

Introduction

The national policy on education in Nigeria (FGN, 2004) is explicit on the need to inculcate good behaviors or character among students irrespective of their level of education towards contributing their own quota in national development. The national policy among other important issues of national interest, lay emphasis on inculcating respect for the worth and dignity of individuals; faith in the ability of man to make rational decisions; moral and spiritual principles in interpersonal and human relations; shared responsibility; promotion of physical, emotional and psychological development of all children; and the acquisition of the right type of competencies which are deemed necessary for self-reliance (FGN, 2004, Section 1, Subsection 8(a)-(f)). These goals are to be attained using the medium of different subjects including mathematics in the school system. For this reason, the objectives of mathematics in the primary and secondary schools in Nigeria have been designed to help the students to (i) generate interest in mathematics (ii) provide solid foundation for everyday living (iii) develop computational skills (iv) foster the desire and ability to be accurate to a degree relevant to the problem at hand (v) develop precise, logical and abstract thinking (vi) develop ability to recognize problems and to solve them with related mathematical knowledge (vii) provide necessary mathematical background for further education and (viii) stimulate and encourage creativity (Report of Mathematics Conference held in Benin, January 6 & 7, 1976). Other objectives are to (i) provide

students with the opportunity to acquire mathematical literacy necessary to function in an information age (ii) cultivate the understanding and applications of mathematical skills and concepts which are necessary for students to thrive in the ever changing technological world (iii) develop the essential elements of problem solving and (iv) help students to solve problems involving communication, reasoning and connection (NERDC, 2007).

These objectives, besides the acquisition of genuine mathematics knowledge, are also aimed at inculcating good behaviors or character and values among students. The inculcation of good behaviors or character and values among students is important because secularly and religiously speaking, the entire society need people who are well-behaved to achieve progress and most religions being practiced in the world today preach and uphold the development of good moral values for the salvation of their members. For instance, Christian values for good living are taught, preached and emphasized strongly in the Holy Bible including the worship of only one God under Christian religion. The Holy Bible says 'Hear, O Israel: The Lord our God, the Lord is one. Love the Lord your God with all your heart and with all your soul and with all your mind and with all your strength' (NIV, Mark 12:28-30). The Holy Bible thus preaches pure Christian love especially when it says; 'Love your neighbor as yourself' and that 'There is no commandment greater than these' (NIV, Mark 12:31). The word 'love' in a broader sense encompasses many important values including respect, affection, benevolence, good-will and concern for the welfare of people in the society. The Holy Bible also preaches other useful and acceptable values like humility, honesty, generosity and forgiveness which are critical for good living among Christians and other individuals in the society in general.

However, whereas the inculcation of good behaviors or character and values among students is important for good living both in the school and the larger society, many students and youths nowadays lack good and acceptable moral values. This is evident in many crimes they most often commit in Nigeria and elsewhere in the world like cheating, arson, bribery, robbery, stealing, kidnapping, murder, gang rape, use of illegal drugs, human trafficking and thuggery. One of the factors responsible for these misbehaviors is corruption. Transparency International (2014) defined corruption as the abuse of entrusted power for private gain. Also, the World Bank (1997) and UNDP (1999) defined corruption as the misuse or abuse of public office for private gain. According to these authors, corruption can come in various forms such as bribery, extortion, fraud, nepotism, graft, speed money, pilferage, theft and embezzlement. Others include falsification of records, receiving kickbacks, influence peddling and campaign contributions. This is practiced in many areas of human endeavor such as education, politics, sports, transport, governance and business.

In education sector for instance, corruption practices tend to be rampant and robust. It could start from the point where a child enters a school to study to the point of completion of the study be it in the primary, secondary or post-secondary school. Also, it could begin from the point of fresh appointment of staff to the point of retirement in the ministry or department of education. It is usually exhibited by demand for bribes like gifts, sex, money, books, plots and cloths for approval to establish schools and admit students, acquire illegal examination question papers, obtain higher scores, get better grades, get good position and obtain fake certificates. Other reasons have to do with facilitating the processing of examination results, transfers, transcripts, approval of projects and theses, allocation of funds and infrastructures, placement in a special class, staff supervision, school inspection, supervision of facilities, accreditation, procurement of learning materials and equipment, allocation of hostels, houses and special employment, and retention of staff. Also, other reasons include the need to cover up for mismanagement of funds and grants, absenteeism, private lessons, plagiarism, illegal and exorbitant fees and tuition, buying of textbooks as condition for passing examinations and paying some students to write examinations for others who are weak. Maduabum (2001) and Tukur and Musa (2001) posited that many weak and anxious students in Nigeria engage in these type of corrupt practices especially cheating to pass and obtain good grades in their examinations in mathematics. They most often use derogatory jargons like bullets, missiles, walkie-talkie, super-print, giraffe, computer, dubbing, body writing, expo, escort, laya and ecomog to commit and perpetrate the act.

Gleaning from the foregoing, therefore, the practice of corruption in education can be said to be multi-faceted and multidimensional in Nigeria. It is committed and perpetrated by the collusion of many stakeholders including students, teachers, parents, tutors, guardians, supervisors, examiners, principals, invigilators, clerks, messengers, matrons, guards and cleaners (Maduabum, 2001). It affects the educational system negatively in terms of poor teaching and learning environment, inefficient leadership and administration, poor quality service delivery and unhealthy competition. Also, it leads to low motivation for teaching and learning and low profile learning outcomes and poor quality products. For example, the level of corruption in relation to cheating among students to pass their examinations that tends to lower the provision and assessment of quality education in the secondary school in Nigeria is given in the Table below. It shows the type of examination malpractice and the percentage of candidates that were involved from 2000-2005.

Table 1: Trend of Incidence of Examination Malpractice in WAEC School Candidates' Examinations (2000-2005) in Nigeria

S/N	Type of Malpractice	Percentage of Candidates Involved					
		2000	2001	2002	2003	2004	2005
1	Bringing in of foreign materials	1.23	1.27	1.43	1.34	1.60	1.17
2	Irregular activities inside and outside the examination hall	1.16	1.45	1.81	2.80	2.35	1.46
3	Collusion	3.71	2.21	7.05	6.00	6.45	4.06
4	Impersonation	0.07	0.06	0.09	0.11	0.11	0.06
5	Leakage	Nil	Nil	Nil	Nil	Nil	Nil
6	Mass cheating	Nil	Nil	Nil	0.61	0.40	0.01
7	Insult/Assault on supervisors and invigilators	0.04	0.04	0.02	0.02	0.07	0.07
8	New/Miscellaneous cases	0.25	0.04	0.07	Nil	0.19	0.03
	Total	6.46	5.07	10.47	10.88	11.17	6.86

Source: WAEC Annual Reports (200-2005)

Table 1 revealed that the types of examination malpractice among secondary school students in Nigeria range from bringing foreign materials, mass cheating to new/miscellaneous cases. The cases, based on the total percentages were high involving 10.47% of the total candidates in 2002, 10.88% in 2003 and 11.17% in 2004. The percentage slightly dropped in 2005 only with 6.86% of the total candidates involved in the malpractice.

Consequently, Nigeria needs to eradicate corruption in its educational system to give room for the admission of only qualified candidates, promote students based on merit only, produce qualified and well-behaved school graduates, promote quality teaching practice, promote quality learning and school based assessment and overall, to promote best practice. It is only when this is done that Nigeria can honestly brag of using education as a veritable tool for the attainment of national development.

To help prevent corruption in education, measures like enlightenment or orientation, sanctions, campaign on values of honesty and integrity, persistence on difficult tasks and the development of good school climate and high students' efficacy (Cornelius-Ukpepi, Ndifon & Enuakoha, 2012) as well as improving the funding of education and teacher empowerment (Jimoh, 2009) have been suggested. Beyond these suggestions, there is the need for proper education of students especially those in the secondary school in Nigeria on how mathematics education can be used to shape their behaviors positively to help them to be able to avoid and prevent corruption.

Mathematics as a Valuable Subject and Important in the Fight against Corruption

Mathematics is a valuable subject because it teaches and promotes the development of numerous critical values in the society. For example, the ideas, concepts, knowledge, skills, tasks, methods, strategies, techniques, formulas, axioms, theorems, propositions, remarks, etc in mathematics are all valuable in training students to develop good character beside knowledge acquisition. Also, considering mathematics as the science of numbers and their operations, interrelations, combinations, generalizations and abstractions and space configurations and their structure, measurement, transformations and generalizations, some values can readily be abstracted. As the science of numbers for instance, mathematics teaches different systems of numbers and counting and calculations within the number systems. Counting is particularly useful in life because it enables people to understand the periods of events and to know the number of seconds, minutes, hours, days, weeks and months in a year in that order among many other things. Counting thus helps students to appreciate order and to respect and cultivate orderly behaviors. Also, as measurement, mathematics enables students learn to estimate quantities in terms of weight, height, volume, capacity, length or distance and manage time and money wisely and so on. Measurement thus enables students to think and reason properly in relation to space, quantity, shapes or objects and their interrelationships.

Mathematics is valuable also for the fact that it is concerned with digging or exploring knowledge and inculcating critical thinking and sound reasoning among learners (Brase & Brase, 2009). Besides this, it helps learners to develop problem solving skills (Polya, 1973; Shoenfeld, 1994); as well as communication, connections and representation skills through modelling and interpreting physical, social and mathematical phenomena (National Council of Teachers of Mathematics (NCTM), 2000).

Also, mathematics is a valuable subject because it reflects and responds to vital societal values. For example, mathematics enables individual or groups of students to solve different problems and engage in various forms of calculations in construction, technology, economics and security and so on. This enable the students to learn and imbibe many inherent societal values like love, patience, perseverance, cooperation, respect, honesty and obedience. These values are useful in developing good behaviors in students to be good and patriotic citizens. Winter (2001) posited that much as mathematics is useful in developing skills and knowledge in its mechanistic nature, it serves as the means for fostering citizenship and responsibility within the society as in developing personal, spiritual, moral, social and cultural dimensions. The remaining part of the paper describes in specific terms how some mathematical concepts are useful towards developing good behaviors to help avoid and prevent corrupt tendencies among students.

Mathematical Formulas and Procedures in Developing Good Behaviors

In the primary and secondary schools in Nigeria and elsewhere in the world, students learn mathematics in the form of number and numeration, geometry, algebra, trigonometry, statistics, probability, problem solving, reasoning and proof (NERDC, 2007; National Council of Teachers of Mathematics (NCTM), 2000). At the tertiary level, the students learn higher mathematics like logic, number theory, game theory, analysis, cryptography, topology and calculus. The knowledge is useful because it is required in problem solving. In solving mathematics problems, certain rules and procedures are utilized via formulas, algorithms and mnemonics like the almighty formula for finding the roots of quadratic equations giving by $x = -b \pm (\sqrt{b^2 - 4ac})/2a$, Pythagora's rule ($h^2 = a^2 + o^2$), Heron's formula ($\text{Area} = \sqrt{[s(s-a)(s-b)(s-c)]}$), SOHCAHTOA and CAST; flowcharts; and heuristics like Polya's problem solving (understand, plan, carry out the plan and looking back) and DUPE (defining the nature of problems, understanding the problems, planning and evaluating the solutions) (Elliot, Kratochwill, Littlefield Cook & Travers, 2000). The use of these formulas, rules and procedures help students approach and solve mathematics problems accurately, reasonably, orderly and honestly. Also, it helps them to learn and be obedient by following rules or directions, and learn to share their knowledge and experiences, and forge ahead collectively with commitment, patience and persistence and so on. This way, students learn to cultivate good behaviors.

The Knowledge of Statistics and Skills in Developing Good Behaviors

Statistics is an important form of mathematics that is very useful in providing students with valuable numeracy skills for data or information management. It involves observation, collection, organization, analysis and interpretation of data or information for the sake of making decision. Whereas information generally is diverse, while teaching statistics, teachers are supposed to engage students in gathering data concerning food production, population growth and distribution, birth and death rates, accidents, water supply, transportation, health services and so on. The data are studied in terms of mean, mode, median, standard deviations among many other things and represented pictorially using graphs for the purpose of decision making. Also, statistics involves decision making from formulation and testing of research hypotheses using parametric and non parametric statistical tools like Mann-Whitney U test, chi-square, t-test, z-test and analysis of variance and covariance. This enables students to learn and gain wide experience in life through critical thinking and reasoning, cooperation, collaboration and so on. This adds to the values that students need to live and enjoy good life. Brase and Brase (2009) concurred that we make decisions based on information we have and this helps in shaping our attitudes and values. The authors further pointed out that statistics is useful in making important decisions when we are faced with uncertainties. For example, we can raise questions or formulate hypotheses with respect to identified problem, collect or gather relevant data, analyze the data and answer the questions raised or test the hypotheses and take necessary decisions. This helps in avoiding unnecessary mistakes and the tendency to be untruthful.

Mathematical Logic and the Development of Good Behaviors

Logic is an important form of mathematics that is useful in developing good reasoning and thinking habits among students irrespective of their level of study. Besides this, Sarkar (2003) stated that logic provides the theoretical basis for many areas of computer science like digital logic design, automata theory and computability and artificial intelligence. Also, logic is useful in training the mind in critical thinking and judgment. For example, the concepts of proposition calculus (statements of values like true and false, analysis of propositions) and predicate calculus (dealing with predicates containing many variables) helps to broaden the ability of students to think, reason and draw conclusions. For instance, a proposition in logic is a declarative statement which may be true or false. If p, q are two propositions for example, the conjunction p & q is said to be true if both p & q are true otherwise it is false. This type of true or false statements and others like converse, contra positive, inverse, negation, induction, tautologies and contradictions in logic are important in training the minds of students to be reasonable, honest, sincere, obedient and humble in decision making. These are important ingredients for developing good behaviors in students for good living in the society.

Geometry as a Valuable Tool in Developing Good Behaviors

In the primary and secondary schools in Nigeria and elsewhere in the world, geometry teaches the understanding of various plane and solid shapes like triangles, spheres, cubes and trapezium in relation to lengths, distances, areas, volumes and capacities. Besides knowledge, geometry prepares students to be imaginative and creative in generating patterns, tessellations and models thereby creating natural beauty and love. When students are creative from their knowledge of geometry for example, they can generate original products like greeting cards, bags, shoes, clothes, chairs, doors, burglaries and also solve mathematics problems in novel ways among many other things. Woods and Barrow (1975) posit that creativity is important because it leads to the production of original products that break new ground. When students break new grounds by creating original products, such can be sold to generate income. This will eventually make the students to be self-reliant. Creativity thus helps in fostering critical thinking, reasoning, imagination, problem solving, self-reliance, persistence, hard work, perseverance and commitment among others. These virtues are useful in training students to live and behave well in the society.

Mathematical Modelling as a Useful Tool for Developing Good Behaviors

Mathematical modelling is concerned with the use of mathematical representation i.e. ability to use the language and tools of mathematics for communication (Schoenfeld, 1994) through verbal or non-verbal expressions like statements, graphs, matrices, equations, models and symbols like x^2 , β , Π and

λ . Also, it is the process of creating and investigating models of phenomena (Hauston, Blum, Huntley & Neil, 1997). It unifies mathematical applications (Lassa, 1981), promotes creativity (Boaler, 1998) and transfer of knowledge, and it helps students to understand and appreciate mathematics and communicate and think about the world (Keeves, 2002). For example in thinking about the world, mathematical modelling can be used to study increase and decrease corruption level in education using model equations. This can help students to learn about corruption and also learn to avoid and prevent it to from spreading. This will help to ensure high quality educational practice less with the prevalence of high level corruption and its negative consequences on the educational system, the quality of teaching and learning and the certificates offered to students will not be valued and this can affect their employability and dignity or integrity.

Growth in corruption for example, can be illustrated for students to see through the use of corruption growth model. Consider for instance that $K = \sum_{i=1}^n c_i$, where K ($-1 < K < 1$) is a constant of proportionality for sum of negative character of a person which may lead to increased or decreased corruption level (K is called mathematical effected virus constant or E-virus constant (Waykar, 2013)) and c_i represents negative character, for example c_1 =not sincere, c_2 =unfaithful, c_3 =dishonest, c_4 =cheating and so on. If $K < 0$, it means negative corruption, $K = 0$ means very strong free corruption and if $K > 0$, it means corruption, that is the system is sick or weak. The corruption growth model is given by the relation $dC/dt \propto C$ meaning $dC/dt = CK$, where C =number of corruption, K =proportionality constant, t =time of growth of corruption (Waykar, 2013). Thus from $dC/dt = CK$, $dC/C = Kdt$, by integration, $\log_e C = Kt + C$, therefore, $C = e^{Kt+C}$ or $C = e^{Kt} \cdot e^C$. Let $e^C = C_1$, then $C = C_1 e^{Kt}$. When $t=0$, $C=C_0$, then $C_0 = C_1$ implying at no time or initially when $t=0$, corruption is zero implying $K=0$.

For instance, suppose in a new school with 1000 students, there is no corruption, then $C=0$ where $t=0$. Suppose after 10years, corruption was 1% of initial entrants, then $C=10$, $t=10$, the mathematical model can be obtained for increase in corruption at any time. Using $C = C_0 e^{Kt}$, when $C=10$, $k=0$, i.e. $\sum_{i=1}^n c_i = 0$, then $10 = C_0 e^0 = C_0$, implying $C_0 = 10$, consequently $C = 10e^{kt}$ (-1). Suppose again that corruption level in the school doubled after 10years, then $t=10$, $C=20$, then from (-1), $20 = 10e^{Kt}$ implying $20 = 10e^{10K}$, $e^{10K} = (20/10) = 2$, $e^{(K)10} = 2$, $e^K = (2)^{1/10}$, therefore, $C = 10 \times (2)^{t/10}$. This is the required model at time t . Again, suppose that corruption level in the new school after 30years is required, then $t=30$, for $C = 10 \times 2^{t/10}$ imply $C = 10 \times 2^{(30/10)} = 10 \times 2^3 = 10 \times 8 = 80$. Thus in 30years, corruption level in the new school will be about 80 students. This figure, hypothetically, is high which can give bad name to the school. Giving this presumptuous knowledge about corruption growth, surely students can learn to work hard by thinking, communicating and enforcing many ways that will help them to avoid and prevent corruption from spreading because of the negative effects.

The Use of Mathematical Games in Developing Good Behaviors

There are quite a number of mathematical games that can be utilized in mathematics instruction to help students especially children in the primary school in Nigeria to develop interest in mathematics and good behaviors. These include Snakes and Ladders, Ludo, Chess, Draught or Checkers and tic-tac-toe. For instance, the tic-tac-toe is a paper and pencil game for two players that make use of a 3x3 grid by placing 3 respective marks in the horizontal, diagonal or vertical rows. A player wins the game when the 3 respective marks are placed accordingly. By playing this game, students will develop observational skills, sportsmanship, honesty, hard work, sincerity, patience, confidence, self-reliance, cooperation, persistence, perseverance, love and courage to score good points and win the game. Also, when students are skillful and overzealous, and make the game and other ones and sell to their colleagues and interested people, it can help them to generate little income that will eventually make them to become self-reliant.

Mathematical Problem Solving and the Development of Good Behaviors

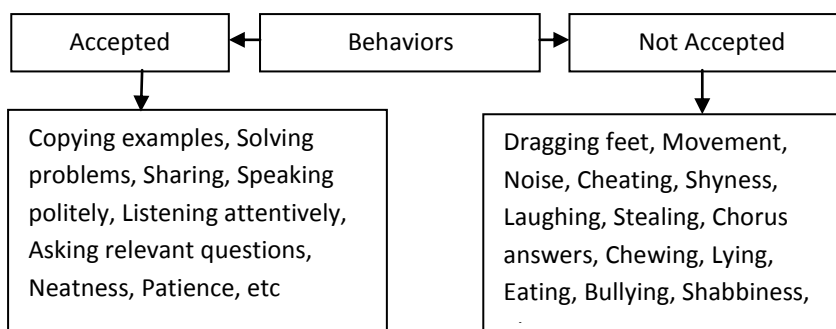
Mathematics, as it is well known, is focused mainly on problem solving. Problem solving is the act of accepting and striving to resolve challenging tasks whose solutions are not immediately known in

advance (National Council of Teachers of Mathematics (NCTM), 2000). The tasks derive mainly from the society outside of the classroom involving calculations as in measurement, construction, technology, business, banking, security and so on. To succeed in problem solving, students require many problem solving skills, strategies and techniques such as ability to think, reason, plan, abstract, calculate, organize, construct and interpret information. When students are involved in problem solving in mathematics and most other subjects especially the sciences, they learn to reason well, the learn to be systematic, logical and analytic because they have to be able to analyze the problems to choose and decide on which strategies or methods are suitable to use. Also, they learn to cooperate and collaborate, share and love; to be accurate, honest, humble, respectful, patient and persistent; and to be willing, confident, self-reliant, self-satisfied and self-motivated when they are successful. All of these virtues are useful ingredients in training students to develop good behaviors to live a good and functional life in the society.

Implications in Avoiding and Preventing Corrupt Tendencies

- Mathematics, as it has been discussed earlier, is a valuable subject such that besides knowledge, it is useful in developing good and acceptable behaviors among students. Consequently, teachers need to teach the subject very well using practical examples and demonstrate how its values can help students to develop good behaviors. This will help in training the students to be able to avoid and prevent corrupt tendencies.
- In education, corruption is committed and perpetrated by the complicity of students, teachers, typists, examiners and invigilators most especially during mathematics tests and examinations. Therefore, mathematics teachers need to prepare students very well before any test or examination is written in mathematics. Since corruption is a serious offence in Nigeria, anyone caught while giving or receiving bribe or engaging in any form of cheating during examinations should be arrested and punished accordingly. There should be no sacred cows whatsoever in sanctioning the culprits.
- Teachers should teach and emphasize the development of mathematics values among their students like critical thinking and logical reasoning, computational and problem solving skills and good communication. This will help the students to cultivate good behaviors like being honest, rational, gentle, caring, humble, loving and respectful in approaching their problems responsibly and maturely. If students grow with these good behaviors, they will not only learn to avoid and prevent corruption like bribery, they will learn to really work hard to obtain what they want for themselves.
- Teachers should help students to develop and sustain interest in mathematics because many of the students especially female students have negative attitudes which results in poor understanding and performance and low confidence in mathematics (Okigbo, 2007; Eshun, 2004). When students understand mathematics very well and have full confidence, no doubt, they will excel in the subject naturally, hence they will have no reason to bribe or cheat to pass and obtain better grades in their examinations except they want to be punished unnecessarily when arrested.
- Since mathematics is very important and useful in cultivating good behaviors among students, teachers should endeavor to use suitable teaching materials and methods like mastery learning, problem solving and cooperative learning as opposed to the use of traditional methods like lecture and expository methods. This will make the teaching and learning processes practical, interactive, captivating, interesting and realistic. This will help students to develop what is called a mathematical disposition (NCTM, 2000) without which it will be difficult for them to do mathematics with confidence. Once students develop requisite confidence, it will help them to avoid temptation to cheat by offering bribe to pass and obtain better grades in their examinations.
- Mathematics teachers should set and paste some rules on good behaviors in the class for students to read and comply with during lessons, test or examination. For example, as students manifest different behaviors in class (some may be calm, anxious, noisy, etc), teachers should write the specific behaviors to tolerate and instruct students to obey otherwise

they will receive punishment. This should be drafted in a table starting with behaviors classified as accepted and not accepted with the list of what students are required to do under each category as illustrated below.



Source: Author

Consequently, teachers should create something similar to this using cardboard paper or plywood. It should be neat, bold enough and should be pasted in a strategic place in the classroom. As a rule, students should be made to read and constantly remind themselves of the need to obey and keep to the rules. This will help in molding their behaviors positively by being patient, obedient, respectful and cooperative in doing what is right, allowed or accepted. These virtues will ultimately help them to avoid and prevent corrupt tendencies.

Conclusion

In conclusion, it is important emphasizing that mathematics is a valuable subject as it is useful to cultivate good behaviors or character among students for good or useful living in Nigeria and the larger society. Once students develop good behaviors, they will learn to avoid and prevent corrupt tendencies. This will ultimately help Nigeria to develop as a corruption-free and healthy nation.

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