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Science Education in Schools: Major Focus on STEM

The current issue of the Newsletter focuses on "Science Education in Schools: Major Focus on STEM (Science, Technology, Engineering, and Mathematics)". The articles have been written by various experts and researchers working in this area in the context of different member-countries in Asia Pacific region. These essays cover Australia, Cambodia, China, India, Malaysia, South Korea, Pakistan and Vietnam.

In this issue...

The immense contribution of Science and technology to quality of life has been widely acknowledged. It plays a key role in the day-to-day life of an individual and therefore it is a core component of human development in today's world. The progress of any country or nation is considerably associated with the advancement in the field of Science and technology influencing every aspect of life i.e. food, shelter, medicine, transportation, communication and so on. It is because of this, all countries across the world are now paying increasing attention on Science education that has a considerable impact on overall and holistic development of every individual citizen, and it is part of school curriculum in all developed and developing countries from the early grades. In most countries, the Science subjects are taught as a separate stream at the secondary and higher secondary levels.

The first article talks about the Science education in Australia where special focus is given on STEM with an integrated approach that focuses on practices, skills and capabilities, and not just on the disciplinary knowledge. It also discusses about the supply of qualified teachers and relevant teaching- learning process.

The next article focuses on Science education in the Kingdom of Cambodia which has adopted a Policy on STEM with its main focus on improving creativity of students and developing highly qualified and responsible human resources in this field for the country's sustainable and inclusive development. The article has thrown some light on different provisions

that have been made in Cambodia for ensuring access to quality Science education at the school and higher levels.

In China, the author has mentioned that STEM education is being developed considerably by strengthening curriculum, establishing STEM classroom, conducting fundamental research, and so on. The author has briefly discussed how the STEM education has been embedded in the national strategic development policies in this country.

Three articles have been included in this issue of newsletter that focus on the policy and present status of the Science education in India. By stating "STEM plays a major role when it comes to innovation, problem-solving and creativity", the author of the first article discusses about various initiatives, including 'Rashtriya Avishkar Abhiyan' to promote Science education. Referring to these schemes, it is argued in the second article that, there is an urgent need for planning and strengthening of Sciences/ STEM (integration of Technology, Engineering with Mathematics and Science-related content) in schools as well as at higher level. Considering Science as an integral part of school education system, third article stresses on equity and quality issues in the provision of Science education in India at every level of school education with a far-reaching impact on the country's overall development. The article has not only raised the issue regarding availability of facilities for promoting Science education of good quality, it has also expressed its concern for flourishing industry of private coaching and tuitions which can be availed by those who can afford these.

The subsequent article has discussed about Science education in South Korea where major emphasis has been laid on age-old practice of subject-based approach for the past many decades. However, Science education has gone through some changes in recent years and now integrated and interdisciplinary approach is gaining importance under the newly designed policy of STEAM making Arts as one essential element of it.

Science education in Pakistan is discussed in the next article. Like elsewhere, STEM has received considerable attention in Pakistan in the recent years. Author talks about involving teachers in the provision of STEM education as one of the major initiatives. This article is followed by Vietnam's experience in Science and STEM teaching as part of general education. After a brief discussion on the recent initiatives taken for STEM education, the author has recommended to conduct more researches for sustainable integration of STEM in general education.

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Science Education in Australia: Major Focus on STEM

The Australian Science curriculum sets a shared understanding for what students should learn as they progress through school, and is implemented separately by each State or Territory government. It focuses on developing students' understanding of the nature of scientific inquiry, including questioning; planning and conducting experiments and investigations based on ethical principles; collecting and analysing data; evaluating results; and drawing critical, evidence-based conclusions. Curiosity and a willingness to explore are valued, as the ability to communicate scientific understanding and findings, to justify ideas on the basis of evidence, and to evaluate and debate scientific claims. Students also gain an understanding of historical and cultural contributions to Science as well as contemporary issues related to Science education.

A shift from the current focus on discrete learning areas to a modern conceptualisation of Science, Technology, Engineering and Mathematics (STEM) as interdisciplinary and constantly evolving is essential to maximise the limited space for STEM in the crowded school curriculum. An integrated approach that focuses on practices, skills and capabilities, and not just disciplinary knowledge, will create a relevant context in which content can be learned. A 2018 ACER report, Challenges in STEM Learning in Australian Schools, calls for reform in three key areas to improve the performance of Australian children in STEM subjects. The report recommends:

- an integrated curriculum
- early intervention
- a stronger teaching workforce.

Research shows that Science achievement gaps begin very early in life. Equitable and early access to STEM is therefore vital and should not depend on a student's capacity to pay for education in this area. STEM learning is often packaged as an extracurricular activity with inherent barriers to access for less privileged learners. We must invest in creating the same level of engagement and excitement about STEM as part of the standard program in all early childhood centers and schools. The Australian Government's Early Learning STEM Australia (ELSA) project is developing play-based STEM programs for preschool children, and recommends establishing a greater number of specialised STEM schools, such as the STEM career academy – or the 'school-within-a-school' model – for older students.

The ACER report notes a lack of expertise and qualifications in STEM areas in Australia's teaching workforce, with only a quarter of primary school teachers possessing a strong background or a university degree in Science or Mathematics. At the secondary level, the relatively small number of STEM specialists tend to teach senior students, leaving students in Years 7–10 to be taught by out-of-field teachers.

Incentives to attract people to STEM teaching are one way to address this, but we need better data to understand where in the teacher supply pipeline we might best target such policies, and to gauge the extent to which those policies are working.

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Science Education in Schools in Cambodia: Major Focus on STEM

Science education has gained more attention in the present era of smart phone, smart classroom, and robotics. Due to the rapid advancement in technology, innovative mind and creativity are now the cornerstones of the industrial revolution 4.0. To cope with this new trend, the Ministry of Education, Youth and Sport (MoEYS) of the Kingdom of Cambodia adopted a Policy on Science, Technology, Engineering, and Mathematics (STEM) with the aim to improve the capacities of students and to develop highly qualified and responsible human resources in this field for the country's sustainable and inclusive development. The STEM is transmitted into Cambodia's education system through:

1. The secondary resource school (SRS) in all aspects such as curriculum implementation, learning outcomes, sharing experiences, school development plan and teacher capacity. The secondary resource schools are equipped with laboratory, computer lab, audiovisual room, network of water and electricity.
2. The new generation schools (NGS), through in-depth new learning curriculum at STEM, attract outstanding students. In the classroom, students have a lot of research on excellence and competitiveness and co-operation with national and international institutions. Students can explore more besides listening to the class teachers, using technology for research and practice. In addition, students have also established a number of study clubs such as Science clubs, video clubs, and newspaper clubs. The school has developed a high-level scientific research framework at upper secondary school, which can compete with other local and international students, having several STEM development projects which include promoting research of teachers and students in STEM subjects, establishing research and creative club for student, reforming STEM curriculum, building research culture and publishing STEM output of high school students and modernizing laboratories and establishing new materials to respond to the needs of the labor market and society.
3. The Royal University of Phnom Penh (RUPP) conducts 10 bachelor degree programs and master programs in STEM subjects, including Biology, Chemistry, Environmental Science, Computer Science, Mathematics, Physics, Engineering, Information Technology, Electronics and Telecommunications, and Natural Resource Management. In future, the RUPP will implement some STEM development projects such as the STEM Research Center, the Entrepreneurship and Creative Center, the STEM Curriculum Development, the STEM Research and Publishing Culture-building, and Laboratory Modernization.
4. The Institute of Technology of Cambodia (ITC) conducts large-scale research on scientific projects with universities and international organizations. ITC provides funding to professors to conduct research in Engineering.

The ministry has promoted formation of the Mathematical, Physics and Mathematics study clubs in 36 high schools in Phnom Penh, and has encouraged teachers to establish study clubs within their schools in Prey Veng province. The ministry has collaborated with STEM Cambodia to lead Science Expo and disseminate Science Education among students across the country through the STEM Bus program. The ministry has collaborated with STEM Cambodia by organizing a STEM festival from 9-11 March, 2017 at the Olympic Stadium. The internet services were being provided at national, provincial departments/offices as well as in schools with a total of 320 locations with the support from Metfone.

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Development of STEM Education in China

STEM education, which originated in the United States, has been gradually introduced in the field of Science and Technology education in China since 2001. The vigorous development of STEM education has made remarkable progress in the educational practice, theoretical research as well as educational policy in China, and now enters in a new era.

Firstly, various regions explore the development mode of STEM education, such as Jiangsu province; cities of Shenzhen and Chengdu have issued special documents to strengthen STEM curriculum as well as carried out application for pilot schools and STEM teacher training. The non-governmental organizations, represented by "Chaihuo Maker Space", make efforts to develop STEM education in various ways. Many schools have developed STEM education classrooms or other "School Maker Space" to explore project-based teaching in the classroom.

Secondly, researching on STEM education shows prosperity and diversified trend, though mostly focused on fundamental research, accounting for more than half of the total. The number of STEM research is rapidly increasing in recent years, especially in education policy, industry guidance, popularization of Science and other fields. For instance, there was an explosive growth of published papers (nearly 300) related to STEM education in 2016.

Thirdly, STEM education has been embedded in the national strategic development policies. For example, "the Implementation Plan of the outline of the National Scientific Literacy Action Plan (2016-2020)", issued by the State Council of the People's Republic of China in 2016, emphasizes that high schools should encourage interdisciplinary activities involving scientific innovation and technological practice. In this year, the Ministry of Education clearly proposed in "the 13th Five-Year Plan of Education Informatization" that suitable regions should actively explore the application of Information Technology in new educational models such as "We Start" interdisciplinary learning (STEAM education), "Swordsman Education" and so on. In 2017, the Ministry of Education issued another policy "Science Curriculum Standard for Primary Schools", advocating interdisciplinary learning mode and suggesting that teachers should try STEM education in teaching practice.

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The next issue of ANTRIEP Newsletter (January-June, 2019) will focus on the theme **"Vocational Education and Skill Development: Policies and Practices"**

Science Education in Indian Schools: Major Focus on STEM

India is called the land of immense diversity in terms of geography, history of civilisation, culture, cuisine, language, religion, weather, economic status and, above all, levels of education. Education is a key to progress and development of any country, in which Science education plays a major role. Science is one of the most important subjects in school as it develops problem-solving and critical thinking among students. Science education has reached a stage where we are not confined to books and classrooms. One of the most innovative curricula which is being frequently heard and has gained popularity in India is STEM. STEM is an acronym for Science, Technology, Engineering and Mathematics. STEM plays a major role when it comes to innovation, problem-solving and creativity. Researches have shown that children develop an interest in the STEM at an average age of eight because, at that age, children are fascinated by gadgets and various other devices.

STEM took its root in the USA, and, in India, it has picked up pace significantly over the past few years. Indian Government launched STEM education to identify scientific talent at the school level. One of the biggest challenges involved in the implementation of STEM education is to design infrastructure, curriculum and to equip children with the best guidance and support. The Government is also focusing on campaigns such as 'Make in India', 'Skill India' to make India a prominent global manufacturing hub. This will create a lot of demand for the highly skilled graduates.

In pursuance of the focus on connecting school- based knowledge to the life outside the school, and making learning of Science and Mathematics a meaningful and joyful experience, to bring focus on innovation and use of technology, Government has set up the Rashtriya Avishkar Abhiyan (RAA) - a convergent framework that aims at nurturing a spirit of inquiry and creativity, love for Science and Mathematics and effective use of technology amongst children, and encourage those who show an inclination and talent for these subjects to be encouraged and supported to heights of academic excellence and research.

Similarly, Atal Tinkering Laboratories (ATLs) have been established across the country to foster curiosity, creativity and imagination in young minds and inculcate skills. ATL is a work space where young minds can give shape to their ideas through hands-on do-it-yourself mode; and learn innovation skills. Young children will get a chance to work with tools and equipments to understand the concepts of STEM. ATL would contain educational and learning 'do it yourself' kits and equipment on Science, electronics, robotics, open-source microcontroller boards, sensors, 3D printers and computers along with video-conferencing facility.

Department of Education in Science and Mathematics (DESM), NCERT is also working for STEM education. The DESM has evolved an exemplar list of activities to be undertaken, and the strategies to be adopted by States/UTs to successfully roll out the major interventions suggested in RAA book to achieve the objectives of RAA. DESM, has also developed "Guidelines for Distribution of Individual Students' Science Box at the Upper Primary stage under Rashtriya Avishkar Abhiyan (RAA)". It is expected that the proposed boxes will be distributed free-of-cost to the students along with free textbooks and uniform by the States/UTs. It is envisaged that the proposed Individual Students' Science Box will contribute towards developing students' interest in Science and enhance their learning levels in Science.

Taking into consideration that India is one of the countries that produce the highest number of scientists and engineers, the growth of STEM has picked up significantly over the past few years.

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Planning and Management of STEM Education in India

The focus on STEM education across the world is increasing though the term is relatively new in the Indian education sector. STEM is an acronym for Science, Technology, Engineering, and Mathematics and is a new cross-disciplinary subject in schools. The teaching of the integrated subjects of Science, Technology, Engineering, and Mathematics offers students a chance to make sense of the integrated world we live in rather than learning fragmented bits and pieces of knowledge and practices about it. Profusion of Science and technological advancements has not only enhanced economic progress/ national development, but also the need for skilled manpower to meet the future demands. Moreover, the way development and use of technology is increasing, in the coming years, majority of jobs created will require one or another form of STEM skills. Therefore, robust STEM education which is perceived to create critical thinkers, problem-solvers and innovators makes it pertinent to promote teaching of STEM in schools. Several countries such as USA, UK, Japan, and others have realised the potential of STEM and so have incorporated education programmes and taken steps towards introducing STEM framework in their country. STEM has been part of educational programmes in BRIC countries as well.

In India, though learning of Science and Mathematics has been an integral component of the school curriculum, yet the quality of Science education has remained a massive challenge. Aspects of Science and Mathematics are part of the school curriculum up to Class X, and diversification in three different streams of Science, Commerce and Humanities mainly starts at the higher secondary stage in case of CBSE and different State Boards but starts at Grade IX in case of ICSE. Rough estimates from the available national level data indicate that, despite the fact, that every year nearly one-third (33 per cent) of the students graduating from their senior secondary years belong to Science stream and had studied Science and Mathematics, yet the share of transition from the higher secondary to undergraduate level science courses is around 6 per cent, and is around 13 per cent, including professional Science courses. Therefore, the factors which lead to dropping out of major chunk of Science students every year need attention and indicate the need for strengthening of Science education at the senior secondary level urgently.

The increasing need for skilled and competent manpower in the 21st century calls for national level initiatives for introduction and strengthening STEM education in the schools. The 'Skill India' programme, 'Made in India' programmes are emerging as drivers for furthering STEM education. Other government initiatives such as Rashtriya Avishkar Abhiyan and Atal Tinkering Laboratories for enhancing curiosity, creativity and love for Science and Mathematics are in their nascent stage. In addition, many companies, working in the field of education and technology such as Educomp, Verizon, and others are moving away from smart classrooms towards hands-on learning and STEM. They are working with largely private schools to set up STEM centres, tinkering labs with upcoming technologies like Virtual Reality and Augmented Reality, etc. At present, the private/corporate organisations constitute the major STEM education providers in the country.

In view of the potential and opportunities of STEM education vis-a-vis quality of school education, there is an urgent need for planning and strengthening of Sciences/ STEM (integration of Technology, Engineering with Mathematics and Science-related content) in all the schools specifically in government schools at the national level. For planning and implementation of STEM education, the biggest challenge is to design infrastructure, curriculum, funding and competent/ qualified teachers. It is expected that such initiative would not only enhance the quality of education and prepare skilled personnel but will also help in increasing the attractiveness and preparedness of the students for Science education career at the higher level.

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Equity and Quality in Science Education in India

It is widely acknowledged that Science has a major role to play in societal development in any country. Being a major channel of knowledge creation and dissemination, it is the basic component of education and culture across the countries, including India. Exploring nature and attempting to explain and predict natural phenomena are the essence of scientific investigations. Formal schooling of a child in India usually starts at the age of five. All states usually follow a uniform academic system i.e. the 10+2 system covering elementary, secondary and higher secondary. Generally, after introducing students with environment science at the primary level, the basic knowledge of Science, including Physics, Chemistry, Biology and Mathematics has been made compulsory for every student till Grade X. After Class X, a student may choose any of the available streams divided into Science, Commerce and Humanities. In view of tremendous development in Science and Technology, especially IT sectors, Engineering and Medical Sciences, the demand for Science stream has increased considerably. However, the state as well the union governments are making efforts to provide quality as well as affordable education for every citizen of the country.

The industrial revolution that started in the 18th century brought Science closer to the common man. The 20th century witnessed rapid progress of Science education all over the world. Science education in India has been greatly accelerated after independence. Since then, many important landmarks in the development of Science education have been laid, including the report of the Secondary Education Commission (1953), All India seminars on teaching Science (1956), National scientific policy resolution (1958), Indian parliamentary and scientific committee, National Council of Educational Research and Training (NCERT, 1961), UNESCO planning mission (1963), Indian education commission (1964-66) and National Policy on Education (1986).

The most widely acclaimed views of teaching Science in schools is that it can inculcate certain values and attitudes in children – scientific temper, rationality, reasoning, problem-solving skill, methods of Science and so on, that are essential for an enlightened citizenship. Science teaching in schools can fasten progress and development of a nation by creating scientific and technological manpower essential for continued economic growth. Despite tremendous improvement in access to school education, teaching and learning of Science are facing many challenges in India. One of the major challenges is non-availability of physical and academic facilities like laboratories and proper teaching-learning materials, particularly in government-run schools even at the secondary and higher secondary stages across the states. In addition, non-availability of trained and qualified teachers for different Science subjects leads to poor quality of teaching-learning process which, in turn, causes poor performance of students. Many teachers who are assigned to teach Science are not adequately qualified to teach Science at the high school level.

Since the Indian school education system is considerably iniquitous because of private-public dichotomy as well as rural-urban dichotomy, the quality Science education remains out of reach for a huge number of students living in remote rural areas and studying in government (public) schools many of which are devoid of basic facilities, library, laboratories and Science kits. It is also noticeable that, a major section of these children are socially and economically deprived groups and specially girls. Apart from this, the role of private coaching institutions has become very prominent to address the educational needs and aspiration of students who can afford to pay for such institutions. Private coaching or shadow teaching of school students is a general phenomenon in some of the developing countries, including India. Most students who opt for Science stream in India generally have

access to a private coaching for additional academic support. Majority of students who qualify joint entrance examination for engineering education in Indian Institute of Technology (IIT) and Medical education need to take extra coaching from such institutions. Private coaching has emerged as a corporate business encouraging commercialisation of education in India. According to a survey, conducted by Assocham, titled "Business of private coaching centres in India", the size of private coaching sector was $23.7 billion or 1.41 lakh crore in 2013. It is understandable that this rapid expansion of private coaching centres, along with private schools, is jeopardising the equity. Under such circumstances, it is required to pay adequate attention for expansion and to improve quality of Science education, particularly in government-run schools right from the early grades.

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Science Education in Schools in South Korea: Major Focus on STEM

Education for Science, Technology, Engineering and Mathematics (STEM) has received a major attention in education, especially as the advancement of technology occurs very rapidly. STEM has been considered a key area which should be promoted and advanced in order to strengthen global competitiveness of each country. Therefore, STEM education has been globally emphasized at each level of education, and South Korea is not an exception.

As a part of the South Korean national curriculum, the subject of Science is taught from primary schools through high schools. Science education in South Korea has traditionally adopted a subject-based approach which usually teaches directly out of Science textbooks. The difference in Science education depending on grade level is the courses of Science taken as general electives and advanced electives for college entrance in upper secondary education after taking general Science classes and scientific exploration and experiments.

However, the trends of approaching Science education have gone through changes in South Korea as the STEM literacy is gaining importance globally. Science is taught in an integrated and interdisciplinary approach under the newly designed policy called STEAM, which represents Science, apart from the traditional discipline-based approach, is Science Technology, Engineering, Arts and Mathematics since 2011. As newly implemented teaching and learning methods, STEAM education aims to encourage more students to be interested in Science and Technology by taking an integrated approach among the elements of STEAM. The distinctive feature of STEAM which separates from the general STEM approach is its inclusion of the elements of Arts. Having Arts as one of the essential elements of STEAM education, it facilitates the process of cultivating creativity.

STEAM education also helps students foster and develop ability to solve the problems that they encounter in the real world. The elements of technology and engineering facilitate the process of identifying the real-world problems and help in better understanding the process of reaching solutions. Another distinctive aspect of South Korea's STEAM education is that it actively and intentionally attempts to integrate the relevant subjects and connecting the subjects among Science, Technology, Engineering, Arts and Mathematics.

As described above, Science education in South Korea began with a subject-centered and textbook-based approach even though it contained some elements of hands-on learning through conducting experiments in labs. However, it will expand the scope of knowledge that can be constructed with integration of other subject areas that generate innovative technological advancement such as Mathematics, and Engineering. Distinctively, serving as a foundation that could bring about such creative innovation, Arts should play an important role in carrying out the goal of STEAM education in South Korea. STEAM education is a crucial advancement in Science education in South Korea, fostering creative and innovative minds with the 21st century skills, as the most recent revision of National Science curriculum also aims to adopt an integrated and interdisciplinary approach to Science education.

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STEM for Strengthening Science Education in Pakistan

Since the inception of Pakistan in 1947, the socio-political situation has never allowed a focus beyond basic educational needs. At the level of schools and higher education institutions, Science education gradually evolved from a fact-based theoretical discipline to more active learning of Science by introducing practical work (Halai, 2008). Initially, Science was taught at the post-secondary institutions only, as it was used to be the practice in the colonial period. From 1959 onwards, when the first comprehensive Education Policy was introduced, subjects of Science and Mathematics were introduced in basic education: Grades I to VIII. It was in the 1970s, when active Science learning featured as practical work in the higher secondary school level: Grades IX to XII. By the turn of the century, Science education moved towards Science and Technology (S&T). The Institute for the Promotion of Science Education and Training (IPSET), established in 1997, grew into the National Institute of Science and Technical Education (NISTE).

Like elsewhere, STEM (Science, Technology, Engineering and Mathematics) has recently gained momentum in Pakistan as well and it has become a strategic area of priority and focus in this country. A visible contribution towards STEM in Pakistan started at the turn of 21st century by Higher Education Commission (HEC) and the Pakistan Institute of Engineering & Applied Sciences (PIEAS) that established a goal to nurture higher secondary education level students (Grades XI and XII) to pursue careers in STEM through a joint venture named as STEM Careers Programme (National Science Talent Contest - NSTC). NSTC has encouraged higher secondary students to come up with innovative solutions to the problems of national concern, however, there is no evidence of such work at the primary and secondary school levels. Recently, the Pakistan Alliance for Mathematics and Science PAMS (2017) has generated a public discourse on "Powering Pakistan for the 21st Century" through transforming Mathematics and Science education in schools. Additionally, private and social enterprises have begun providing STEM learning opportunities mainly through after school programmes.

A recent development, 'a teacher as a researcher' offers a new role for teachers in Pakistan (GOP- MOE, 2009a; Halai, 2012) and provides the right entry point

by developing partnership with teachers by initiating conversations on STEM education and developing STEM models which are most suited for various local contexts. Moreover, focusing at the current Science education goals, STEM integration approach has potential of rejuvenating the true purpose of Science education and providing a conceptual framework to achieve the goals of promoting scientific inquiry and problem solving through student-centered pedagogies (Anwar, 2017). The Aga Khan University's Institute for Educational Development has started yet another groundbreaking research in STEM education through STEM for Teacher Education of Analysis, Measurement and Science (STEM TEAMS), where Grades III-VIII teachers are engaged in the development of STEM integrated curricular units which are contextually relevant and aligned with the National Curriculum of Pakistan through STEM focused professional development combined with STEM coaching support. Despite the infancy of STEM TEAMS, role of STEM in strengthening Science education seems to be promising.

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Overview about Sciences and STEM Teaching in Vietnamese General Education

In the Vietnam, currently practiced general education curriculum (issued in 2006), Science is a core subject taught from Grade IV to Grade V over two periods per week with various topics such as Human Body and Health, and Matters and Energy. From Grade VI to Grade XII, there is no general Science subject; Physics, Chemistry and Biology are taught separately instead. Vietnamese students have achieved impressive results in international and regional Olympics in Sciences and also ranked eighth on the Programme for International Student Assessment in Science by OECD (PISA 2015 and 2018).

Recently, the teaching of STEM has been encouraged in mainstream schools. Due to the lack of official guidelines in the general education curriculum, STEM teaching is being integrated in various formats, including experiential and experimental learning, STEM clubs, robotics or introduction to scientific research. STEM has initially helped to develop general and core abilities and motivate student. STEM activities have been growing in about 60 districts and boroughs of 22 cities and towns, including rural and mountainous areas, which have renovated Science and Technology education in Vietnam. However, in some cases, STEM learning activities have been too complicated compared to the expected outcomes of the syllabus which is added up by severe lack of experimental learning and technology. This has discouraged many students from pursuing a career in this field. Therefore, there exists a need to conduct extensive research for STEM education to be sustainably integrated in the general education system.

The new proposal of the national general education curriculum (from 2015 onwards) has introduced several new changes such as the employment of an open approach and the expansion of experiential activities; the introduction of IT from Grade III; the increasing focus on Technology as a subject; and Science is taught from Grade IV to Grade IX (mainly by integrating knowledge

and findings from Physics, Chemistry, Biology, Health Education and Environmental Studies). At the upper secondary level, due to career orienting purposes, the curriculum with three elected subject groups also enhance STEM teaching; there is no Science subject (Physics, Chemistry and Biology are taught separately). Although there is no clear cut STEM section in the general education curriculum, there are topics of Physics, Chemistry, Biology and Technology giving opportunities for incorporation of STEM. The Ministry of Education and Training also offers guidelines for schools to selectively enhance STEM education.

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News from ANTRIEP Member-Institutions (July-December, 2018)

Australian Council for Educational Research (ACER)

Australia

- The Deputy CEO (Research), Dr. Sue Thomson, was elected to join the Standing Committee of the International Association for the Evaluation of Educational Achievement (IEA) for providing input of Australia's involvement in TIMSS, PIRLS and the OECD's programme for PISA.ACER India is working with partners across South Asia to ensure inclusive and quality education for all. The organization is also working in capacity development to support student learning assessments.

- ACER organized the Australian STEM Video Game Challenge in which around 3000 students had participated. These children designed and built video games addressing the 2018 theme of 'Transformation' related to topics like climate change, the life cycle of animals, evolution and devolution, family, shapes and time travel, etc.

- The Australian Council for Educational Research (ACER) has signed a Memorandum of Agreement with the Kuala Lumpur-based Emerging Markets Innovative Research (EMIR) on 20 September, 2018. It is a commitment between two independent research bodies to collaborate on educational research and development programs in the areas of policy review, assessment for learning, national surveys, and education quality evaluation and impact studies.

- A ten-day International Professional Learning Programme (IPLP) was held during 23 November–2 December 2018 in Melbourne, Australia. ACER had invited school leaders and teachers to participate in it for an immersion experience.

International Institute for Educational Planning (IIEP)

Paris, France

- IIEP-UNESCO collaborated in the bi-annual Forum on Quality Assurance organized by Directorate of Higher Education Reviews on 2 December, 2018. The objective of the Forum was to report on the achievements of the BQA after its creation 10 years ago and to share the findings from the IIEP research on 'Exploring innovative and effective options in internal quality assurance.'

- The Ministry of National Education and Vocational Training (MENFP), the UNESCO International Institute for Educational Planning (IIEP-UNESCO) and the European Union (EU) have launched the project 'Improving the Haitian education system through planning and strategic management' in Haiti during the second week of November, 2018.

- The 11th edition of the Convergences World Forum was held on 3-4 September, 2018 at the Palais Brongniart in Paris focusing on the theme 'Make Society, Make Tomorrow'. The Director of IIEP-UNESCO had taken part in a panel session on "What levers for girls' education?" - in this forum.

Aga Khan University (AKU-IED) Institute for Educational Development

Pakistan

- Dr Ayesha Mian, chair of the department of psychiatry at Aga Khan University has been recognised with a lifetime achievement award for her outstanding leadership, impactful mentorship for medical students and her efforts towards improving the mental health for children and adolescents.

The award was rewarded from the University of Missouri-Columbia's International Center for Psychosocial Trauma and the University's Child and Adolescent Psychiatry Alumni Association in November, 2018. AKU conducted a Teaching and Learning Enhancement Workshop (TLEW), to support novice and experienced faculty members to develop increased competence and confidence as facilitators of learning as well as provide them with resources to be more reflective about their teaching.

- The AKU Institute for Human Development has planned and collaborated with other agencies of the Aga Khan Development Network to introduce professionals from government and NGOs to the Science of Early Child Development (ECD). Face-to-face seminars and an online course to 190 individuals from 10 countries were delivered by the Institute and its partners, providing them with a thorough grounding in the Science of ECD. AKU.

Korean Educational Development Institute (KEDI)

Korea

- KEDI Journal of Educational Policy Vol. 15 No. 2 came out on 31 December, 2018. It included 9 articles covering topics like testing pressure, multi-cultural education, Mainland Chinese students, in-service teacher burnout, policy implementation, shadow education, KELS 2013, e-learning, etc.

- Few delegates of the Ministry of Education visited Library, KEDI on 3 December, 2018 to learn about the educational policy of elementary and secondary schools and successful cases in Korea.

- A Korea-OECD International Seminar was held on 29 November, 2018 at KEDI. The theme of the Seminar was 'Educational Equity for Quality Life: Moving Forward Beyond Barriers'.

National Council of Educational Research and Training (NCERT)

New Delhi, India

- A National Conference on 'Science Education 2018' was organised during 29 November-1 December, 2018 at the Regional Institute of Education (Odisha), NCERT to provide a platform to all stakeholders working in the field of science education to share their experiences, researches, innovative practices and their impact in improving the quality of science education in schools.

- A National Conference on 'Achieving Sustainable Development Goals 2030' was held during 15-16 November, 2018. It was organized by North-east Regional Institute of Education (Meghalaya), NCERT. The 11th edition of the Convergences World Forum was held on 3-4 September, 2018 at the Palais Brongniart in Paris focusing on the theme 'Make Society, Make Tomorrow'. The Director of IIEP-UNESCO had taken part in a panel session on "What levers for girls' education?" - in this forum.

National Institute of Educational Planning and Administration (NIEPA)

New Delhi, India

- A Workshop on 'Access and Participation of Children in Elementary Schools in the Educationally Backward Blocks in India' was conducted during 26-30 November, 2018 at NIEPA, New Delhi.

- A Workshop on 'Improving Participation of Children in Elementary Schools in India' was organised by the Department of School and Non-formal Education, during 29-31 October, 2018 at NIEPA, New Delhi.

- A Programme on 'Leadership in Educational Administration for Academic Administrators in

Universities and Colleges' was organised during 24-26 September, 2018 at NIEPA, New Delhi.India Higher Education Report (IHER) 2019 First Peer Review Meeting on Governance and Management of Higher Education in India was organized by CPRHE on 4 May, 2018 at NIEPA New Delhi.

- The Fifth Post-Graduate Diploma in 'Educational Planning and Administration' (PGDEPA), Second Phase: was successfully conducted during 1 September-30 November, 2018 at NIEPA, New Delhi.

- An Eleventh Annual Orientation Programme on 'Institutional Planning for Heads of Muslim Minority Managed Senior Secondary Schools' was held from 27-31 August, 2018 at NIEPA, New Delhi.

- An International Programme for 'Educational Administrators' fully funded by ITEC/MEA,GOI was organised from 16 July-10 August, 2018 at NIEPA, New Delhi.

- A National Workshop on 'Guidelines for Action for School Improvement' was held during July, 2018 at NIEPA, New Delhi.

Vietnam Institute of Educational Sciences (VNIES)

Philippines

- VNIES conducted a ceremony of the 40th Anniversary of School Establishment on 28 December, 2018. On this occasion, the Ministry of Education and Training awarded the Emulation Flag to the school and rewarded teachers with outstanding achievements.

- A Workshop on 'Building models and leadership capacity of smart schools: Kinh international experience and practice' was organized by VNIES cooperated with the University of Education - Hanoi National University on 28 December, 2018.

- A Seminar on 'Theories and practices in skill education in the 21st century for middle school students in difficult areas of Vietnam' was organized by VNIES on 26 December, 2018.

- A meeting was organized by VNIES with the representatives of Korea Educational Development Research Institute (KEDI) on 6 December, 2018. The major focus of the meeting was on the 'Education Reform Strategy in Korea: Educational Reform Strategies in Korea: Challenges and Issues.'

- VNIES organized a Training Workshop on 'MT4T - Application of technology on phones for teachers in teaching' on 7 November, 2018, within the framework of cooperation with SEAMEO INNOTECH.

- Vietnam Institute of Educational Sciences cooperated with the Center for Education and Development and the Association for Education for all Vietnamese people (VAEFA) organized the Workshop on 'Enhancing mobilization capacity resources, connecting with local organizations to improve the quality of community learning centers' on 12 October, 2018.

- Consent Leaders of Vietnam Education Science Institute and Ms. Ceinwyn Elleway, Lecturer - PhD student from Flinders University, Australia, Center for Higher Education Research and Department Management-Science, Training and International Cooperation jointly organized a Seminar on 'Multicultural approach to research' on 28 September, 2018.

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News from ANTRIEP Member-Institutions (July-December, 2018)

1. Academy of Educational Planning and Management (AEPAM), Ministry of Education, Taleemi Chowk, G-8/1, P.O. Box 1566, ISLAMABAD, Pakistan (http:/aepam.edu.pk)
2. Australian Council for Educational Research (ACER), 19 Prospect Hill Road, Private Bag-55, Camberwell, Melbourne, VICTORIA-3124, Australia (www.acer.edu.au)
3. Balitbang Dikbud Centre for Policy Research (Puslit Penelitian), Office for Educational and Culture Research and Development (Balitbang Dikb), Ministry of Education and Culture, Jalan Jenderal Sudirman, Senayan, JAKARTA-12041, Indonesia.
4. Bangladesh Rural Advancement Committee (BRAC), 75, Mohakhali Commercial Area, DHAKA-1212, Bangladesh (www.brac.net)
5. Campaign for Popular Education (CAMPE), 5/14, Humayun Road, Mohammadpur, DHAKA-1207, Bangladesh (www.campebd.org)
6. Centre for Multi-Disciplinary Development Research (CMDR), D. B. Rodda Road, Jubilee Circle, DHARWARD-380001, Karnataka (INDIA) (www.cmdr.co.in)
7. Centre for Education Leadership Development (CELD), National Institute of Education (NIE), Meepe Junction, PADUKKA, Sri Lanka (www.nie.lk)
8. Institute Aminuddin Baki (National Institute of Educational Management), Ministry of Education, Sri Layang 69000, Genting Highland, PAHANG, Malaysia
9. International Institute for Educational Planning (IIEP), 7-9 rue Eugene-Delacroix, 75116 PARIS, France (www.iiep.unesco.org)
10. Korean Educational Development Institute (KEDI), 92-6 Umyeon-Dong, Seocho-Gu, SEOUL 137-791 Korea (www.kedi.re.kr)
11. National Academy for Educational Management (NAEM), Dhanmodi, DHAKA–1205, Bangladesh (www.naem.gov.bd)
12. National Centre for Educational Development (NCED), Sanothimi, BHAKTAPUR-2050, Nepal (www.nced.gov.np)
13. National Council of Educational Research and Training (NCERT), 17-B, Sri Aurobindo Marg, NEW DELHI-110016 (INDIA) (www.ncert.nic.in)
14. National Institute of Education (NIE), 123, Preah Norodom Blvd, PHOM PENH, Cambodia (www.nie.edu.kh)
15. National Institute of Educational Planning and Administration (NIEPA), 17-B, Sri Aurobindo Marg, NEW DELHI–110016, (INDIA) (www.niepa.ac.in)
16. Research Centre for Educational Innovation and Development, Tribhuvan University, P.O. Box 2161, Balkhu, KATHMANDU, Nepal (www.cerid.org)
17. Shanghai Institute of Human Resource Development (SIHRD), 21 North Cha Ling North Road, SHANGHAI-200032, China
18. South-East Asian Ministers of Education Organisation Regional Centre for Educational Innovation and Technology, SEAMEO- INNOTECH P.O. Box 207, Commonwealth Avenue, U.P. Diliman, QUEZON CITY 1101, Philippines (www.seameo-innotech.org)
19. State Institute of Educational Management & Training (SIEMAT), 25 P.C. Banerjee Road, Allenganj, PRAYAGRAJ, Uttar Pradesh (INDIA)
20. The Aga Khan Education Service, Pakistan (AKES,P) House Nos.3 & 4, F-17/B, Block VII, KDA Scheme 5, Clifton, KARACHI-75600, Pakistan (www.akdn.org/akes)
21. The Aga Khan University - Institute for Educational Development, (AKU-IED), 1-5/B-VII, F. B. Area Karimabad, P.O. Box No.13688, KARACHI-75950, Pakistan (http://www.aku.edu)
22. Vietnam Institute of Educational Sciences (VNIES), 101, Tran Hung Dao-Hoan Kiem, HANOI, Vietnam (www.vnrw.vnies.edu.in)

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