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HOW 60:40 POLICY AFFECTS THE DEVELOPMENT OF SCIENCE CURRICULUM IN MALAYSIA

Suhanna Zainudin
Lilia Halim
Zanaton Iksan
Fakulti Pendidikan, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, MALAYSIA.

Abstrak

Since 1967, Malaysian's Ministry of Education has constructed a policy called the 60:40 Policy. This Policy aims to enroll 60% of students into Science/Technical stream while the other 40% into Art streams. This policy is based on the 1967 Statement Report of Higher Education Planning Committee. Although the implementation of this 60:40 policy has been almost half a decade, targeted ratio was found to be very far from the desired goals. Among the factors that influence students not to choose the Science / Technical stream is due to their lack of interest in Science subjects, they also felt that Science is difficult and the circle of people don't encourage them enough to participate in the Science stream, caused by inadequate exposure to science-based careers. The involvement and achievement of students in rural areas are lower compared to those in urban area, which is caused by geographical factors and low socio-economic status. Ministry of Education (MOE) has taken initiatives to replace the Integrated Curriculum for Primary Schools (KBSR) to the Standard Curriculum for Primary Schools (KSSR) in 2011. But this transformation does not agree well with the 60:40 Policy because Science subjects have been replaced by the World Science and Technology. Other than that, the integration of Science, Technology, Engineering and Mathematics subjects (STEM) and 21st century learning is also seen as an approach that draws students interest to science. This approach must be integrated into the Science curriculum and consequently supporting the 60:40 policy. It is a hope that the 60:40 Policy can be realized by our country's education system by the year 2020.

Keywords*: 60:40 Policy, STEM, KSSR and 21st Century Learning*

Abstrak

Sejak tahun 1967, Kementerian Pelajaran Malaysia telah membuat satu dasar iaitu Dasar 60:40. Dasar ini menyasarkan 60% murid mengikuti aliran Sains/Teknikal manakala 40% lagi mengikut aliran Sastera. Dasar ini dibuat dengan berdasarkan Laporan Penyata Jawatankuasa Perancang Pelajaran Tinggi 1967.*Walaupun pelaksanaan Dasar 60:40 ini telah hampir separuh dekad, nisbah yang disasarkan ini didapati sangat jauh daripada sasaran yang ditetapkan. Antara faktor yang mempengaruhi murid untuk tidak memilih aliran Sains/Teknikal ialah murid tidak meminati mata pelajaran Sains, mereka juga merasakan Mata Pelajaran Sains adalah subjek yang sukar serta orang sekeliling yang tidak menggalakkan mereka menyertai aliran Sains kerana kurangnya pendedahan mengenai kerjaya dalam bidang Sains. Penglibatan dan pencapaian murid di luar bandar adalah lebih rendah berbanding murid di bandar berikutan faktor geografi dan status sosio ekonomi yang lebih rendah*

di kawasan luar bandar. Kementerian Pelajaran Malaysia (KPM) telah mengambil langkah menggantikan Kurikulum Bersepadu Sekolah Rendah (KBSR) kepada Kurikulum Standard Sekolah Rendah (KSSR) pada tahun 2011. Namun begitu langkah transformasi ini dilihat kurang menyokong Dasar 60:40 kerana mata pelajaran Sains telah digantikan dengan mata pelajaran Dunia Sains dan Teknologi. Selain itu Integrasi mata pelajaran Sains, Teknologi, Kejuruteraan dan Matematik (STEM) dan pembelajaran abad ke 21 juga dilihat sebagai pendekatan yang berupaya menarik minat murid terhadap Sains. Pendekatan ini perlu diterapkan ke dalam kurikulum Sains dan seterusnya dilihat menyokong Dasar 60:40. Diharapkan Dasar 60:40 ini berjaya dicapai oleh sistem pendidikan negara menjelang tahun 2020 nanti

Kata kunci: *Dasar 60:40, STEM, KSSR dan Pembelajaran abad ke 21*

INTRODUCTION

As a developing country, Malaysia is concerned on the education system to ensure the country's economic development, supported by quality human capital and the spirit of competitiveness. This leads to the evolution of education system in Malaysia since the pre independence before the year 1957.The evolution process includes the construction of policy and the direction tailored to suit the current needs of the national education system. This is in order to achieve specific goals planned by the government. Construction of a policy in Malaysian education system is also categorizedinto few departments such as education policy control, education policy solutions, policy on educational welfare and policy of innovation in education. Each Policy formulated have an important role in ensuring the country's education system is in good quality and can benefit the Malaysians themselves.

According Sufean and Norliza (2009) the education policy in Malaysia begun with the policies set forth in the Education Ordinance 1957, this was later followed by the Education Act 1961 and the Education Act 1996. Education Act 1996 not only set the policy of education in Malaysia which outlines key policy for development of nation building but also nurtures the basic education to produce skilled and professional labors in various fields including science and technology.

iMPORTANCE OF THE 60:40 POLICY

The 60:40 Policy is the basis for Educational Policy that has been apprehended by the Ministry of Education (MOE) with reference to the Report of Higher Education Planning Committee 1967.The Committee has suggested the change ratio of students in Science / Technical and literature gradually starting from 1970 with the ratio of 45 percent in science / technical and 55 per cent of students in the field of Arts to 60 percent of students in the Science / Technical and 40 percent in Literature stream starting from 1980.The committee also recommended that the enrollment of students, especially at the secondary education level and higher level in the ratio of 60 per cent in the Science / Techical and 40 percent in Arts (Sufean and Norliza 2009).

The 60:40 policy is still used today as stated in item 5.3.3 of the National Education Policy (MOE, 2012). The existence of this policy can be seen in line with the national goal of achieving Vision 2020, which aims to place Malaysians as a scientific and progressive society and to support economic development by focusing on the development of the technology industry.The 60:40 Policy is also seen as having an important part in the nation's economy because according to the Policy Strategy Report

60:40 (2013), education is the foundation of national development, especially in developing capacity and capability of human resources which are competitive. This has brought Malaysia to aim 493,830 scientists and engineers by 2020 as reported by the Council of State for Scientific Research and Development in 1999.

According to The 60:40 Policy Strategy Report on Science / Technical Stream: Arts (2013), Government Transformation Program aims to provide employment, especially in Science / Technical by 1.3 million by the year 2020. The projected manpower needs in the field of Science / Technical and level of expertise required by the country targeted is shown in Figure 1.

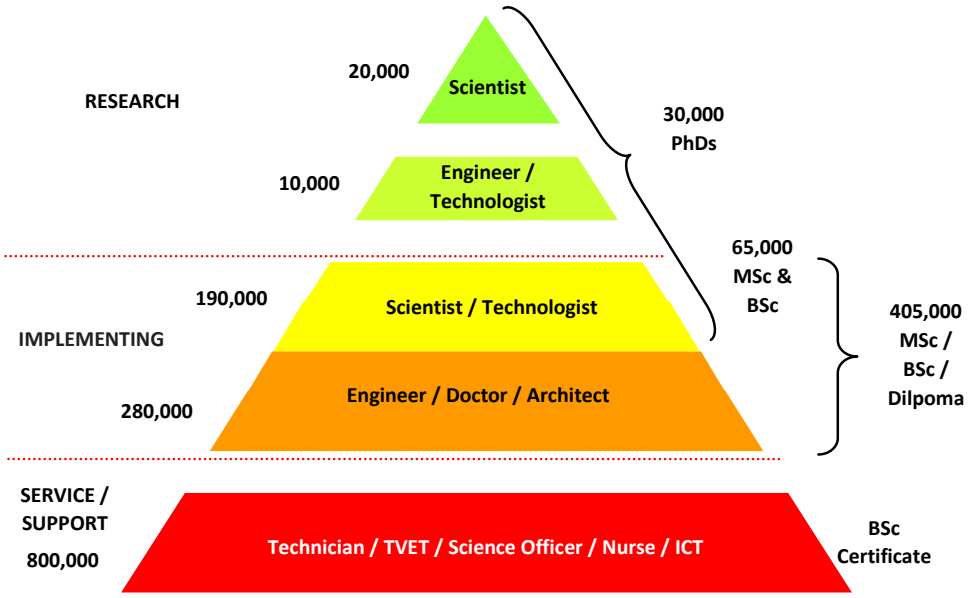

Figure 1 Pyramid of Resource Development of Science and Technical Workers in 2020

(Source: Report of 60:40 Policy Strategy Flow Science / Technical: Arts)

Status of 60:40 Policy Achievement

It has been 48 years since this policy is implemented. However, the participation of school students in science stream has not yet reached the prescribed ratio. According to Idris Jusoh in a press conference in Utusan on 25 February 2014, during the launch of the Science Engineering Fair in Cyberjaya, Kuala Lumpur, only 37% of students enroll in Science stream at school. This value is seen to increase when it is compared to the highest participation in 2005 at 31.22% as reported by Fatin, Mohd Saleh, Mohammad Bilal and Salmiza (2012). This opinion is supported by the 60:40 Strategy Report Policy Science / Technical: Arts (2013) as shown in Figure 2. This figure shows the trend of the percentage of the PMR students who are eligible but does not registerfor Science / Technical steam, it is increasing starting in 2008 the rate of 7:53 percent to 13.12 percent in 2011.

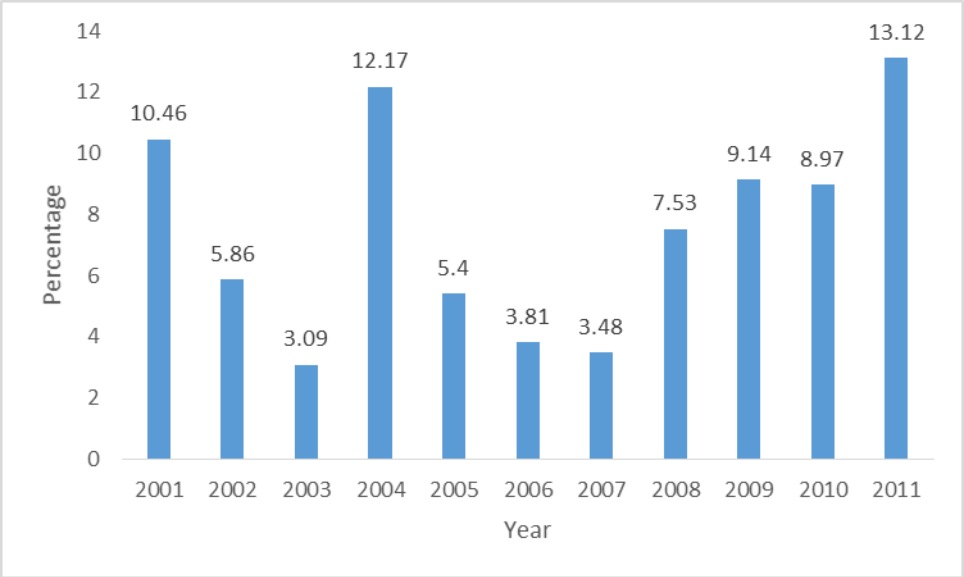

Figure 2: The percentage participation trend of PMR students who are eligible but not participating in the Science / Technical stream.

Source: Report Achieve Strategy 60:40 Association of Technical Science Stream: Arts (2013).

In addition, the Malaysian Science, Technology and Innovation (STI) Indicators Report 2013 as have shown in Table 1 shows the percentage of student participation in the Malaysian Certificate of Education (SPM) in science stream subjects such as Chemistry, Physics and Biology. The enrollment of students in Chemistry, Physics and Biology are stationary and there was no dramatic increase. Strictly, serious actions are needed and should be implemented to attract students of science stream in order to realize the target of 60:40 by 2020.

Table 1: Percentage of students who took the SPM in 2010 and 2012

Subjects	Sijil Pelajaran Malaysia (SPM)		
	2010	2011	2012
Chemistry	31.0	31.1	31.3
Physics	30.0	30.1	30.5
Biology	24.0	24.5	24.5

Source: Malaysian Science, Technology and Innovation (STI) Indicators Report 2013

Figure 1 Percentage of SPM candidates from the year 2010 to 2012

3. FACTORS AFFECTING THE ACHIEVEMENT OF 60:40 POLICY

Many studies and research have been made to see why this policy is not achieved. Among them, as reported by Fatin et al. (2012) is because of students' perception on the curriculum of science subjects being difficult to be learned. In addition, students also have different opinions towards Science such as it is difficult for them to achieve excellent results, difficulty to master science concepts related to teaching and learning processT&L and the effect of discouraging opinions on science from people around them. It is the result of a lack of knowledge and exposure to careers in science that exist within themselves.

Aminah Ayob (2012) have also concluded in a Colloquium on Mathematics and Science in 2012 at the University of Malaya, Kuala Lumpur that among the reasons for their interest in Science declining is due to the education system has not changed and adopted over the years. This causes the content and methods available in the Science syllabus are considered as outdated and unable to attract students' attention. She also mentioned the factors and interests of teachers has also been the reason why students are not interested in science subjects.

Teachers also become a focus for studying the factors that influence this policy and the lack of access are discussed in the study Syed Othman & Hasnan (2001).Their study found that the number of graduate teachers in science is too low in secondary schools compared with the number of graduate teachers in the social sciences about as much as 70-80 percent of the number of teachers available at the time. The shortage of teachers in science graduates will certainly impact on 60:40 Policy as social science teachers could not afford to attract students to science. In addition, the problem also stems from teacher-centeredteaching and learning process and the teachers only spend syllabus focuses on preparing the student for the exam , it is also called by Aminah Ayob(2012).T&L that focuses on teacher-centered approach makes the students bored because they were only taught the theory to be memorized as preparation for examination. This approach is counterproductive as it will block the associations of science with the world around them while Science is a fascinating subject about what is happening in the students and their environment.

Research conducted by Ling Siew Eng et al (2014) further emphasizes that the geographical factors also play a role in this policy'sfailure. This is due to the schools in the rural areas suffering from a shortage of conducive infrastructure and facilities for the learning of their students. Fatin et al.(2012) also explained students in rural areas show a low competitiveness compared to students in urban areas due to lack of motivation for learning because students had to work to support the family economy. In addition, the location of the school, which is far from home, is also a factor in addition to the lack of facilities for them to study at home as a result of the economic hardship faced. The gap high school students in rural areas and urban in aspects of science and mathematics can be seen in Table 1. This table shows the percentage of students who scored in the Lower Secondary Examination (PMR) or A1 and A2 for the Certificate Examination (SPM). Available achievement of rural students who obtained A in PMR and SPM A1 or A2 in is very far behind when compared to urban students.

Table 1: Comparison of the percentage of students gaining A (PMR or A1-A2 (SPM) in urban and rural schools

	Urban Schools	Rural Schools
PMR Science 2008	21.5%	9.8%
PMR Mathematic 2008	31.2%	15.9%
SPM Science 2008	10.9%	7.9%
SPM Mathematic 2008	31,4%	17.4%
SPM Physics 2008	18.1%	8.3%
SPM Chemistry 2008	19.7%	9.1%

Source: (Fatin et al 2012)

Although there are many factors of failure identified by researchers, the survey by Trends in International Mathematics and Science Study (TIMSS) 2007, found that student interest in the science and mathematics is high (Fatin et al 2012). Immediate action must be taken on the basis of these findings by the MOE to take steps to transform the science curriculum. Hopefully the measures and transformation steps undertaken to attract more pupils to follow the flow of Science / Technical before the year 2020 thus achieving Policy 60:40 enacted over the years.

Development of science curriculum

3.1 KBSR to KSSR

Integrated Primary School Curriculum is a curriculum as known as *"Kurikulum Bersepadu Sekolah Rendah (KBSR)"* adopted since 1993. The curriculum emphasizes the 3M skills (reading, writing and arithmetic) and the cross-curricular elements (Shurainee & Sharipah 2011). The curriculum is also planned with curriculum design based on three areas: communication, humans and the environment and the development of the individual. It is clear that this curriculum emphasis on science in the field of human and the environment and have the description of the measure and that there are lessons to state what should be mastered by students. According to Olivia 2009, the curriculum is the result of current products; development of curriculum is always based on the existing curriculum. This statement is perfect because in 2011, where KBSR converted to the Standard Curriculum for Primary Schools as known as *"Kurikulum Standard Sekolah Rendah (KSSR)*. KBSR changes to KSSR as a massive transformation since it involves eight key aspects of curriculum which are design, organization, content, pedagogy, time allocation, assessment methods, materials and curriculum management in schools (Shurainee & Sharipah 2011).

KSSR was also designed to take into account the needs of education in the 21st century it can be seen by six element in KSSR, which are communication, spirituality, attitudes and values, human, physical and aesthetic development, science and technology and the skills themselves. Moreover KSSR also highlight changes to the skills that should be mastered by students at the school. Reasoning skills wasadded to the skills of the existing 3M and the name changed to 4M. Although science and technology has become one of the bases of KSSR, science subjects are not included in the Core Module Basic subjects such as Bahasa Melayu, English, Islamic Education, Physical Education, Health Education and Mathematics. Science is only a theme module in KSSR and subject known as World of Science and Technology.In addition, the approach to make science as Theme Modules is somehow seen as a move that was

not supporting the 60:40 Policy. Science teaching and learning period has also been reduced from three periods to two periods only a week. As the subject is called World of Science and Technology, KSSR has combined science subject with information technology with the designation of two times a week. The initial review was conducted by Fazliza, Zurida, Noraida and Abdul Majeed (2012) found that two periods allocated to the subjects World of Science and Technology is not enough. The results of this survey also found that teachers are unsure how to implement and determine the extent to how far the students must master the reasoning skills.

Problems that occur during the execution of KSSR especially in the science curriculum should be in the attention of the Ministry of Education because if this reasoning skills cannot be properly controlled in short teaching and learningperiod allotted for science subjects, most likely, it would be difficult to achieve a 60:40 Policy. The situation could worsen further if the students are not interested in science subjects and are not ready to be in science stream when they enroll in secondary schools later.

3.2 SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS (STEM)

Realizing the needs of 21st century skills and the requirements of the Malaysian economy to an economy based on information technology and services, MOE has devised various strategies through the National Education Blueprint (2013-2025), to provide a skilled workforce capable of meeting the requirements of the current job market ,. Among the strategies put forward is the integration of Science, Technology, Engineering and Mathematics (STEM). This is in line with the findings of Edy Hafizan, Lilia, Sattar, Kasimah, Zanaton and Faszly (2015), who also expressed that the success of a country is relies on the quality of STEM education provided to their students.

According to a newspaper report of Kamalanathan in the Sinar Harian (9 April 2015), the strengthening of the STEM initiative is one of 100 key initiatives within the Blueprint 2013-2025 and taking into account the report of 60:40Policy Strategy. It is clear here that MOE sense that STEM is an approach that supports the 60:40 Policy. STEM is a model and system practiced in western countries and which would help their students interested in the field of science and mathematics so on the basis of the students in the master of science engineering and technology (Razali, Halizah, Badarudin & Siti Hajar, 2013). Through STEM, the integration of four subjects in terms of theory, application of science to better prepare students to work in a more natural and meaningful sessions of teaching and learning as these subjects are taught separately as in the Integrated Secondary School Curriculum (ICSS). Studies have also shown that the integration of these subjects have a positive impact on student learning, especially in motivating and teaching STEM (Becker & Park, 2011).

Although the MOE has decided to change Integrated Secondary School Curriculum as known as *"Kurikulum Bersepadu Sekolah Menengah (KBSM),* to Secondary School Standard Curriculum, *"Kurikulum Standard Sekolah Menangah" (KSSM)* by the year 2017, STEM approach was initiated much earlier through science project competitions such as Formula 1 (F1), National Robotics Competition (NRC) and the National Science Challenge (NSC). For now, these competitions are shaded by large

agencies, each of which tries to highlight the identity and interests of each company in the competition. According to Masturah and Tamby Subahan (2013), the activities carried out by these agencies are an informal approach to science. This activity seeks to increase students' interest and make students more interested in finding out more fully the specific field of knowledge.

Although the competitions organized by external agencies have succeeded in attracting students to STEM and science in particular, a slight improvement can be made so that it becomes more meaningful to students. Among the suggestions propose, is for the MOE to have a planning with these agencies so that the objectives of the competition do not overlap and can include more aspects of STEM. The entry should also be extended to all schools or schools located in rural areas. On the financial aspect, the involvement of many agencies only offers participation only to selected schools. Sometimes the same school was chosen to participate in different competitions. This problem can be further improved by planning in advance the involvement of schools to be involved in and more schools will get a chance to participate in such competitions.

In addition, it is expected that the elements of STEM will be inculcated in KSSM and controlled approach to formal learning. This is seen to provide opportunities for all students to benefit from the integration of STEM. Furthermore, according to Stohiman et al. (2013) STEM learning that will enable the learning of a subject to be more meaningful and relevant to the needs of students. When the students and the people around them realize and see the importance of STEM in economics and employment, indirectly they will try to get involved with STEM and science in particular. This approach can be used to enhance students' motivation towards learning science

3.3 INCULCATING THE 21ST CENTURY LEARNING SCIENCE IN CURICULUM

As we know the skills of the 21st century appears along with the rapid development of technology. In Science, students not only have to master this technology with good skills even have to know how to use it as a tool to generate a new knowledge or invention. This process will require students to master the skills of communication, collaboration, critical and creative thinking as well as the application of moral values.

Recognizing the importance of 21st century learning in the curriculum of Science, Tuan Masturah et al. (2012) have suggested elements of the instrument for this skill for secondary school science students. The proposed skills are seen according to the climate and the goal of science curriculum in Malaysia. Tuan Masturah et al (2012) suggest inventive thinking skills, effective communication skills, proficiency in the spiritual as well as digital literacy. The skills to be an element of the proposed instrument is viewed very appropriate to thiscurrent time.

21st century learning taking into account the technological developments which still happening now. The approach involves computer literacy seems to attract students for as we all know has been exposed to the use of technology in their daily lives. The technology makes the communication and information become broad and accessible at anytime and anywhere as long as we connected to the internet. This advantagecan be

use by our students to gain more knowledge even they are not in a class. They can get information from their friends and thousands of websites in cyberspace. This can be supported by a report in 2007 that found the TIMSS science results of students from families of low socio-economic status and no computer at home was lower than students with high socio-economic status and has a computer at home. Even though the study conducted by the Norsuhaidah et al. (2010) found no significant association between socio-economic background and their home computer with student results. However she did not rule out the importance of computers and technology in the learning of chemistry.

In addition, the skills of the 21st century also emphasize critical and creative thinking skills. This is because the need of skilled manpower in this age requires them to master this values and in line with the economic focus of this century. These skills can be mastered very well through inventive thinking can be applied to the teaching and learning process. According NCREL (2003) Inventive thinking listed as one of the 21st Century skills are required of every citizen of the world in this century whether workplace or in education.

When we examined the importance of the implementation of the 21st century and the goal of the 60:40 Policy, there are similar features such as to ensure the competitiveness of Malaysian students in the job market of this century,. In addition to fit with the evolution of the times that happens, the application of learning in the 21st Century Science curriculum also creates more attractive teaching and learning sessions because a featured element of skills appropriate to the climate and requirements of current developments. As such the application of 21st century skills is seen particularly suitable for application in the science curriculum in Malaysia and to achieve the 60:40 Policy.

conclusion

In conclusion, the primary school curriculum through KSSR seem less emphasis on science subjects . This is because in KSSR, science subjects have been combined with information technology subject. MOE should consider and take measures for improvement of the initial survey studies that have been performed on KSSR. This is because soon KSSM also be launched and the weaknesses in KSSR should not happen again the next drive to the successful achievement of a 60:40 Policy by the year 2020. Integration of STEM and 21st century learning is seen as a best approach to achieve 60:40 Policy. It is expected that the integration of STEM and 21st century learning can be applied to the existing science curriculum now.

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