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Science Education in Sri Lanka: Current Status and Challenges Ahead

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The recent pandemic and the following economic turmoil have challenged all sectors including the education. The Covid – 19 outbreak numbs entire nations across the world, affecting both teachers and students alike. Of all major areas, Science Education seems to be the worst affected as Science is best taught in face-to-face mode. Once the teaching-learning process was switched to online mode overnight, the teachers struggled to convey important scientific concepts to their charges through these digital modalities that are new to them as well as for their charges. In comparison to western countries, developing countries like Sri Lanka faced even worst consequences due to lack of resources and infrastructure facilities to adjust to this new mode of teaching-learning process. Despite all these consequences of the pandemic, the importance of science literacy has never been highlighted as much as it was during the Covid era. Science literacy helped people to better understand the Covid-19, its origin and mutations, its spread, long-term health consequences, the significance of the vaccination program etc. For example, the health authorities managed to get rid

of the peoples' fear of the vaccination drive through awareness programs, where people with strong scientific literacy were able to grasp the importance quickly that prompted the rest to follow. Furthermore, this understanding also helped authorities to make people conscious of preventive measures to control further spreading. The preventive measures of Covid-19 such as social distancing, personal hygiene such as hand washing, wearing masks etc. and their importance were effectively conveyed to the general public with the help of their sound knowledge in science.

As the pandemic is creeping away from our horizon, the country is facing now the worst economic turmoil since the independence in 1948. Corruption, long-term mismanagement of public funds, unsustainable developmental projects, and ill-conceived policies are some of the contributory factors for the present debacle. To make things worse, the economic crisis is bringing new challenges to the education sector. In order to bring the national economy back on tracks, some short- and long-term progressive measures should be taken. Science Education has long being recognized as

a key indicator of the economic and social growth of a country. Education is known to increase productivity and creativity, thus triggering entrepreneurship and technological innovations. Therefore, it is crucial to allocate more resources to secondary education to boost the economic development. This impact is much higher than what could be achieved by primary education alone (Grant, 2017). Accordingly, the Sustainable Development Goals (SDGs) have earmarked education targets to include that 'by 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes'. Especially for poor countries, the right investments in the education sector can lessen the poverty notably. As a fitting step towards this future goal, the United Nations General Assembly adopted a resolution proclaiming the year 2022 as the year of Basic Sciences for Sustainable Development, highlighting the decisive role of Basic Sciences for sustainable development as well as the vital link between Science Education and Sustainable Development Goals. Taking into consideration all the challenges faced by Sri Lanka in recent times, it is a timely action to identify issues and challenges related to Science Education and bring some progressive reforms to rectify them. If the authorities and policy makers have taken timely decisions and policy directions, this could be the first step in steering the country towards the economic prosperity.

Current challenges

The report released by the National Institute of Education (NIE) in 2018 has clearly identified the issues that the country's overall education system face. This comprehensive report also proposed some productive and far-reaching reforms to resolve some of these long-lasting issues. The proposed reforms are imperative in facilitating the rapid advancements in science and technology and, also to inculcate useful skill and knowledge in students that required beyond the 21st century. In the Sri Lankan context, the lack of equal access to quality education is one of the huge impediments in the Education sector, which is not yet addressed appropriately. According to Abayasekera and Arunathileke (2018), the schools with better allocation of physical and human resources perform better at the G.C.E. (O/L) examination. According to a report

released by the World Bank in 2011, the G.C.E. (O/L) pass rate in Science has declined from 55% to 48% during a time span of 7 years (from 2002 to 2009), largely owing to high province-wide disparity with 20% difference in the year 2009 alone. The Western Province recorded the highest pass rate and the lowest in Uva Province. Furthermore, out of the 93 education zones in Sri Lanka, Colombo zone ranked top with a pass rate of 68%, while the Madu Education Zone trailed behind with a mere 9%. According to a National Cognitive Achievement Test conducted by the University of Colombo for grade 8 students in 2005 and 2008 also revealed an achievement gap between urban and rural schools as well as between school types. In urban schools, the level of achievement has risen from 57.5% to 58% from 2005 to 2008, while rural schools it was 52.4% to 55.1% for the same time period. Significant differences were also noted for between school types, 1AB, C and 2. All these evidences suggest the inequalities exist in schools in terms of infrastructure facilities and human resources. The lack of monetary strength of the country could be one of the major impediments to improve infrastructure facilities and share resources in an equal manner, which is expected to be further strained by the current economic crisis. Sadly, the dearth of budgetary allocations is not the only reason behind these disparities. The lack of unbiased policies to share resources in a fair manner between schools irrespective of their locality and school categorizations also have contributed to this plight in rural schools. While some urban schools receive politically-motivated galore of resources and infrastructure facilities, schools in rural areas are even without basic necessities. In comparison to other subjects, the shortage of Science teachers is another chronic issue in provinces including North-Central, Northern and the Central. Therefore, it is crucial for the policymakers to take some progressive steps to address and rectify these issues in the education sector. Ignoring these issues may lead to more serious social consequences in the future.

According to the current Science curriculum, both teachers and students are unnecessarily overburdened by its exceptionally high content and coverage. The curriculum reforms and syllabus revisions that have been carried out from time to time add more content to the existing syllabus making things unendurable

for teachers and students. With the rapid development of Information and Communication Technology, the facts are easy to gather, thus spoon-feeding facts is not necessary anymore. Instead, the rote learning should be encouraged and the teachers should guide students to search knowledge. It is important to enhance their skills to gather and collate relevant information, analyze and interpret them logically and communicate the findings to a relevant audience. Unfortunately, the students are overburden with facts with less or no attention given to improve their soft skills. Interactive sessions and hands-on practicals are far behind, which are crucial in the teaching-learning process in Science Education. Though teachers are encouraged to use novel methodologies in teaching, the enormosity of the syllabus may not give them a chance or time to follow them. Furthermore, the current curriculum is designed mainly to face national examinations rather than steered towards meeting the objectives of national goals and 21st century skills. As the global labor market is changing rapidly, it is the responsibility of the education policy makers to adjust the education system not only to cater the national economic goals but also the global labour market.

In science education, laboratory work and practical play an important role in conveying scientific concepts to children effectively and also to get some hands-on skills. However, these hands-on activities receive less attention in today's school education system in Sri Lanka. Despite rightly introducing student-centered, activity- and competency-based teaching and assessment strategies in 2007 with the aim of developing personal, inter-personal and higher order thinking skills, it is worth checking that these are actually practicing in schools, especially in G.C.E. (O/L) and (A/L) classes (World Bank Discussion Report, 2011). Teachers are busy completing their bulky syllabi, thus have little time to spend on laboratory activities and practical with zero contribution to final grades at national competitive examinations. Lack of laboratory facilities and poor student attendance are also known reasons for not undertaking laboratory activities in schools. Thus, in order to make a significant impact of the practical component in the school curriculum, it is vital to make it a compulsory component in the final assessment with some contribution to the final grade.

However, in order to make this a reality, the laboratory facilities need to be developed in all schools, to make it a fair judgement.

The lack of well-trained teachers is another obstacle that needs urgent attention from relevant authorities. Rural schools are generally constrained by lack of well-trained teachers or even no teachers at all. Even if teachers are available, sometimes the quality of Science teachers is questionable. Due to the lack of trained Science teachers, sometimes the school authorities are compelled to assign Arts graduates to teach Science, and is a common occurrence in rural schools. On-going training programs are crucial to update teachers with new information, teaching methodologies, new syllabus revisions etc. The lack of ICT literacy among teachers is another drawback especially in an era where virtual and/or hybrid modes of teaching are in the forefront. In-service teacher education programs for Sri Lankan teachers are broadly classified into long- and short-term programs. The long-term training programs are mainly conducted by universities, National Institute of Education and Teacher Training Colleges in Sri Lanka. Of them, universities are especially aiming graduate teachers, while the NIE and Training Colleges conduct training programs for non-graduates as well. The short-term in-service programs (ranging from one day to 7 days) are conducted by provincial level by in-service advisors and Subject Directors of the Zonal Education Departments attached to the Ministry of Education (MoE). These short-term programs help teachers to broaden the understanding of curriculum reforms, innovative teaching methodologies etc. Despite this well-structured mechanism and some benefits, the effectiveness of these in-service programs has shown some limited outcomes. Lack of human resources, monetary incentives, issues related to coordination, and lack of enthusiasm of the teachers are some of the reasons for making this system somewhat ineffective.

Measures taken and Challenges ahead

Reforming the education system of a country from time to time is crucial to make it align with rapidly changing global educational trends. Through many stakeholder discussions and research, the authorities have rightly identify the drawbacks in the existing system, and even proposed some progressive measures to rectify them (NIE, 2018). So far, key reforms

to the Science curriculum and, teaching-learning methodologies have been introduced in 1999 and 2007 with the prime aim of improving Science Education. Even at present, the NIE is in the process of reforming the school curriculum with the aim of switching from teacher-centric and examination-oriented education to a more dynamic system of student-centered and skill-oriented education, which is a much-needed step in the education sector in Sri Lanka. In addition, teacher training is also needs careful consideration from the authorities to make it more effective. Over the years, Sri Lanka has taken steps to bring reforms to the curriculum of the Science Education to achieve future goals of the country. In addressing these reforms and bringing new policies, the National Education Commission and the National Institute of Education are in the forefront. Some of the aims of these reforms are that students should give opportunities to master skills and knowledge and attitudes required for higher education while acquiring practical competencies and soft skills (NIE, 2018).

During the last decade, reforms have been introduced in the science curriculum and new teaching-learning strategies with the aim of improving the learning experiences and outcomes. Competency-based teaching, learning and assessment practices were introduced to enhance students' skills, while novel teaching methodologies were announced to improve student-centered learning and student-teacher interactions. Despite taking some progressive measures over the years, some issues are still lingering due to various reasons. Introducing new teaching-learning methodologies is definitely a positive outcome of identifying the lapses in the existing system. Despite introducing activity- and competency-based teaching and assessment approach to the Science teaching-learning process, their actual practice in schools is questionable. Identifying reasons for this lack of consistency among teachers and their reluctance to implement them is crucial to bring remedial measures in the future. The lack of initiative, knowledge and hands-on experience to implement these new teaching approaches are some of the reasons pointed out by teachers for not adhering to the instructions given by the education authorities. Despite providing pre- and in-service training opportunities for teachers to

disseminate this information, the lack of motivation of the teachers to learn new teaching methodologies can be a major hurdle to overcome. Due to the lack of transport facilities, monetary incentives and other day-to-day hindrances, teachers are reluctant to learn and employ new teaching interventions, and thus stick with conventional teaching methods. Lack of time to complete the syllabus before national examinations can be another setback to implement new teaching-learning approaches. In new interventions, the teachers need to spend some quality time to organize activity and lesson plans prior to the class, which could be another reason why some teachers shy away from implementing them. The exam-oriented education system is another major setback in implementing activity- and competency-based teaching and assessment strategies as well as laboratory work.

The state-owned universities can be a major partner in assisting training teachers in a methodical manner. The postgraduate Institute of Science (PGIS), University of Peradeniya and also the Science Education Unit, Faculty of Science, University of Peradeniya is doing a noteworthy contribution in training teachers in Science Education. The PGIS offering two programmes; Postgraduate Diploma in Science Education and Masters' degree programme in Science Education (SLQF Levels 9 and 10) for science teachers since 2006. In addition, the Science Education Unit of the Faculty of Science, University of Peradeniya conducts 'Science Camps' in schools to popularize Science, enhance students' attitudes and interest in Science. The Ministry of Education (MOE), Sri Lanka Association for the Advancement of Science (SLAAS) and National Science Foundation (NSF) also undertaking many activities to popularize and develop Science Education in the country. The projects such as Olympiad, School Science Projects and School Science Days are some of the projects that attract interest from the students and teachers alike.

Concluding Remarks

Covid pandemic has changed the world where there is no return to as it before. The economic crisis that followed the pandemic made things even worse for countries with fragile economies like Sri Lanka. These new changes have brought new challenges and

issues that countries never undergone before. Of many sectors, Education is one of the worst affected sectors with long-term negative impacts on economic development. Learning losses and their consequent impacts are not yet known. At the same time, the Covid pandemic reminded us how important the Science Education is for societies and communities, despite negative impacts. Covid-19 has transformed the education sector profoundly, and broaden the inequality while enhancing the gap between the poor and the rich in the society. In developing countries, education unravel new opportunities for individuals, and provide a chance to safeguard against inequalities prevail in underprivileged societies. In addition to pandemic-driven challenges face by the Education sector in Sri Lanka, new challenges are also in the horizon due to the ongoing economic crisis. These new challenges can make things even more challenging in addressing equality and quality of education in Sri Lanka. Due to the economic crisis, further spending cuts in the education sector can be expected in the coming years. Thus, the policy makers and education authorities need to revisit the education system and its organizational framework to identify issues and address them in a conducive manner. Achieving short- and long-term goals can become a nightmare for education authorities, thus careful planning and policies will be crucial to get through this most challenging era.

In addition to learning losses, social lockdowns imposed long-term impacts on social and emotional development of children. Recent studies emphasized a close association between social lockdown during Covid pandemic and mental health symptoms (i.e. distress, anxiety) and health behaviors (lower physical activity, more time on computers, bad dietary habits) among school children and adolescents. Therefore, in addition to academic drawbacks, educationists and policy makers should also pay more attention on social

and emotional shortcomings among children and to uplift their well-being.

Despite online teaching-learning process was in the forefront in maintaining some form of continuity of the education system worldwide during the pandemic, studies confirmed that a majority of the main stakeholders (teachers and school children) did not relish on that process. However, online teaching-learning process is not just an option, but it is the 'only option' in a pandemic situation in the future too. Therefore, it is important to make this virtual teaching-learning process more interactive, and interesting to reach effective academic outcomes. Adoption of new teaching/learning strategies, and new means of evaluation of knowledge and skills can make this virtual experience more effective and stimulating to both parties. Therefore, it is the responsibility of the educationists to explore new vistas in virtual or hybrid teaching-learning process to transform it into a more thought-provoking experience for its stakeholders.

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