

IMPACTS OF MATHEMATICAL SKILLS ON NATIONAL SECURITY

Charles-Ogan, Gladys

Department of Curriculum Studies & Edu.Tech.
University of Port Harcourt, Choba Port Harcourt

Abstract

The utilization of mathematical skills in the nation's security systems is highlighted. The various forms of security and the role that mathematics plays in each of them are examined. Thus it is being recommended that there should be effective and functional mathematics education at all levels so as to transform skills realized for mathematics to solve the nation's security challenges.

Keywords: Mathematical skills, national security

Introduction

In his submission to the United States Congress, on the aftermath of the attack of September 11, 2001 at the World Trade Centre towers, Farrar (2002), emphasized the need for critical skills in mathematics, engineering Information and Communication Technology to enable the Federal Bureau of Investigation (FBI) to exploit digital evidence and the technologies that collect, convey or process digital information about the nations security. To complement, the above emphasis, Schatz (2004) further pointed that the United State National Security Agency hires approximately 50 highly qualified mathematicians per year to enhance its operational work. Mathematics is therefore seen as the language of science and technology (Ugbebor, 2009).Ibidapo-Obe (2011) also stated that mathematics knowledge is fundamental in addressing the critical issues of economic transformation and globalization. Otunu-Ogbisi and Ukpebor, (2009), see mathematics as an effective tool for solving crime and security problems. It is on the basis of this that the paper examines the various mathematics skills and the effect on the National Security System.

Mathematical Skills

Trombley and Weiss (1993) defined basic mathematics skills as those skills that the majority of high school graduates would be able to perform

successful after exposure to the typical mathematics curriculum. They went further to remarked that mathematical skills is a multi-faceted construct that in general, reflects the ability to do quantitative thinking, or more specifically, be able to discover, manipulate and evaluate relationships. According to the National Council of Teachers of Mathematics NCTM(2011), basic skills of mathematics must not be limited to routine computation at the expense of understanding, application and problem solving. The council reiterated that the identification of basic skills in mathematics is a dynamic process and should be continually updated to reflect new and changing needs.

According to Odili (1986), Harvey (2008) and National Council of Teachers of Mathematics, (2011), ten basic skills areas were developed by National Council of Mathematics Supervisors (NCMS).

These are:

1. Problem solving:- The principal reason for studying mathematics; posing questions, analyzing, translating and illustrating results, drawing diagrams, using trials and error, applying rules of logic, recognizing relevant facts and subjecting conclusion to scrutiny.
2. Apply-mathematics to everyday situation:- Inter-related with all computational activities. Use everyday situations, translate them into mathematics expressions, solve and interpret results in the light of initial situation.
3. Alertness to reasonableness of result-calculating devices in society makes this skill essential.
4. Estimation and approximation:- Technique for estimating quantity, length, distance, weight, etc; know when result is précised enough for purpose at hand.
5. Appreciate computational skills:- Addition, subtraction, multiplication and division with the whole numbers, decimals and simple fractions; complicated computations will usually be done with a calculator. Knowledge of simple digit number facts and mental arithmetic; use of percents should be developed and maintained.
6. Geometry-concepts of points, line plane, parallel, perpendicular, basic properties of simple geometric figure with emphasis on measurement on problem solving; recognize similarities and differences among objects.
7. Measurement: - minimally; measure distance, weight, time capacity, temperature and angles; calculate simple areas, volumes; use both metric and customary system with appropriate tools.
8. Reading, interpreting and constructing tables, charts and graphs:- Considering information into manageable/meaningful terms and use conclusion with simple tables, maps, charts and graphs.

9. Using mathematics to predict- Elementary notions of probability to determine likelihood of future events and identify immediate past experience that does not affect the likelihood of future events: use mathematics to help make predictions.
10. Computer literacy:- Understanding what computer can/cannot do.

Mathematical skills and its effect on National Security

The effect of mathematical skills in a nation's security can be highlighted in some characteristic areas. These are:

Cryptography (Data Security)

This makes use of Number Theory (Modular Arithmetic) and concept of Prime Number, and is the science of using mathematics to encrypt and decrypt data. Data security is a chief security concern when it comes to transmission of computer passwords, electronic e-commerce, private conversations and Automatic Teller machine (ATM) cards (Jiang, 2013). Cryptography is the practice of hiding information, converting some secret information to a non-readable text. It enables one to store sensitive information or transmit it across insecure networks (like the internet) so that it cannot be read by anyone except the right person(s). Applications of cryptography include military information and intelligence, electronic commerce, bank and payments and electronic building access. It is one of the cornerstones of internet security (Zakariyya & Barwa, 2013).

Wavelet Transformation (Signals Intelligence)

This is a new technique which is very important in all types of signal transmission and it is based on transmission of a series of numbers. Wavelet analysis is an exciting new method which applies principles of mathematics and physics in solving difficult civil and security problems.

Some applications of wavelets are powerful statistical tool which can be used for a wide range of applications namely:

- Signal processing
- Data compression
- Fingerprint (which is more surprising), for detecting the properties of quick variation of values
- In internet traffic description for designing the services size
- Industrial supervision of gear-wheel
- Computer graphics and multi-fractal analysis
- Wave propagation
- Image processing
- Pattern recognition
- Detection of aircraft and submarines.

Wavelets process complex information at different positions and scales and reconstructs them with high precision.(Zakariyga & Barva, 2013).

Financial Security

According to Abubakar, Charles-Ogan and Albert (2014), financial security involves financial instrument which is a tradable asset of any kind, either cash, evidence of an ownership interest in an entity or a contractual right to receive or deliver cash or another financial instrument. Mathematics skills such as counting and budgeting are needed for personal financial security. Also skills such as identification of numbers and correct valuation of money are needed for easy assessing of ATM cards and detection of fraud respectively. In the banks, savings, assets and liabilities, and bonds are valued using numbers. Loans, overdrafts and Commission OnTransaction (COT) are given out using simple or compound interest rates. Also mathematical skills consistency is required when for example a share price is taken and stochastic calculus is used to obtain the corresponding value of derivatives of the stock.

Food Security

Food availability is synonymous with food security and Carletto, Zezza and Bonerjee, (2013) identified the elements of a strategy built around a combination of short term fixes, and long term methodological innovation in food measurements and monitoring. Mathematical skills are used to calculate food security indicators such as:

Household Food in Security Access Scale (HFIAS);

Household Dietary Diversity Scale (HDDS) – measures the number of different food groups consumed over a specific reference period (24Hrs/48 Hrs/7 days);

Household Hunger Scale (HHS) – measures the experience of household food deprivation based on a set of predictable reactions captured through a survey and summarized in a scale.

Coping Strategies Index (CSI) – assess household behavior and rates them based on asset of varied establishment behaviours as how households cope with food shortages.

Food Security can be explicitly explained using mathematical variables as percentages, rates, graph and numbering.

Economic Security

Economic security is measured using economic indices to measure the economic well being of a nation. Mathematical skills are utilized to measure these indices. One primary indicator used to gauge the economic

health of a country is the Gross Domestic Product (GDP). A negative GDP is a sign of recession which signifies unhealthiness while a positive GDP implies healthiness. Other economic indicators that requires mathematics skills are: Human Capital Index (HCT), Education Index (EI), Mean Years of Schooling Index (MYSI), Expected Years of School Index (EYSI), Income Index (II) and Consumer Price index which is used to measure reflection ultimately, the aspects of ratio, percentages, ordinal counting and algebra of numbers are essential mathematics to be used to be able to interpret the economy of any nation.

Conclusion

This paper has looked at the effect mathematical skills have on National Security. Certainly the advancements in the areas of science and technology are indebted to mathematics to a great extent. The nation's security systems also owe their functionality on the abundance of mathematical skills. Mathematicians should therefore rise up and play a prominent role in solving the security problems in Nigeria.

Recommendations

1. A credit level pass in senior secondary school mathematics should be a pre-requisite for recruitment into both the military and paramilitary organizations in the country.
2. A significant number of graduates of mathematics and applied sciences should be enlisted into the nation's security manpower structure to elicit critical/logical reasoning.
3. Government at all levels should continue to provide functional mathematics education at all levels since it is paramount in crime and security problems solutions.
4. Senior and competent mathematics experts should be encouraged by government to conduct researches, the outcomes of which can assist Nigeria in combating the nation's security challenges.

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