

The Process and Factors Shaping the New Senior Secondary Mathematics Curriculum Decision Making in Hong Kong¹

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In the new senior secondary mathematics curriculum launched in 2009 in Hong Kong, schools and teachers were granted the autonomy to decide which modules are to be offered to students. Such a move is an important step in curriculum decision making in Hong Kong which for a long time has been characterized by its centralized nature. The move has had a significant impact on the quality of the school curriculum as the decision makers are now vested with the responsibility for choosing the curriculum options most appropriate to their students. Who are the decision makers in the schools? What factors do they consider? To answer these questions, a study was

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conducted in six secondary schools; 14 school administrators and teachers were interviewed. The study showed that students, mathematics teachers, mathematics panel heads and principals all influenced each other in the curriculum decision-making process. The process was far from simple. On the one hand, the needs, interests and abilities of students were considered with the aim of preparing them for the university entrance examinations; and on the other hand, practical considerations including the availability of suitable and qualified teachers were also influential. These findings point to the importance of taking curriculum decision making at the school level into consideration when formulating curriculum policy and the structure of the school curriculum.

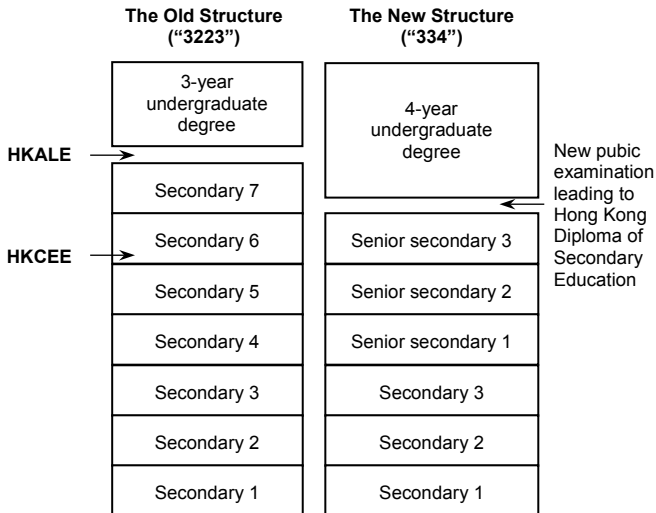
Keywords: curriculum decision making; curriculum reform; Hong Kong; mathematics curriculum design

Background

In 2009, Hong Kong launched a major restructuring of its senior secondary and tertiary education by changing its British “3223” system (3-year junior secondary, 2-year senior secondary, 2-year sixth-form education,² and 3-year university education) to a new “334” system (3-year junior secondary, 3-year senior secondary, and 4-year university education). This academic restructuring is more than a change in length of study, because free education has been extended from the junior secondary level to the senior secondary level, with the whole of senior secondary education becoming part of the general education stage (Education and Manpower Bureau, 2005). This shift from an elitist education at senior secondary level inevitably intensifies the issue of catering to learning diversity (Curriculum Development Council & Hong Kong Examinations and Assessment Authority [CDC & HKEAA], 2007), and a range of curriculum measures have subsequently been adopted to cope with this challenge. One such measure is that students are required to take four core subjects, namely Chinese, English, Mathematics, and Liberal Studies; in addition to this, students are allowed to choose one to

three elective subjects such as Chemistry or History (Figure 1). The third measure is the introduction of optional and elective components into subject curriculum.

Figure 1: The New Academic Structure



Note: HKALE = Hong Kong Advanced Level Examination;
 HKCEE = Hong Kong Certificate of Education Examination.

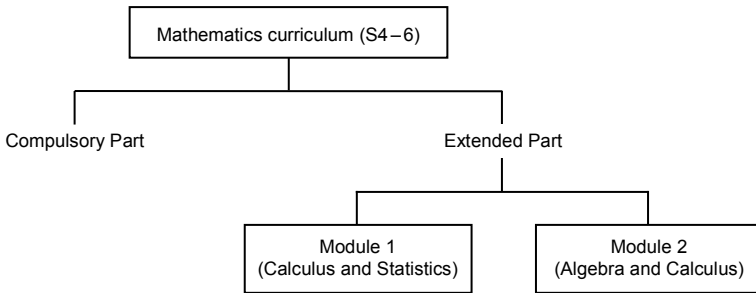
Source: Education and Manpower Bureau (2004, p. 5).

The new senior secondary mathematics curriculum (NSSMC) incorporated this element of including optional and elective components into its structure. This is highly significant as all senior secondary students, regardless of their interests and abilities, are required to take mathematics up to Secondary 6, one year longer than the requirement in the old system. A large-scale study in the late 1990s showed that many Secondary 5 students lost their interest in learning mathematics and found it difficult to cope with the demands of the old Hong Kong Certificate of Education Examination (HKCEE) (N. Y. Wong, Lam, Leung, Mok, & Wong, 1999). Forcing all students to take one more year of mathematics is likely to intensify learning diversity issues (Lin & Luo, 2006).

In order to satisfy the diversified needs of students with varying abilities and learning inclinations, the NSSMC is divided into two parts: Compulsory and Extended. The latter targets the more capable students who have greater interest in mathematics (CDC & HKEAA, 2007).

There are two modules in the Extended Part: Module 1 (Calculus and Statistics) and Module 2 (Algebra and Calculus) (CDC & HKEAA, 2007); they are usually abbreviated as M1 and M2 respectively. Students can choose to take either M1 or M2. The structure of the mathematics curriculum (S4–6) is shown in Figure 2.

Figure 2: Framework of the NSSMC



Source: Adapted from CDC and HKEAA (2007).

These elective modules are designed for students who require more mathematical knowledge and skills for their future studies and careers, and for those who have demonstrated adequate levels of interest and maturity that will allow them to benefit from further mathematical study in different areas (CDC & HKEAA, 2007, p. 43). The emphases of the two modules are different in that M1 focuses on the application of mathematics whereas M2 focuses mainly on the understanding of advanced mathematics (N. Y. Wong, 2010).

Schools are granted the autonomy to decide whether, and how, to offer M1 and/or M2 to their students. Such flexibility, for example, allows schools to integrate the contents of the Extended Part with the Compulsory Part in mathematics lessons as a whole, or to separate the Extended Part from the Compulsory Part. In the latter case, there are

“Mathematics” and “Mathematics (Extended Part)” lessons allocated to different timeslots in the school timetable.

The new senior secondary *Mathematics Curriculum and Assessment Guide (C&A Guide)* suggests that schools proportionately allocate lesson time as shown in Table 1.

Table 1: Suggested Time Allocations in the NSSMC

Students taking	Lesson time allocated (approximate number of hours)
Compulsory Part only	10–12.5% (270–338 hours)
Compulsory Part with a module	15% (405 hours)

Source: CDC & HKEAA (2007, p. 13).

Two points should be noted with reference to the *C&A Guide*:

1. The suggested lesson time for the Extended Part is not explicitly set. Schools may adjust the amount of lesson time for the Extended Part and the Compulsory Part.
2. The Extended Part is not officially seen as “half of the Compulsory Part” or “half of an elective subject.” Because of this official stance, there is a potential danger that the Extended Part may not be treated as being of equal status to other elective subjects such as Biology in timetable allocation.

Issues which loom large are: How did schools and teachers make the curriculum decisions? What factors did they consider? Did they work toward the best interest of the students? Did they exercise their decisions based on their professional judgments? Were the decisions rational, reasoned and evidence-based? These are important questions to be investigated as their decisions directly affect whether the widened learning diversity is properly addressed. The present study therefore delves into curriculum decision making issues at the school level in order to shed light on the appropriateness of leaving this kind of curriculum decision making to schools in a system where centralized control and high-stakes public examinations have long been seen as the norm.

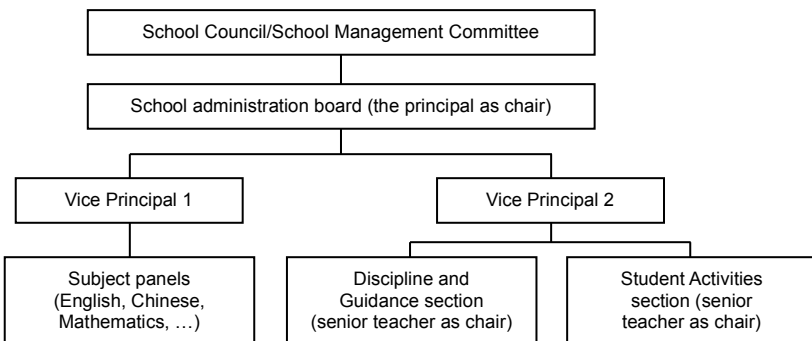
Factors Shaping Curriculum Decisions

Marsh and Willis (2003) comment that curriculum decisions are seldom completely free choices and that school practitioners must consider not only what the options are, but also how the choices are made. Such choices may not only be influenced by the expectations and beliefs of educators, but may also reflect the expectations and beliefs of society at large (Westbury, 2002). Indeed, several contextual factors have a strong impact on school curriculum decisions.

The contextual factors in school

Curriculum decisions at the school level are in the hands of different school practitioners (Leung, 2001). In general, three groups of school practitioners (namely subject teachers, subject panel heads, and principals) are involved in subject-based curriculum decision making. Within the school system in Hong Kong, the School Management Committee (SMC), vested with management responsibilities, has the final say on all school matters, including the curriculum. A typical school organization chart in the Hong Kong context is depicted in Figure 3. However, many members of the SMC may see themselves as non-professionals and may believe that curriculum decisions are best

Figure 3: A Typical School Organization Chart



left to professional educators (Marsh & Willis, 2003). For example, T. H. Wong (1990) found that although school supervisors have the legal responsibility for a school, most of them are laypersons and have low participation in the day-to-day running of the school. Therefore, principals, having more professional knowledge in education, are granted decision-making power over everyday school administration (Leung, 2001).

It has been widely agreed that the principal should exercise professional leadership, particularly in curriculum decision making (see for example, Glatthorn, 2000). However, because they have to handle numerous other tasks every day, principals often rely on other staff members to plan, implement and evaluate the curriculum (Ornstein & Hunkins, 2004). In reality, curriculum decisions are often left to teachers. Teachers' decisions are mainly influenced by their own experiences, the opinions and behavior of students, and, to a lesser degree, by the principal and other teachers in their schools (Leithwood & MacDonald, 1981). In addition, various features of the curriculum affect how teachers read and interpret the curriculum, which in turn influences their decisions on instruction and curriculum (Kim, 2007). Teachers, therefore, need to have sufficient subject and pedagogical knowledge so that they can understand the rationale behind the curriculum. At the same time, teachers' beliefs and identities may also affect their decision making (Cooney, 2001; Ernest, 1989). Leung (2001) also discovered that teachers' willingness (to teach a specific subject) and their qualifications and suitability posed critical influence on their curriculum decisions and implementation.

Students' views also come into play. Marsh (2004) commented that students' views on curriculum may affect how decisions are mediated by teachers. For example, students with different backgrounds may respond differently to the teaching content, and teachers have to adapt to such backgrounds by mediating the curriculum so that most students are satisfied. Ornstein and Hunkins (2004) assert that the curriculum should be designed to bring about most benefits for the learners. As a result,

schools should have the responsibility to acknowledge their students' specific needs.

External contextual factors

The school curriculum is constantly subject to pressure from parents and the general public for students to achieve high academic performances (Hargreaves & Shirley, 2009; Marsh, 2004). The education system in Hong Kong has long been exam-driven (Choi, 1999; Morris, 1996). Such a strong emphasis is partly due to the Chinese cultural belief in the superiority of academic qualifications and the fact that public examination results are the main determinants for admission to higher education in Hong Kong (Biggs, 1996; Lee, 1996).

In light of the importance of the Hong Kong Diploma of Secondary Education (HKDSE) results, both for academic qualifications and as a benchmark for employment, it is expected that school practitioners will take the examination requirements and students' performances in examinations into consideration when they make curriculum decisions. There is another subtle parental influence in this particular context. Parents may not directly influence school decisions concerning module offerings; however, if a school, say, only offers the compulsory part in mathematics, it is possible that the school will be seen as second class, thus adversely affecting the status and attractiveness of the school.

However, the role of parents is often unacknowledged in school management despite the parents' strong vested interest (Chavkin & Williams, 1987). Studies by Leung (2001) and Ng (2004) have revealed that some school teachers and administrators in Hong Kong confirmed their unwillingness to involve parents in school decision making because parents were seen as not having adequate knowledge of either the school or education per se.

With this background, it is of interest to understand how curriculum decisions regarding the offering of mathematics elective modules were made and what factors were considered in the process.

Research Method

Data Collection

This study focused on the decision making surrounding the Extended Part of the NSSMC in Hong Kong government-aided secondary schools. Specifically, it was concerned with how school practitioners made curriculum decisions and what factors they considered in the process.

Since the process and considerations of the decision makers were complex and closely knitted with contextual factors, a case study approach was adopted (Stake, 1995; Yin, 2009). A multiple-case study design is adopted to allow comparison among cases with different backgrounds (Yin, 2009). Six case schools were selected based on the following criteria:

1. All the case schools were government-aided schools as most of the secondary schools in Hong Kong are aided schools funded by public money.
2. The case schools represented the whole range of quality of intake of Secondary 1 students.
3. The curriculum structure including the number of M1/M2 classes to be offered, the number of elective subjects each student could take, the arrangement of M1/M2 lessons and so on was specifically considered.

The backgrounds of the case schools are shown in Table 2. Their diverse background and characteristics allowed comparison among the cases. The case selection was conducted in two phases.

The main objective of the current study was to investigate the curriculum decisions regarding the NSSMC; consequently, principals, mathematics panel heads, and current new senior secondary mathematics teachers (teaching either M1 or M2) were the potential informants. These stakeholders could be divided into two groups: the frontline mathematics teachers, and the school curriculum planning team — which might include the principal and the vice principal. In some cases, the head of the mathematics subject panel wore more than

Table 2: Characteristics of Schools Participating in the Research

School	Type	Students' academic standard	MOI in S1–3*	No. of M1/M2 classes
1	co-educational	High	English	M1: 1** M2: 1**
2	co-educational	Low	Chinese	M1: 2 M2: 0
3	co-educational	Medium	Chinese	M1 : 0 M2 : 1
4	co-educational	Medium	Chinese	M1 : 1 M2 : 1
5	co-educational	Medium	Chinese	M1 : 1 M2 : 0
6	girls	High	English	M1 : 1 M2 : 1

* For the schools with Chinese as the MOI (medium of instruction), it is expected that not more than 30% of lesson times were conducted in English, which is in accordance with the recommendation by the Education Commission (2005) in the *Report on Review of Medium of Instruction for Secondary Schools and Secondary School Places Allocation*.

** School 1 offered two classes of the Extended Part of the NSSMC for their students, but they needed to study both the contents from M1 and M2 in Secondary 4. According to their preferences and performances, students were allocated to M1 and M2 stream respectively in Secondary 5.

one hat, serving also as a key member of the school curriculum planning team. In each case school, the research team invited two mathematics teachers (including the subject panel head) and one member of the school curriculum planning team to be interviewed on an individual basis. However, not all of the school personnel invited were willing or able to arrange time for interview. A total of 14 informants were interviewed. Table 3 lists the characteristics of the 14 school practitioners.

A set of semi-structured interview guidelines which comprises six themes (see Appendix) was developed. In the interviews, respondents were asked to talk about these themes in a semi-structured manner. The researcher asked questions according to the informants' responses, and arranged the questions in a manner appropriate to their knowledge, involvement and status (Merriam, 2001).

Table 3: Characteristics of Informants

School	Code*	Years of teaching	Years of teaching in current school	Related post within school (number of years in current post)	Related post outside school**
1	H1	18	16	Chairperson of administrative board (7)	—
	T1	7	7	Leader of counseling team (7)	—
2	P2	24	10	Principal (10)	CDC member/ ONE committee member
	H2	23	23	Vice principal, Head of academic board (23)	M1 working group member/ HKEAA Mathematics committee member
	T2	25	15	—	—
3	P3	20	14	Principal (4)	—
	H3a	7	7	School executive board member (1)	—
	H3b	29	4	—	NSSMC working group member/ CDC member
4	H4a	7	7	Curriculum development team member (3)	—
	H4b	7	7	School NSS working group member (3)	—
5	H5	20	19	Vice principal, school policy board member (4)	EC member
	T5	7	1	—	—
6	H6	34	34	—	—
	T6	10	10	—	—

* P: Principal; H: Mathematics panel head; T: Current teacher of M1/M2

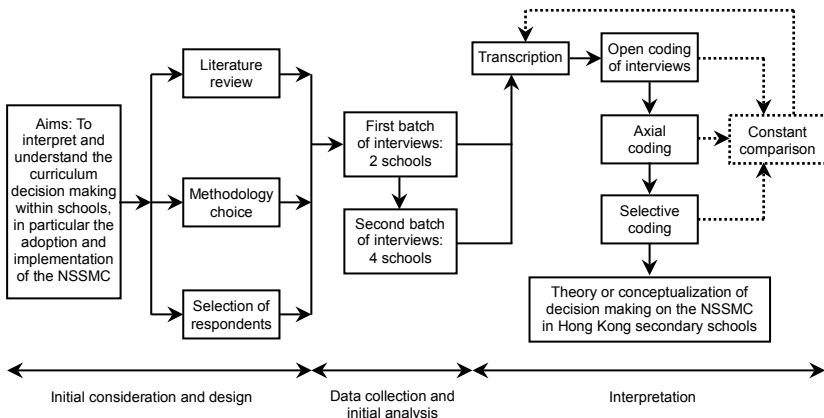
** CDC: Curriculum Development Council; HKEAA: Hong Kong Examinations and Assessment Authority; ONE committee: Joint CDC-HKEAA committee; EC: Education Commission

With the informants' consent, all interviews were audio-recorded for protocol transcription. Following the practices suggested by Miles and Huberman (1994), all the transcripts were read in order to identify

themes and categories. For example, the factors curriculum planners took into consideration were identified as a theme and the various factors such as students' academic ability and public examinations were sub-themes under this "big theme." The interview transcripts were extracted and categorized accordingly. The data from different schools and different roles (for example, mathematics teachers and principals) were compared in order to identify propositions relating to the adoption and implementation of the NSSMC.

In sum, the research procedure was shown in Figure 4.

Figure 4: Research Procedure



Results

NSSMC Decision-making Process

Results revealed that the involvement of the principals in NSSMC decision making varied among the schools, whereas school mathematics panel heads (i.e., head of subject department), in general, played a critical role. Table 4 summarizes the NSSMC decision-making process in the six participating schools. Table 5 summarizes the NSSMC frameworks of these schools.

Table 4: Summary of the NSSMC Decision-making Process in the Participating Schools

School	Major school boards / committees / persons involved*	NSSMC decision-making process	Any balloting involved?
1	School administrative board / principal	Maths panel head both formally and informally consulted maths teachers → Maths panel head proposed a plan to the principal → Head of school administrative board and the principal lobbied other subject panel heads to accept the plan → Consensus reached and the plan was passed in the school administrative board → The principal passed the plan to the school SMC → The SMC endorsed the plan or rejected it and passed it back to the school for re-planning	No
2	School academic board / vice-principal	Extensive consultation with and surveying of teachers, students and parents were conducted to obtain data → The vice-principal (head of academic board) proposed a plan to the school administrative board for approval → The principal endorsed the approved plan	No
3	School executive board / principal	The principal consulted maths panel head / teachers → The principal proposed a plan in the school executive board for approval → Board members sought consensus in the meeting, or consulted their subordinates for further discussion in the board meetings if no consensus was reached → The plan approved and endorsed by the school executive board was final	Yes, but only for members' orientation; not strictly as a means of decision making
4	Principal	The principal proposed a plan to the maths panel → Maths panel heads rejected any infeasible planning as proposed and sought for consensus with the principal → The plan agreed upon by both the principal and the maths panel head was passed to the school academic board for discussion, if any → The principal further adjusted, if any, the curriculum and finally approved it when compromise reached among related staff members	No
5	School policy board / principal / vice principal	Different types of data including student academic performance and preferences, time ratio suggested by the Education Bureau, etc., were collected → Discussion and negotiation in school maths panel and other related boards → A plan was proposed by the vice principal (maths panel head, member of the school policy board) to the school policy board for discussion → The plan approved and endorsed by the school policy board was final → The principal reported the plan to the SMC	No
6	Principal / maths panel heads	Maths panel head consulted maths teachers → Maths panel head proposed a plan to the principal → The principal discussed with other senior staff members and fine-tuned the plan → The principal passed the plan to the maths panel heads for further discussion → If the maths panel had no objection to the revised plan, the principal approved it and disseminated it in the general staff meeting	No

* Except for School 3, the mathematics panel head was usually one of the members of the school administrative / academic / executive boards in the course of NSSMC decision making.

Table 5: Summary of the NSSMC Frameworks of the Participating Schools

School	Banding of school	No. of M1/M2 classes	No. of NSS students allowed to take	Timetabling	No. of lessons allocated to the Compulsory Part	No. of lessons allocated to the Extended Part	When were M1/M2 lessons arranged?	Consider M1/M2 as separate "subject"?	When the contents of M1/M2 were first taught?	Supplementary lessons arranged?
1	1	M1: 1* M2: 1*	3	6-day cycle, 40 minutes per lesson	8	0	Incorporated in normal school mathematics lesson	No	Beginning of Secondary 4	Yes, on Saturdays and school holidays
2	3	M1: 2 M2: 0	2	5-day cycle, 35 minutes per lesson	7	4	2 weekdays after school	Yes	First week of Secondary 4	No
3	2	M1: 0 M2: 1	3	5-day cycle, 45 minutes per lesson	6	0	Incorporated in normal school mathematics lesson	No	Late 1st semester of Secondary 4	Yes, regularly one weekday after school
4	2	M1: 1 M2: 1	2-3	6-day cycle, 40 minutes per lesson	6	3**	Saturdays	Yes	Beginning of Secondary 4	No
5	2	M1: 1 M2: 0	2***	5-day cycle, 55 minutes per lesson	4	2	Within normal timetable	Yes	Late 1st semester of Secondary 4	Yes, on Saturdays and school holidays
6	1	M1: 1 M2: 1	3	6-day cycle, 40 minutes per lesson	7	1	Incorporated in normal school mathematics lesson	No	Second semester of Secondary 4	Yes, starting before the summer vacation of Secondary 4

* Expected number of M1/M2 classes in Secondary 5 as there was no separation in Secondary 4

** The official teaching loads allocated was 3 lessons, although most likely the lessons last for 3 to 4 hours.

*** Students not taking M1 were allowed to take 3 electives, but students taking M1 can only take 2 electives.

The use of ballots to vote on options was generally not adopted in making curriculum decisions, although a show of hands was sometimes used to indicate choices and preferences of the members involved in the decision-making process. As suggested by P3 and H3a, voting might not always be the best way for making decisions, especially when the votes for different opinions were close.

In fact, no informants from any of the participating schools regarded voting as a mechanism of decision making. On the contrary, trying to reach a compromise on decisions through discussion was seen as the preferred way.

Roles of the principal

As reflected in the interviews, the roles of the principal ranged from that of passive provider of information and suggestion to active participant. The curriculum decision making for specific subjects required the principal to have a good understanding of the nature of the subject as well as the details of the operations of the subject panel. As most of the principals interviewed were not trained as mathematics teachers, and had not participated in the day-to-day running of the mathematics subject panel, it was difficult for the principals to make concrete proposal regarding the NSSMC. In fact, in most cases, the principal worked closely with the mathematics panel head to devise a plan that best fit the school's context. School 6 was a case in point:

Normally, our principal did not change our proposal significantly. She is not a specialist in mathematics ..., therefore she seldom gets involved in the curriculum decisions of each [individual] subject panel ... Each subject panel head consults their members and makes a proposal for the principal to comment and make suggestions on ... If she wanted to make some adjustments or fine-tuning, she would seek our opinion.
(H6)

Influences of mathematics panel heads

When it comes to making school curriculum decisions, mathematics

panel heads played a variety of roles. Mathematics panel heads acted as bridges between the school senior management and the panel. As such, they disseminated subject information and proposed curriculum suggestions to the school authority.

They proposed the curriculum framework to the school boards for deliberation. For example:

The principal and other senior staff may only have a rough idea [of the mathematics panel's situation] ... I can say that the panel heads have the decisive powers and the school usually respects what we have proposed. (H6)

On the other hand, certain mathematics panel heads — those in Schools 1 and 4, for example — viewed themselves as insignificant in curriculum decision making because their proposed ideas or plans were subject to the approval of the higher committees in their schools:

We [mathematics panel head and the principal] have planned everything and each department head has agreed on the arrangement, but at last the School Management Committee turned down our decision ... (H1)

The principal is the most influential [in NSSMC decision making] ... I only played a tiny role in the [NSSMC] planning ... (H4a)

Another difficulty faced by the mathematics panel heads was their overlapping roles in curriculum decision making. In the cases of Schools 1, 2 and 5, the mathematics panel heads were also either vice principals or chairpersons of the school administrative board. With such hats, they had to act as being fair to all subjects. Hence it was difficult for them to make or pass any decisions that obviously favored the mathematics subject panel. School 2 was a typical example. The panel head explained his position and struggle:

If I were only the panel head, of course I would fight for it [allocating more lessons for mathematics]. But now, being the chairperson of the Academic Board, I have to be fair and view the whole planning from a macroscopic perspective ... (H2)

Factors Influencing NSSMC Decisions

It was observed that several factors shaped the curriculum decisions. These factors included the characteristics of students, the availability of teachers, and the influence of university entrance requirements and public examination results. Interestingly, these factors interacted with one another in shaping the curriculum decisions.

Characteristics of students

The findings indicate clearly that curriculum decisions were, to a large extent, based on the perceived interests of students. Among all the characteristics of students, student abilities and student preferences were the most explicit in influencing the school's NSSMC decisions.

Teachers' perceptions of student abilities

Nearly all the school practitioners considered student ability as the most influential factor when they made their curriculum decisions. For example, School 6 (one of the top-ranked schools in Hong Kong) decided to offer both extended modules:

Of course we have considered the abilities of our students when we offer the subjects ... and it is just very natural [to offer one class of M1 and one class of M2]. (H6)

However, it may not be accurate to claim that low-banding schools, admitting academically less able students, would definitely offer fewer M1 or M2 classes. When making their curriculum decisions, schools did not focus solely on improving students' public examination results, but often also hoped to give students more chances to experience advanced mathematics. For example, in School 2:

... in planning our NSS curriculum, ... we shall first consider their [students'] abilities ... For those smart students in our school, we provide a chance for them to study M1. (P2)

Teachers' perceptions of student abilities also influenced which module was to be offered. Both Schools 2 and 5 only offered M1. The rationale provided by School 2 was:

The mathematical foundation of our students is weak ... The last few parts of the M1 curriculum are related to statistics in which there is not much complicated manipulation and a strong mathematical background is not required ... so, we decided to offer M1 only. (T2)

School 5 offered similar rationale.

Student preferences

Students' subject preference was another factor that school practitioners took into consideration. All the schools participating in this study had conducted surveys of S3 student preferences.

The schools were aware of the problem that students might not have adequate knowledge of what M1 and M2 were. Hence, all the case schools organized seminars to explain the details of the curriculum structure to students as well as to parents. Nevertheless, some teachers believed that this was not adequate in ensuring a deep understanding of the meanings and differences of the various combinations of the options. As a result, for example, teachers of School 1 opted not to rely much on student preferences when making their curriculum decisions:

[In junior form,] students did not know any complicated or advanced mathematics ... In my opinion, it seems very difficult for Secondary 3 students to understand the requirements of advanced mathematics ... Using student interest as a criterion of curriculum decision is ambiguous. (T1)

Availability of teachers

According to Leung (2001), the availability of teachers was a great concern for schools when making curriculum decisions, especially in relation to the subjects to be offered. In the present study, all the case schools took the availability of suitable teachers into consideration.

Teachers' mathematics background

Most informants indicated that they expected that M1 and M2 teachers should have a relevant subject specialty at undergraduate level. School 4 is a case in point:

I don't think those non-major teachers [in mathematics] were competent in teaching M1/M2. (H4a)

Relevant teaching experience

Teachers with relevant teaching experiences usually were viewed as suitable to teach the related new subjects. Nearly all informants claimed that teachers who had taught HKALE (Hong Kong Advanced Level Examination) Pure Mathematics and HKCEE Additional Mathematics should be competent to teach M2, while those who had taught HKALE/HKASL (Hong Kong Advanced Supplementary Level Examination) Applied Mathematics or HKASL Mathematics and Statistics were better at teaching M1.

University entrance requirements and public examination results

In Hong Kong, a major responsibility of secondary schools is to help their students enter a university. All informants responded that they had considered the relevance of the Extended Part in helping students gain admission to universities. For example, the principals of Schools 2 and 3 admitted that the entrance requirements of tertiary institutions played a crucial role in their consideration of whether or not to offer M1 or M2:

We cannot deny, and I don't think anyone would deny, that the school curriculum is designed to satisfy university entrance requirements ... Therefore, I am 100% sure that school is led by university entrance requirements. (P2)

In addition, how advantageous M1 or M2 were perceived to be in supporting students' admission to universities was also critical to decision makers. For example, P3 explained her stance:

As we were planning the NSS curriculum, we received information [from the universities] that those who intend to study programs in the social sciences, or programs that require statistics, like finance, may benefit if they also take M1. However, students in our school have already taken three [NSS] electives ... Therefore, I think our students [in the Arts and Commerce streams] need not take M1 ... and they would still have a good chance to be admitted to universities if they perform well in the core and elective subjects ... It is too much for them to take three electives and M1. (P3)

Curriculum decisions were also influenced by the requirements of the public examinations. As mentioned, schools conducted some sort of projections as to estimate how their students would perform in the new HKDSE. For instance, Schools 2 and 5 offered only M1 as they felt that their students could cope with the examination requirements and thus achieve good scores in the HKDSE.

Reputations and survival of schools

The school banding and background has also influences on the curriculum decision making. In general, those schools with longer history and with better students' academic performances inclined to offer the Extended Part, to uphold the school reputation. High-banding schools such as Schools 1 and 6 believed that they ought to offer the Extended Part to live up to high expectations of stakeholders:

It is impossible to ignore the impact of public examinations on Hong Kong secondary schools. Everyone, especially parents, puts the public examination as a top priority ... The higher banding the school is, the higher the pressure of public examinations [the school] has to withstand. (H6)

On the other hand, schools with shorter history or with intakes of less able students like Schools 2, 3 and 5 usually put the capability of the students over school reputation in their consideration. However, there is still a need to offer the Extended Part to the students. An informant from School 5 explained:

... If none of the modules [of the Extended Part] was offered, parents at other schools would consider the students and teachers of the school to be of such an extremely low standard that they cannot afford to offer even one group [of the Extended Part]. (T5)

Considerations of school administration

Most informants commented on how NSSMC extended curriculum arrangements had created considerable administrative problems within schools. In fact, the schools took administrative convenience into consideration as an important concern when making curriculum decisions. For example, in School 4, all M1 or M2 lessons were arranged on Saturdays as the timetable was so packed that no curriculum time from Monday to Friday could be arranged.

Discussion

Interrelationships between Different Players in NSSMC Decision Making

The findings show that factors such as the influence of parents, support from the government, and mathematical beliefs of teachers were not important in shaping curriculum decisions in schools. Students were the main focus of all the four major groups of stakeholders (i.e., students, mathematics teachers, mathematics panel heads, and principals) in the decision-making process.

Basically, it was the principal who led the entire decision-making process and the principal played the major, if not ultimate, role. The usual procedure was that the principal would consult stakeholders like panel heads and frontline teachers, and discussed the issue in the school administration board. Initial decisions could be presented to parents as well as the school council for endorsement. As said above, it is unusual to have casting vote in all these procedures but the principal, possibly together with other senior management personnel like vice principal and

panel heads, would try to build consensus through formal and informal negotiations.

The findings illustrate how students, mathematics teachers, mathematics panel heads and principals were interrelated, and how they influenced each other in the curriculum decision process. Nevertheless, the mathematics teachers were found to be passive in that they were only consulted rather than being actively involved in the decision process. The mathematics panel head and the principal were the two key players in the NSSMC decision-making process. The interactions between these two players were the closest in that they worked together to make NSSMC decisions that were considered to be best suited to their school context. Figure 5 show the different factors that influenced NSSMC decisions made by the different players in the whole NSSMC decision-making process.

The factors affecting curriculum decision included teachers' subject knowledge, students' abilities and university entrance requirements/public examination results. These were the three factors considered most important by the curriculum decision makers.

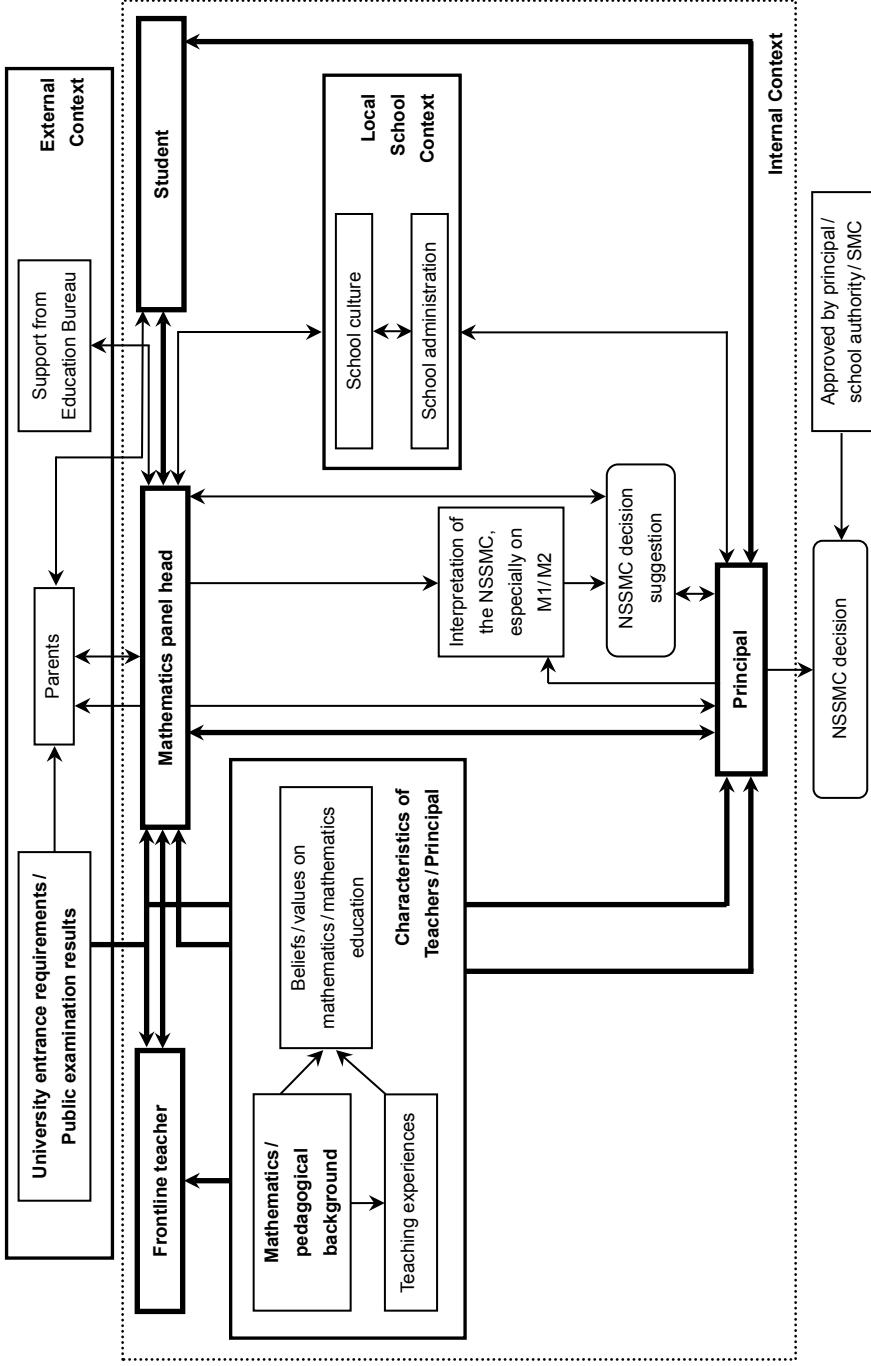
In particular, the subject knowledge of school practitioners was important in that this provided teachers and principals with the knowledge base for interpreting the curriculum, which in turn influenced their orientations toward curriculum decisions. Moreover, with an understanding of their students' abilities, school practitioners would normally make curriculum decisions that can maximize the chances for their students to be admitted to universities. Figure 6 highlights the key factors of the framework of NSSMC decision making.

Implications in Curriculum Decision Making

The policy level

The most controversial arrangement in the current NSSMC framework was that the extended mathematics components (M1 and M2) are of lesser importance than other NSS elective subjects, even though the

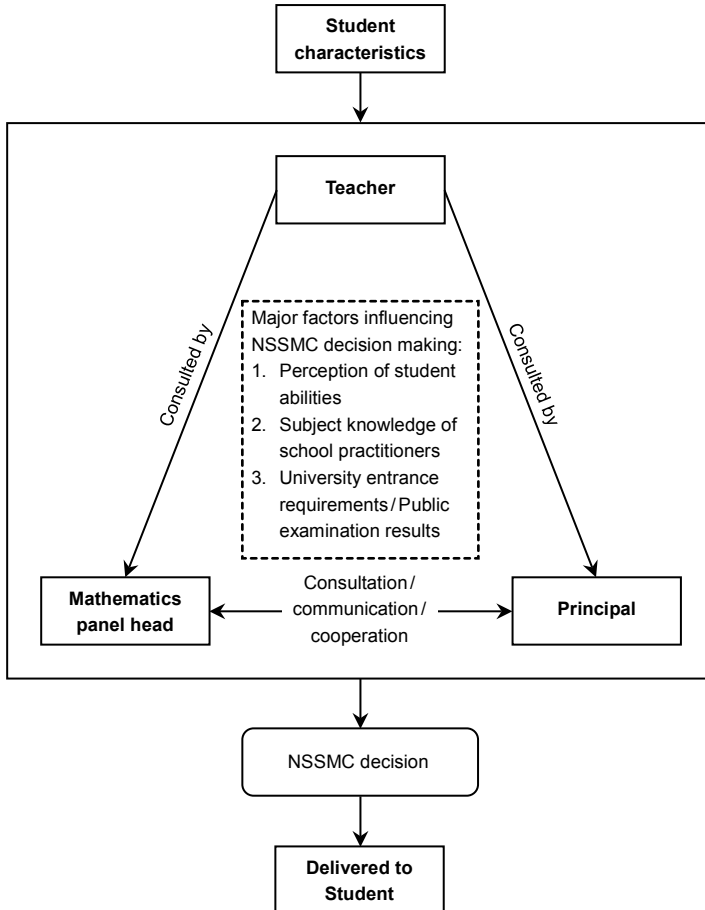
Figure 5: Different Factors Affecting Players in NSSMC Decision Making



* Single arrow: one-sided influence; double arrow: reciprocal influence

Thin arrow: minor influence; thick arrow: major influence

Figure 6: Interrelationship Between Different Components in the Conceptualization of NSSMC Decision Making



contents of M1 or M2 are comparable to an NSS elective subject in terms of academic rigor and the amount of time involved in learning. Nearly all informants opined that M1 and M2 were worthy of being categorized as NSS elective subjects.

Policy makers responsible for the design of the NSSMC should revisit the whole curriculum structure and arrangements. There are a number of other issues worthy of further examination and investigation.

First, there should be more consultation with frontline teachers. The consultation should be genuine, open and frank, and permit input from all parties. Hence, instead of organizing large-scale seminars, the curriculum developers in the Education Bureau should make school visits so that teachers and principals may express their opinions and views on the curriculum in a more direct way.

In addition, policy makers need to clarify the status of the Extended Part. In Hong Kong, school curriculum has long been centralized (Morris, 1996), with school curriculum planners used to allocating lesson times in accordance with the official curriculum guide. The present arrangement of treating the Extended Part as an extension, rather than an independent elective subject, means that the Extended Part is at a disadvantage when it comes to the allocation of teaching time. In quite a number of schools, the teaching of M1 or M2 was conducted after school or on Saturdays. This is highly undesirable from the perspective of student learning as well as that of teachers' work-life balance. From an academic point of view, as the amount of time and level of difficulty covered in either M1 or M2 are both comparable to an elective subject, M1 and M2 should be awarded independent subject status.

Implications for the university entrance requirements

A major factor influencing the NSSMC decision-making process is the concern with university entrance requirements. Because some high-ranking university programs require students to have taken the Extended Part, most schools in Hong Kong are constrained, and to a certain extent even forced, to offer at least one module of the Extended Part, regardless of their students' abilities. This situation is mostly a function of trying to satisfy parents' expectations while also keeping the school competitive. However, it is difficult for teachers to encourage students to put much effort into the Extended Part since it is not an NSS elective subject and is not counted in the requirements of most university programs.

In this regard, curriculum policy makers should also urge local universities to explicitly state the requirements of the Extended Part in

their programs, especially in universities which are more competitive. The admission requirements of the Hong Kong University of Science and Technology provide a possible solution. This university provides an alternative in its entrance requirements so that, on top of the four core subjects, students can choose to take either a minimum of two NSS elective subjects or one NSS elective subject with M1 or M2 in their senior secondary education. Such an alternative recognizes the status of M1 and M2, and their significance in university studies, while circumventing the argument over whether or not to change the status of M1 and M2 to an elective subject.

Conclusion

The present study has attempted to understand the curriculum decision-making process at the school level in the Hong Kong context, with the adoption and implementation of the Extended Part of the NSSMC as an example. Even though the generalizability of the study is limited by its smaller number of sample schools, and the data were from the recollection of the decision-making processes and factors considered by the stakeholders, the findings can still shed light on curriculum decision making in schools. In the current study, different factors, both inside and outside the school boundary, have been examined with a view to reflecting their influences on different school practitioners when they made their NSSMC decisions.

Three factors (student abilities, subject knowledge of school practitioners and university entrance requirements/public examination results) were identified as the important factors that influence NSSMC decision making. Most of the decisions appear to be based on pragmatic considerations rather than on prior knowledge or curriculum ideology.

In the current study, it has emerged that school practitioners base their NSSMC decisions on two concepts. The first is the “usefulness” of the Extended Part. Though different school practitioners have their own interpretations of the term “usefulness,” in general, they often view M1 or M2 as a supplement (rather than a necessity) to assist students to be

admitted into universities (or to a lesser extent, to help students obtain better results in the HKDSE examination). This is the major aim of most secondary schools. Any decisions that violate this aim are seen as inappropriate and nearly impossible to be approved by the school authorities.

The second concept considered is the “status” of the Extended Part. Most school informants felt ambivalent about the place of M1 and M2. Although the *C&A Guide* (CDC & HKEAA, 2007) clearly states that both the Compulsory Part and the combination of M1 or M2 constitute one, and only one, subject, the different perceptions of M1 and M2 may create a variety of modes of implementation, as demonstrated in the case schools in this study. However, in reality, the restrictions imposed by the school administration, the school culture, and other contextual factors make it difficult to provide enough support for the teaching and learning of M1 or M2.

The different interpretations of the NSSMC also create different expectations between school practitioners and government officials. In practice, the Education Bureau is responsible for providing professional programs for teachers and on-site school support. Nevertheless, it is doubtful whether such support really meets the needs of the teachers within the school context. Most informants complained that they observed little practical support from the government. Part of the significance of the current study therefore lies in exposing practical problems associated with the implementation of the NSSMC. In short, the current study can be seen to help curriculum review, improve the curriculum structure, and provide support for the smooth implementation of the new curriculum reform.

Notes

1. This article is generated from an M.Ed assignment of the first author under the supervision of the third author.
2. In Hong Kong, “sixth-form education” is used instead of “matriculation.” This is equivalent to the two-year A-level program in England.

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Appendix

The following themes were covered in the interviews, with specific questions and follow-up questions being asked depending on the responses from the interviewees.

- (I) Questions concerning your perceptions of the NSSMC, especially on the Extended Part (M1/M2)
 - General ideas of the NSSMC curriculum and assessment guide
 - Comparisons with NSSMC and HKCEE/HKALE mathematics curriculum
 - Understandings and interpretations of the Extended Part of the NSSMC
 - Comments of the time allocation of the Extended Part of the NSSMC

- (II) NSSMC planning
 - Description of the school NSSMC arrangement
 - Timetabling of the school NSS curriculum
 - Arrangement of teachers in the NSSMC
 - Arrangement of supplementary lessons, if any

- (III) Curriculum and decision-making mechanism
 - Description of the school NSSMC decision-making mechanism
 - Factors influencing NSSMC decision making (students/teachers/principals/public examinations/parents/university entrance requirements/etc.)
 - Roles and influences of different school practitioners in NSSMC decision making

- (IV) Additional questions for M1/M2 teachers
 - View of teachers toward their panel heads on the school NSSMC decision making
 - View of teachers toward their principals on the school NSSMC decision making
 - Roles of M1/M2 teachers in NSSMC decision making
 - General comments on the school NSSMC

- (V) Additional questions for mathematics panel head
- View of mathematics panel head toward their principals on the school NSSMC decision making
 - Roles of mathematics panel head in NSSMC decision making
 - General comments on the school NSSMC
 - Impact of the NSSMC on school mathematics panel
- (VI) Background information
- Post held inside/outside school
 - Length of time teaching at the school/HKCEE or HKALE mathematics subjects