MIDDLE EAST TECHNICAL UNIVERSITY

Singapore Education System & PISA

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1. Introduction

1.1.Country facts

Singapore is relatively a small country in terms of areas it has and number of inhabitants when it is compared with Turkey. Singapore has been described in OECD report such as;

"Singapore, a city-state of approximately 700 km2 in Southeast Asia, has made great strides since it was established as a republic in 1965. In its early years of independence, Singapore was a poor, undeveloped island with a lack of natural resources, high unemployment, rapid population growth, substandard housing and sanitation, and tension among its various ethnic groups. As a small nation with limited natural resources, human resources have always been the island republic's most precious asset. Today, Singapore is a vibrant global hub of trade, finance and transportation, with a strong and harmonious community of citizens of different ethnicities and religions. Its transformation "from third world to first" in one generation is one of Asia's great success stories (Lee, 2000; OECD, 2010; cited in OECD, 2016, p.1).

1.2.General overview of Singapore's education system

All children start primary school education at age 7. This is a compulsory six-year course designed to give them a strong educational foundation. It aims to develop language and numeracy skills, build character and nurture sound values and good habits. At the end of Primary 6, students take the Primary School Leaving Examination (PSLE), which assesses their suitability for secondary education and places them in a secondary school course that matches their learning pace, ability and inclinations. Students can also seek admission to a secondary school based on their diverse strengths and interests in areas such as art and sports through the Direct School Admission exercise (MOE, 2016a, in OECD, 2016, p.3-4).

At the lower secondary levels (grades 7 and 8), students experience a broad-based education in the languages, the humanities and the arts, mathematics and sciences, design and technology, physical education as well as character and citizenship education. At grades 9 and 10, all students learn two languages, social studies and mathematics, and select from a wide range of elective subjects

and programs (MoNE, 2016b). Almost all students proceed to one of the following post-secondary education institutions:

- Junior Colleges/Centralized Institutes, which offer an academic pre-university course.
- Polytechnics, which offer three-year, practice-oriented diploma courses that equip students with industry-relevant skills (while most of the polytechnic graduates' progress to work, a proportion of them move on to university education).
- the Institute of Technical Education (ITE), which offers a broad-based, multidisciplinary curriculum including engineering, technical, business and service skills.
- Arts Institutions for students interested in the creative arts. About 30% of each cohort enroll in government-funded, autonomous, local universities. The university landscape continues to diversify with the establishment of new institutions, including those with different specializations (e.g. Singapore University of Technology and Design) and different approaches to tertiary education (e.g. the Yale-NUS Liberal Arts College).

As it can be seen from the Figure 1, primary school take 6 years, then secondary school may take 4 or 5 years, and as for high school there are options, JC, Poly, or ITE which may take 2 or 3 years, and lastly students may go to university which may take 3 or 4 years.

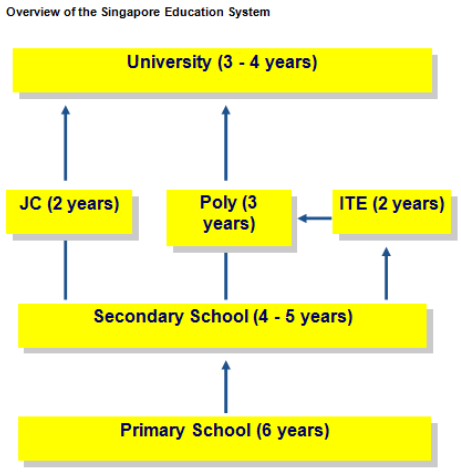

Figure 1. Overview of Singapore Education System

After finishing primary education which of its 4 years are seen as foundation stage and its last 2 years as orientation stage, students took an exam named Primary School Leaving Examination.

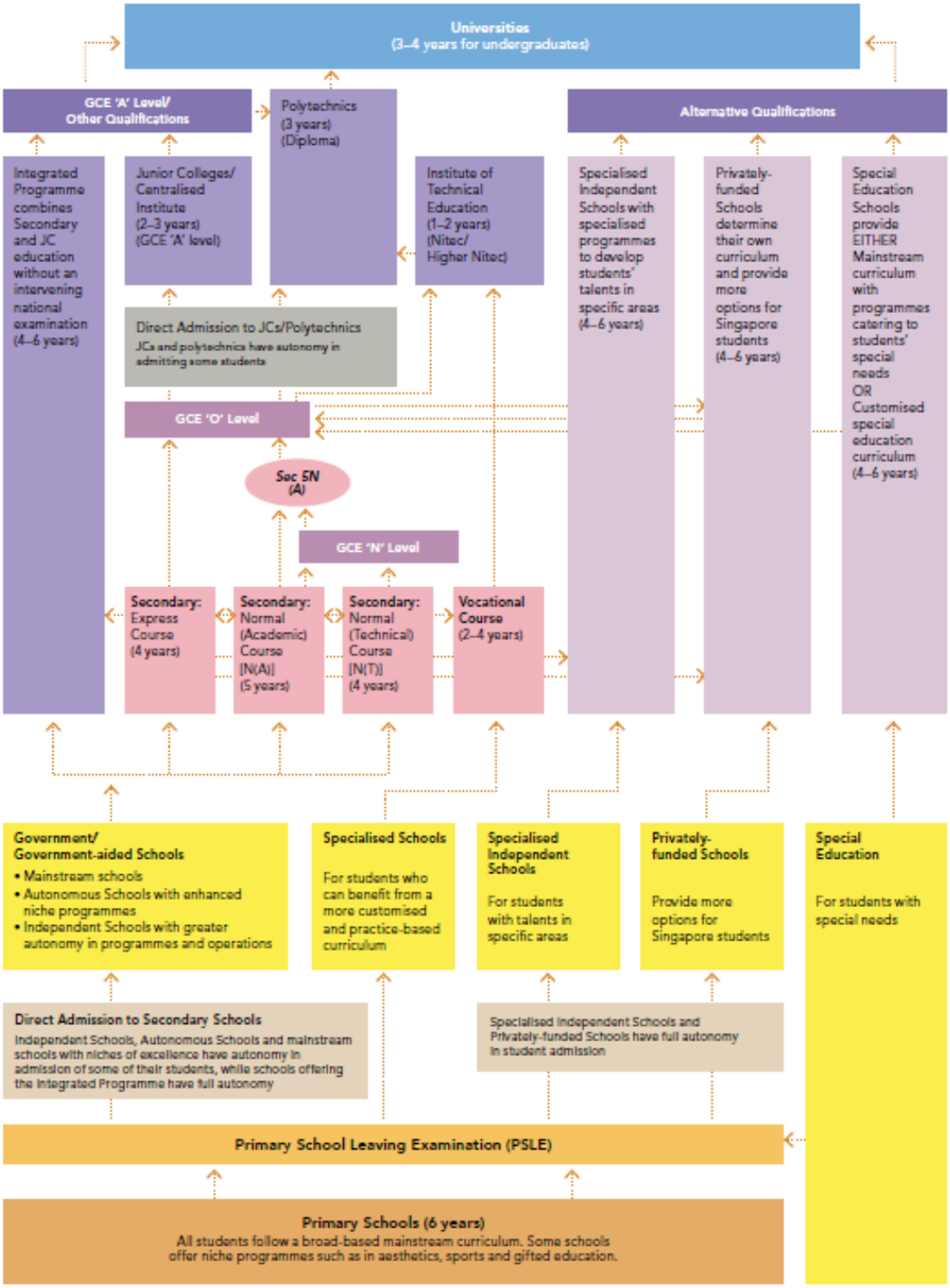

Figure 2. The detailed overview of the education system (MoNE, 2008).

There is also flexibility among secondary education level after taking PSLE, and students may get through these paths. To be able finish and go next education level, JC (Junior College), Poly (Polytechnics) or ITE (Institute of Technical Education), they also take an examination named GCE Level Examination, 'O' or 'N' according to their secondary level type. (see Figure 2.)

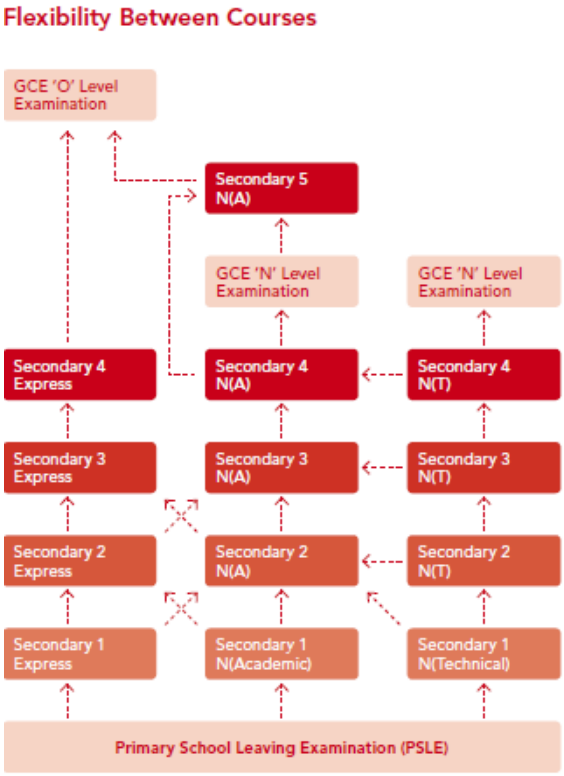

Figure 3. Flexibility in Secondary Level

2. Curriculum main objectives & core skills and values

MoNE (2008) expresses that the eight core skills and values presented in the curriculum. These skills and values are:

1. Character Development
2. Self-Management Skills
3. Social and Cooperative Skills
4. Literacy and Numeracy
5. Communication Skills
6. Information Skills

7. Thinking Skills and Creativity
8. Knowledge Application Skills

Main objectives that are aimed to be acquired by the students at the end of each education level are presented such as;

Table 1. *Objectives of education levels*

At the end of primary education, students	**At the end of secondary education, students**	**At the end of pre-university education, students**
are able to distinguish right from wrong	have moral integrity	are resilient and resolute
have learnt to share and put others first	have care and concern for others	have a sound sense of social responsibility
are able to build friendships with others	are able to work in teams and value every contribution	understand what it takes to inspire and motivate others
have a lively curiosity about things	are enterprising and innovative	have an entrepreneurial and creative spirit
are able to think for and express themselves	possess a broad-based foundation for further education	are able to think independently and creatively
take pride in their work	believe in their ability	strive for excellence
have cultivated healthy habits	have an appreciation of aesthetics	have a zest for life
love Singapore	know and believe in	understand what it takes to lead

3. Science education in Singapore

The Singapore Science Curriculum Framework (Figure 4) is centered on the spirit of scientific enquiry and is based on three domains essential to the practice of science: knowledge, understanding

and application; skills and processes; and ethics and attitudes (MOE, 2012; MOE, 2013). The curriculum aims to help students value the pursuit of science and appreciate the important role it plays in daily life and society.

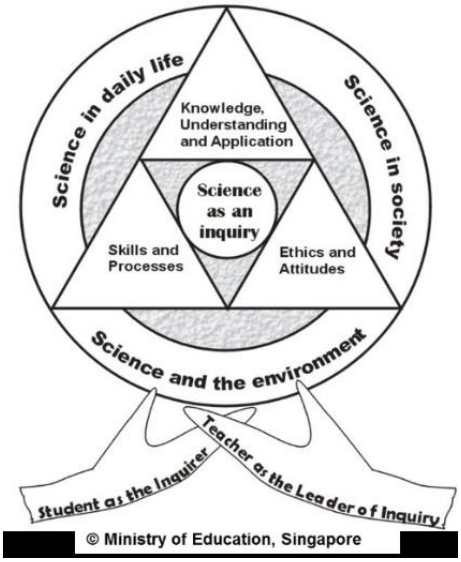

Figure 4. Singapore Science Curriculum Framework

4. Mathematics education in Singapore

Kaur (2013) states that "The developments from 1946 to 2012 that have shaped the present School Mathematics Curricula in Singapore, are direct consequences of developments in the Education System of Singapore during the same period." Also the framework of the school mathematics curriculum is given in the Figure 5.

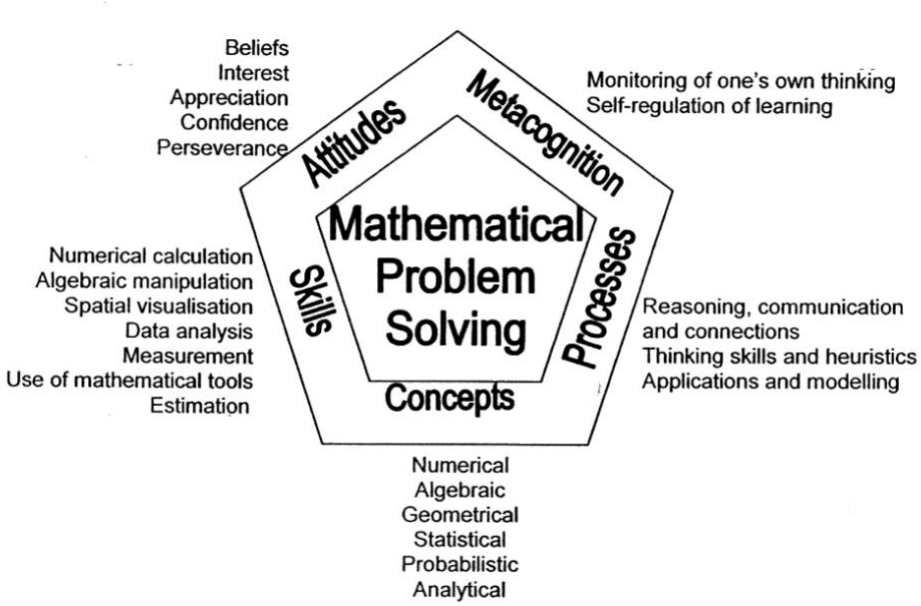

Figure 5. Framework of mathematics curriculum

According to Kaur (2013), the three mathematics courses are offered. These courses are;

•Special/Express mathematics course

- 4 year / GCE'O' level maths

•Normal (Academic) mathematics course

- 4 year / GCE 'N' level maths syllabus A

- Additional year / GCE 'O' level maths

•Normal (Technical) mathematics course

- 4 year / GCE 'N' level maths syllabus T

- Additional year / GCE 'N' level maths syllabus A

Kaur, (2013) also mentions that the recommended curriculum time for mathematics in the secondary school is as follows:

- Special / Express Course (2.5 to 3 hours per week)
- Normal (Academic) Course (2.5 to 3 hours per week)
- Normal (Technical) Course (4 to 5 hours per week)

Kaur (2013) also added and elaborated that Math curriculum is based such an understanding "Mathematics for all but more mathematics for some". Mathematics is a compulsory school subject from grades 1 – 10 and mathematics courses are tailored to meet the needs of the students. Also, there are various courses and types offered in different levels.

•Primary school

- Mathematics

- Foundation Mathematics

•Secondary School

- Special course / Express course mathematics

- Normal (Academic) course mathematics

- Normal (Technical) course mathematics

- Special / Express course Additional mathematics

- Normal (Academic) course Additional mathematics

Note: The Normal (Technical Course) was introduced in 1994

5. Teacher education in Singapore

Quality teachers are the sine qua non for any education system. To sustain excellence, emphasis has to be placed on building capacity among teachers and school leaders, to engender a teacher-driven culture of professionalism (Building Blocks, (n.d.), p.12).

Kaur (2013), expresses the pre-service and in service training for teacher by stressing the importance of teachers in education system.

For Pre-service education of teachers

- recruitment is based on aptitude and qualifications

- rigorous pre-service education programs

Professional development of teachers (In-service training)

- lifelong learners

- entitled to 100 hours of PD per year

- Enhanced performance management system (EPMS)

- Beginning Teacher

- General Education Officer (GEO) 1 / 2

- General Education Officer (GEO) 1A1 / 2A1

- General Education Officer (GEO) 1A2 / 2A2

- Senior Teacher

- Master Teacher

Lim (2013, p.), also further explain the teacher education system in Singapore by stating that

"The National Institute of Education (NIE), Singapore is the national teacher education institute in Singapore. Since its establishment as the Teacher Training College in 1950, NIE has since developed into one of the leading teacher education institutes in the world. NIE is an autonomous institute of the

Nanyang Technological University (NTU). NIE also plays an important role in providing education research and research based-pedagogical curriculum and direction to the Ministry and its schools. Working in partnership with the Ministry of Education (MOE) and schools, NIE is an integral part of the education service in Singapore" (p.2).

He also expresses that there is only one institution which is NIE, autonomous institute of NTU and it serves as the source of pre or in-service teacher training education. Lim (2013) also expresses that "NIE provides all levels of teacher education, from initial teacher education programs to professional development programs for in-service teachers and executive leadership programs for Principals, Departmental Heads and other school leaders. NIE's initial teacher education programs prepare teachers for all government schools ranging from primary schools to Junior Colleges in Singapore". According to Lim (2013, p. 3). Duration and level for teaching of teachers are varied based on the program they studied. The details can be seen in Table 2.

Table 2. *Type and duration of NIE's Initial Teacher Education Programs*

Program	Level for Teaching	Duration
Diploma in Education	Primary/Secondary	2 years
Bachelor of Arts (Education) Bachelor of Science (Education)	Primary & Secondary	4 years
Bachelor of Education	Primary	3 years Part-time + 0.5 year Full-time
PGDE (Primary) PGDE (Secondary) PGDE (Junior College)	Primary, Secondary Junior College	1 year (2 years for Physical Education)
Diploma in Special Education	Special Education/ Allied Educators	1 year

6. International exams and Singapore's status

In recent years, especially after 2005 Singapore started to be seen in top 5 among many international exams among many education systems. They have started to be seen as one of the best countries which have the best education system and/or the most successful students.

6.1. Success of Singapore in an international level

Singapore ranked 1st in quality in education system- Global Competitiveness Report 2007-2008.

Singapore ranked one of the world's best-performing school systems- McKinsey Report, published in September, 2007.

Singapore students ranked among the top in Mathematics and Science-Trends in International Mathematics and Science Study (TIMSS), 2007.

Singapore ranked 4th among 45 education system, Progress in International Reading Literacy Study (PIRLS), 2006. According to TIMSS (2016a, 2016b, 2016c, 2016d), Singapore is the best country in the Science and Mathematics both in 4th and 8th grade levels.

6.2. PISA and Singapore

PISA is an international exam which has been conducted triennial once in a three years after 2000. In each exam, it focused on one aspect as it did on science in 2015. PISA as it is explained in its report titled PISA 2015 Results in Focus, "PISA assesses the extent to which 15-year-old students, near the end of their compulsory education, have acquired key knowledge and skills that are essential for full participation in modern societies. The assessment focuses on the core school subjects of science, reading and mathematics. Students' proficiency in an innovative domain is also assessed (in 2015, this domain is collaborative problem solving). The assessment does not just ascertain whether students can reproduce knowledge; it also examines how well students can extrapolate from what they have learned and can apply that knowledge in unfamiliar settings, both in and outside of school. This approach reflects the fact that modern economies reward individuals not for what they know, but for what they can do with what they know". In 2015 survey, "approximately 540 000 students completed the assessment in 2015, representing about 29 million 15-year-olds in the schools of the 72 participating countries and economies".

Figure 6. 2015 Science Score

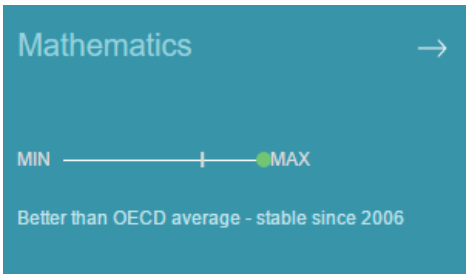

Figure 7. 2015 Math Score

Figure 8. 2015 Reading Score

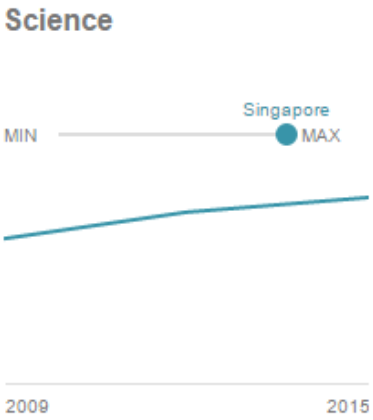

Figure 9. Science 2009 to 2015

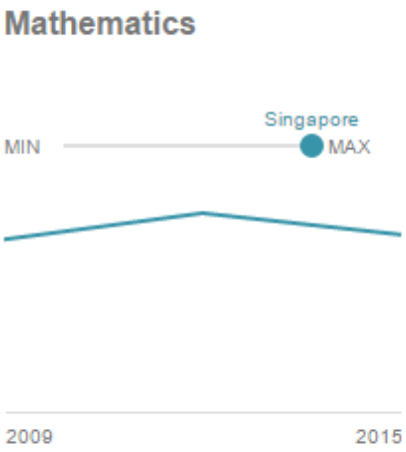

Figure 10. Mathematics 2009 to 2015

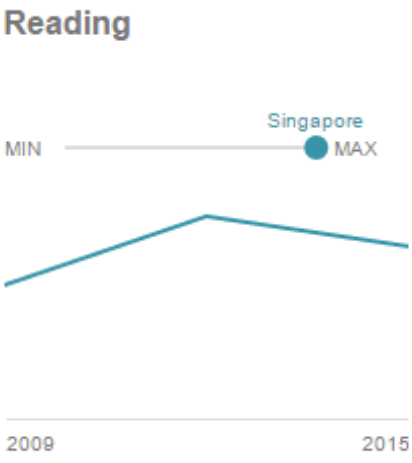

Figure 11. Reading 2009 to 2015

As it can be seen from Figure 6, Science score of Singapore in PISA 2015 is better than OECD average, the best (max.) and it has shown improvement since 2006 (Figure 9). Also, similarly in Figure 7. Mathematics score of Singapore in PISA 2015 is better than OECD average and the best (max.), however, it is stable since 2006 (Figure 10). Lastly, as it can be seen from Figure 8, the Reading score of Singapore in PISA 2015 is better than OECD average and the best score (max.) and it has improved its status since 2006, as well (Figure11) (PISA, 2016a, 2016b, 2016c).

7. Teaching Strategies

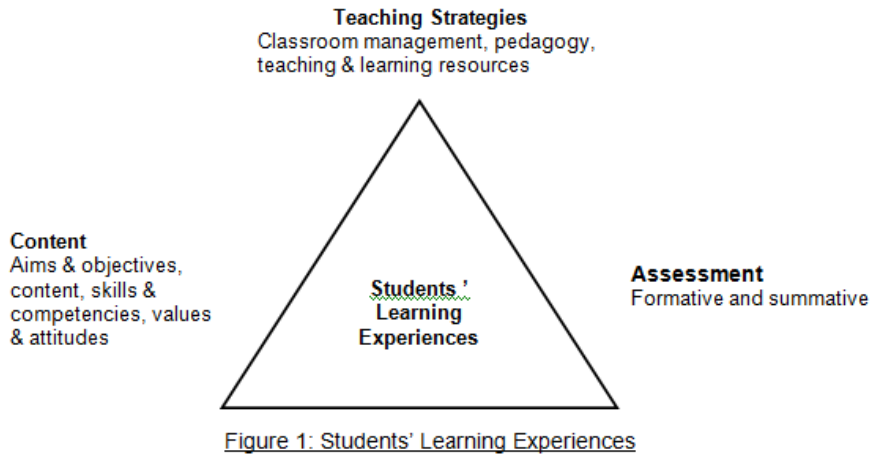

Figure 4. Teaching Process

As it can be seen from Figure 4, students' learning experiences are in the middle of teaching and learning process and surrounded by content, teaching strategies and assessment. As for teaching strategies; classroom management, pedagogy, teaching &learning resources are mentioned, for content; aims & objectives, skills, competencies, values and attitudes are concerned, and in the assessment part, formative and summative assessment are concerned.

8. Critical Success Factors

Gopinathan (2011), expresses that reasons for success in international exams are such; strong sensitivity to labor market needs, strong emphasis on bilingualism and values and character education, careful mix of certificate, diploma and graduate qualifications – 27% go to universities, 40% to

polytechnics and 20% to Institute of Technical Education, curriculum modernization – strong emphasis on Science, Mathematics, languages and technology, strong centralized direction by MOE and building strong fundamentals before introducing flexibility, choice, diversity.

9. Challenges for Singapore

For the challenges for Singapore, the former prime minister of the country, Lee Kuan Yew has told in 2011 that:

"Singapore is still a work in progress" (need to understand) that vulnerability, that fragility of our society and keep it in cohesion" (started off) "with multiple peoples, no common language, no common culture … but "created" a very rare society where people of all races live in the same tower blocks and now speak a common language which is not their native language (cited in Gopinathan, 2011).

Gopinathan (2011) further lists and explains the challenges for Singapore as;

1. Demand for greater inclusiveness, transparency, accountability and a more plural political culture
2. New immigrants – strains on social cohesion (one in four are foreigners)
3. Difficulties in building a culture of innovation, enterprise and productivity
4. Strong state led to stunted civil society
5. Need for a new 'social compact'

10. Conclusion

All in all, I might say that if we aim to reorganize the country's whole education system according to what is required to be successful in international exams, if you value your teachers and design such an teacher education which train well-qualified teachers and even if you have a centralized system, you give much autonomy to the teacher training institutions, and use innovative and creative teaching strategies, a country can be successful in terms of international exams such as PISA and TIMSS. Furthermore, the country can train its students to be able to apply knowledge, think

creatively and critically and productive. So, as for Turkey, we can also learn the best points that Singapore has achieved and learn lessons from its mistakes if there is any and based on such considerations by keeping in mind the Turkey's unique culture and context, we can also redesign the system and change its score and train more students who are in the top performers in such exams sooner or later.

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