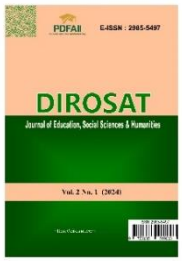

DIROSAT
Journal of Education, Social Sciences & Humanities
Journal website: https://dirosat.com/

ISSN : 2985-5497 (Online) Vol. 3 No. 3 (2025)
DOI: https://doi.org/10.58355/dirosat.v3i3.154 pp. 342-363

Research Article

Efficacy of Stem /Steam /Metals as Comprehensive Strategies in Sri Lanka Education System

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Received : April 15, 2025 Revised : May 17 , 2025
Accepted : June 19, 2025 Available online : July 26, 2025

How to Cite: Abi Huraira Rifas, M.M. Sithy Fathima, & K.R. Fathima Seefa. (2025). Efficacy of Stem /Steam /Metals as Comprehensive Strategies in Sri Lanka Education System. *DIROSAT: Journal of Education, Social Sciences & Humanities*, *3*(3), 342–363. https://doi.org/10.58355/dirosat.v3i3.154

Abstract. Education encompasses the integration of knowledge, attitudes, skills, practice, and experiences. The concept of education has undergone evolutionary changes over time, influenced by educational policies and their intersection with political dynamics. This study aims to study the significance of Science, Technology, Engineering, Mathematics, Aesthetic, and Language (STEM/STEAM/METALS) strategies in transforming the education system. This research employs the documentary analysis technique that uses circulars, books, handbooks and guides as secondary data. The primary concerns impacting the economy and development of Sri Lanka include job dissatisfaction, inadequate income, unemployment, and a workforce lacking in necessary skills. Hence there is an urgent need for expertly formulated reforms and ideas in the sphere of education,

specifically focusing on Science, Technology, Engineering, Aesthetic, and Mathematics from grade 01 to grade 13, as well as in higher education. This article provides an overview of the STEAM background, educational challenges, and the existing syllabus and curriculum for primary, junior secondary, senior secondary, and advanced level education. It also compares the Ministry of Education's (MOE) proposal for Science, Technology, Engineering, and Mathematics (STEM) with the policy reforms suggested by the National Education Commission (NEC). In recent years, it is anticipated that there will be an emergence of new educational trends in Sri Lanka, driven by the innovative perspectives of the current government. These trends are expected to contribute to the nation's progress and prosperity through an enhanced focus on education in the soon future.

Keywords: Education, STEAM, STEM, Ministry of Education, Sri Lanka

INTRODUCTION

Education is widely regarded as an exceptionally potent tool. This tool possesses the potential to make significant global transformations. The aforementioned statement, while commonly expressed, is currently seeing a decline in its appeal within the present context. The concept of education is multi-faceted and evolving. The word education is derived from the Latin root 'educare' which means 'to train / mold' (Chazan, 2022). "Education is the deliberate, systematic, and sustained effort to transmit, provoke or acquire knowledge, values, attitudes, skills or sensibilities as well as any learning that results from the effort" (Cremin, *Public Education*, 27). —In this scholarly definition, the term 'acquiring knowledge' is the core of education. Hence acquiring knowledge by learning" refers to the process of gaining information and understanding through educational activities. Now, a crucial inquiry emerges regarding the process of learning.

Real education transcends the mere acquisition of degrees and extends beyond the realm of theoretical knowledge. Education encompasses the process of instilling moral beliefs, fostering positive thinking, cultivating a mindset of altruism, promoting contributions to society, and nurturing ethical principles. These particular students possess the capacity to effect societal transformations. These individuals have the potential to develop into exemplary citizens of their respective nations, as well as morally upright individuals. Furthermore, pupils possessing such qualities are capable of making ground breaking discoveries. It is highly probable that they will achieve success in their future endeavors (Muskan, n.d.). in addition, the rate at which knowledge expands can vary depending on the specific field. For instance, whereas the rate of human knowledge accumulation is estimated to double every 13 months on average, the field of nanotechnology experiences a doubling of knowledge every two years, while clinical knowledge undergoes a doubling every 18 months (Bordeianu, 2015).

International Business Machine (IBM) cooperation has stated that the expansion of the 'internet of things' will result in a twofold increase in knowledge every 12 hours (Pllana, 2019). Accordingly, individuals who lack preparedness to confront this particular difficulty may encounter difficulties in achieving success in the contemporary era of the 21st century. Hence, it is imperative for policymakers in the field of education to develop initiatives that enable the younger cohort to cultivate

creative, critical, and profound thinking skills. By doing so, these individuals will be better equipped to assume roles as innovators, educators, researchers, and leaders, thereby effectively addressing the urgent challenges faced by a nation and approaching the future with assurance. The consideration of STEM/STEAM Education as a complete method to solve the challenge is situated within this specific context.

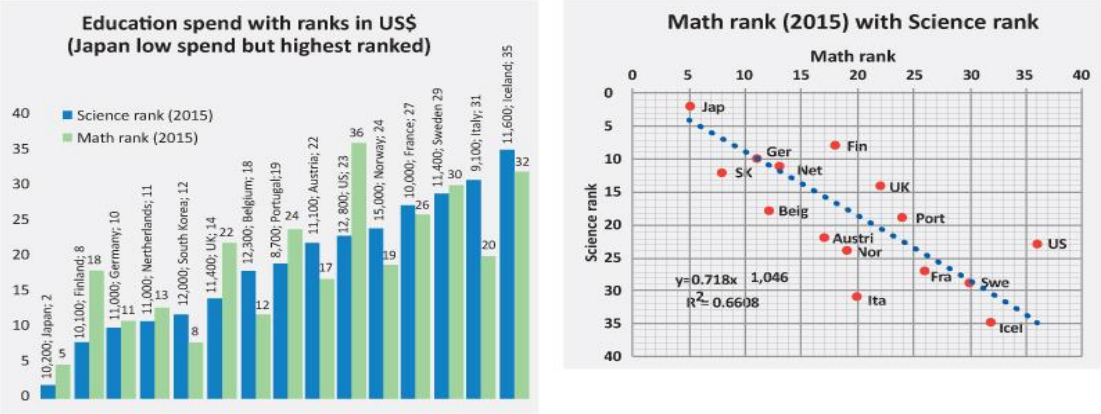
Introduction to STEM/STEAM Approach

The acronym STEM denotes the fields of science, technology, engineering, and mathematics, encompassing a broad range of subjects within these four disciplines (Hafni et al., 2020). This acronym was introduced by the United States National Science Foundation in the 1990s as a means of "reforming" education (Hanover, 2011). This approach incorporates artistic elements into scientific fields, providing students with the chance to cultivate a holistic perspective. Although engineering is not typically taught in a traditional classroom setting, there are several possibilities for students to engage in creative activities and demonstrate problem-solving skills through integration.

According to the MOE (2013), circular 25/2013, technology is the field of study that encompasses the scientific exploration and development of tools and techniques aimed at resolving various problems and challenges. For instance, the utilization of an aluminum ladder can be considered as a technological approach to provide access to a roof, whereas the field of Mathematics can provide insights about its load-bearing capacity. Engineering involves the process of designing a sturdy and resilient construction, while Science contributes by offering aluminum as a suitable material choice. The pupils should possess the ability to generate these answers spontaneously or acquire them through practical application.

As per a report published by The Guardian, the primary objective of this extensive program is to provide aspiring teachers with the autonomy to develop their own instructional frameworks. In Finland, the prevalence of private schools is notably low, and the curricula in these institutions place less emphasis on extensive hours of instruction and monotonous homework assignments, instead prioritizing opportunities for imaginative and creative play. The Finnish education system, which fosters "academic and social inclusion and high percentage of resilient students points out the Finnish miracle in educational equity" (Ustun & Eryilmaz, 2018). -Another factor that has garnered recent attention is the allocation of funds towards education and the corresponding performance of each country in internationally accepted assessments of STEM education.

Figure 1: Educational Ranks



According to the above graphs, by the study conducted by Pew Research in 2017, the United States allocated a total of $700 billion on public education, resulting in an expenditure of $12,800 per student in the year 2017. The Figure 1 depicts the expenditure of funds by each of the fifteen highest-ranking countries in the survey, along with their corresponding rankings. Japan consistently achieves top rankings in Science and Math Scores while allocating much lower financial resources than many other nations. Furthermore, this figure positions the United States as the second-highest spender per student among all nations globally. However, in terms of overall expenditure, the comparison is not even remotely similar. The United States was positioned at the 38th rank in mathematics and the 24th rank in science, in comparison to 71 other nations. Just twenty years ago, the education system of the United States was ranked sixth globally.

Upon analysis of the data, it becomes apparent that there is a positive correlation between the improvement in Math Rank and the corresponding improvement in Science Rank. The significance derived from this research is in the recognition of the importance of integrating Science and Mathematics education, as evidenced by the economic growth indexes of the countries surveyed. These nations are widely recognized for their significant advancements in technology and their provision of cutting-edge technological solutions to the global community.

History of STEM/STEAM Approach

It is projected that in the foreseeable future, around 75 percent of emerging employment opportunities on a global scale will necessitate individuals to possess qualifications and proficiencies in the fields of STEM. The demand from employers for graduates with these qualifications and skills is seeing an upward trend. Nevertheless, a significant percentage of students are not pursuing studies in the fields of STEM/STEAM or contemplating employment relevant to these disciplines. A further point of concern pertains to the fact that 60 percent of young individuals are pursuing educational paths that may either cease to exist or undergo significant transformations due to the impact of automation within the forthcoming 10 to 15 years. The number of employment prospects in industries related to science,

technology, engineering, and mathematics (STEM) is steadily growing on an annual basis. Employers are actively seeking individuals who possess the appropriate qualifications and skills such as;

- *Analytical skills:* Conducting a comprehensive analysis and interpretation of information in order to evaluate and determine the most optimal course of action.
- *Scientific skills:* Breaking down intricate scientific concepts and processes.
- *Mathematical skills*: Precisely collecting and evaluating data. Utilizing elementary and intricate mathematical equations to address problem-solving scenarios.
- *Technical skills*: Diagnosing and resolving issues with intricate technological systems or performing maintenance on a mechanical apparatus.

The acquisition of STEM-related qualifications holds significant importance, as the study of STEM subjects also imparts transferrable skills that are vital for success in the contemporary work market. The aforementioned transferrable abilities encompass problem-solving, creativity, critical analysis, teamwork, independent thinking, initiative, communication, and digital literacy.

Although Sri Lanka provides free education to all its citizens up to the university level and is renowned for its excellent literacy rates, the current education system in Sri Lanka is predominantly rooted in traditional and examination-oriented approaches. The Sri Lankan authorities, namely the Ministry of Education and National Education Commission, have initiated efforts to enhance the efficacy of the country's education system by exploring innovative strategies that are suitable for the rapidly evolving global educational environment. In addition, one of the primary strategies suggested was the integration of STEM in Sri Lanka. The Cabinet approved the STEM Education Subjects Development Act on August 29, 2017, and the Department of Science, Ministry of Education commenced efforts to establish a framework for STEM education in 2018. A group consisting of 38 experts from the fields of education and industry has been convened to collaborate on the development of a fundamental framework. Simultaneously, the Oversight Committee on Education and Human Resources Development of the Sri Lankan Parliament has undertaken a dedicated initiative to facilitate the implementation of this framework.

The integration of STEM education, in any way, reduces the significance of performing arts, religion, literature, other human sciences, and languages that foster the development of creative and well-rounded individuals. The inclusion of artistic subjects inside the approach of STEM is the rationale behind this decision. Following a modification, the acronym STEM was altered to STEAM. In several nations, the STEAM framework has incorporated the inclusion of language skills. The term "METALS" is used to refer to the subjects of mathematics, technology, engineering, aesthetics, language, and science.

Advantages and Implication of STEM/STEAM/METALS education

There are four significant ways in which it exerts a favorable impact on the entire economy of a country.

- STEM education equips students with the necessary skills and knowledge to effectively navigate and capitalize on the economic landscape of the 21st century and beyond.

- It improves the influence and overall efficacy of the school system.
- A workforce that possesses a strong foundation in STEM education contributes significant value, enhanced efficiency, heightened productivity, and increased innovation to the economy.
- STEM education encompasses the examination of socio-cultural dimensions pertaining to both the individual and society, hence fostering the cultivation of conscientious and accountable citizens.

It is imperative for Sri Lankan educators to possess a STEAM mindset in order to effectively cultivate a similar mindset among our students. By doing so, educators can elaborate on the potential economic contributions that students might make as innovators, value creators, and future entrepreneurs. Accordingly, the objective of this initiative is to cultivate a holistic perspective among students, enabling them to identify practical solutions for enhancing value through the application of STEM/STEAM methodologies. In the 21st Century, school teachers are bestowed with the noble responsibility of guiding Sri Lanka along a path of consistent progress and advancement. Thus, this paper provides a convincing demonstration that more expenditure on education does not necessarily lead to improved educational outcomes or economic growth.

RESEARCH METHODS

This study employs the qualitative research method using library or documentary research approach. This research carries out as a conceptual, theoretical paper with documentary approach. The secondary data and information relevant to the study from different kinds of methods such as government circulars, ministry of education guidelines and circulars, research papers, books, websites, policy guidelines and reports. Documentary research method deeply discloses the whole evidence of documents that establishes or discovers the existence the researchers plan to study (Bailey, 1994). According to Payne & Payne (2004), the documentary analytical method as the technique is used to categorize, investigate, interpret, and identify the limitations of physical sources, most commonly written documents whether in the private or public domain". This approach establishes strong findings with cheaper and, it cognitively contributes to the development of the concept and understandings to the literature (Kasim et al., 2016; Rifas et al., 2023).

RESULTS AND DISCUSSION

Stem in Primary Education (Grade 1-5)

Primary education has a crucial role in fostering the development of inquisitive, inventive, and technologically proficient pupils who are equipped to confront the complexities inherent in contemporary technical, economic, and socio-cultural shifts.

According to educational psychologists, there exist two distinct cognitive developing stages among elementary students namely Pre-operational stage (Age 2-5) and concrete operational stage (Age 8-11). Primary education serves as the initial phase in cultivating inquisitive, inventive, and technologically adept children who are equipped to confront the complexities arising from contemporary technical,

economic, and socio-cultural shifts. At the moment, the primary education system in Sri Lanka is structured into three distinct stages namely Key stage 1 (include grade 1 and 2), Key stage 2 (include grade 3 and 4) and Key stage 3 (include grade 5 only).

The prevailing primary curriculum has four distinct topic areas. The primary disciplines encompassed within the acronym ERA are first language acquisition, mathematics, religious studies, and environmental activities. ERA is a multidisciplinary field that incorporates various subjects, including science, creative arts, health and nutrition, aesthetics, physical education, and activity-based English.

The major aim of implementing STEM education at the primary level is to cultivate a child's capacity for innovation and creativity, such that by the time they reach grade five, they possess the necessary skills and knowledge to engage effectively with STEM subjects and are prepared for further study at the secondary level.

STEM Reforms Proposed for Primary Level

The thirst for knowledge of the world and its inhabitants, the capacity to effectively express one's thoughts in a congenial manner, the aptitude to employ mathematical principles in resolving everyday issues, the ability to engage in logical reasoning with assurance, the skill to gather information for the purpose of elucidating phenomena, qualities of leadership and teamwork, an appreciation for the heritage, culture, environment, and indigenous practices of Sri Lanka, the social skills necessary to be a responsible member of society, fundamental computer literacy, a preparedness to transition from dependence to independence within a family unit, and an inclination towards pursuing further education in STEM fields.

According to the Table 1, subjects covered in the curriculum include first language acquisition, second language acquisition, mathematics, religious studies, ethics and moral principles, social decorum, aesthetics, scientific inquiry, engineering technology, physical education, artistic expression, geography, and agricultural studies.

Table 1: Proposed Subject Allocation for Primary Level

	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
1st language	Names of food	Food for growth	Types of food	Constructing sentences	Writing essays
2nd language	Food for growth				
Mathematics	Measuring food	Symmetry	Venn diagrams	Standard measurements	Standard measurements
Religion	Food related religious practice				
Ethics and etiquettes	Food hygiene and good practices				
Aesthetics	Recite and action song of food.	Recite and action song of food.	Drawing fruits dance, poems related to food		

Science	Grouping food	Grouping food	Grouping food on nutritional value	Energy values And food preservations	
E-technology			Kitchen utensils	Kitchen utensils	Kitchen utensils
Physical education	Simple activity as a game	Simple activity as a game			
Creative works	Designs of foods	Designs of foods			Creating models
Geography			Geographical Distribution of growing food	Geographical Distribution of growing food	
Agriculture			Soil types	Soil types	Hydroponics

Stem in Secondary Education (Grade 6-9)

The objective of secondary level education is to build upon the competences obtained during elementary level education by implementing a theme-based spiral curriculum. The proposed methodology would be organized around a subject-oriented framework. Junior secondary education serves as a transitional phase that facilitates the transition from the scholastic environment to the professional realm. The implementation of a subject-based approach facilitates students in acquiring a comprehensive understanding of concepts and abilities pertaining to each individual subject. This platform enables students to broaden their options and enhance their personal and professional skills in several areas, which can have a significant impact on their educational and career-oriented choices.

In the present educational framework, there are two distinct phases within the secondary level. These stages are commonly referred to as junior secondary, encompassing grades 6 to 9, with an age range of 11 to 14 years. According to the MOE (2011), circular 2011/01, the subjects offered within the current system for grades 6 to 9 are as follows: Mathematics, Sinhala, Tamil, PTS, History, Science English, Physical education, Civics, Geography, Art and ICT. Similarly, the senior secondary students consist of grade 10 & 11 at the age of 15+ to 16+. At the end of grade11, students sit for the general certificate of education, ordinary level (G.C.E O/L) examination. Therefore, secondary education is considered as last six years.

STEM Reforms Proposed for the Junior Secondary Level

A proposition has been put up to decrease the duration of secondary level schooling by one year. As per the proposed plan, the duration of junior secondary education in Sri Lanka will be shortened to a period of five years, as outlined below: The lower junior secondary level encompasses students in Grades 6-8, typically ranging from 11 to 13 years of age. On the other hand, the upper junior secondary level includes students in Grades 9-10, typically ranging from 14 to 15 years of age. The following Table 2 is a suggested framework for the academic progression of lower junior secondary level.

Table 2: Suggested Framework for Academic Progression

Grades 6,7 & 8		
Scope of Learning	**Important Consideration in Development Curricula**	**Recommended Methods**
• Science • Mathematics • First language • Second language • English • Religion • Digital competency • PTS (need to increase the number of periods per week) • Aesthetic • Health physical education • Social studies (geography, history, natural disaster, civic, and economics)	• Indigenous knowledge needs to be integrated in a relevant manner with the context. • Focus more on fundamental principles of the particular subject. • Input should be invited from all relevant civil and public organizations. • Focus more on enhancing skills and attitudes to proactively meet the needs of society and economic development	• Inquiry based learning • Guided discovery method • Problem/project-based learning • Lecture discussions • Group activities skills expected to be developed • Collaboration • Creativity • Innovation • Critical thinking • Communication • Problem solving • Hands on skills • Entrepreneurship

Upper Junior Secondary Level (Grades 9-10: ages 14+ to 15+)

The current age limit for this particular level encompasses students in grades 10 and 11, with ages ranging from 15 to 16 years old. The STEM programme suggests that the age restriction for participation and the required grades are set at grade 9 and grade 10 for the General Certificate of Education Ordinary Level (G.C.E(O/L)). This corresponds to an age range of 14 years old to 15 years old. The disciplines included in the present upper junior secondary level curriculum are as follows in the below Table 3.

Table 3: Current Structure of Subject Allocation

Main/core subjects	Basket-1	Basket-2	Basket-3
Mathematics	Geography	Art	Health and Physical Education
Science	Civics	Tamil Literature	Home economy
First Language	Accounting & business studies	English Literature	Agriculture
English	Second language	Arabic Literature	ICT
Religion	Arabic	Dance	Design Technology
History	Other languages	Music	Design and mechanical Technology

	Entrepreneurship	Drama & Theatre	Art and craft
			Communication media

**In order to fulfill the academic requirements, a student is mandated to enroll in six fundamental courses, which encompass the basket subjects numbered 1, 2, and 3. A student will be covering a total of nine subjects.*

Table 4: Structure of the Grade 9 and 10 STEM subjects

Grades 9-10		
Scope of learning	**Modules**	
(1) Science, (2) Mathematics, (3) First language, (4) English, (5) Religion, (6) Digital competency (coding, robotics, mechatronics, electronic, electricals), (7) Civics and governance (history, the legal system in the country, constitution, psychological aspects, social media, protections, local government rules and regulations, economics, court system, administrative system, banking, insurance etc.), (8) Aesthetic, (9) Health and (10) Physical education	(need to choose 2 modules) (Modules will be based on A/L modules and career paths) These modules will come under two groups-vocational and academic	The STEM will be integrated with relevant contents

**Competency will be assessed by formative evaluation.*

In addition to the acquisition of competencies in fundamental academic disciplines such as mathematics, physics, first language, English, and religion, students are now provided with the opportunity to engage with a new subject known as "civics and governance." This encompasses a comprehensive examination of historical events, administrative structures, legal frameworks, as well as the associated roles and responsibilities.

A curriculum component titled "health and physical education" is implemented, incorporating an appropriate level of physical activity. In addition to engaging in physical activity, it is mandatory for students to participate in chess or checkers, alongside the promotion of carom and scrabble. Similarly, the inclusion of aesthetic disciplines in the curriculum will persist as a mandatory component of education. Every academic discipline is carefully constructed with the objective of cultivating a well-rounded individual who possesses the capacity to discern and value exceptional aesthetic creations. The subject of "science" encompasses the integration of scientific methods and recognition of the limitations inherent in the scientific process.

Table 5: Proposed Basket Subjects

Basket-1 (Academic)	Basket-2 (vocational)*
Earth, atmosphere and space science (Geology, Oceanography, Terrestrial weather and atmospheric science, Space technology, Space weather and Astronomy).	Designing (fashion designing, horticulture, Landscape, Architecture, Graphic designing).
Technologies (electrical, electronics, telecommunication, mechanical, modern technologies)	Entrepreneurship (marketing, innovation, value addition, packaging).
Literature (Sinhala/English/Tamil).	Aqua science (Oceanic science, Horticulture, Fisheries and Aquaculture, Aquarium, Aqua phonics).
Energy and environment (Energy sources, clean energy, climate change, environment impact analysis)	Agriculture (livestock farming, food processing, agriculture machinery, post-harvesting technologies, hydroponics, horticulture)
Health systems and biomedical science (medical instruments, ergonomics, need assessment tools, pharmacology, health care, traditional medicine, gene technology)	Handicrafts (garments/textile, pottery, murals, value addition)
commerce and management	Tourism and hospitality (value addition, culinary arts, event management)
History and archaeology	performing Arts (media, videography, photography, drama, DJ music, cinematography, theatre, stage maintenance)
Geography and economics	mechanics, motor mechanics
	Construction technology (masonry, wood technology, plumbing, quantity survey)
	information and communication technology (software development, hardware, information system, web designing, graphics designing printing, data base management, community informatics)

**Incorporation of contemporary technologies and project management principles will be implemented across all disciplines within the vocational subject's category.*

Proposed Assessment and Evaluation

A national-level test, known as the General Certificate of Education Ordinary Level (G.C.E O/L), is administered upon completion of grade 10. A total of five subjects, namely mathematics, science, first language, English, and Religion, will undergo evaluation. The cumulative grade for each subject will be determined by a combination of 50% marks obtained in the examination and 50% marks carried forward from the school-based Assessment (SBA) conducted during grades 9 and 10.

The user's text does not contain any information to rewrite. The allocation of 50% of the continuous assessment marks is contingent upon many variables,

including attendance (10 out of 50 marks), individual assignments (20 out of 50 marks), and group assignments (20 out of 50 marks). It is worth noting that the group assignments often involve a group size ranging from three to six students. These evaluations are conducted using many strategies, including poster presentations, PowerPoint presentations, role plays, performances, debates, group assignments, field excursions, maintenance of field notebooks, practical tests, individual assignments, students' portfolios, and physical training**.** However, MOE (2008), circular 2008/17(i), now the general education system of Sri Lanka has set a criterion to pass for G.C.E(O/L) is 06 pass concept (3Cs 3Ss) including Mathematics and 1st language out of 9 subjects.

Stem in General Certificate of Education Advanced Level (G.C.E. A/L)

According to the MOE (2016), circular 2016/13, the current educational curriculum at the advanced level encompasses 06 primary streams: science (including biology, physical science, and technology), arts, and commerce. In Sri Lanka, there are a total of 10,194 schools. There are a total of 1818 educational institutions that provide advanced level education, excluding those that offer the scientific stream.

The current education system primarily focuses on delivering content through lectures and emphasizes the acquisition of factual knowledge. As a result, the development of critical thinking abilities, social skills, and creativity among students who undertake the A/L examination is limited. Out of the total number of candidates who sat for the A/L examination in the given year (206,630), around 66% (136,421) are deemed eligible for university admission. Approximately 20% of the total student population, which amounts to 27,000 individuals, has the eligibility to get admission into government colleges.

Arts Stream In Advanced Level Education

The topic combination and available courses for each stream in advanced level entrance are concisely outlined in the MOE's circular 2009/16. The current system in arts offers a range of available subjects, which include the following.

Table 5: Arts Stream (present) Subjects

	Social science Subjects - (A)	**Religion and civilization related Subjects- (B)**	**Aesthetic subjects – (C)**	**Language Subjects –(D)**
1	Economics	Buddhism or Buddhist civilization	art	Sinhala, Tamil, English
2	Geography	Christianity or civilization	Dance	Arabic, Pali, Sanskrit
3	Home Economic	Islam or civilization	Music	Chinese, Malay, French, German, Russian, Hindi and Japanese.

4	Political Science	Greek or civilization	Drama and theatre	
5	Logic and Scientific Method			
6	Accounting/Business statistics			
7	Agriculture/Mathematics			
8	Technology Subjects			
9	History			
10	Communication and Media			
11	ICT			

In this context, it is possible for a student to select many subjects from a given column. Simultaneously, it is not feasible to consider religion and its associated culture as distinct subjects within the same category. However, students have the option to choose three different languages as three separate subjects. Students have the option to enroll in one or two artistic subjects, denoted as subject C.

However, the current employment prospects for these graduates seeking high-paying and intellectually stimulating positions are diminishing as a result of the lack of emphasis on non-STEM/STEAM/METALS topics. The contemporary student in the 21st century would greatly benefit from an increased emphasis on standardized courses that pertain to creativity, critical thinking, communication (specifically soft skills), and cooperation. Only by doing so can they effectively compete in the competitive employment market. In recent times, a significant proportion of job-seeking individuals have been graduates hailing from the arts stream and holding external arts degrees. Subsequently, they were incorporated into the recruitment initiative for employing graduates as part of the special project led by His Excellency the President. The factors contributing to their unemployment were emphasized, with a significant proportion of individuals possessing degrees in traditional academic disciplines. Currently, all individuals are undergoing comprehensive training that encompasses many practical experiences in several fields, including research and the development of leadership skills.

STEM Proposed Subjects in Arts Stream

The areas of study that are specifically mentioned are trade, linguistic studies, religion, classical language, humanities, and fine arts.

Table 6: STEM Subjects for HS Stream

Commerce	Linguistic Studies	Religion and Classical	Humanities	Fine Arts

		Languages					
Management studies	awareness of Language	Fundamentals of religion	Geography	Applied music			
Business studies	National Language1	Religious ethics and philosophy	History	Applied of dancing			
Economics	Foreign Language1	Contemporary religious	Design media	Applied drama &theatre			
Tourism hospitality	National Language2	History and Arts of Religion	political science	Realistic art			
Accounting	Foreign Language2	Religious civilization	Logic & scientific method	Classical music	Classical dance	stylized drama	Abstract art
Entrepreneurship	Literature only National Language	Classical Language1	Education psychology	cultural & multimedia studies	cultural &multimedia studies	cultural &multimedia studies	cultural &multimedia studies
Capstone Module	Language communication journalism	Classical Language2	capstone module	creative activity capstone mod	creative activity capstone mod	creative activity capstone mod	creative activity capstone mod

**The suggested Arts stream encompasses a variety of STEM subjects. In the future, this initiative has the potential to generate employment opportunities for students that require a high level of expertise.*

Science Streams In Advanced Level

The topic combination and available courses for each stream in the advanced level entrance, as outlined in the MOE's circular 2009/16, are succinctly described. The available subjects of the current system in science are as follows. Example; Physics, Chemistry, Biology, Agricultural science, Mathematics. However, students have the option to select any three of the aforementioned subjects. According to the University Grants Commission's handbook, there are a total of 29 courses offered for students in the scientific stream in Sri Lanka.

STEM Pipeline is Leaking Badly

If around 33% of students who are eligible for the Advanced Level (A/L) examination choose the scientific stream, it can be inferred that the proportion of students who meet the requirements for university admission will be around 30%. Additionally, it is projected that 30% of the graduates who have completed these courses will possess the necessary skills and knowledge. The individual intends to pursue a major in the field of STEM. Regrettably, a significant portion of these individuals opt to pursue employment opportunities abroad that offer higher

remuneration and superior occupational status. Fifty percent of individuals are employed in positions inside the country that are incongruous with their STEM-related qualifications. It is imperative to provide a substantial production of STEM graduates who can be effectively employed within their own nation in positions that require a high level of expertise. The rationale for the new STEM method is to elucidate the conceptual framework for the proposed structure within the field of science.

STEM Proposed Science Stream

There exist four main subject pillars encompassing Mathematics, Life Science, Physical Science, and Technology. This program will cater to those that possess a greater inclination towards pursuing a future route in science and technology. Students are required to complete a total of 17 modules, which encompass a project component as well as the capstone module. The project pertains to a collaborative endeavor involving a team including six individuals, or a number as proximate to six as feasible.

ST study stream

Mathematics	Life science	Physical Science	Technology
Mathematics	Biology1	science	technology
Pure mathematics	Agri science	Physics1	Engineering tech
intermediate mathematics	Biology2	chemistry1	information technology
Probability & statistics	Biochemistry &bio physics	earth science	communication technology
Advanced maths1	Botany	physics2	control tech
Advanced maths2	Zoology	chemistry2	advanced technology
Capstone module	Capstone module	capstone module	capstone module

Physical Science Streams In Advanced Level

The physical science stream, commonly referred to as the mathematics stream, encompasses four primary disciplines. The academic curriculum encompasses the integration of multiple disciplines, including mathematics, physics, chemistry, and information technology. According to the revised curriculum, students are provided with the option to select either chemistry or information and communication technology (ICT) as subjects, although the combination of mathematics and physics remains compulsory. Combined mathematics is an amalgamation of both pure and practical mathematics. In the past, the students were required to adhere to two distinct processes of appending and redrafting. The curriculum additionally encompasses practical experiments that students are required to carry out inside the educational framework.

As to the guidelines outlined in the handbook of the University Grants Commission (UGC), there are a total of 11 distinct academic disciplines offered within the physical science stream across 13 universities in Sri Lanka. The table presented above displays the planned STEM disciplines.

Technology Streams In Advanced Level

The inclusion of this stream in the examination curriculum was initiated in 2013. The subject encompasses engineering technology, bio-system technology, science for technology, information and communication technology (ICT), and other subjects falling within this category. Additionally, students have the option to select either E-tech or B-tech programs. The study of science for technology is a mandatory subject for students in both academic streams. According to the data provided by the Ministry of Education, the proportion of students who took the Advanced level examination in STEM topics was 33% in 2017.

Among the cohort of students who successfully passed the advanced level examination, a mere 38.33% are granted admission to institutions for pursuing STEM-related disciplines. Moreover, this proportion has exhibited a downward trend over time. Individuals who meet the eligibility requirements for university admission but are not granted admission may pursue vocational and technical training courses instead. Alarming trends have emerged in recent years, revealing a substantial annual attrition rate of students from STEM disciplines.

The student's enrollment in this particular field is deteriorating. Individuals often choose to seek employment opportunities overseas in order to secure higher-paying jobs. Individuals in this particular demographic face limited prospects for securing the most desirable employment positions inside the nation. In order to ensure their survival in Sri Lanka, individuals must seek employment within private organizations. However, there is a significant demand for engineers in Sri Lanka. Nevertheless, there is an ongoing reliance on the importation of vehicles, as well as other related accessories and technologies, from foreign nations. Therefore, they have the potential to be manufactured and employed within our domestic nation. This is the rationale for the proposal of STEM subjects.

Commerce Stream In A/L

As per MOE (2009), circular 2009/16, the subsequent subject combination is applicable within this stream: (1) Accounting, (2) Business studies, (3) Economics. A student has the option to select a maximum of two subjects from the above available choices and must choose at least one subject from the following list as; (1) Business statistics, (2) Geography,(3) Political science, (4) History, (5) Logic, (6) English, (7) German, (8) French, (9) Agriculture, (10) Combined Mathematics, and (11) ICT.

Unfortunately, the number of work opportunities and prospects for graduates of this nature is somewhat limited. Despite having successfully obtained their degrees, individuals have encountered difficulties in securing suitable employment opportunities inside the government sector. They engage in job roles that are incongruous with their educational degrees and qualifications. New employment opportunities can be generated in the private sector within the industrial sectors. This

is the reason why the field of STEM seeks to identify alternative structures within the realm of education systems. In order to pursue more lucrative career opportunities, business graduates require access to advanced technologies. The integration of both business and technology streams within the STEM field is demonstrated as follows. The table presents the planned STEM topics.

Business and Enterprise Studies (BE)

This seminar will attract students who possess a heightened inclination towards pursuing an entrepreneurial trajectory. Students are required to complete a total of 16 modules, each of which encompasses a project component. The project pertains to a collaborative endeavor involving a team of a maximum of six members or a number near six. A total of 12 modules may be chosen from the first and second pillars, while an additional 4 modules can be taken from the first four rows of pillars 3 and 4. Furthermore, the remaining 4 modules can be chosen from the first four rows of pillars 1 and 2. The Bachelor of Education program does not incorporate a capstone module.

Business and Enterprise Stream			
1	2	3	4
Mathematics	Biology 1	Management studies	Geography
Technology	Science	Business studies	National language1
Physics	Agri culture	Economics	Mechanics
Chemistry1	Zoology	Tourism &hospitality	Design &media studies
Engineering tech	Pure mathematics	Accounting	abstract arts
Communication tech	Probability statistics	Culture &multimedia studies	Entrepreneurship
Control tech	Information and Technology	Foreign language	Education and psychology

Vocational Stream (VS) In Advanced Level

Students who do not desire to pursue Advanced Level (A/L) studies should be afforded the opportunity to make a decision. Furthermore, it is worth noting that certain students may lack the necessary qualifications and aptitude for academic pursuits yet demonstrate exceptional proficiency in practical applications. Majority of these concepts are also creative in nature. Individuals should be provided with opportunity to pursue activities that align with their areas of expertise, encompassing both soft skills and manual dexterity. Hence, in order to provide assistance to these individuals, the vocational studies (VS) program will be in place. The selection of subjects within this academic stream should be meticulously crafted**.** The current curriculum, as outlined in Circular 37/2017, encompasses the following courses within the 13-year school system.

The academic disciplines encompassed in this list include plantation product studies, livestock product studies, aquatic resource studies, food processing studies, construction studies, automobile studies, electrical and electronic studies, textile and apparel studies, metal fabrication, and aluminum fabrication. The field of web design encompasses the creation and development of websites, involving the integration of various elements such as layout, graphics, and the field of tourism and hospitality. The process of software design involves the creation and organization of a system's structure and components, with the goal of achieving a desired set. The academic disciplines of study include environmental studies, child psychology and care, and health and social care, Physical education and sports. The subject matter of visual arts encompasses a wide range of artistic expressions that are primarily visual in nature. The field of event management encompasses the planning, organizing, and execution of various events, ranging from corporate conferences to social gatherings. The fields of art and craft, interior design, fashion design, graphic design, and art and design are being considered.

The implementation of a government policy mandating a 13-year education guarantee is likely to receive widespread support. However, it is important to ensure that this policy allows for flexibility, particularly for students who may not be inclined towards traditional classroom-based learning, but instead want to gain practical experience in relevant industries, should they choose to pursue such opportunities. This will be executed using three distinct methods, namely:

1. Upon the culmination of a decade of formal education, individuals may opt to transition from the educational institution to the professional realm.
2. Subsequent to the completion of the tenth grade, a condensed instructional program of approximately six months will be made available.
3. In order to pursue further education beyond the tenth grade and attain a comprehensive academic background.

The specialized discipline will be duly considered, adopting a modular strategy for pupils of this nature namely; (1) Language and presentation skills, (2) Communication (3) Entrepreneurship, (4) Music and arts (performing arts) health and well being

In addition to students enrolled in vocational streams, individuals from five distinct subject streams are eligible to apply for a total of 39 courses offered by our universities. The courses can be categorized as follows.

(1) IT (information technology), (2) Management and information technology, (3) Quantity surveying, (4) Surveying science, (5) Town & country planning, (6) Architecture, (7) Fashion design &product development, (8) landscape architecture, (9) Design, (10) Law, (11) Facilities management, (12) Computation and management, (13) Management and information technology (MIT), (14) Science technology, (15) Computer Science & technology, (16) Entrepreneurship and management, (17) Industrial information technology, (18) Mineral resources and technology, (19) Palm and latex technology& value addition, (20) Hospitality, tourism and event management, (21) Sports science and management, (22) Speech and healing science, (23) Information technology and management, (24) Information system, (25) Translation studies, (26) Film and television studies, (27) Project management, (28)

Information and communication technology, (29) Software engineering, (30) Food business management, (31) Marine and fresh water science, (32) Business science, (33) Financial engineering, (34) Geographical information system, (35) Financial mathematics and industrial studies, and (36) Human resource development, etc.

The aforementioned courses were implemented utilizing the STEM/STEAM/METALS framework. The underlying principle of 21st century education is to its ability to reshape skills and experiences. Regrettably, the provision of adequate career guidance for pupils at the school level, ranging from grade 6 to Advanced level, is lacking. Even in the current circumstances, assuming that teachers were appointed, and a curriculum was developed. The majority of academic research emphasizes the significance of career assistance and counseling inside educational institutions. Many students fail to seize possibilities due to their limited understanding of subjects and inadequate consideration of their personal interests when selecting academic streams.

Importance of Career Guidance and Counseling in Schools

According to NEC (2014), the significance of career counseling has long been recognized, although it has only recently gained the appropriate level of acknowledgment. In the past, individuals would typically use the services of career counselors mostly in response to job dissatisfaction, following their acquisition of employment. Currently, there is a growing acknowledgement among individuals that this situation is less than optimal. It is of significance to contemplate the underlying reasons behind individuals' decision to transition between professions.

In addition, the selection of a career typically follows the selection of a course of study. If a student fails to select an appropriate course, it could unwittingly have an impact on their career decision. As several students are dissatisfied with their job, it unequivocally highlights the significance of incorporating career counseling programs within educational institutions. Career counseling in educational institutions provides valuable assistance in addressing such cognitive patterns and preventing students from committing such errors. Numerous students opt to undergo a psychometric assessment with the intention of minimizing errors, a praiseworthy endeavor. However, it is worth noting that the outcomes of such evaluations may potentially engender a greater state of perplexity among these individuals. The psychometric test serves to delineate the strengths and shortcomings of students, while also illuminating their aptitudes and interests. However, it is important to note that their aptitudes and interests do not necessarily have to align. This implies that individuals may possess proficiency in mathematical subjects while also harboring a keen fascination for artistic disciplines. Therefore, which career option should they select?

A proficient career counselor will initially provide a comprehensive explanation of the report, elucidate the benefits and drawbacks associated with pursuing both the individual's interests and aptitudes, and facilitate the attainment of clarity and comprehension necessary for making informed judgments. This is a crucial necessity, particularly in light of the fact that students are susceptible to seeking guidance from sources lacking in expertise. Students often seek guidance

from someone whom they perceive to possess relevant expertise or experience. However, it is possible that it may not always be correct or, moreover, the optimal choice. The trajectory pursued by their ostensibly accomplished peers may not necessarily facilitate their own attainment of comparable outcomes. Their role models, who serve as adult figures, likely encountered setbacks in their own journeys, while their parents may lack awareness of current industrial requirements. In order to ensure students, possess a lucid thought process, it is imperative that educational institutions have continuous access to career counselors, who can offer up-to-date and appropriate guidance during the students' academic tenure.

The decisions made within an educational setting can significantly impact a student's future trajectory, potentially leading to either success or failure in their chosen career path. Career counselors with extensive experience undergo specialized training to gain a deep understanding of students' cognitive processes and their inherent capabilities. Once the counselor comprehends the student's aptitude, they are able to provide guidance in selecting the most appropriate professional path and assist in making decisions that will lead to successful career outcomes.

CONCLUSION

Education encompasses the integration of knowledge, attitudes, skills, practice, and experiences. The actual application of theoretical concepts holds significant significance. However, a common critique of our nation's education system is its emphasis on the creation of theoretical knowledge. As a result of this rationale, education has undergone a transformation towards a competency-based education (CBE) model. The aforementioned five themes encompass the concept of competency. The notion of education has undergone several transformations over time, influenced by the interplay between educational policy and political dynamics. The trajectory of education has evolved from the provision of free schooling to encompass the broader scope of skill development within the global workforce. Skills are essential for securing employment opportunities. The skills that are developed through schooling are particularly distinctive and noteworthy. The use of both soft and hard talents is often developed through practical experience. This pertains to the concept of a knowledge-based economy and its impact on the country's development. Individuals who obtain knowledge through the school system ought to find contentment in securing a suitable occupation or career, as well as deriving satisfaction from the corresponding money. However, regrettably, both of them experience a negative impact. The primary concerns impacting the economy and growth of Sri Lanka include job dissatisfaction, inadequate income, unemployment, and a work force lacking in necessary skills. The urgent need for expertly designed reforms and ideas in the sphere of education, namely in Science, Technology, Engineering, Aesthetic, Mathematics, and Language (STEAM/METALS), from grade 01 to grade 13 and higher education, is evident in our country. Hence, the implementation of appropriate guidance and counseling services is imperative within the educational setting. This article provides an overview of the STEAM background, educational challenges, and the existing syllabus and curriculum for primary, junior secondary, senior secondary, and advanced level education. It also includes a

comparison of the Ministry of Education's proposal for STEM with the policy reforms suggested by the National Education Commission (NEC). In the year 2026, the government of Sri Lanka is expected to introduce new educational trends, driven by the innovative ideas of its employees. These initiatives aim to foster a prosperous future for the country by emphasizing the role of education in growth.

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