

# Report

## **Updating the Curriculum of Mathematics Education of Yogyakarta State University, Leading to the International Standard in Ma- thematics Education**

*(A Benchmarking at the Mathematics and Mathematics  
Education Group of National Institute of Education  
(NIE), National Technological University, Singapore)*

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# Executive Summary

In responding to the development of international standardized schools by the Indonesian government through the Ministry of National Education, which demands qualified mathematics teachers who are competent in teaching mathematics in English, the Department of Mathematics Education (MED) of Yogyakarta State University (YSU) is currently revising the curriculum for mathematics teacher students. This effort is also in accordance with the YSU policy to establish international study programs. MED is one of three study programs selected by the university to initiate the establishment of international study programs. The international study programs, which are developed from the existing study programs, will be expected to prepare professional graduates who are competent in teaching at international standardized national schools or international schools (at foreign countries).

Some efforts have been doing to initiate the establishment of the international mathematics education study program. Among these are conducting some courses in bilingual – bahasa Indonesia and English, improving lecturers and students' English proficiency, improving the quality of teaching and learning processes and facilities, updating the curriculum, and having benchmarking materials from internationally reputable institutions, including the National Institute of Education (NIE) of Nanyang Technological University, Singapore. The study has been conducted during the periods of 18 to 28 August 2008 at the Mathematics & Mathematics Education (MME) Academic Group of NIE.

The information has been collected through activities such as:

- 1) Interviews with the Head of MME and the Deputy Head of MME, and also some staffs of MME;
- 2) Observations of teaching and learning processes: lectures, laboratory activities, and students teaching practice at school;
- 3) Observations of teaching and learning facilities: class rooms, lecture theaters, computer laboratories, mathematics (education) laboratories, and library;
- 4) Discussions with staffs of MME during Weekly Wednesday-Meetings; and
- 5) Studying the contents of MME and NIE's Websites.

Among the findings from the benchmarking study are that : (1) structure of curriculum of MME is more or less similar to the MED curriculum, but the MME curriculum gives more stress on the professional student teachers development, (2) the MME has qualified academic and administrative staffs – all academic staffs are PhD or master in mathematics or mathematics education, (3) the MME facilities for doing research, teaching, and learning (such as classrooms, lecture theatres, laboratories, and library) are in high standard, (4) the MME academic atmosphere is very conducive for supporting staffs in doing research, teaching, and making collaboration among staffs, (4) most MME academic staffs have international experiences in doing research and publication as well teaching.

Based on the benchmarking results, the following is provided some suggestions to the MED in order to establish international Mathematics Education Study Program. These suggestions may also apply to the faculty level (Faculty of Mathematics and Sciences), as well as the university level (Yogyakarta State University).

1. Structure of Mathematics Education curriculum should be adjusted in such a way that:

- a. the contents of general subjects & education studies should not just theoretical but they should be linked with the application in the classrooms (e.g. application of educational psychology in the teaching and learning, English/bahasa Indonesia for classroom communication and academic discourse, etc.)
  - b. the professional development of teacher candidatures students should gain serious attention with by stressing much more on teaching practices and school experiences, not just one teaching practice.
  - c. If possible, not all subjects are counted or given credit (SKS) for calculating the cumulative grade point average (CGPA). The CGPA calculation may only by taking account the mathematics, mathematics education, and general educational subjects. Other compulsory subjects such university level subjects (except English) may be credited by a certification system and as graduation requirement. In this way, it easy to compare the CGPA obtained from the MED to international CGPA system.
2. To support the implementation of developed (international standardized) curriculum, MED (with support from the faculty and university) should provide high standard facilities for teaching and learning. This standard should include:
    - a. standard classroom equipped with high standard facilities for teaching
    - b. standard laboratory equipped with high standard facilities for teaching and learning
    - c. standard library collections and facilities for supporting researches, teaching, and learning.
    - d. standard for academic rules and procedures with consistent enforcement, such as:
      - i. standard teaching administrations (e.g. student absence list must be ready before lecture time starts)
      - ii. standard evaluation administrations and procedures
      - iii. standard academic students evaluation (e.g. two-semester CGPA students evaluation and its consequences).
  3. The MED should develop standard course evaluation by reviewing examination papers. This review can be done by external (from external university) or internal (other staffs and Head of Department) examination paper reviewers. This can ensure the standard of course contents and student evaluation to make easy for international accreditation.
  4. The MED should improve the quality of staffs by supporting them to undertake masters or PhD degree in mathematics or mathematics education in English speaking countries. The MED should has definite target about the staffs whose specializations (based on their master or PhD degrees) in mathematics or mathematics education, not enough just have master or doctoral degrees but not related with mathematics or mathematics education.
  5. To support the academic staffs and students to conduct research, education, and educational services, the MED, faculty, or university should provide conducive working environment, such as:
    - a. provide each staff with a private room equipped with standard facilities for doing academic works and giving students consultations.
    - b. provide a seminar room and weekly schedule for staffs to discuss each other on academic matters.
    - c. provide facilities for comfort such as pantry or tea rooms
    - d. provide an easy way to staffs to communicate or to meet each other, e.g. by placing the staff rooms at the same level of the same building, not separated at different levels and different rooms or buildings
    - e. provide a way to enable all staffs are easily contacted from their rooms, e.g. by giving a local phone at each staff room, and each staff should be ready to open their e-mail from his/her private room.

6. The MED should immediately establish an MoU with the MME Academic Group of NIE, NTU Singapore for further collaboration for improvement of staffs quality, research, and teaching. The possibility for doing such collaboration has been talked during the visit to NIE, so the MED must do the follow up.

# Introduction

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Some efforts have been doing to initiate the establishment of the international mathematics education study program. Among these are conducting some courses in bilingual – bahasa Indonesia and English, improving lecturers and students' English proficiency, improving the quality of teaching and learning processes and facilities, updating the curriculum, and having benchmarking materials from internationally reputable institutions, including the National Institute of Education (NIE) of Nanyang Technological University, Singapore. The study has been conducted during the periods of 18 to 28 August 2008 at the Mathematics & Mathematics Education (MME) Academic Group of NIE.

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- 5) Studying the contents of MME and NIE's Websites.

The purpose of this benchmarking is to get some inputs from the MME Academic Group of NIE on some aspects related to the following matters: (1) the structure of international standardized curriculum for mathematics education for secondary school teachers, (2) the process of developing the curriculum, and (3) the implementation of the curriculum. These may include the involvement of the policy makers within the department, faculty, university, or even at national levels in determining the structure of the curriculum. In addition, how are the involvements of internal academic members and external stakeholders? The most important questions may be related to the standard of subject knowledge and pedagogical contents (syllabi), the standard for teaching and learning processes, including the evaluation process standard, and also the supporting facilities. The obtained information will be used for revising the curriculum and syllabi of Mathematics Education Study Program of MED.

The revised curriculum and syllabi will be documented in both Indonesian and English and will be implemented gradually by conducting lectures in English for some topics on some

selected subjects. This implementation will be applied to the existing mathematics education classes. Having the international standard mathematics education curriculum, in the future the MED may welcome international students from other countries, and the graduates will be competent in teaching mathematics at international standardized national schools or international schools (at foreign countries).

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# Benchmarking Results

The following will be described the results of visiting the Mathematics & Mathematics Education Academic Group of NIE (National Institute of Education) of NTU (Nanyang Technological University) Singapore during 18 to 28 August 2008. The information has been collected through activities such as:

- 1) Interviews with the Head of MME and the Deputy Head of MME, and also some staffs of MME;
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- 3) Observations of teaching and learning facilities: class rooms, lecture theaters, computer laboratories, mathematics (education) laboratories, and library;
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## A. About MME of NIE

The Mathematics and Mathematics Education (MME) Academic Group is one of the eleven academic groups of the National Institute of Education (NIE), Singapore. NIE was established on 1 July 1991 as an institute of the Nanyang Technological University (NTU). However, NIE has long experiences as an educational institution, since its origin name, TTC (teacher training center) established on 1950.

MME conducts courses in mathematics and mathematics education for pre-service and in-service teachers from primary to graduate levels. These courses are offered through NIE Foundation Programs, Graduate Programs, Professional Development Programs, and External Programs. Besides these, MME academicians conduct workshops and seminars at school, cluster, and zone level to upgrade the content and pedagogy of mathematics teachers in Singapore and beyond. They also supervise research students at Masters and PhD level in mathematics and mathematics education.

MME academicians work actively with international collaborators in research and publication in mathematics and in mathematics education. Key research areas include: mathematics modeling, graph theory, alternative assessment in mathematics, thinking in mathematics, calculator and technology use, mathematics pedagogical content knowledge, mathematics curriculum, and mathematics teacher education.

Their professional work is achieved through the dedication and commitment of a team of highly qualified academicians and competent administrative staff.

# 1. Vision and Mission of MME

## a. Vision

*To strive to be a leader in the field of Mathematics Education*

This is a short and clear formulation of a vision and provides an image to every body about how the institution will be in the future.

## b. Mission

*MME is committed to the professional preparation and development of mathematics teachers and educators in Singapore and beyond within a rapidly changing and increasingly technological environment. In particular, MME aims to:*

- prepare mathematics teachers for the primary, secondary and pre-university levels;
- update the content knowledge and pedagogy skills of practicing mathematics teachers;
- guide senior mathematics teachers to become effective heads of departments;
- carry out research, in both content and pedagogy, to meet the needs of a technological society in the 21st century.

This vision and mission of MME is in accordance with the **NIE's vision**, which is *to be an Institute of Distinction*, and the **NIE's while mission**, which is *to excel in teacher education and educational research*.

The formulation of the mission is also very clear and clearly derived from the vision. The mission describes the efforts that the institution will do to reach its vision.

# 2. Academic Programs

MME Academic Group has 5 programs: (1) degree program, (2) diploma program, (3) PGDE program, (4) In-service program, and (5) postgraduate program.

## a. Degree Program:

The degree (bachelor) program consists of BA (Ed) (Primary), BA (Ed) (Secondary), BSc (Ed) (Primary), and BSc (Ed) (Secondary). Student teachers in the bachelor's degree programs are registered as undergraduates of the Nanyang Technological University and these programs are administered by the Foundation Programs Office which is committed to developing educational professionals ready to be leaders in the service of learners. All student teachers come under the purview of the Dean of Foundation Programs.

### Aims of the BA (Ed) & BSc (Ed) Programs

The degree programs are positioned to integrate the best of an academic degree with a good foundation in the field of education to produce graduates with the knowledge and skills to excel in careers both in education and education-related fields and beyond. The curriculum of these programs is broad-based and flexible with the rigor expected of any internationally recognized undergraduate program. The best graduates are able to pursue advanced qualifications both in the academic disciplines and in the field of education. The programs prepare student teachers for primary or secondary teaching.

## Duration of the BA (Ed) & BSc (Ed) Programs

The programs extend over a period of four years and lead to the award of the degree of Bachelor of Arts (Education) or Bachelor of Science (Education). Student teachers may be awarded honors degree based on excellent overall performance in the four year programs. The minimum period of study required for the degree of BA/BSc (Ed) is 3½ years. No candidate is permitted to take more than 7 years to obtain the degree.

## The Academic Unit System

The University adopts the Academic Unit System, that is, academic units are used to measure academic workload per semester and per academic year. The academic year is currently divided into two semesters. The Academic Unit (AU) provides a consistent measure of the student teacher's academic workload related to both class attendance and independent preparation. Used to weight courses in a subject taught for the duration of one semester of 13 teaching weeks, each Academic Unit represents an average workload of one hour per week in the form of lecture/tutorial classes, or three hours per week in the form of laboratory/field work sessions. For example, a typical course with one lecture hour per week and one tutorial hour per week carries 2 AUs. Academic Units are calculated on a course basis, that is, subjects are made up of courses, and each course carries a certain number of AUs.

## Core Courses, Prescribed Electives & General Electives

There are three categories of subject courses in the degree programs:

<b>Core Courses</b>	Compulsory courses that must be passed to fulfill degree program requirements (inclusive of the ONE Essential Course);
<b>Prescribed Electives</b>	Electives that form a certain field of specialization in a particular subject. They add to the depth and/or breadth of knowledge and skills to be acquired by student teachers;
<b>General Electives</b>	Electives which may be chosen from a broad list of courses offered by the University, whether within or outside the Institute, on the approval of the Dean meant only for BA(Ed)/BSc(Ed) student teachers in the Secondary track. This is a 3 AU course under "General Electives".

Each course is assigned academic units. Minimum academic unit requirements for completing the degree programs are shown in the **Table 1**. Note that in addition to the core courses and the required number of prescribed electives, student teachers in the Secondary track must also offer 3 AUs of general electives which can be chosen from subjects offered.

## Structure of Programs

The BA(Ed)/BSc(Ed) programs comprise 8 areas of study, namely: (1) education studies, (2) curriculum studies, (3) subject knowledge, (4) essential course, (5) practicum, (6) language enhancement & academic discourse skills (LEADS), (7) Group Endeavours in Serving Learning (GESL), and (8) academic subjects.

### 1) Education Studies

Student teachers will learn the key concepts and principles of education that are necessary for effective teaching and reflective practice in schools. They will also have the opportunity for in-depth study of some significant aspects of education.

Table 1 Academic Unit Requirements of NIE's bachelor degree

Program	Strand/ Specialization	Option	Year of Study	No. of Academic Units (AUs)		
				Core Courses, Prescribed Electives & Practicum	General Electives	Total
BA (Ed)	(General, Primary)	A	1	24	-	126 / 128
			2	30* / 32		
			3	37+ / 39		
			4	31# / 33		
		B	1	24	-	
			2	30* / 32		
			3	37+ / 39		
			4	29		
BA (Ed)	(General, Secondary)	-	1	34	-	131
			2	31	3	
			3	36	-	
			4	27	-	
BSc (Ed)	(General, Primary)	A	1	24	-	126 / 128
			2	30** / 32		
			3	37++ / 39		
			4	31## / 33		
		B	1	24	-	
			2	30** / 32		
			3	37++ / 39		
			4	29		
BSc (Ed)	(PESS, Primary)	-	1	26	-	128
			2	37		
			3	33		
			4	32		
BSc (Ed)	(General, Secondary)	-	1	34	-	131
			2	31	3	
			3	36	-	
			4	27	-	
BSc (Ed)	(PESS, Secondary)	-	1	36	-	135
			2	37	3	
			3	33	-	
			4	26	-	

**Notes:**

\*) : For student teachers offering AS: English Language or AS: History and CS3: Social Studies

+) : For student teachers offering AS: Geography and CS3: Social Studies

#) : For student teachers offering AS: Art and CS3: Art, AS: Music and CS3: Music

\*\*) : For student teachers offering AS: Physics and CS3: Science

++) : For student teachers offering AS: Biology and CS3: Science

##): For student teachers offering AS: Mathematics

Chinese Language and Malay Language specializations are not described here.

PESS: Physical Education and Sport Sciences.

## 2) Curriculum Studies

BA(Ed)/BSc(Ed) student teachers will specialize in the methodology for teaching at either the primary or secondary school level. These are designed to give student teachers the pedagogical skills in teaching specific subjects in Singapore schools. The choice of Curriculum Studies (CS) subjects depends on the track and strand to which the student teacher belongs.

Table 2 CS Subject Choices for BA(Ed)/BSc(Ed)

Track	Strand/Specialization	CS Subject Choices
Primary	General (Option A)	Any 3 CS subjects from: Art, English, Mathematics, Music, Science, Social Studies <i>For each CS, the number of courses is one more than that in Option B.</i>
	General (Option B)	1. English Language 2. Mathematics 3. And 1 more CS from: Art, Music, Science, Social Studies <i>A set of Lower Primary Integrated Courses worth 8 AUs is available in this option.</i>
	PESS	<b>CS1:</b> PESS <b>CS2:</b> English Language or Mathematics <b>CS3:</b> any one from (if not selected for CS2): Art, English, Mathematics, Music, Science, Social Studies
Secondary	General	Student teachers will offer 2 CS subjects which are aligned with the choice of Academic Subjects (AS) chosen. CS1 will align with AS1 and CS2 will be aligned with AS2. For a full list of AS subjects, see section on Academic Subjects.
	PESS	<b>CS1:</b> PESS <b>CS2:</b> aligned with AS2

## 3) Subject Knowledge

This group of courses helps to reinforce subject content mastery for primary school teaching. Student teachers in the primary track must offer Subject Knowledge courses aligned with their choice of CS subjects. For each CS subject, there will be two Subject Knowledge (SK) courses for those in the primary track in Option B while those who select Option A will have three SK courses for further deepening their subject knowledge. In the case where the student teacher's Academic Subject (AS) is related to the CS subject, he/she will only be required to do only 2 SK courses if Option A is selected and either 1 or 2 SK courses if Option B is selected as determined by the Academic Group. For PESS specialization in the primary track, student teachers will offer

SK courses aligned with the CS2 and CS3 subjects and will read 3 SK courses per subject. Those in the Secondary track will not be reading SK courses as it is assumed that they would have obtained this knowledge from the 2 AS subjects offered.

#### 4) Essential Course

There will only be 1 essential course that introduces student teachers to the implications of living in a diverse society entitled "*Multicultural Studies: Appreciating & Valuing Differences*".

#### 5) Practicum

Student teachers will be attached to schools for 2, 5, 5, 10 week blocks so that they can develop teaching competencies in a variety of contexts and at different levels.

- (i) **School Experience (SE):** This is 2 weeks long, with 1 week in a primary school and 1 in a secondary school. The purpose for this is to provide student teachers opportunities to observe lessons in the primary and secondary classrooms.
- (ii) **Teaching Assistantship (TA):** This comprises 5 weeks and its purpose is to provide student teachers opportunities to observe their Cooperating Teachers (CTs) teach and to reflect on the roles and responsibilities of a teacher.
- (iii) **Teaching Practice 1 (TP1):** This is 5 weeks long and its purpose is to help student teachers to begin to teach independently. They will learn to plan their own lessons to teach, prepare relevant resources and to manage pupils independently while still being able to consult their CTs and to observe their CTs teach.
- (iv) **Teaching Practice 2 (TP2):** This is the final component and it lasts for 10 weeks. Besides focusing on independent teaching, TP2 allows for a more holistic school attachment experience which could include exploring other aspects of a teacher's life, such as, the management of CCAs.

For all 4 school attachments, student teachers will be closely supervised by NIE's lecturers and will also learn from experienced teachers in the schools about the schooling process. They will use the knowledge and skills obtained from the Education Studies and Curriculum Studies courses to integrate theory with practice.

#### 6) Language Enhancement and Academic Discourse Skills (LEADS)

The courses in this component equip student teachers with the basic language and voice skills that they require for teaching, as well as for successfully engaging in academic writing of assignments and theses. BA/BSc (Ed) student teachers will have to offer 2 compulsory courses, Communication Skills for Teachers (CST) and Academic Discourse Skills (ADS).

#### 7) Group Endeavours in Service Learning (GESL)

Group Endeavours in Service Learning (GESL) Project is a compulsory project work that all student teachers are required to undertake. Student teachers in an assigned group are to collaboratively complete a project in a community service within the program. Student teachers will benefit from the GESL experience in acquiring generic knowledge and skills of project management in service learning. Groups will showcase their completed

projects and a record of student teachers' involvement in GESL will be issued at the end of the program.

## 8) Academic Subjects

This area of study covers knowledge of the content and fundamental concepts and principles of either one or two subjects depending on the program enrolled for.

- BA(Ed) (Primary): the choice of the first Academic Subject must be an Arts subject
- BSc(Ed) (Primary): the Academic Subject must be a Science Subject.
- BA (Ed) (Secondary): must read an arts subject as Academic Subject 1 but can choose an Arts or Science subject as Academic Subject 2.
- BSc (Ed) (Secondary): must choose a Science subject as Academic Subject 1 but can choose an Arts or Science subject as Academic Subject 2.

The lists of subjects for the different program are shown on the **Table 3**. However, due to the nature of workload for some subjects, the subject combinations allowed will have to be necessarily limited.

**Table 3 Academic Subjects for BA (Ed)/BSc (Ed)**

Academic Subject	BA (Ed)			BSc (Ed)		
	Primary	Secondary		Primary	Secondary	
	AS	AS1	AS2	AS	AS1	AS2
Art	√	√	√	X	X	√
Biology	X	X	√	√	√	√
Chemistry	X	X	√	√	√	√
Chinese Language	√	√	X	X	X	X
Chinese Literature	X	X	√	X	X	X
Drama	√	√	√	X	X	√
English Language	√	√	√	X	X	√
English Literature	X	√	√	X	X	√
Geography	√	√	√	X	X	√
History	√	√	√	X	X	√
Malay Language	√	√	X	X	X	X
Malay Literature	X	X	√	X	X	X
Mathematics	X	X	√	√	√	√
Music	√	√	√	X	X	√
Physics	X	X	√	√	√	√
Family & Consumer Science	X	X	X	X	√	X
PE & Sports Science	X	X	X	√	√	X

## Curriculum Structure

For reference purposes that appropriate to the curriculum of MED, only the curriculum structure for BSc(Ed) (General, Secondary) program of NIE will be presented in the **Table 4**.

The list of Curriculum Studies and Academic Subjects courses for Mathematics is provided on the **Appendix 2** and **Appendix 4**.

Table 4 Curriculum Structure for BSc(Ed)(General, Secondary) Program

Year	Category/Subject	Course Code	Title	No. of AUs
1	Educational Studies	AED102	Educational Psychology I: Theories and Applications for Learning & Teaching	3
		AED104	ICT for Engaged Learning	2
		AED105	Critical Perspective on Education	2
	Academic Subjects	AS1: ....	Select courses from 1 science subjects (Biology, Chemistry, Family and Consumer Sciences, Mathematics, Physics)	12
		AS2: ....	Select courses from 1 art/science subjects (Art, Drama, English Language, English Literature, Music, History, Geography, Biology, Chemistry, Mathematics, Physics)	12
	Language Enhancement and Academic Discourse Skills	ALS101	Academic Discourse Skills	3
	Practicum	APR101	School Experience	0
Additional (Compulsory)	AGS101	Group Endeavour Service Learning (GESL)	0	
2	Educational Studies	AED201	The Social Context of Teaching and Learning	2
	Academic Subjects	AS1: ....	Select courses from 1 science subjects (Biology, Chemistry, Family and Consumer Sciences, Mathematics, Physics)	12
		AS2: ....	Select courses from 1 art/science subjects (Art, Drama, English Language, English Literature, Music, History, Geography, Biology, Chemistry, Mathematics, Physics)	12
	Language Enhancement and Academic Discourse Skills	ALK101	Communication Skills for Teachers	2
	General Elective		Select 1 course of "General Elective"	3
	Practicum	APR201	Teaching Assistantship	3
3	Educational Studies	AED301	Educational Psychology II: Providing for Individual Differences in Learning & Teaching and Classroom Management	3
	Academic Subjects	AS1: ....	Select courses from 1 science subjects (Biology, Chemistry, Family and Consumer Sciences, Mathematics, Physics)	12
	Curriculum Studies (CS1 aligned with AS1, CS2 aligned with AS2)	CS1/CS2: ....	Select courses from 1 art/science subjects (Art, Drama, English Language, English Literature, Music, History, Geography, Biology, Chemistry, Mathematics, Physics)	12
	Essential Courses	AMX301	Multicultural Studies: Appreciating Differences	3
	Practicum	APR301	Teaching Practice 1	6
4	Academic Subjects	AS1: ....	Select courses from 1 science subjects (Biology, Chemistry, Family and Consumer Sciences, Mathematics, Physics)	3
	Curriculum Studies (CS1 aligned with AS1, CS2 aligned with AS2)	CS1/CS2: ....	Select courses from 1 art/science subjects (Art, Drama, English Language, English Literature, Music, History, Geography, Biology, Chemistry, Mathematics, Physics)	12
	Practicum	APR401	Teaching Practice 2	12

In summary, the number of AUs for each curriculum component for different MME academic program is presented on **Table 5**.

**Table 5 the number of AUs for each curriculum component for different MME academic program**

	Concurrent			Consecutive	
	Dip in Ed (General Option A)	BA/BSc(Ed) (Primary Option B)	BA/BSc (Ed) (Secondary)	PGDE (Primary, General) Option A	PGDE (Secondary)
<b>Duration</b>	2 years	4 years	4 years	1 year	1 year
<b>Cur. Component</b>		Direct Hon.	Direct Hon.		
<b>Education Studies</b>	8	12	15	8	8
<b>Curriculum Studies</b>	20	24	24	12	18
<b>Subject Knowledge</b>	18	12		8	
<b>Academic Studies</b>		39	60		
<b>Practicum</b>	15	21	21	10 weeks	10 weeks
<b>LEADS</b>	4	5	5	2	2
<b>GESL</b>		√	√	√	√
<b>Other Courses: General Elective Essential Course</b>		11	6		
<b>Total AU</b>	<b>65</b>	<b>124</b>	<b>131</b>	<b>44</b>	<b>40</b>

**Table 6 MME Coordinators of AS, CS, SK, and GE Subjects for Degree Programs**

Component	Coordinator	Course Structure and Descriptions
Academic Subject	Ast/P Tang Wee Kee	AAM Series
Curriculum Studies	<b>Secondary Year 4:</b> Mr Leong Yew Hoong <b>Year 3:</b> Mr. Chua Boon Liang <b>Primary Year 4:</b> Mr Lee Ngan Hoe	ACM Series
Subject Knowledge	<b>Year 4:</b> Asst. Prof. Paul M.E. Shutler ASM401 <b>Year 3:</b> Asst. Prof. Paul M.E. Shutler ASM302 Asst. Prof. Lee Tuo Yeong ASM301 <b>Year 2:</b> A/P Teo Beng Chong ASM202 Asst. Prof. Cheang Wai Kwong ASM201	ASM Series
General Elective	Dr Emmanuel Cabral	AAM Series

**Lesson learned:**

- In principle, the structures of the both curriculums are similar – some components and courses are the same or analogous.
- The workload measure of both curriculums is also equivalent.
- The different number in workload measure is mostly caused by the fact that MED curriculum contains more courses on computer and the general (university level) courses.

- The MME BSc(Ed) curriculum stresses much more on teaching experiences/practices for the students. This reflects the good professional development of student teachers. The MED curriculum should also adopt the similar stressing on produce qualified teacher candidates by reducing the number of SKS for the theoretical educational courses.

## b. Diploma Program

Table 7 MME Coordinators of CS and SK Subjects for Diploma Program

Component	Coordinator	Course Structure and Descriptions
Curriculum Studies	Year 2: Ast/P Yeap Ban Har	DCM Series
Subject Knowledge	A/P Teo Beng Chong (DSM100) Asst. Prof. Dong Fengming (DSM200)	DSM Series

## c. PGDE Program

Table 8 MME Coordinators of CS and SK Subjects for PGDE Program

Component	Coordinator	Course Structure and Descriptions
Curriculum Studies	<b>Primary (July Intake):</b> Mr Eric Chan <b>Secondary (July Intake):</b> Mr Leong Yew Hoong <b>Lower Secondary (July Intake):</b> Mr Chua Boon Liang <b>Secondary (January Intake):</b> Asst. Prof. Dindyal Jaguthsing <b>Lower Secondary (January Intake):</b> A/P Yap Sook Fwe	Primary QCM Series Secondary QCM Series Lower Secondary QCM Series
Subject Knowledge	Ast/P Tang Wee Kee (QSM502 ) Asst. Prof. Teo Kok Ming (QSM502 )	QSM Series

## d. Postgraduate Programs

Table 9 MME Postgraduate Program Coordinators

Programs	Coordinator	Course Structure and Descriptions
PhD/MSc (Mathematics)	A/P Tay Eng Guan	MME Research Degrees Brochure
PhD/MA (Mathematics Education)	A/P Fan Liang Huo	MME Research Degrees Brochure
MEd (Mathematics Education)	A/P Fan Liang Huo	MME Series
MSc (Mathematics for Educators)	A/P Zhao Dongsheng	MSc (Mathematics for Educators) website MSM Series Courses Detail Descriptions of MSM 814 and MSM 830

## e. In-Service Programs

Table 10 MME In-Service Program Coordinators

Component	Coordinator	Course Structure and Descriptions
General Courses	A/P Koay Phong Lee	In-Service website
MLS Primary	A/P Foong Pui Yee	Detail Description of MLS116
MLS Secondary	A/P Berinderjeet Kaur	Detail Description of MLS117

### **Lesson learned:**

- It is interesting that the pre-service training institution is also an in-service training institution, so there is connection between pre-service and in-service training and no overlap in the both curriculum. Also, in this way, the pre-service institution will be more responsible to the teacher professional development.
- The availability of curriculum for different academic programs, including the in-service teacher training, can be useful as reference to the Indonesian in-service teacher training, especially for MED which also conduct in-service teacher training.

## 3. Students & Graduates

### a. Entry Requirements for the BA/BSc (Ed) Programs

#### 1) For GCE 'A' Level Holders (for Examinations taken up to Year 2006)

Applicants who have taken the Singapore-Cambridge GCE Advanced Level Examination or Higher School Certificate Examination must have obtained:

- i) passes in at least two subjects at 'A' level and two subjects at 'AO' level including a pass in General Paper (English) taken at one and the same sitting of the examination;
- ii) a minimum grade of C6 in at least five subjects including English as a First Language taken at the GCE 'O' Level Examination;
- iii) a minimum grade of D7 in a second language (Chinese/Malay/Tamil) taken at the GCE 'A' Level Examination, or a minimum grade of D7 in a first language (Higher Chinese/Higher Malay/Higher Tamil) taken at the GCE 'O' Level Examination;
- iv) a pass in Mathematics obtained either at the GCE 'O' Level Examination or at least at 'AO' level in the GCE 'A' Level Examination; and

#### 2) Applicants who have taken commercial subjects in the Singapore-Cambridge GCE Advanced Level Examination or equivalent examination must meet the requirements stipulated in paragraph 1) above. However,

- i) Office Administration and Principles and Practice of Office Administration are not subjects acceptable for admission to the University, and
- ii) Office Administration and Stenography, Shorthand and Typing, and Office Administration and Shorthand/Typewriting duties are counted as subjects at 'O' level irrespective of the level at which the applicant has passed the examination.

#### 3) For GCE 'A' Level Holders (for Examinations taken from Year 2007 onwards)

Applicants who have taken the Singapore-Cambridge GCE Advanced Level Examination must have obtained:

- i) passes in at least two subjects at H2 level and two subjects at H1 level including a pass in General Paper (or Knowledge and Inquiry at H2 level) taken at one and the same sitting of the examination;
- ii) where applicable, a minimum grade of C6 in at least five subjects including English as a First Language taken at the GCE 'O' Level Examination;
- iii) a minimum of 'S' grade in a Mother Tongue Language (Chinese/Malay/Tamil) taken at the H1 level or pass in Mother Tongue Language =B' taken in the GCE 'A' Level Examination, or a minimum grade of D7 in a first language (Higher Chinese/Higher Malay/Higher Tamil) taken at the GCE 'O' Level Examination; and
- iv) a pass in Mathematics obtained either at the GCE 'O' Level Examination or at least at H1 level in the GCE 'A' Level Examination.

#### **4) For International Baccalaureate Diploma Holders**

Applicants who have taken the International Baccalaureate (IB) Diploma Examination must have obtained: Singapore-Cambridge GCE Advanced Level Examination must have obtained:

- i) a good overall IB Diploma score;
- ii) Pass at least at grade 4 in English and Mathematics done at standard level; and
- iii) Where applicable, a minimum grade of C6 in at least five subjects including English as a First Language taken at the GCE 'O' Level examination.

#### **5) For Polytechnic Diploma Holders:**

- i) Any polytechnic diploma with good results;
- ii) Same as (ii) under paragraph 1)
- iii) Same as (iv) under paragraph 1)

### **b. Special Mathematics Academic Subject Requirements**

There are prerequisites for reading the Mathematics Academic Subjects:

- i) At least a Grade C at GCE 'A' level in Mathematics (Syllabus C), Or
- ii) At least a Grade C at H2 level Mathematics, Or
- iii) At least a Grade C at GCE 'A' level in Further Mathematics, Or
- iv) At least a Grade 5 pass at Higher Level Mathematics for IB holders.

Students from the polytechnics will have to pass the Mathematics Qualifying Test.

### **c. Second Language Requirements**

Applicants who do not satisfy the requirements for second language as set out in paragraph 1) (iii) under entry requirements may still submit an application for admission. If selected, such applicants will be admitted to the University on a provisional basis. During their program of study in the University, they will be required to meet the requisite minimum language requirements before they are allowed to graduate.

#### d. Suitability Tests

Applicants may, at the discretion of the Singapore Ministry of Education and the University, be required to undergo such tests as may be set to assess their suitability for University study and teacher-training and to appear for interviews.

##### Lesson Learned:

- Most students are teachers paid by the Singapore government.
- MME has multi-ethnic students
- All graduates automatically employed by the government
- Students belong to FP of NIE, not MME AG
- Students administration is done by the FP

### 4. Curriculum Development

According to the NIE Model of Teacher Education, the attributes of the beginning teacher comprises three components: values, knowledge, and skills, each consisting the following competences.

**Table 11 The NIE Model of Teacher Education  
(The Attributes of the Beginning Teachers)**

Values	Knowledge	Skills
<ul style="list-style-type: none"> <li>➤ Belief that all pupils can learn</li> <li>➤ Care and concern for all pupils</li> <li>➤ Respect for diversity</li> <li>➤ Commitment and dedicated to the profession</li> <li>➤ Collaboration, sharing and team spirit</li> <li>➤ Desire for continuous learning, excellence and innovation</li> </ul>	<ul style="list-style-type: none"> <li>➤ Knowledge of Educational Contexts</li> <li>➤ Knowledge of Contents</li> <li>➤ Knowledge of Curriculum</li> <li>➤ Knowledge of Pupils</li> <li>➤ Knowledge of Pedagogy</li> <li>➤ Knowledge of Self</li> </ul>	<ul style="list-style-type: none"> <li>➤ Pedagogical Skills</li> <li>➤ Interpersonal Skills</li> <li>➤ Reflective Skills</li> <li>➤ Personal Skills</li> <li>➤ Administrative and Management Skills</li> </ul>

The MME curriculum is derived from those attributes. To result in the stated competences of beginning teachers the curriculum structure is determined the MOE representative, Foundation Program, and the Head of the MME Academic Groups. Furthermore, the content or syllabus of each course within the curriculum structure is determined by the associated committee (Curriculum Studies Committee, Academic Studies Committee, etc).

1. MOE representative, Foundation Program, and the Head of the MME Academic Groups determine the curriculum structure
2. Curriculum Studies Committee, Academic Studies Committee, etc. within the MME AG determine the syllabus for related courses

##### Lesson learned:

Basically the development of curriculum at both MME and MED involves lecturers within the AG and Dept, especially in the determination of course content/syllabus.

## 5. Curriculum Implementation (Teaching & Learning Processes)

### a. Matriculation and Registration

Matriculation will take place two weeks before Semester I. Registration for courses to be offered in Semesters I and II will normally take place one week before each semester. Student teachers can register for or drop a course offered in the semester within the first week of that semester. A course that is dropped within the first week of a semester will not appear in the student teacher's official transcript. A student teacher who drops a course after the deadline, that is the end of the first week of a semester, will be deemed to have sat and failed in the course. 'F' will appear on the official transcript and will be used in the computation of Cumulative Grade Point Average (CGPA). Please note that when the practicum is held in the Jun/Jul period (e.g. Teaching Assistantship) at the end of an academic year before the start of a new academic year, student teachers must register for the practicum course in Semester 1 of the new academic year (July rather than December's registration exercise). Therefore, registration for that practicum posting is done after it has been completed.

### Enrolment

Although student teachers usually get to read the subject/courses of their own choice, the final choice of subjects/courses sometimes has to be determined by the Dean of Foundation Programs/Heads /Coordinators of subjects concerned. Student teachers are responsible for ensuring that the courses they select do not clash on the class time-table and the examination time-table which are both prepared before the registration exercise.

### b. Examination, Assessment of Coursework & Practicum

Different modes of assessment including Continuous Assessment (CA) have been built into coursework. These include test/practical test, essay assignments, project work, progress ratings and examinations. Examinations will be held at the end of each semester. There are no supplementary examinations. No special examination will be held for student teachers who are not able to take any paper because of illness or other special reason. Such student teachers and those who fail will be allowed to take the examination in that course on the next occasion when it is conducted.

Before sent to the examination administration, the MME examination papers are reviewed by other staffs from the same committee, and then by the Head of MMED Academic Group. In the previous years, there were external examination paper assessors from New Zealand, but now MME only use internal examination paper reviewers.

Student teachers must successfully complete all the prescribed academic unit requirement as set out by the program curriculum and earn a minimum Cumulative Grade Point Average (CGPA) of 2.00 at the end of the final semester of study before qualifying for the award of the degree of BA/BSc (Education). Student teachers are responsible for ensuring that they register for all the courses and examinations necessary to fulfill the requirements of their program of study.

Student teachers are not allowed to re-take an examination in order to improve on the grades of courses they have passed. The grades for a course taken by any student teachers in all attempts are reflected on the official transcript. The degree classification will be based on the

CGPA student teachers obtain throughout their program of study as well as performance in Practicum. Credits earned in other approved institutions will be excluded from CGPA computation.

### Grade Point Average (GPA) System

The Grade Point Average (GPA) system is applicable to all student teachers admitted to Year 1 with effect from the academic year 2005-2006 and direct entry/returning teachers admitted to Year 2 with effect from the academic year 2006-2007.

- 1) Grade and grade points are assigned as follows:

Letter-Grade	Grade Point	Academic Unit (AU)	Letter-Grade	Grade Point	Academic Unit (AU)
A+	5.00	AU is earned	B-	3.00	AU is earned
A	5.00		C+	2.50	
A-	4.50		C	2.00	
B+	4.00		D+	1.50	
B	3.50		D	1.00	
			F	0.00	

- 2) The following non-letter grades and notations are also used, but will not be counted in computation of CGPA.

\* : Courses with Pass/Fail grading only

**IP** : In-Progress

**ABS** : Leave of absence granted

**TC** : Transfer Credit

**DIST/CR/P/F** : Distinction/Credit/Pass/Fail (Grading for Practicum only)

- 3) The Cumulative Grade Point Average (CGPA) represents the grade average of all courses (including failed courses) attempted by a student teacher. The computation of CGPA is as follows:

$$\frac{[GP \times AU \text{ of Course 1}] + [GP \times AU \text{ of Course 2}] + \dots + [GP \times AU \text{ of Course N}]}{\text{Total AU Attempted in All Semester so far}}$$

- 4) The CGPA will be reflected on student teachers' transcripts.
- 5) An 'F' grade obtained in a course, and a new grade attained for the subsequent repeat, will be both reflected in the transcript. Both grades will also be counted in the computation of CGPA. No AU is earned for courses with 'F' grade.
- 6) Student teachers are not allowed to repeat any courses taken except those with 'F' grade.
- 7) The requirements for graduation are as follows:
- Successful completion of the prescribed academic unit requirement as set out by the program curriculum.
  - A minimum CGPA of 2.00 is required at the end of the final semester of study.
- 8) The criteria for satisfactory academic standing in any given semester are:
- Maintaining a minimum CGPA of 2.00
  - Completing at least 75% of the normal AU workload

- 9) Student teachers with poor standing will be subjected to the following performance review:
  - i. Academic Warning – if the CGPA falls below 2.00 for any given semester.
  - ii. Academic Probation – if the CGPA falls below 2.00 for the following semester.
  - iii. Academic Termination – if the CGPA falls below 2.00 for the 3rd consecutive semester, or at the end of the final semester of study. A letter of termination will be issued.
- 10) Appeal against termination on the grounds of extenuating circumstances may be made, subject to the following rules: - the appeal must be submitted to NIE by the end of the 1st week of the semester following the termination - normally only one appeal is allowed per candidature.
- 11) A minimum CGPA of 2.00 must be maintained at the end of each semester to qualify for the overloading of courses.
- 12) Credits for courses taken from approved student exchange programs will be excluded from the CGPA computation. But they will be counted toward the academic unit requirement for graduation, and reflected on the transcript.
- 13) The cut-off for BA(Ed)/BSc(Ed) classification is as follows:

<b>Class of Award</b>	<b>CGPA Range</b>	<b>Minimum Final Practicum Grade *)</b>
First Class Honors	4.50 – 5.00	Credit
Second Class Upper Honors	4.00 – 4.49	Pass
Second Class Lower Honors	3.50 – 3.99	Pass
Third Class Honors	3.00 – 3.49	Pass
Pass	2.00 – 2.99	Pass

\*) The final Practicum Grade is based on the grade obtained at the first attempt for Teaching Practice 2. A student teacher who fails at the first attempt for Teaching Practice 2 but subsequently passes it is only eligible for the Pass Award for the Degree regardless of the grade obtained for repeat Teaching Practice 2 and the CGPA obtained.

### **Certificate in English Language Studies (CELS)**

BA/BSc (Ed) student teachers doing English Language as a Curriculum Studies (CS) but not studying English as an Academic Studies (AS) subject are required by the Ministry of Education to do language enhancement courses leading to the Certificate in English Language Studies (CELS). Spread over the second and third years of the degree program, CELS courses are designed to benefit student teachers in two ways: to equip them with the content knowledge for teaching English confidently, and to enhance their language and communication skills so that they can serve as good models of spoken and written English.

### **Talks, Seminars, Workshops and Other Activities**

During the period of training, student teachers are expected to study diligently and participate actively in talks, seminars, workshops and other activities organized for them, such as the National Education program and the Induction Seminar. These activities form an integral part of the degree program.

## Plagiarism and Copyright

The Institute advises all student teachers to respect all copyrighted works and encourages the purchase of original textbooks and/or other copyrighted materials that are required for your programs. Student teachers should not plagiarize or pass off as one's own, the writing or ideas of another, without acknowledging or crediting the source from which the ideas are taken. The Institute takes a serious view of any form of plagiarism and infringement of copyright by student teachers. A contravention of the provisions of the Copyright Act is deemed to be a breach of the Institute's rules and regulations, which could result in disciplinary action. Cheating, plagiarism and other forms of academic dishonesty are considered serious offences for which disciplinary penalties will be imposed.

### c. International Student Exchange Program

The International Student Exchange Program allows student teachers to spend one or two semesters in an overseas university to read courses which may be counted towards their program requirements in the Nanyang Technological University. However, the total number of credits transferred from other universities must not exceed 35% of the total number of academic units required for the degree. Marks obtained for the credits earned in other institutions do not count towards the total for the award of Honors or Pass with Merit.

The program is open to all undergraduates. Those interested should speak to the Sub-Dean for Degree Programs.

For foreign universities which have signed memoranda of understanding (MOU) with NTU, student teachers will enjoy a tuition fee waiver while studying there. This means that each student teacher will only have to pay for travel, accommodation and living expenses. There are a number of travel grants available to student teachers who need financial help and who have good academic and extra-curricular activity records.

Teaching & learning activities include: lectures, tutorial, and self learning (assignment).

Assessment for CS subjects is by assignment, while assessment for AS subjects is by assignment & examination. Exam papers are reviewed by "checker" reviewer and the head of MME before sent to the Examination Administration. Lecture is a big class conducted at a lecturer theatre (1-hour lecture is very common). Parallel classes used only for tutorials. Among tutors there is a coordinator. The lecture schedule is handled by the FP Administration.

## 6. Supporting Staff and Academic Atmosphere

The MME Academic Group has staff composition as follows:

### ➤ **Academic Staffs:**

There 38 MME academic staffs. Among them, 13 are Associate Professors, 13 are Assistant Professors, 8 are Lecturers, 4 are staff on secondment (former school teacher lecturers from MOE). In addition, there some part time lecturers from other Academic Groups or institutions. Among the 38 MME academic staffs, 29 are PhD holders, and the rests are masters (3 are pursuing PhD in mathematics education. All academic staffs have qualification (PhD or master) in maths or maths education.

➤ The MME Academic Group is coordinated by the Head of MME assists by the Deputy Head of MME

➤ **Administrative Staffs:** 3 persons (Officer, Group Secretary, Resource Staff)

➤ **Technicians:** 3 persons

All staffs have good qualifications and good dedication to professional works. The administrative staffs provide good services for academic staffs and students.

There are strong collaboration among MME's academic staffs in the forms of teaching, researches, and writing books. Informal discussions among staffs are very commons, in person to person discussion as well as in group discussion through Wednesday sharing ideas meeting at the Journal Rooms. Staffs can communicate each other by face to face communication (they can easily meet each other), using phone from their private rooms, using e-mail, or during the Wednesday meeting.

Cooperation among academic staffs who have the same expertise or teaching and research interests has also been doing within the MME Academic Group.

## 7. Facilities

All facilities used for academic works by MME staffs and for teaching and learning processes are belong to NIE. All facilities are on high standard quality and well maintained. Based on observations that have been done during this visit, the facilities can be categorized into two four parts:

**a.** Facilities for administrative works:

- 1) There are administrative staff rooms with office facilities such as furniture, fax/telephone machine, computer and printers (color deskjet, laserjet), scanner, photocopy machines, etc.
- 2) Spacious private secretary room (the same as lecturer room) facilitated with furniture like working table, adjustable chairs, cabinets, cupboard/book shelf, and telephone, computer with Internet connection, etc.

**b.** Facilities for lecturers academic works:

- 1) Spacious private staff room facilitated with furniture like working table, adjustable chair, cabinets, cupboard/book shelf, and telephone, computer with Internet connection, etc.
- 2) Journal (Seminar) Room facilitated with tables and adjustable chairs, computer and LCD projectors and display for presentation with Internet connection ready, small library, pantry for making tea/coffee, etc.

**c.** Facilities for teaching and learning:

The facilities for teaching and learning consist of classrooms, lecture theatres, laboratories, and library.

- 1) **Classrooms.** There are a lot of classrooms within the NIE, each is facilitated with student chairs, lecturer table and chair, sliding white/black board, screen and projector. There are two types of classrooms, lecture classrooms (larger capacity) and tutorial rooms (smaller capacity). The classrooms are used not only by MME AG, but also by other academic groups within the NIE.
- 2) **Lecture theatres.** There are more than ten lecture theatres within the NIE. A lecture theatre (LT) can accommodate 75 – 200 students and facilitated with students chairs arranged in circular form and composed such that back position chairs are higher than the front position ones, so the lecturer can observe all students. Each LT is also facilitated with traditional sliding black/whiteboard and modern presentation

equipments like multimedia computer, audio, two projectors with switch for selecting the presentation sources, etc. The walls of an LT are also soundproof.

- 3) **Laboratories.** The MME has two types of laboratories, computer labs and mathematics (education) labs. MME has five computer laboratories equipped with the usual projection system for teaching and personal computers for students. All five Computer Labs are located at the basement level of the Science block. All computers are connected to Internet and run under MS Windows XP/Vista operating system, installed with standard MS Office, mathematics software, and teaching management software.

The seating capacities of the five computer labs are as follows:

Archimedes Lab	30
Bernoulli Lab	30
Cauchy Lab	50
Descartes Lab	25
Fourier Lab	30

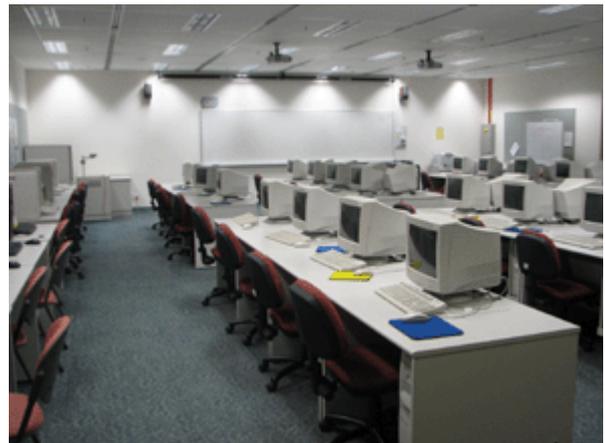
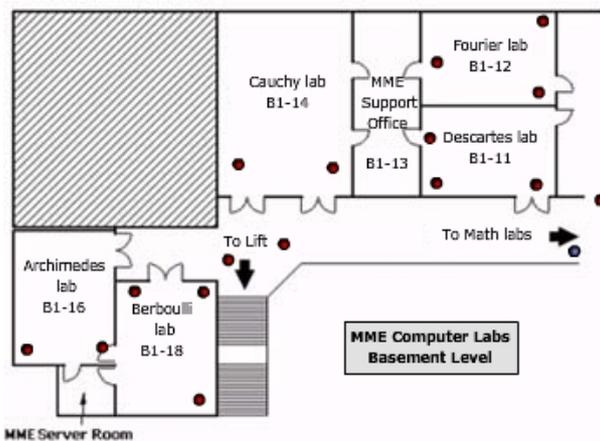




Figure A.1 The map and pictures of MME Computer Labs

### MME'S Math Labs

MME has five Math laboratories equipped with the usual projection system, personal computers for teaching, mathematics manipulative, hexagonal form tables, and students chairs. All five Math Labs are located at the basement level of the Science block.

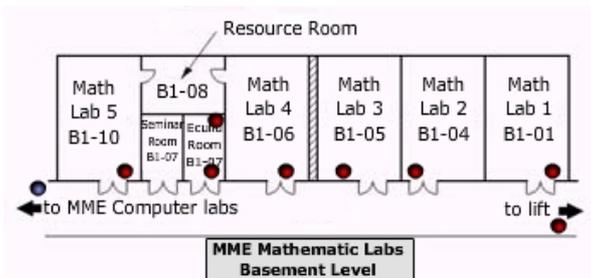




Figure A.2 The map and pictures of MME Math Labs

- 4) **Library.** Founded in 1950 as a Teachers' Training College library, the NIE [Library and Information Services Centre](#) is the largest education library in Singapore. It is located at Nanyang Technological University. The Library provides resources to support the teaching, learning and research programs of the Institute. It also reaches out to meet the needs of the education professionals in the Ministry of Education, schools and other related organizations.

**d. Facilities for Comfort:**

- 1) Rest rooms separated between ladies and gent rooms
- 2) Pantry facilitated with kitchen set for making tea/coffee and meals

All MME staffs (academic and administrative staffs) rooms are located on the same floor at the same building, so among the staffs can meet and communicate each other easily.

Along the walls in front of office rooms and lecturer rooms, there are some displays on publication by lecturers (Books, research topics, etc), and mathematics as well as mathematics education posters.

All facilities are highly standard and well maintained.

## B. Recommendations

Based on the benchmarking results from the MME Academic Group of NIE, NTU Singapore above, the following is provided some suggestions to the MED in order to establish international Mathematics Education Study Program. These suggestions may also apply to the fa-

culty level (Faculty of Mathematics and Sciences), as well as the university level (Yogyakarta State University).

7. Structure of Mathematics Education curriculum should be adjusted in such a way that:
  - a. the contents of general subjects & education studies should not just theoretical but they should be linked with the application in the classrooms (e.g. application of educational psychology in the teaching and learning, English/bahasa Indonesia for classroom communication and academic discourse, etc.)
  - b. the professional development of teacher candidatures students should gain serious attention with by stressing much more on teaching practices and school experiences, not just one teaching practice.
  - c. If possible, not all subjects are counted or given credit (SKS) for calculating the cumulative grade point average (CGPA). The CGPA calculation may only by taking account the mathematics, mathematics education, and general educational subjects. Other compulsory subjects such university level subjects (except English) may be credited by a certification system and as graduation requirement. In this way, it easy to compare the CGPA obtained from the MED to international CGPA system.
8. To support the implementation of developed (international standardized) curriculum, MED (with support from the faculty and university) should provide high standard facilities for teaching and learning. This standard should include:
  - a. standard classroom equipped with high standard facilities for teaching
  - b. standard laboratory equipped with high standard facilities for teaching and learning
  - c. standard library collections and facilities for supporting researches, teaching, and learning.
  - d. standard for academic rules and procedures with consistent enforcement, such as:
    - i. standard teaching administrations (e.g. student absence list must be ready before lecture time starts)
    - ii. standard evaluation administrations and procedures
    - iii. standard academic students evaluation (e.g. two-semester CGPA students evaluation and its consequences).
9. The MED should develop standard course evaluation by reviewing examination papers. This review can be done by external (from external university) or internal (other staffs and Head of Department) examination paper reviewers. This can ensure the standard of course contents and student evaluation to make easy for international accreditation.
10. The MED should improve the quality of staffs by supporting them to undertake masters or PhD degree in mathematics or mathematics education in English speaking countries. The MED should has definite target about the staffs whose specializations (based on their master or PhD degrees) in mathematics or mathematics education, not enough just have master or doctoral degrees but not related with mathematics or mathematics education.
11. To support the academic staffs and students to conduct research, education, and educational services, the MED, faculty, or university should provide conducive working environment, such as:
  - a. provide each staff with a private room equipped with standard facilities for doing academic works and giving students consultations.
  - b. provide a seminar room and weekly schedule for staffs to discuss each other on academic matters.
  - c. provide facilities for comfort such as pantry or tea rooms

- d. provide an easy way to staffs to communicate or to meet each other, e.g. by placing the staff rooms at the same level of the same building, not separated at different levels and different rooms or buildings
  - e. provide a way to enable all staffs are easily contacted from their rooms, e.g. by giving a local phone at each staff room, and each staff should be ready to open their e-mail from his/her private room.
12. The MED should immediately establish an MoU with the MME Academic Group of NIE, NTU Singapore for further collaboration for improvement of staffs quality, research, and teaching. The possibility for doing such collaboration has been talked during the visit to NIE, so the MED must do the follow up.

## Appendix 1: Education Studies Subjects and Syllabi

This area of study will acquaint student teachers with the key concepts and principles in education that are necessary for effective instruction and reflective practice in primary and secondary schools. Five core courses for Education Studies are compulsory and deal with basic educational concepts such as pupil development, the learning and thinking process, the social context within which schooling operates, the application of psychology in teaching and learning, and the use of instructional technologies.

Table 12 Education Studies Subjects

Year	Course Code	Title	Course Category	No. of AUs	Prerequisites
1	AED102	Educational Psychology I: Theories and Applications for Learning and Teaching	Core	3	-
	AED104	ICT for Engaged Learning	Core	2	-
	AED105	Critical Perspectives on Education	Core	2	-
2	AED201	The Social Context of Teaching and Learning	Core	2	-
3	AED302	Education Psychology II: Teaching and Managing Diverse Learners in the Classroom	Core	3	-
*)	AED231	Diversity, Inclusivity and Reflective Practice	Prescribed	3	-
	AED232	Introduction to Counselling Psychology	Prescribed	2	-
	AED233	Critical Reasoning Skills for Effective Teaching	Prescribed	2	-
	AED234	ICT-based Cognitive Tools for Engaged Learning	Prescribed	2	-

\*) These courses are only meant for Dip Ed crossovers and returning teachers entering the BA/BSc (Ed) programs who need to top up on AU requirements in order to meet the minimum number of AUs required for graduation.

### AED102: Educational Psychology I: Theories and Applications for Learning and Teaching

This course provides the foundation for understanding the learner, their development and the psychology of learning. Key areas include: Understanding different aspects of pupil development and how these influence the teaching and learning processes. Psychosocial development, stages of moral development and the self-concept, and theories of intellectual development. Application of psychological principles and learning theories to classroom learning; understanding how pupils learn and how some pupils fail to learn; proactive approaches to motivate and enhance learning, develop creative and critical thinking and problem-solving skills.

### AED104: ICT for Engaged Learning

Information and Communications Technologies (ICT) are an important part of classroom environments in Singapore today. In line with MOE's Second Masterplan for IT in Education, this course adopts four major thrusts:

- a) working in teams to modify or create authentic interactive ICT-based learning resources for engaging learners

- b) creating and facilitating online collaborative learning environments
- c) managing ICT learning environments
- d) professional development by independent self-learning of innovative technologies

### **AED105: Critical Perspectives on Education**

This course takes a multi-disciplinary approach to expose student teachers to the broad concerns and challenges to contemporary educational thought and practices. It introduces key aspects of education to students and provides a platform to stimulate critical individual reflection and class discussion. Topics may include the philosophical foundations of education; concepts in education such as teaching, learning, moral education, citizenship education, and multicultural education; and current educational issues and challenges in Singapore, Asia and the rest of the world. In the course of exploring topics such as these, students will be encouraged to reflect on what it takes in terms of skills, knowledge, attitudes, and motivation to become a teacher.

### **AED201: The Social Context of Teaching and Learning**

This course provides student teachers with an introduction to the Singapore education system that they will be working in. They will need to know the functions of the school system in socializing citizens for economic, political and social roles in the context of a multi-ethnic and multicultural society. They will have the opportunity to understand the rationale of major education policies and new government initiatives that impact the work of school leaders, teachers, students and other stakeholders in order to achieve the Desired Outcomes of Education laid out by the Ministry of Education. At the same time, they will be made aware of the diverse and multiple roles that are played by teachers in the education system.

### **AED302: Educational Psychology II: Teaching and Managing Diverse Learners in the Classroom**

Pupils with diverse abilities and needs are increasingly found in mainstream schools in Singapore. Greater diversity among pupils requires pedagogical approaches that are inclusive of the learning needs of all and yet responsive to individual abilities. This course seeks to help student teachers to understand the characteristics and needs of diverse learners and how to provide optimal learning for all pupils. This course also seeks to help student teachers acquire and apply basic knowledge and skills in relation to creating conducive learning environment, managing and facilitating teaching and learning activities, and school/classroom discipline. The importance of the practice of proactive classroom management and positive teacher-student relationship will also be emphasized.

### **AED231: Diversity, Inclusivity and Reflective Practice**

This course situates teachers within the realities of their classrooms and the lives of their pupils in contemporary Singaporean society where diversity is increasingly recognized as the norm. The emphasis in the course is on student teachers learning the knowledge and skills to build classroom communities that are inclusive of and responsive to pupils of diverse needs and abilities. Student teachers will have the opportunity to become reflective practitioners in understanding and engaging with their own experiences in working with their pupils for the purpose of regenerating themselves and their classroom communities.

### **AED232: Introduction to Counseling Psychology**

This course is intended to provide a general introduction to the field of counseling psychology. An overview of the philosophy, history, as well as basic theories and principles of counseling process and counseling skills will be presented. The role and function of the counselors in the educational settings will be discussed. The characteristics of good counselors, conditions for an effective counseling relationship and techniques of interviewing used especially to problems of educational, vocational, and personal counseling will be integrated into the course content. Emphasis will also be placed on multicultural counseling, career counseling, and research in counseling. The course is also designed to explore contemporary, legal, ethical and professional issues that influence the counseling profession, including confidentiality, assessment and working with students from diverse background.

### **AED233: Critical Reasoning Skills for Effective Teaching**

The course will equip participants with a broad range of critical reasoning skills to develop the thinking and analytical abilities of their pupils in schools. Critical reasoning is based in part on mastery of basic rules of elementary logic, as well as practical reasoning skills. These skills are used for the analysis and evaluation of situations and arguments, as well as the formulation and articulation of good arguments and judgments. By learning how to formulate and articulate good arguments, participants will acquire an appreciation of how these critical thinking skills can be used to facilitate multi- and inter-disciplinary learning in their teaching. Working in groups, they will design innovative lesson plans that would help to stimulate interest in critical thinking and problem solving among their pupils.

### **AED234: ICT- based Cognitive Tools for Engaged Learning**

The participants will be introduced to the concepts and theories of cognitive tools with their applications in international as well as local primary and secondary schools. When ICT tools are used as cognitive tools, they help to foster students' higher order thinking through collaborative construction of mental representations such as concept maps, models, websites or databases. The participants are expected to work in pairs or groups on a project employing one or two ICT-based cognitive tools. The participants are expected to contribute actively to the class and group project. The course assessment includes oral presentation and write-up of the group project as well as class participation.

## Appendix 2: Mathematics Curriculum Studies Subjects and Syllabi

### 1. The Teaching of Mathematics (Primary)

Table 13 Mathematics Curriculum Studies Subjects (Primary)

Course Code	Title Course	Cate-gory	No. of AU <sub>s</sub>	Prere-quisites
ACM201	Teaching and Learning Primary Mathematics I	Core	3	-
ACM301	Teaching and Learning Primary Mathematics II	Core	3	-
ACM401	Teaching and Learning Primary Mathematics III	Core	2	-
ACM402	Teaching and Learning Primary Mathematics IV *)	Core	2	-

\*) For student teachers opting Primary (Option A)

#### ACM201: Teaching and Learning of Primary Mathematics I

Overview of the Singapore Primary Mathematics Curriculum; NE infusion; Preparation of Scheme of Work and Lesson Plans; Pedagogical Strategies and Psychological Theories; Teaching of Whole Numbers, Fractions, Decimals, Percentages, Ratio and Direct Proportion, Rate and Speed. [ICT and common pupils' errors will be dealt with in the teaching of various topics.]

#### ACM301: Teaching and Learning of Primary Mathematics II

- Teaching Problem Solving and Investigations
- Mathematical Communication
- Teaching of Geometry, Money and Measures, Mensuration, Graphical Representation and Statistics, Algebra

[ICT and common pupils' errors will be dealt with in the teaching of various topics.]

#### ACM401: Teaching and Learning of Primary Mathematics III

This course covers two broad areas: (a) Various traditional assessment modes in Mathematics and the use of these modes in schools to assess pupil performance, in particular, the planning and construction of test items and (b) Practice of teaching skills, including catering for pupils of mixed abilities.

#### ACM402: Teaching and Learning of Primary Mathematics IV

This course provides further pedagogical skills for those who will go deeper into teaching mathematics, especially at upper primary levels. Topics include: Games in Mathematics; Advanced use of ICT in mathematics teaching; Challenging Problems in Upper Primary Mathematics. Student teachers will also undertake Independent Study Topics which will enhance their teaching repertoire.

## 2. The Teaching of Mathematics (Secondary)

Table 14 Mathematics Curriculum Studies Subjects (Secondary)

Course Code	Title Course	Category	No. of AUs	Prerequisites
ACM321	Teaching and Learning Mathematics I	Core	3	-
ACM322	Teaching and Learning Mathematics II	Core	3	-
ACM421	Teaching and Learning Mathematics III	Core	3	-
ACM422	Teaching and Learning Mathematics IV	Core	3	-

### ACM321: Teaching and Learning Mathematics I

The main objective of this course is to equip student teachers with a working knowledge of basic teaching principles and a comprehensive knowledge of the curriculum. The content of this course includes: aims objectives of mathematics education; mathematics curriculum in Singapore; problem solving; presentation of mathematical ideas in a whole class instructional setting; teaching of mathematics topics – Arithmetic and Algebra.

### ACM322: Teaching and Learning Mathematics II

This course is designed to equip student teachers with an understanding of the theories of learning that inform instruction and practical classroom skills and preparation based on such theories. The content of this course includes: learning theories in mathematics; task analysis; lesson planning; role of ICT in mathematics education; teaching of mathematics topics – Functions and Graphs, Statistics, Probability, Sets and Matrices.

### ACM421: Teaching and Learning Mathematics III

This course seeks to help student teachers understand the major issues in teaching secondary mathematics and to further extend their knowledge of pedagogy to include more innovative teaching strategies. The content of this course includes: current issues in mathematics education; design of investigative and enrichment activities; hands-on learning using dynamic geometry software; teaching of mathematics topics – Mensuration, Geometry, Trigonometry and Vectors.

### ACM422: Teaching and Learning Mathematics IV

This course seeks to help student teachers understand the fundamentals of assessment in teaching secondary mathematics and to develop their pedagogical content knowledge for the teaching of Higher Algebra and Calculus.

## Appendix 3: Mathematics Subject Knowledge Courses and Syllabi

This group of courses helps to reinforce subject content mastery for primary school teaching. Student teachers in the primary track must offer SK courses aligned with their choice of Curriculum Studies (CS) subjects. For each CS subject, there will be two Subject Knowledge (SK) courses for those in the primary track in Option B while those who select Option A will have three SK courses for further deepening their subject knowledge. In the case where the student teacher's AS is related to the CS subject, he/she will only be required to do only 2 SK courses if Option A is selected and either 1 or 2 SK courses if Option B is selected as determined by the Academic Group.

For Physical Education and Sports Science specialization in the primary track, student teachers will offer SK courses aligned with the CS2 and CS3 subjects and will read 3 SK courses per subject. Those in the Secondary track will not be reading SK courses as it is assumed that they would have obtained this knowledge from the 2 AS subjects offered.

**Table 15 Mathematics SK Subjects for student teachers offering AS**

Course Code	Title	Course Category	No of AUs	Pre-requisites
ASM202	Fundamental Principles of Primary Mathematics I	Core	2	-
ASM302	Fundamental Principles of Primary Mathematics II	Core	2	-

**Table 16 Mathematics SK Subjects for student teachers offering Other AS**

Course Code	Title	Course Category	No of AUs	Pre-requisites
ASM201	Number Topics	Core	2	-
ASM301	Geometry Topics	Core	2	-
ASM401	Further Mathematics Topics *)	Core	2	-

\*) Only for student teachers in the Primary (Option A) strand

### ASM201: Number Topics

This course provides the foundational understanding of arithmetic topics which form a major portion of the primary mathematics curriculum. Problem solving processes will be introduced and re-visited in the different topics. Course topics are: Problem solving; Foundations of the Hindu-Arabic System; Algorithms on number operations in a place value system; Classification of number systems; Divisibility; Ratio, proportion and rates.

### ASM202: Fundamental Principles of Primary Mathematics I

This course surveys topics covered in primary school curriculum and provides linkages between the Academic Subject Mathematics courses. Topics include: Problem solving and problem posing; Binary operations and four operations of numbers, classification of number systems; Sequence and Series and decimal representation of numbers, rational and irrational numbers; Computation in different bases; Historical Numeration system; Number Theory

and divisibility; Proportional reasoning; Algebraic reasoning; Inequalities and approximations; Counting methods and systematic listing.

### **ASM301: Geometry Topics**

This course aims to equip the primary mathematics teacher with a deeper understanding of geometry and measurement topics in the primary mathematics curriculum. Processes such as mathematical deduction and induction will be emphasized. Topics are: Mathematical deduction and induction; Basic elements of geometry as study of space in 2 and 3 dimensions; Properties associated with parallel lines; Properties of geometrical figures; Similarity and Congruency; Measurement; Constructions and proofs; Motion Geometry and tessellations.

### **ASM302: Fundamental Principles of Primary Mathematics II**

This course builds up the student teacher's knowledge of geometry and data topics from the perspective of concepts which are taught in the primary mathematics syllabus. The course will draw upon concepts and processes learned in Academic Subject Mathematics courses. Topics are: Introduction to Geometry and geometrical entities; Measurement in Geometry; Geometrical constructions with concrete and virtual tools; Problem solving in geometry; Statistics.

### **ASM401: Further Mathematics Topics**

This course provides the mathematics teacher with deeper understanding and appreciation of the topics in the upper primary mathematics curriculum. Topics are: Mathematical thinking; Use of dynamic geometry software and other software for mathematical investigations; Geometrical figures in 3-dimensions; Algebra; Statistical investigations: Stages, Representations of data; Measures of central tendency and spread; misuse of statistics.

## Appendix 4: Mathematics Academic Subjects Courses and Syllabi

Table 17 AS1 Math Structure for B Sc (Ed) (Primary & Secondary)

Year	Course Code	Title	Course Category	No. of AUs	Pre-requisites	
1	AAM101	Calculus I	Core	3	-	
	AAM102	Algebra I	Core	3	-	
	AAM103	Finite Mathematics	Core	3	-	
	AAM104	Number Theory	Core	3	-	
2	AAM201	Calculus II	Core	3	-	
	AAM202	Algebra II	Core	3	Must have done AAM102	
	AAM203	Statistics I	Core	3	-	
	AAM204	Computational Mathematics	Core	3	-	
3	<b>Select any 4 courses, at least one from Group A and one from Group B</b>					
	Group A	AAM331	Differential Equations	Pres	3	-
		AAM332	Statistics II	Pres	3	-
	Group B	AAM341	Real Analysis	Pres	3	-
		AAM342	Modern Algebra	Pres	3	-
	Group A	AAM333	Modeling with Differential Equations	Pres	3	AAM331
		AAM334	Statistics III	Pres	3	AAM332
	Group B	AAM343	Combinatorial Analysis	Pres	3	-
		AAM344	Complex Analysis	Pres	3	-
	4	<b>Select any 1</b>				
AAM431		Advanced Mathematical Modeling	Pres	3	AAM331	
AAM432		Statistical Theory	Pres	3	AAM332	
AAM433		Applied Statistics	Pres	3	AAM332	
AAM434		Techniques in Operations Research	Pres	3	-	
AAM435		Mathematical Programming and Stochastic Processes	Pres	3	-	
AAM436		Metric Spaces	Pres	3	AAM341	
AAM437		Galois Theory	Pres	3	AAM342	
AAM438		Graph Theory	Pres	3	-	
AAM439		Geometry	Pres	3	-	
<b>Total AUs for Degree</b>				<b>39</b>		

Table 18 AS2 Math Structure for BA/BSc(Ed) (Secondary)

Year	Course Code	Title	Course Category	No. of AUs	Prerequisites
1	AAM101	Calculus I	Core	3	-
	AAM102	Algebra I	Core	3	-
	AAM103	Finite Mathematics	Core	3	-

	AAM104	Number Theory	Core	3	-
2	AAM201	Calculus II	Core	3	-
	AAM202	Algebra II	Core	3	AAM102
	AAM203	Statistics I	Core	3	-
	AAM204	Computational Mathematics	Core	3	-
<b>Total AUs for Degree</b>				<b>24</b>	

### AAM101: Calculus I

Functions: domain, codomain, range, composition of functions, graphs; Limits and continuity; Differentiation and applications of differentiation; Integration and applications of integration.

### AAM102: Algebra I

Introduction to set theory; Linear systems and methods of solving linear systems; Matrix algebra, determinant function; Vectors in  $\mathbb{R}^2$  and  $\mathbb{R}^3$ , dot product, cross product and geometric applications; Euclidean n-space, linear transformations.

### AAM103: Finite Mathematics

Basic principles of counting; Permutations and combinations; Generalized permutations and combinations; Binomial theorem and combinatorial identities; The Pigeonhole principle; Sample space and probability distributions; Conditional probability; Independent events.

### AAM104: Number Theory

Divisibility; Greatest common divisor; The Euclidean algorithm; Prime numbers; The Fundamental Theorem of Arithmetic; Linear Diophantine equations; Congruencies; The Chinese Remainder Theorem; The Euler's Phi function; The sum and number of divisors; Euler's Theorem; Quadratic residues; The Law of Quadratic Reciprocity; Primitive roots and indices; Real-life applications such as check digits, cryptography.

### AAM201: Calculus II

Sequence and series; Power series; Partial derivatives for functions of two or more variables, differentiability and chain rules for functions of two variables, directional derivatives and gradients for functions of two variables, tangent planes and normal lines, maxima and minima of functions of two variables, generalization of the concepts to functions of more than two variables; Double integrals and triple integrals.

### AAM202: Algebra II

Introduction to propositional logic; Methods of proof; General vector spaces, bases and dimensions; Linear transformations between general vector spaces, matrices of linear transformations; Eigenvalues and eigenvectors, diagonalization; Orthogonality in n-space, diagonalization of quadratic forms, conic sections; Applications.

### AAM203: Statistics I

Descriptive statistics; Random variables; Probability distributions and probability density functions; Cumulative distribution functions; Mathematical expectations; Sampling

distributions and central limit theorem; Estimation and confidence intervals: one and two samples.

### **AAM204: Computational Mathematics**

Introduction to computational methods and computing tools; Use of computing techniques to solve problems in mathematics, science and other disciplines; Examples may be drawn from problems involving numerical solutions of equations in one variable, approximation of functions, solving systems of linear equations, and numerical simulations.

### **AAM331: Differential Equations**

Separable, linear and exact first order ordinary differential equations (ODEs); Existence and uniqueness of solutions; Modeling with first order ODEs; Second order ODEs: fundamental solutions, Wronskian, linear dependence; Applications and approaches in modeling, solving and interpreting physical problems with second order ODEs; Laplace transform method for initial value problems.

### **AAM332: Statistics II**

Hypothesis testing: large and small samples; Tests concerning variances; Bivariate distributions: marginal and conditional distributions, covariance, independence; Simple linear regression.

### **AAM341: Real Analysis**

The Completeness Axiom; The Archimedean Property; Density of rational and irrationals; The limit of a sequence, limit theorems; The limit of a function, the continuity of a function; The Intermediate Value Theorem; The Bolzano-Weierstrass Theorem; Extreme Value Theorem; Differentiation; Mean Value Theorem; Riemann Integration; The Fundamental Theorem of Calculus.

### **AAM342: Modern Algebra**

Permutations and permutation groups; Groups, Lagrange's Theorem; Symmetry groups of plane figures; Quotient groups, Cauchy's theorem; Group homomorphisms and the Fundamental homomorphism theorems; Rings and fields, ring homomorphism; Ideals, quotient rings; Rings of polynomials.

### **AAM333: Modeling with Differential Equations**

The solution of ordinary differential equations (ODEs), including system of ODEs; Phase-plane, trajectories and fixed points; Stability and classification of fixed points; Sketching solutions in the phase-plane; Examples will include mass/spring systems, pendulum motions and predator/prey models; Numerical solution of ordinary differential equations: initial value problems, Euler's method; Runge-Kutta method; Applications of numerical techniques.

### **AAM334: Statistics III**

Analysis of variance: completely randomized design, randomized block design, factorial designs; Chi-square tests and contingency tables; Non-parametric tests.

### **AAM343: Combinatorial Analysis**

Combinatorial techniques in proving; The principle of Inclusion and Exclusion and the general principle of Inclusion and Exclusion; The generating function of a sequence of numbers.

### **AAM344: Complex Analysis**

Complex numbers, complex functions; Complex differentiation, analytic functions, the Cauchy-Riemann equations; Complex integration over paths, Cauchy integral theorem, Cauchy integral formula; Fundamental theorem of algebra; Taylor series; Residues and poles; Laurent series, the residue theorem, evaluation of real definite integrals.

### **AAM431: Advanced Mathematical Modeling**

Introduction to partial differential equations (PDEs) and classification into elliptic, parabolic and hyperbolic PDEs; Analytical and numerical solutions of PDEs; Explicit and implicit finite difference techniques for time-dependent PDEs, such as the unsteady diffusion equation; Direct and iterative methods for solving systems of algebraic equations; Application of numerical techniques for solving PDEs to industrial problems.

### **AAM432: Statistical Theory**

Distribution theory, moment generating functions, central limit theorem; Sampling distributions: t-, F-, and chi-square distributions; Estimation theory and hypothesis testing theory.

### **AAM433: Applied Statistics**

Selected topics from multiple regression models, design of experiments.

### **AAM434: Techniques in Operations Research**

Topics from the theory of networks: minimal spanning trees, shortest paths, maximal flows, critical path analysis; Topics from the advanced theory of networks: least cost flows, transportation problem, travelling salesman problem, dynamic programming.

### **AAM435: Mathematical Programming and Stochastic Processes**

Selected topics from the theory of linear programming: the simplex algorithm, introduction to duality, sensitivity analysis, dual simplex algorithm, integer programming, non-linear programming; Selected topics from the theory of stochastic processes: queuing theory, probabilistic inventory models, project scheduling under uncertainty.

### **AAM436: Metric Spaces**

Topology in  $\mathbb{R}$ . Metric spaces; Open sets and closed sets; Convergence and completeness; Continuity and compactness; Equicontinuity, Arzela-Ascoli Theorem; Topological spaces.

### **AAM437: Galois Theory**

Field extensions, simple, finite and algebraic extensions, constructions with straight-edge and compass, splitting fields, normal and separable extensions, primitive elements, finite fields, Galois groups, Galois extensions, The Fundamental Theorem of Galois Theory, solvability by radicals.

### **AAM438: Graph Theory**

Graphs; Euler tours, Hamiltonian cycles, representations of graphs, isomorphisms of graphs, planar graphs; Trees and applications; Selected topics from: Connectivity and matching: Hall's theorem, transversals, Konig's theorem, vertex and edge cuts, Menger's theorem; Coloring: vertex coloring, Brook's theorem, chromatic polynomials, map coloring and the four color problem, edge coloring, Vizing's theorem; Planarity: planar graphs, Kuratowski's theorem, Euler's formula, dual graphs; Ramsey theory, extremal graphs.

### **AAM439: Geometry**

The axiomatic approaches to various geometries, including finite geometries, Euclidean geometry, hyperbolic geometry and spherical geometry; Geometric transformations of the Euclidean plane, symmetries and isometries; Brief excursions to the classical projective geometry and the modern geometry of fractal.

## Appendix 4: General Elective Subjects Courses and Syllabi - Education Studies & Mathematics

In addition to the core courses and the required number of prescribed electives, student teachers in the Secondary track must offer 3 AUs of general electives which can be chosen from subjects offered by the University, whether within or outside the Institute. The following table provides "General Elective" courses for Education Studies and Mathematics subjects. Other General Elective subjects include: Art, Chinese Language & Literature, Drama & Performance, English Language & Literature, Foundation Programs, History, Geography, Malay Language & Literature, Music, Natural Sciences, Physical Education & Sports Science, and Tamil Culture.

Category/ Subject	Course Code	Title	No. of AUs	Pre-requisites
<b>Education Studies</b>	AED280	Problem-solving Strategies of Primary School Pupils	3	-
	AED281	Basic Counseling Skills for Teachers in Initial Training Program	3	-
	AED282	Fundamentals of Group Guidance	3	-
	AED380	Motivating Pupils to Learn	3	-
	AED381	Facilitating Asynchronous Online Discussion	3	-
	AED382	Designing ICT-Based Constructivist Activities	2	-
	AED383	Facilitating and Managing ICT-Supported Interdisciplinary and Collaborative Projects	2	-
	AED480	Problems and Issues in Singapore Education	3	-
<b>Mathematics</b>	AAM180	History of Mathematics	3	-
	AAM181	Statistics Around Us	3	Non-AS: Math student teachers
	AAM182	Introductory Mathematics	3	-
	AAM183	Understanding Higher Mathematics	3	-

### AED280: Problem-solving Strategies of Primary School Pupils

Strategies of investigation; imitation; imagination; language and manipulation; material-rich environment; problem, knowledge and discovery activities; ways of consolidating and generalizing competencies; further elaboration.

### AED281: Basic Counseling Skills for Teachers in Initial Training Program

This course is a practical "how-to" guide to using basic counseling and helping skills for working with pupils. The main features include an introduction to the concepts of helping; an exploration into the concepts of mental and maladjustment with pupils; identification of

pupils with behavioral and emotional problems; qualities of the effective teacher-helper; and the relationship and role of the teacher as a helper and teacher-counselor. Study topics include: active listening; interpreting body language; basic helping skills; the ethics of helping; and different approaches and techniques in counseling and helping.

### **AED282: Fundamentals of Group Guidance**

This course introduces student teachers to the theory and practice of group guidance. An understanding of the history and development of group guidance, purpose of group guidance, group dynamics in the classroom, group theories, and developmental guidance to facilitate holistic development of pupils will be dealt with. A broad spectrum of techniques and approaches in group guidance will also be presented, covering themes of development and competencies in self-esteem, self-management, social awareness and management, and competencies in problem-solving and decision-making.

### **AED380: Motivating Pupils to Learn**

This course is designed to help student teachers understand the theoretical and practical considerations regarding motivating pupils in the classroom. Opportunities will be provided for participants to examine themes such as the psychological principles affecting pupils' learning, motivation and its relationship to classroom learning and pupil behavior, and theories of motivation. Throughout the course, student teachers will be making connections of theory to practice – examining effective strategies to motivate reluctant and disinterested learners and designing and evaluating motivational strategies in the classroom.

### **AED381: Facilitating Asynchronous Online Discussion**

This course will discuss how the asynchronous online discussion can be used as an effective instructional strategy within primary and secondary school contexts. The topics covered will include the integration of the asynchronous collaborative online discussion environment with the face-to-face approach, the role of the teachers in designing and evaluating the environment, and the use of scaffolds in the online discussion environment to facilitate critical thinking skills.

### **AED382: Designing ICT-Based Constructivist Activities**

This course provides an opportunity for participants to learn constructivist learning theory and examples of how ICT tools may be used to support constructivist learning. We will also discuss how to assess constructivist learning. Opportunities will be provided for participants to design ICT enhanced learning activities using constructivist approach.

### **AED383: Facilitating and Managing ICT-Supported Interdisciplinary and Collaborative Projects**

The participants will be introduced to the key features of an interdisciplinary project, skills of collaborative learning and scaffolding tools to design projects for primary schools. They are expected to work in groups of 4-5 to design the project, hold online meetings, conduct on-going group and individual reflections and maintain the project file in the online environment. At the end of this course, the participants will be equipped with the necessary knowledge and skills to conduct Project Work (PW) via the online and face-to face classroom setting.

### **AED480: Problems and Issues in Singapore Education**

A socio-historical study of problems and issues in Singapore Education; reform and school effectiveness; school drop-outs and the educational disadvantages of working class children; subject-centered and student-centered curriculum; co-operative learning and beginning teachers' concerns.

### **AAM180: History of Mathematics**

Open to both mathematics and non-mathematics majors. Student teachers survey the personal lifestyles and philosophies of several well-known mathematicians, from Archimedes to Einstein. This will highlight the historical development of certain branches of mathematics.

### **AAM181: Statistics Around Us**

Introductory course in statistics for student teachers who need to understand basic statistical concepts in their own field of study; Topics covered include: sampling techniques, generation of random numbers, applications and examples of distributions, e.g. binomial, Poisson, geometric distributions etc; The use of appropriate statistical software; This elective is not for student teachers taking AS Mathematics.

### **AAM182: Introductory Mathematics**

Basically a bridging course for AS mathematics student teachers who require it; Topics to be covered are: number systems, set theory, co-ordinate geometry, functions and relations, trigonometry, matrices and vectors, methods of proofs, complex numbers, binomial theorem, partial fractions, probability and statistics.

### **AAM183: Understanding Higher Mathematics**

Limits and continuity; Differentiation and applications of differentiation; Integration and applications of integration; First and second order ordinary differential equations; Vectors in 2-space and 3-space, norm of a vector, dot product, cross product, lines and planes in 3-space; Euclidean n-space, vector operations; dot product, orthogonality; Cauchy-Schwarz inequality; Linear transformation from  $\mathbb{R}^n$  to  $\mathbb{R}^m$ , standard matrices; Eigenvalues and eigenvectors; Student teachers will also be introduced to a Computer Algebra System (or CAS) and its applications in the topics discussed.

## Appendix 5: Other Courses Description

### 1. Essential Courses

Course Code	Title	Course Category	No. of AUs	Pre-requisites
AMX301	Multicultural Studies: Appreciating and Valuing Differences	Core	3	-

#### AMX301: Multicultural Studies: Appreciating and Valuing Differences

This course introduces student teachers to the implications of living in a diverse society—primarily through the prisms of "race" and ethnicity, but also through addressing issues of class, gender, and other social structures. In an increasingly complex world, understanding the dynamics suggested by multiracialism, multiculturalism and "cultural relativism" is an important step in gaining the necessary perspective of one's relationship to community, society and the larger world.

### 2. Language Enhancement and Academic Discourse Skills

Course Code	Title	Course Category	No. of AUs	Pre-requisites
ALK101	Communication Skills for Teachers	Core	2	-
ALS101	Academic Discourse Skills	Core	3	-

#### ALK101: Communication Skills for Teachers

This is a practical course designed to provide student teachers with the oral and written skills necessary for effective communication as teachers in the classroom and in their professional interaction with colleagues, parents and the general public. Student teachers learn about vocal health care and quality, and the practice of good voice production. They are familiarized with the use of a pronunciation dictionary to help them resolve pronunciation and word stress difficulties. They become aware of the importance of considering the purpose, audience and context when communicating and learn how to communicate effectively to promote student learning. They also engage in practical hands-on activities of making oral and written presentations in a variety of school contexts. Built into the tutorials are opportunities for student teachers to reflect on their practices as well as on-going assignments and oral and written presentations to assess their application of the knowledge and skills that they acquire during the course.

#### ALS101: Academic Discourse Skills

This course will introduce student teachers to academic reading materials and teach them how to produce academic discourse of their own with regard to researching and writing assignments in their chosen areas of academic specialization. The course will introduce student teachers to the conventions of academic writing, including citation and documentation procedures, and provide them with a level of expertise in primary and secondary data-gathering. They will learn how to generate and develop argument, support it with evidence, and present it in a coherent manner. In addition, they will gain some

experience in other activities related to academic writing such as time-management, group collaboration, and liaising with the research supervisor.

### 3. Practicum

The Practicum is a very important component of the degree program. Its principal function is to provide student teachers with the opportunity to develop teaching competencies in a variety of instructional contexts and at different levels, under the guidance and supervision of cooperating teachers and university lecturers. They will learn from experienced cooperating teachers about the schooling process and prepare themselves for their roles and responsibilities in teaching.

During the Practicum, student teachers will be able to use the knowledge and skills acquired in the subjects they read at the university, and have opportunities to integrate theory and practice in schools.

The Practicum is spread throughout the entire program and is developmental in nature. It comprises four school attachment periods, i.e., School Experience (SE), Teaching Assistantship (TA), Teaching Practice 1 (TP1) and Teaching Practice 2 (TP2).

When the practicum is held in the Jun/Jul period (e.g. Teaching Assistantship) at the end of an academic year before the start of a new academic year, student teachers must register for the practicum course in Semester 1 of the new academic year (July rather than December's registration exercise). Therefore, registration for that practicum posting is done after it has been completed.

Student teachers who fail to register for the necessary practicum course will be issued warning letters. A copy of the letter may be forwarded to the Ministry of Education (MOE) for student teachers employed by MOE.

Course Code	Title	Course Category	No. of AUs	Pre-requisites
APR101	School Experience	Core	0	-
APR201	Teaching Assistantship	Core	3	SE
APR301	Teaching Practice I	Core	6	TA
APR401	Teaching Practice II	Core	12	TP1

#### APR101: School Experience

This is 2 weeks long, with 1 week in a primary school and 1 in a secondary school. The purpose for this is to provide student teachers opportunities to observe lessons in the primary and secondary classrooms.

#### APR201: Teaching Assistantship

Next the student teachers will undergo a 5-week TA. Its purpose is to provide them opportunities to observe their Cooperating Teachers (CTs) teach and to reflect on the roles and responsibilities of a teacher.

#### APR301: Teaching Practice I

The 3rd component is TP1. It is 5 weeks long. Its purpose is to help the student teachers begin to learn to teach independently. They will learn to plan their own lessons to teach,

prepare the relevant resources and manage pupils independently, in consultation with their CTs. They will continue to be provided opportunities to observe their CTs teach.

### **APR401: Teaching Practice II**

TP2 is the last component of the Practicum, stretching over a period of 10 weeks. It will expose the student teacher to opportunities of teaching and managing students for the subject that he/she has been trained to teach. By this stage of professional training, the student teacher will be exposed to the multi-faceted role of the teacher, such as planning, instructing, managing and assessing pupils' learning, as well as having some practice in using appropriate enrichment and remedial learning activities for target students in classrooms. The 10-week duration will also provide time for the student teacher to have a more holistic school attachment experience which would include exploring other aspects of a teacher's life besides classroom teaching, for example, observing how CCAs are managed.

## Appendix 6: List MME Academic Staff

No	Name & Designation	Field of Specialization	Academic Position	Room & Phone
1	Ang Keng Cheng , PhD <b>Deputy Head/MME</b>	Mathematics	Associate Professor	7-03-30, (65) 6790 3915
2	Koay Phong Lee, PhD	Maths Edu		7-03-22, (65) 6790 3925
3	Tay Eng Guan, PhD	Mathematics		7-03-47, (65) 6790 3894
4	Zhao Dongsheng, PhD	Mathematics		7-03-48, (65) 6790 3893
5	Berinderjeet Kaur, PhD	Maths Edu		7-03-46, (65) 6790 3895
6	Lee Peng Yee, PhD	Mathematics		7-03-14, (65) 6790 3903
7	Teo Beng Chong, PhD	Mathematics		7-03-09A, (65) 6790 3981
8	Fan Liang Huo, PhD	Maths Edu		7-03-34, (65) 6790 3911
9	Lim-Teo Suat Khoh, PhD <b>Dean, Academic</b>	Maths Edu		3-03-176, (65) 6790 3450
10	Wong Khoon Yoong, PhD <b>Head of MME</b>	Maths Edu		7-03-20, (65) 6790 3927
11	Foong Pui Yee, PhD	Maths Edu		7-03-32, (65) 6790 3913
12	Ng Swee Fong, PhD	Maths Edu		7-03-25, (65) 6790 3922
13	Yap Sook Few, PhD	Maths Edu		7-03-15, (65) 6790 3904
14	Cheang Wai Kwong, PhD	Mathematics	Assistant Professor	7-03-27, (65) 6790 3920
15	Lee Tuo Yeong, PhD	Mathematics		7-03-41, (65) 6790 3900
16	Tang Wee Kee , PhD	Mathematics		7-03-31, (65) 6790 3914
17	Yeap Ban Har, PhD	Maths Edu		7-03-29, (65) 6790 3918
18	Cheng Lu Pien, PhD	Maths Edu		7-03-44, (65) 67903954
19	Ng Wee Leng, PhD	Maths Edu		7-03-28, (65) 6790 3919
20	Teo Kok Ming, PhD	Mathematics		7-03-11, (65) 6790 3892
21	Dindyal Jaguthsing, PhD	Maths Edu		7-03-39, (65) 6790 3906
22	Paul M.E.Shutler, PhD	Mathematics		7-03-45, (65) 6790 3896
23	Toh Tin Lam, PhD	Mathematics		7-03-43, (65) 6790 3898
24	Dong Feng Ming, PhD	Mathematics		7-03-42, (65) 6790 3899
25	Soon Wan Mei, Amanda, PhD	Mathematics		7-03-18, (65) 6790 3917
26	Yeo Kai Kow, Joseph, PhD	Maths Edu		7-03-33, (65) 6790 3912
27	Chan Chun Ming Eric, MEd	Maths Edu	Lecturer	7-03-38, (65) 6790 3876
28	Leong Yew Hoong, PhD	Maths Edu		7-03-13B, (65) 6790 3973
29	Chua Boon Liang, MEd	Maths Edu		7-03-13A, (65) 6790 3971
30	Ng Kit Ee Dawn, MEd	Maths Edu		7-03-10, (65) 6790 3987
31	Ho Siew Yin, MEd	Maths Edu		7-03-17, (65) 6790 3916
32	Yeo Boon Wooi Joseph, MEd	Maths Edu		7-03-36, (65) 6790 3988
33	Lee Ngan Hoe, MScEd	Maths Edu		7-03-34, (65) 6790 3905
34	Emmanuel Cabral, PhD	Mathematics	(Visiting Fellow)	7-03-37, (65) 6790 3989
35	Boey Kok Leong, PhD	Maths Edu	Staff on Secondment (MOE)	7-03-36A, (65) 6790 3975
36	Chua Puay Huat, MEd	Maths Edu		7-03-24, (65) 6790 3923
37	Teo Soh Wah, MSc	Maths Edu		7-03-9B, (65) 6790 3972
38	Irene Ng Sze Kiat	Maths Edu		7-03-35, (65) 6790 3970

## Appendix 7: Schedule of Benchmarking Activities

Program for Mr. Sahid's Visit to NIE (18 - 27 August 2008)

Date/Day	Time	Activity	Venue	Staff
18 Aug Monday	morning	Collect key to room; settle in	MME	LCT AKC
		Meet Head/MME Meet Deputy of Head/MME	Head's office Deputy's Room	
	2:00 pm	Tour of MME facilities	Block 7, B1	NHT
19 Aug Tuesday	11:30 am	Lesson Observation – Lecture (Statistics for Year 2 degree students)	LT10	CWT
	afternoon	Free talk & interact with MME staffs, visit NIE's library, etc.		
20 Aug Wednesday	11:30 am	Lesson Observation – Tutorial (PGDE - All Sec)	Math Lab 4	BKL
	3:30 pm	Tea and interaction with MME faculty and staff – informal discussion	Journal Room	TSW
21 Aug Thursday	10:30 am	Interview with Head/MME	Head's office	WKY
	2:30 pm	Lesson Observation - IT-based Tutorial (PGDE - Lower Sec)	Archimedes Lab	DN
22 Aug Friday	morning	Practicum Observation (PGDE - Sec)	School	LYH
	afternoon	Free talk & interact with MME staffs, visit NIE's library, etc.		
25 Aug Monday	12:30 pm	Observation of lecture(PGDE)	LT2	CBL
	afternoon	Free talk & interact with MME staffs, visit NIE's library, etc.		
26 Aug Tuesday	morning	Discussion with faculty members	Journal Room	CBL
	afternoon	Free talk & interact with MME staffs, visit NIE's library, etc.		
27 Aug Wednesday	morning	Free talk & interact with MME staffs, visit NIE's library, etc.		
	3:00 pm	Presentation to MME staff	Journal Room	TSW, CLP
	5:00 pm	Return key to room, etc.	MME	LCT

Abbreviation	Name	Designation	Room
LCT	Mrs. Low Chwee Tee	Department Secretary	7-03-21
AKC	A/P Ang Keng Cheng, PhD	Deputy Head/MME	7-03-30
NHT	Ngo Hong Tat	Technical Executive	7-B1-14
TSW	Mdm Teo Soh Wah	Lecturer	7-03-9B
DN	Ms Dawn Ng	Lecturer	7-03-10
CBL	Mr Chua Boon Liang	Lecturer	7-03-13A
LYH	Dr. Leong Yew Hoong	Lecturer	7-03-13B
BKL	Dr. Boey Kok Leong	Lecturer	7-03-36B
WKY	A/P Wong Khoon Yoong	Head/MME	7-03-20
CLP	Dr. Cheng Lu Pien	Assistant Professor	7-03-44
CWK	Dr. Cheang Wai Kwong	Assistant Professor	7-03-27

## Appendix 8: Photos Album



NIE Front Sign



NIE Building Complex



Sahid's Room Door during Visit NIE



Sahid's Room during Visit NIE



NIE Library building



NIE history on its logo



Two different Lecture Situations at a Lecture Theatres



Students activities at Computer & Math Labs



School observation to see PGDE student practice

