

Assessment and National Educational Goals: The Core Knowledge Skills Subjects in the Pre-University Curriculum in Singapore

Karen Bryer (SEAB)

Abstract

Over the past ten years, the education landscape in Singapore has seen and continues to see rapid and dramatic change. The Ministry of Education in Singapore has been introducing greater flexibility and diversity into the education system in order to provide students with greater choice in and ownership of their learning. The Ministry has also introduced a more broad-based curriculum which aims to promote holistic development of the individual both in academic and non-academic pursuits. A key feature of the revised curriculum is its emphasis on the development of students' thinking, process and communication skills. The development of these skills has been very clearly articulated in the revised pre-university curriculum which was implemented in 2006.

This paper focuses on assessment of core elements that make up the central, knowledge skills area of the revised pre-university curriculum, namely: a new subject, Knowledge and Inquiry, along with two other established subjects: the General Paper and Project Work. Some of the implementation issues and challenges on the assessment of the knowledge skills will be discussed in the paper.

Introduction

In 2006, I presented a paper at the IAEA conference in Singapore on the development of an alternative mode of assessment in Singapore, namely, Pre-University Project Work¹. While Project Work is again dealt with in this paper, it is accompanied by two other subjects: General Paper and Knowledge and Inquiry, which together make up the core knowledge skills subjects in the Singapore pre-university curriculum. The focus of my paper for this conference is on how the outcomes of assessment of these core knowledge skills subjects reflect the national "Desired Outcomes of Education".

Background

In 1999, Kam and Gopinathan² published a paper entitled *Recent Developments in Education in Singapore*, which analysed the nature of educational reform in Singapore over the previous ten years. The paper traced the political, social and economic factors in the country's history that had influenced the structure of the education system. Recession in the mid-eighties prompted a government review of the education system. The review led to emphasis on the need for education to keep pace with future economic needs, as well as to stress the importance of critical and creative thinking and independent learning. In his review of the megatrends in education, Caldwell (1996)³ also noted that the basics of education would need to expand to include problem solving, creativity and a capacity for lifelong learning. These new 'basics' or critical competencies⁴ emerge as core skills for the twenty-first century in much of the literature on education reform in recent years and the Singapore Ministry of Education (MOE) has been engaged in implementing policies to draw these core skills into the curriculum. A report entitled *Excellence in Education* was published in the nineteen nineties identifying the qualities associated with effective schools in other

¹ Bryer, K, 2006, Pre-University Project Work in Singapore: An Alternative Mode of Assessment in Singapore

² Kam, H.W. & Gopinathan, S. 1999, *Recent Developments in Education in Singapore*

³ Caldwell, B, 1996, *Reengineering the Secondary School: Leadership, Culture and Change for the Third Millennium*

⁴ Hargreaves, A, 1994, *Restructuring restructuring: Postmodernity and the Prospects for Educational Change*

countries. This report highlighted the importance of the development of skills for higher order thinking, effective communication and teamwork in the school curriculum. This report was closely followed by the publication of an MOE policy document in the year 2000, entitled ***The Desired Outcomes of Education***⁵. The document set out eight broad outcomes that all post-secondary and tertiary students should achieve by the completion of their education.

The Desired Outcomes of Education aim to develop students who are:

1. morally upright, culturally rooted yet understanding and respecting differences, responsible to family, community and country
2. believe in the principles of multiculturalism and meritocracy, appreciating the national constraints but seeing the opportunities
3. constituents of a gracious society
4. willing to strive, take pride in work, value working with others
5. able to think, reason and deal confidently with the future, with courage and conviction in facing adversity
6. able to seek out, process and apply knowledge
7. innovative, with a spirit of continual improvement and lifelong habit of learning and an enterprising spirit in undertakings
8. global thinkers but rooted in Singapore

The New Singapore A-Level Curriculum⁶

The new Singapore GCE A-Level curriculum aims to prepare students for the rapidly changing world of the 21st century. It emphasises depth of knowledge, breadth of study and multi-disciplinary learning. It fosters new approaches to learning and develops in students a wider range of skills. Students are challenged to think critically and creatively.

The framework for this new curriculum is represented by three concentric circles. The inner circle centring on **life skills** ensures that students acquire sound values and skills to take them through life as responsible adults and active citizens. It refers to the non-academic curriculum. The middle circle centring on **knowledge skills** seeks to develop students' thinking, process and communication skills. These skills will enable students to analyse and use information and be able to express their thoughts and ideas clearly and effectively. The outermost circle covers the **content-based subject disciplines** i.e. Languages, Humanities and the Arts, and Mathematics and Sciences. This ensures that students have a good grounding in content across different areas of study.

The new curriculum was introduced in 2006 as a two-year course in the Junior Colleges (JC). The first cohort of students offering this curriculum took their examinations in 2007. The new curriculum and examination have been developed jointly by the Ministry of Education, Singapore (MOE), the University of Cambridge Local Examinations Syndicate (UCLES) and the Singapore Examinations and Assessment Board (SEAB).

The academic curriculum comprises compulsory and optional subjects. Students may offer subjects at three levels of study: Higher 1 (H1), Higher 2 (H2) and Higher 3 (H3). The following subjects are compulsory and are taken at H1:

- General Paper (GP).
- Project Work (PW)
- Mother Tongue Language (MTL)

⁵ Desired Outcomes of Education, MOE, Singapore 2000

⁶ Breadth and Flexibility: The new A-Level Curriculum 2006, Ministry of Education, Singapore (MOE) 2006 A-Level Examinations, Singapore Examinations and Assessment Board (SEAB)

In addition to the three compulsory subjects, students must take at least four content-based subjects, three of which must be at H2, with the fourth either at H1 or H2 level. One of the four content-based subjects must be drawn from a contrasting discipline and can be taken at either H1 or H2 level.

Able students who are interested in broadening their range of subjects and intellectual horizon have the flexibility to offer an expanded curriculum by taking on an additional H1 or H2 subject, while those with passion and ability are allowed to further specialise by offering up to two H3 subjects. Students offering an H3 programme must offer the corresponding subject at H2 level.

Content and Structure of the Core, Knowledge Skills Subjects

General Paper⁷

The H1 General Paper (GP) is taken by all students except for a small number of very able students who may opt to take the new H2 subject, Knowledge and Inquiry, which is taken in lieu of GP and can be counted as a contrasting subject because of its interdisciplinary nature. Students study the General Paper over a two-year period in order to ensure that there is sufficient time for them to fully develop, internalise and practise the many skills they need to acquire.

The aims of the GP syllabus can essentially be divided into three broad categories of skills' development:

1. Cultivating an awareness and understanding of issues of universal importance at both global and regional levels
2. Enhancing the ability to comprehend and interpret a broad range of subject matter and then apply that understanding
3. Enhancing the ability to communicate understanding effectively and proficiently.

Given the fact that the GCE A-Level curriculum in Singapore emphasises the importance of knowledge skills, especially thinking and communication skills, it is not surprising that GP is considered a core element within the "Knowledge Skills" middle circle of the GCE A-level curriculum framework. The following three paragraphs look in greater depth at how the three categories of broad syllabus aims outlined above translate into students' experience of their GP programme.

Comprehension and interpretation of a broad range of subject matter and application of understanding

GP carries no specific body of content knowledge. Rather, it is interdisciplinary, aiming to develop students' understanding of the nature of knowledge by appreciating the inter-relationships of ideas across disciplines; important preparation for university approach to study. The syllabus also aims to help students better understand the world they live in by fostering a critical awareness of both continuity and change in the human experience. Students are encouraged to broaden their global outlook, but at the same time remain mindful of the historical and social experience they share with others both within Singapore and the region and beyond.

Awareness and understanding of issues of universal importance at both global and regional levels

At the end of their programme of study in GP, students are expected to demonstrate a broad and mature understanding of subject matter ranging from the humanities and culture to

⁷ General Paper Examination Syllabus, MOE & SEAB, 2007

science and technology, including issues of significance to Singapore and the region. They achieve this through acquiring knowledge and understanding of diverse topic areas through extensive reading and independent study, then analysing and evaluating issues arising across disciplines and developing an awareness of the significance and implications of those issues for both themselves as individuals and society at large. Students are expected to demonstrate their understanding of this range of subject matter and the issues arising from it by responding to questions set with personal responses that show evidence of both critical and creative thinking. In addition to responding to the wide range of subject matter that they have been exposed to through their own reading and research, students are also expected to be able to comprehend and interpret unseen materials they are presented with and then apply that understanding by linking the information or views they have been presented with to their own experience or that of their society.

Communicate understanding effectively and proficiently

Clear, accurate and effective communication skills underpin the syllabus. Students are expected to present information clearly and to formulate cogent arguments in presenting their views, or in analysing and evaluating the views of others. They are also expected to write accurately using Standard English, as well as use a range of vocabulary; a variety of linguistic styles and expressions appropriate to the context, task and audience. Assessment of GP is carried out over two 1½ hour examination papers.

Paper 1 comprises 12 essay questions which cover a wide range of topic areas. Students choose one topic on which to write an expository essay. The questions set provide students with the opportunity to draw on the knowledge and opinions they have gained from extensive reading. Students are required to express an informed, critical, creative and relevant response and credit is given to the ability to convey a sustained, balanced and well thought-out argument.

Below are the six broad topic areas from which questions may be drawn, although questions may not necessarily be set on every topic area in a single examination:

1. Historical, social, economic, political and philosophical topics
2. Science, including its history, philosophy, general principles, current developments and applications
3. Mathematical and geographical topics
4. Literature and language
5. Arts and crafts
6. Topics of local interest and national concern

The questions are general in nature and require students to draw on their knowledge from across disciplines as well as to show an awareness of current, global and significant local/national issues. Some examples of previous essay questions include⁸:

- *Are the poor an inevitable feature of any society?*
- *Can small countries have a significant voice in world affairs?*

Paper 2 is a Comprehension paper in which students are presented with either one or two passages of unseen text. The text is followed by a range of compulsory questions that test students' literal and inferential understanding, their ability to explain, evaluate and summarise and their command of vocabulary. An extended "Application Question" requires students to synthesise information and respond to concepts or ideas conveyed in the text in a task derived from the text. The task often requires students to consider viewpoints or issues they have been presented with and apply them to the context of their own country. In expressing their own beliefs and opinions, they are expected to make close reference to the

⁸ General Paper Examination, Paper 1, UCLES & MOE, 2004

authorial viewpoints and/or how the issues dealt with in the text relate to their own country. An example of a previous application question is⁹:

- *In this article, the author gives an account of what he calls the 'gender revolution'. To what extent do you agree or disagree with his views? Support your answer with examples drawn from your society's experience of the 'gender revolution'.*

General Paper and The Desired Outcomes of Education

If we take the three categories of broad syllabus aims, i.e. comprehension and interpretation of a broad range of subject matter and application of that understanding; awareness and understanding of issues of universal importance both globally and regionally and effective and proficient communication of understanding, we can see how these aims begin to reflect elements of some of the Desired Outcomes of Education.

Both Paper 1 and Paper 2 require students to process information, think critically and apply their knowledge and understanding of their own reading and personal research into a wide variety of subject areas. This is in line with the Desired Outcome that requires young people to be able to *'think and reason'* (Outcome 5) and *'seek out, process and apply knowledge'* (Outcome 6).

Another important element in the GP syllabus aims is to encourage students to not only look beyond their own shores but also to consider issues at home and the fact that the same issues can and often are faced by others. In the application question in Paper 2 of the examination, students are required to consider viewpoints or issues they have been presented with, which generally represent an international perspective, and apply them to the context of their own country. Indeed, students are encouraged to draw comparisons between situations and issues in Singapore and similar ones in other countries and look at the differences in impact and how they are addressed. This helps students to develop a balanced viewpoint. If we look at the first, second and last of the Desired Outcomes with their emphasis on being *'rooted in Singapore, yet understanding and respecting differences, as well as appreciating national constraints but seeing opportunities'*, we can see how GP assessment reflects these three outcomes.

Project Work¹⁰

H1 Project Work (PW) is a compulsory subject for all A-Level students. It provides opportunities for students to work in groups to synthesise and apply knowledge, skills and values learnt from different subject areas. Students learn how to engage with issues critically and creatively, and to process information that is less structured, not subject-specific and open-ended. The study is completed in 70 curriculum hours over 28 weeks. Students also undertake generally about 30 to 40 hours of independent research outside the specified curriculum time.

A key feature of PW is its interdisciplinary nature which provides students with opportunities to explore the inter-relationships and inter-connectedness of subject-specific knowledge in real life situations. PW is not centred on content per se, but on knowledge application, in terms of the generation, substantiation, analysis and evaluation and organisation of ideas for the project task. Students are constantly engaged in the discussion, communication and negotiation of new ideas for their project. Students acquire collaborative skills as they work in groups to achieve common goals. They also engage in independent learning as they conduct research, reflect on their learning and take appropriate action to improve it. Emphasis is also placed on the presentation of ideas and information in both written and oral

⁹ General Paper Examination, Paper 2, UCLES & MOE, 2007

¹⁰ Project Work Syllabus, MOE & SEAB, 2007

forms. Students internalise knowledge and skills through working with real issues, situations and people.

Students choose 1 of 2 set tasks broad enough to encompass a very wide range of topic choices. Previous tasks have resulted in some highly successful and creative outcomes. Examples of project topics for the task “New Perspectives”¹¹ included the automation of aircraft passenger meals and the use of Kapok fibres for oil spillage collection. Indeed, the local press published an article about student projects that have been turned into real life ventures that benefit the community and cited the example of how one school project eventually became a record-breaking recruitment drive for Singapore’s bone marrow donor programme.¹²

In essence, in completing a project successfully, a student must demonstrate the quality of being self directed, self motivated, an independent learner and thinker who can work well in a team and communicate clearly and effectively with team members and stakeholders. The student must also have the ability to synthesise knowledge from various areas of learning and apply it critically and creatively to real life situations.

Assessment of PW is school-based and is carried out on both a group and individual basis, covering both product and process. Product assessment focuses on the group’s Written Report and Oral Presentation. In the Written Report, students present the findings from their research and their proposals. The report is assessed for the generation and substantiation of ideas, analysis and evaluation of ideas and the presentation of ideas. Students are also required to consistently reference and cite all sources of information.

The Oral Presentation assesses the effectiveness of the presentation as a whole, in terms of its organisation and coherence, and the use of audio visual aids. Individual assessment is also carried out of each group member’s five-minute section of the presentation. The assessment criteria for Oral Presentation focus on students’ fluency and clarity of speech, their awareness of audience and their response to questions. Oral Presentation skills are a key skill requirement of tertiary education and ultimately of the workplace. The Oral Presentation component requires students to be able to present themselves and their ideas to an audience. PW therefore develops confidence and effective communication skills in students early.

Process assessment focuses on the Group Project File. Individual group members submit three documents relating to the processes involved in carrying out the project. These are: generation and evaluation of their own preliminary ideas for a project, their analysis and evaluation of some of the information they have contributed and their reflections on the project.

Project Work and The Desired Outcomes of Education

When we look at PW, the link between the Desired Outcomes, the intent of this subject and the way it is assessed is very clear. Given that students carry out their projects over an extended period of time on a group basis and that the vast majority of groups experience some difficulties in working together and achieving their goals at some stage of the project, students do need to be ‘*willing to strive*’ (Outcome 4) to complete their projects. This is especially so since they are randomly assigned to groups so that they are not working with their friends. This also helps to teach them the *value of being able to work with others* and the effort that this takes (Outcome 4). Indeed, in their reflections on their projects, many students cite this as being one of the most valuable aspects of their PW experience.

¹¹ Project Work Examination, UCLES & MOE, 2005

¹² Project featured in an article entitled “JC Student Projects Yield Real Life Benefits”, by Liaw Wy-Cin, in The Straits Times, 2006

Desired Outcomes 5 and 6 focus on the ability to search for, process and apply knowledge, as well as to think and reason. These outcomes are at the heart of PW. Students not only have to search for information for their projects from a variety of both primary and secondary sources, they must evaluate the information for its reliability and usefulness to the project before deciding what to use to substantiate their ideas. At a time when students and adults are bombarded by the welter of information available on the internet, developing the ability to judge and question the reliability of information is widely recognised as being a critical skill for the 21st century¹³. Equally important is developing in students an awareness of the importance of intellectual property rights and the need for proper citation and referencing in their work. Students must then process the information they have gathered and apply it to answer the requirements of the selected project task and the topic they have chosen relating to the task. The fact that the skills of analysis and evaluation of ideas (both the students' own and those contained in the information gathered) is assessed as part of the Written Report (group assessment) and Group Project File (individual assessment) is a measure of the importance placed on these two critical thinking skills. The Oral Presentation ensures that students not only develop these skills, but that they are able to develop the ability to verbally communicate what they have learned in an interesting and informative way, as well as answer questions about their project and their approach to it.

Desired Outcome 7 and its focus on '*a spirit of continual improvement and lifelong habit of learning*', is reflected in the compulsory "Insights and Reflections" document submitted by each student as part of their Group Project File submissions. In this document, students are required to critically consider both the strengths and limitations of their project work, as well as consider other approaches they could have taken, either as a group or as individuals.

Desired Outcome 7 also identifies the need to be '*innovative and [have] an enterprising spirit in undertakings*' as being important. This is reflected in the assessment criterion "Generation of Ideas" which requires students to use the information they have gathered to come up with fresh ways of looking at solutions to problems, or new ways of doing things. As mentioned in page 6 (paragraph two) of this paper, since the inception of PW in 2003, we have seen a number of highly innovative projects. Amongst others, these have included: the development of battery charging shoes and 'non-slip' chopsticks; the use of secretions by ants to help the visually impaired in finding direction and a simple, but highly effective method of developing and maintaining young people's interest in donating to charity, the latter of which was adopted by a high profile charity in Singapore. It is perhaps worth noting here that a large number of projects (sometimes very successful ones) often show a genuine desire to help others in society, which can be linked to Outcome 1, '*responsible to (family), community and country*'.

Knowledge and Inquiry¹⁴

Knowledge and Inquiry (KI) is a new, skills-based subject which is only available at the H2 level. KI is a two year course of study with a recommended curriculum time allocation of 240 hours. It is intended that KI should stretch Singapore's most able students and to that end it is only offered to the most able students. Such students may take KI as a fourth H2 subject, in addition to their other three H2 and one H1 content subjects, along with the core subjects. This subject was introduced into the pre-university curriculum because it was felt that the knowledge-driven nature of modern societies requires students to have a better understanding of the nature and construction of knowledge and the ability to apply that understanding to the different areas of knowledge they might be engaged in.

KI is interdisciplinary in nature; students study the nature and construction of knowledge and modes of inquiry in the different fields of knowledge such as the sciences, humanities,

¹³ Bundy, Alan, Information Literacy: The Key Competency for the 21st Century

¹⁴ MOE & SEAB 2007, Knowledge and Inquiry Syllabus

mathematics and aesthetics. Students are required to critically evaluate what is regarded as knowledge in the context of particular disciplines and apply a theoretical understanding of the nature and construction of knowledge in the different areas of study. For this reason, students studying subjects in either the arts or the sciences may use KI to fulfil the requirement that they take a subject from a contrasting discipline.

Through the process of inquiry, KI aims to develop skills that will enable students to understand the nature and construction of knowledge in different fields; reflect on it and apply critical reasoning to evaluate it. Students explore the strengths and limitations of the construction of knowledge and consider the ethical dimensions to the construction and use of knowledge in the various fields. Students are expected to analyse and critique information and arguments; determine their validity in a reasoned and substantiated manner and articulate and defend their ideas and arguments effectively. In addition, KI students are required to carry out an Independent Study over a six-month period on a topic of their choice related to the nature and construction of knowledge.

The core framework for the KI syllabus focuses on six key questions for exploration:

1. Why ask questions?
(Exploration of the different types of questions: logical, ethical, epistemological, metaphysical and aesthetic)
2. What is knowledge?
(Exploration of different types of knowledge: personal, common sense, cultural, academic)
3. How is knowledge constructed?
(Modes of inquiry: deductive and inductive approaches, scientific inquiry, mathematical inquiry, social science inquiry, aesthetic inquiry)
4. What makes knowledge valid?
(1 - Facts, argument, reasoning and logic, rationalism, empiricism) (2 – Methodology in the different fields of knowledge; questioning sources of knowledge and authorship; the subjective inquirer; conflict between different fields of knowledge)
5. How is knowledge affected by society?
(Belief structures, Western and Eastern constructions of knowledge, gender, shared historical background, political constructs)
6. How should knowledge be used?
(The question of ethics in society; the ethics of enquiry, knowledge and power)

There are three assessment objectives for KI:

1. Understanding the Nature and Construction of Knowledge
2. Critical Thinking
3. Communication

These objectives are tested in all three of the compulsory components that make up the assessment framework.

Paper 1, a three hour written examination, tests students' understanding of and ability to apply the concepts they have learned. The essay questions in Section A of the paper cover the theoretical aspects of exploration identified above and students are required to answer one of the two questions set. In answering, students are likely to have to draw on material from across different key questions. Section B of the paper covers the application of the areas of exploration and the questions set draw on applications of the key questions.

Students choose one question out of four. Some examples of questions set in the first year of the examination include¹⁵:

- *'Because all human knowledge is merely provisional, there is no real distinction between fact and belief.'* Discuss (Section A)
- *'If there is absolute truth about right and wrong in ethics, we have no way of knowing what this truth might be.'* Discuss (Section B)

Paper 2, a two hour written examination, focuses on critical thinking and requires students to demonstrate critical thinking skills by applying their knowledge and understanding of what they have studied to unseen stimulus material. Section A of this paper is compulsory and requires students to respond to an extended text on a topic related to the nature and construction of knowledge. In Section B, students are required to analyse and evaluate the arguments presented in three out of four short texts.

Papers 1 and 2 both require students to:

- demonstrate their understanding of the nature and construction of knowledge in their critical analysis of the arguments, information and views presented in the texts
- apply their broader understanding of the nature and construction of knowledge to address specific contexts as required by the questions
- critically analyse different kinds of arguments and information presented
- identify and evaluate assumptions and points of view and verify claims
- provide reasoned and supported arguments
- use language appropriately and effectively to communicate a clear and well structured argument.

The third component of the KI assessment framework is the Independent Study which is conducted over a six month period. This gives students the opportunity to select a topic of their choice, which must be clearly grounded in an area of the nature and construction of knowledge outlined in the syllabus, and carry out independent research on it. Students must submit their proposals for approval before they embark on writing the study and while supervising teachers may give as much guidance as is necessary during the crafting of the proposal, subsequently, students are expected to work independently and are only permitted one conference with their supervisor mid-way through the writing period. In their Independent Study, students are expected to:

- demonstrate their understanding of the nature and construction of knowledge as it relates to their chosen area of study
- apply their understanding of the nature and construction of knowledge in addressing the specific context of their chosen area of study
- select appropriate material from the content of the syllabus in addressing their chosen area of study
- show that they have engaged in relevant reading during the course of their research by presenting a literature review and applying what they have read to support the arguments they present
- use language appropriately and effectively to communicate a clear and well structured argument

Some examples of Independent Studies that students have undertaken include:

- *Addressing Gettier-style problems due to the insufficiency of justified, true belief as a requirement of knowledge*

¹⁵ Knowledge and Inquiry Examination, Paper 1, UCLES & MOE, 2007

- *Cultural Determinism and Gender Identity*
- *Neologisms and their Effect on the Debate between Language and Thought*

Knowledge and Inquiry and The Desired Outcomes of Education

It can be seen that the very nature of some of the key questions forming the framework of KI syllabus reflect a number of elements in the Desired Outcomes. For instance, the study of facts, argument, reasoning and logic, along with the questioning of sources of knowledge identified as areas of study within the key question, 'What makes knowledge valid?' is aligned to Outcomes 5 and 6. Equally, the key question, 'How should knowledge be used?' with its exploration of ethics in society and the relationship between knowledge and power echoes the elements of uprightness and responsibility found in Outcome 1. In addition, the KI teaching syllabus states that '*KI also aims to develop in students a sense of global identity that is grounded in a strong sense of social responsibility and students are encouraged to explore issues of both global and local concern*'. While this is not explicitly assessed, nevertheless, the ethos behind it is very much in line with Outcome 8, that students be, '*global thinkers but rooted in Singapore*' and echoes a similar ethos found in the General Paper.

In the assessment of KI, we can once again see clear links to the Desired Outcomes. Outcome 5, with the requirement that students demonstrate an ability '*to think and reason*' underpins the KI syllabus and is assessed under the assessment objective 'Critical Thinking' which is assessed in all three KI papers. The fact that Critical Thinking carries the highest weighting overall in the KI examination (over 40% of the total) reflects its importance over and above understanding the nature and construction of knowledge and communication. In all the questions set in the two examination papers, students are required to unpack arguments they are presented with, evaluate logic, identify assumptions and flaws in the arguments presented, as well as compose their own reasoned arguments in response to the material they have been given. Students must also take their knowledge and understanding of the theories underpinning the nature and construction of knowledge and '*apply*' these to answer the questions that have been set (Outcome 6)

The Independent Study also requires students to '*seek out, process and apply knowledge*' (Outcome 6). As its name implies, the Independent Study also aims to develop the skill of independent learning and this is emphasised by the fact that students are permitted only one consultation with their supervisor midway through the writing process. This is in line with the first part of Outcome 4, as students must be '*willing to strive and take pride in work*' to achieve their goal of completing the Independent Study, by monitoring their own progress, and evaluating their own strengths and weaknesses which also echoes Outcome 7, that students have '*a spirit of continual improvement and lifelong habit of learning*'.

It should be noted that the skills-based subject syllabuses all refer to the importance of a spiral progression in the development of critical thinking, process and communication skills. This is clearly reflected in the three core knowledge skills subjects in that the skills students develop in their study of GP and, in particular, PW provide a firm foundation for students wanting to take up H2 KI. The skills of gathering, analysing and evaluating information that are developed in these two H1 subjects are all required for KI, but at a higher, more complex level.

Conclusion

Singapore is certainly not alone in producing its set of Desired Outcomes for Education. Many countries have produced similar documents, which not only encompass desired core skills or critical competencies that students need to succeed in the 21st century, but also values, which relate to the kinds of people we want students to be.

In the United Kingdom, the Dearing Report of 1997¹⁶ stated that *'the four main purposes which make up the aim of higher education are:*

- *to inspire and enable individuals to develop their capabilities to the highest potential levels throughout life, so that they grow intellectually, are well equipped for work, can contribute effectively to society and achieve personal fulfilment;*
- *to increase knowledge and understanding for their own sake and to foster their application to the benefit of the economy and society;*
- *to serve the needs of an adaptable, sustainable, knowledge-based economy at local, regional and national levels;*
- *to play a major role in shaping a democratic, civilised, inclusive society.'*

A Ministerial Statement issued in March 2004 by the Deputy Premier for New South Wales and Minister for Education and Training, set out the Values Education Outcomes in New South Wales Schools as follows¹⁷:

Student Learning Outcomes

'In the process of learning, students develop:

- *knowledge and understandings from the key learning areas*
- *skills and competencies in communication, problem solving, planning, organisation and research*
- *literacy and numeracy skills*
- *confidence in using new technologies*
- *safe and healthy lifestyles*
- *ecologically sustainable practices*
- *core values*
- *employment related skills*

Outcomes of Schooling

Some of the broad goals of outcomes of public schooling include:

- *love of learning*
- *high standards*
- *care and respect for self and others*
- *care and respect for families and communities*
- *respect for work*
- *fairness and social justice*
- *pursuit of excellence*
- *being active citizens of Australia and the world*
- *appreciating Australia's history and multicultural society'*

From these two examples, we can see that Singapore's Desired Outcomes of Education reflect similar concerns about the kinds of students, and ultimately adults, countries would like to produce, in terms of both their academic abilities and the values they hold in respect of their responsibilities to others in their communities and countries. It is no surprise then that Life Skills, and not skills associated with academic study, sit at the heart of Singapore's new pre-university curriculum; those skills that ensure students acquire sound values and skills to take them through life as responsible adults and active citizens. These skills are developed through the non-academic curriculum, i.e. through programmes that involve service to others and national and civics education, among others. Radiating outwards from Life Skills, in the middle circle, we find the Knowledge Skills subjects that have been the

¹⁶ Dearing, R, April 1997, national Committee of Inquiry into Higher Education (p. 5, para 23)

¹⁷ Hon Andrew Refshauge, MP, Deputy premier, Minister for Education and Training and Minister for Aboriginal Affairs: Values in NSW Public Schools, March 2004

focus of this paper. Indeed, it is these subjects, with their emphasis on interdisciplinary study, learning to learn independently, seeking out and processing information, questioning, analysing and evaluating information, thinking both critically and creatively, as well as communicating effectively and working collaboratively, which underpin and reinforce the traditional, academic content knowledge found in the outer circle. Taking all three circles of the curriculum framework together in conjunction with the Desired Outcomes of Education, we can see that these outcomes can be achieved through the balance of programmes of study that make up the curriculum.

Given that the new curriculum was implemented only in 2006, it may take several years before any judgement can be made on its success in achieving the Desired Outcomes of Education, or indeed how successful it is in producing students who are well rounded and well prepared for study at Institutes of Higher Learning, which is the next step in their academic journey. However, in the meantime, there has been some positive feedback on the effects of student exposure to the core knowledge skills in the new curriculum, in particular, Project Work.

When asked whether he had seen any difference in students' skills in research work when they entered the Nanyang Technological University in Singapore, following their exposure to five years of Project Work, Associate Professor Tan commented¹⁸:

"Students are more interested and eager to work out project details themselves; dividing up the different parts of the project without any intervention from the professors, including the technical work, sourcing for information, report writing and final oral presentation. They seem to be able to cope with and handle issues systematically and confidently. They can be good leaders as well as team players. Our students are more confident, especially during oral presentations. They are also better in the report writing skills."

¹⁸ Tan, Ooi Kiang, Associate Professor, Nanyang Technological University (Faculty of Engineering), Singapore, 2008

Full List of References

1. Bryer, K, 2006, Pre-University Project Work in Singapore: An Alternative Mode of Assessment in Singapore. Paper presented at IAEA Conference in Singapore, 22nd May
2. Kam, H. W. & Gopinathan, S. 1999, **Recent Developments in Education in Singapore**, School Effectiveness and School Improvement, Vol.10, 1
3. Caldwell, B, 1996, **Reengineering the Secondary School: Leadership, Culture and Change for the Third Millenium**. Paper presented as individual address at the annual conference of Western Australian Secondary School Principals in Perth, March 21st
4. Hargreaves, A, **Restructuring restructuring: Postmodernity and the Prospects for Educational Change**, Journal of Education Policy, Vol. 9, 1
5. **The Desired Outcomes of Education**, Ministry of Education, Singapore (MOE), 2000
6. **Breadth and Flexibility: The new A-Level Curriculum 2006**, Ministry of Education, Singapore
The 2006 A-Level Examinations, Singapore Examinations and Assessment Board (SEAB)
7. **General Paper Syllabus**, MOE & SEAB 2007,
8. **General Paper Examination**, Paper 1, UCLES & MOE, 2004
9. **General Paper Examination**, Paper 2, UCLES & MOE, 2007
10. **Project Work Syllabus**, MOE & SEAB, 2007,
11. **Project Work Examination**, UCLES & MOE, 2005
12. Liaw Wy-Cin (Education Correspondent), **JC Student Projects Yield Real Life Benefits**, The Straits Times, 2006
13. Bundy, Alan, 1998, **Information Literacy: The key Competency for the 21st Century**. Paper presented at the Annual Conference of the International Association of Technological University Libraries held in Pretoria, South Africa.
14. MOE & SEAB 2007, **Knowledge and Inquiry Syllabus**
15. **Knowledge and Inquiry Examination**, Paper 1, UCLES & MOE, 2007
16. A Ministerial Statement by Hon Andrew Refshauge, MP, Deputy Premier, Minister for Education and Training and Minister for Aboriginal Affairs: **Values in NSW Public Schools**, March 2004
17. Dearing, R, April 1997, **National Committee of Inquiry into Higher Education** (p.5, para 23)
18. Tan, Ooi Kiang, Associate Professor, Nanyang Technological University (Faculty of Engineering), Singapore, 2008