9. QUESTIONNAIRE FOR TEACHERS

9.1 Instrument

The teacher questionnaire consisted of 6 parts, on top of background information and some open-ended questions. It attempts to tab teachers' view on the current curriculum, teacher education, major learning problems, methods to cater for individual differences and use of information technology in the area of mathematics. The teachers' belief on mathematics learning and instruction is also delineated via a well-established inventory.

9.1.1. Satisfaction with the existing curriculum

The teachers were asked to rate their level of satisfaction with the existing mathematics curriculum. The questions were designed to address issues at the three levels of the intended, the implemented and the attained curricula (Travers & Westbury, 1989). At the intended level, teachers were asked whether the current curriculum could meet the goals of learning a particular content area. At the implemented level, they were asked whether they were equipped with the knowledge to teach and at the attained level, the teachers were asked if the student could attain the set goals of that particular area. The questions on different syllabuses at different levels (junior primary, senior primary, junior secondary, senior secondary mathematics, additional mathematics, pure mathematics, applied mathematics and mathematics & statistics) were asked separately. The same topics used in the parent questionnaire were used here. Teachers were asked to check upon a 5-point Likert scale for each question.

9.1.2. Perceived usefulness of teacher education

Next, the teachers were asked to rate the relevance of 9 means for teacher professional growth across a 5-point Likert scale. They were the teachers' own school learning experience, their learning experience at universities, learning in teacher education programmes, consultation of syllabuses, consultation of textbooks, consultation of reference books, short in-service courses, educational seminars, and collegiate exchange with other teachers.

9.1.3. Major problems in mathematics education

The teachers were then confronted with 17 major problems in mathematics education and were asked to rate the extent they agreed with each of them across a 5-point Likert scale. The situations with junior and senior grade levels (junior primary and senior primary for the primary teacher questionnaire and junior

secondary and senior secondary for the secondary teacher questionnaire) were posted separately. These problems included "curriculum too bulky", "curriculum content too hard", "the goals of curriculum not clear enough", "curriculum unable to cater for individual differences", "not enough time to prepare the lesson", "too much non-teaching duties", "inadequate teacher training", "standard of student too low", "students' learning motivation too low", "students knowing nothing about ways of thinking", "students unable to understand mathematical concepts", "mixed ability of the students", "students stressing too much on examinations", "parents stressing too much on examinations", "the principal stressing too much on examinations", "standard of textbooks too low" and "textbooks not providing relevant teaching methods".

9.1.4. Methods to cater for individual differences

Teachers were also asked whether each of the following methods to cater for individual differences was implemented in their school, and if it was, what the effectiveness was. These methods were streaming according to abilities, remedial/small group teaching, having different teaching schedules for different classes, teaching according to the *Guideline for Tailoring Syllabus* issued by the Curriculum Development Council, using different teaching materials (including worksheets) for different classes, using different assessment standards (including different sets of test papers) for different classes, and teachers adjusting by oneself. The situations with junior and senior grade levels were asked separately and the extent of effectiveness was checked across a 4-point Likert scale.

9.1.5. Use of information technology

The perceived effectiveness of using the following devices was asked. They were computer-assisted learning packages, computer application programmes including Microsoft PowerPoint® and Excel®, ordinary pocket calculators, scientific calculators, programmable calculators, graphic calculators and the internet. Likewise, the situations of junior and senior grade levels were separated.

9.1.6. Beliefs on mathematics learning

The scale was developed and validated by Perry, Tracey & Howard (1998) and translated into Chinese and validated again for local use by Wong, Lam, & Wong [(6)].

[(6)] The research was supported by the Direct Grant for Research 1998-99 of the Social Science and Education Panel, The Chinese University of Hong Kong and the research team (C.C. Lam, K.M.

It consisted of 7 items on "mathematics instruction as transmission" and 11 items on "child-centredness of mathematics instruction" [(7)]. They were put in a 5-point Likert scale.

The respondents' years of experience in mathematics teaching, their qualifications and whether they were the head of department were asked and 4 open-ended questions were also included. They were: the major difficulties their students faced in learning mathematics, the strengths and weaknesses of the current mathematics curriculum, their suggestions for the future mathematics curriculum, and their anticipations of the support system in order to implement the future curriculum. The medium of the instruments was Chinese. The draft questionnaire was sent to the ad-hoc committee for comments and then some parts were revised accordingly.

The finalised questionnaires are shown in Appendices 22 to 23.

9.2. Sampling and administration

The same random sampled schools obtained in the student survey were used here. All teacher teaching more than one class of mathematics in these schools in the current year (1999) were requested to respond to the questionnaire. Details of the return rate are listed in Table 6.

Table 6. Return rate of the teacher questionnaire

Level	Packages sent out	Packages returned	Return Rate (%)
Primary level	90	72	80%
Secondary level	50	43	86%

The overall return rate is 82.1%. A total of 379 primary and 289 secondary mathematics teacher returned their questionnaires.

9.3. Results

9.3.1. Teachers' background

Results revealed that most schools, be it primary or secondary, had 8 mathematics

Wong, & N.Y. Wong) possesses the copyright of the Chinese translation of the scale).

[(7)] The original version consisted of 20 items. After factor analysis, 7 were loaded on "mathematics instruction as transmission" and 11 items on "child-centredness of mathematics instruction". Two items were sporadic. All the 20 items were included in our questionnaire but only the above 18 items were used in the analysis.

teachers (teaching more than one mathematics class in the current year) in their schools (Figure 36). 44.9% of primary mathematics teachers were non-degree teacher certificate holders but not majoring in mathematics. Only 27.7% of the primary teachers held non-degree teacher certificate in mathematics. 24.8% of the primary teachers attended teacher training courses (not confining to mathematics) comprising more than 30 contact hours.

As for secondary teachers, the majority held a bachelor degree in mathematics (46.6 %). 29.7% got non-degree teacher certificate in mathematics and 25.1% got a bachelor degree not majoring in mathematics (Figure 37).

9.3.2. Views on the curriculum

In general teachers were most satisfied with their own competence in teaching, quite satisfied with the goal of the curriculum but less satisfied with what the students attained. The extent of satisfaction declined as we moved up the grade levels.

At junior primary level, "fraction" was the topic in which most teachers (20%) felt students' attainment not satisfactory. The next was "time, capacity and money" (11%). Agreement of over 90% was found for all other items regarding the attainment of the curriculum, the attainment of the students and teachers' competence in teaching (Figure 38). At the senior primary level, this general picture still held. The most (perceived) unsatisfactory topic was "percentage" (18.2%) and the next was "equations" (17.3%) (Figure 39).

The above general picture still held for junior secondary mathematics but teachers were more dissatisfied with the curriculum. "Trigonometry" was the most underachieved topic (68.2%: in reverse direction) as perceived by the teachers. The next was "geometry" (72.2%: in reverse direction). 15.8% of the teachers regarded the goal of statistic was not attained by the current curriculum (Figure 40). For senior secondary mathematics, the extents of satisfaction continued to decline though the majority of the teachers still regarded themselves as competent. The most underachieved topic was "geometry" (62.5%) and next being "trigonometry" (67.1%) as perceived by the teachers (Figure 41).

The above results showed commonality with the students' and parents' views. The comparison is given in Table 7.

Table 7. Most difficult topics as perceived by students, parents and teachers

Level [8]	In students' eyes [9]	In parents' eyes	In teachers' eyes
Junior primary	- Mixed manipulation with multiplication and division - Factors and multiples - Kilometre and millimetre	- Time, capacity and money	- Fraction - Time, capacity and money
Senior primary	- Application of algebraic equations to solving algebraic problems - Percentage and its application - Speed	- Equation and its applications	- Percentage - Equations
Junior secondary	- Coordinate geometry of straight lines - Common logarithm	- Geometry	- Trigonometry - Geometry

The case of Additional Mathematics was found to be similar to Certificate Mathematics and there was no topic with which teachers are particularly satisfied or dissatisfied (Figure 42).

Teachers found Pure Mathematics quite satisfied too. In fact, their satisfaction with students' performance was generally higher than that for both Certificate Mathematics and Additional Mathematics, though the extent was not big. 1.4% of the teachers regarded themselves as possessing inadequate knowledge to teach calculus (Figure 43).

The goals of Applied Mathematics curriculum were not so satisfactory as compared with those of Pure Mathematics. "Vectors" was the topic for which the goals were most unsatisfactory. 33.3% of the teachers reflected that they were not competent to teach classical mechanics (Figure 44).

As for Mathematics and Statistics, comparatively more teachers felt dissatisfied with students' performance. 5.7% and 2.9% of the teachers reflected that they were not competent to teach statistics and probability respectively (Figure 45).

[8] Both the students' and parents' questionnaire referred to the grade levels P.3, P.6 and S.3 whereas the teachers' questionnaire referred to the intervals of junior primary (P.1-P.3), senior primary (P.4-P.6) and junior secondary (S.1-S.3).

[9] The classifications of topics for parents and teachers were the same, but those for students were more refined.

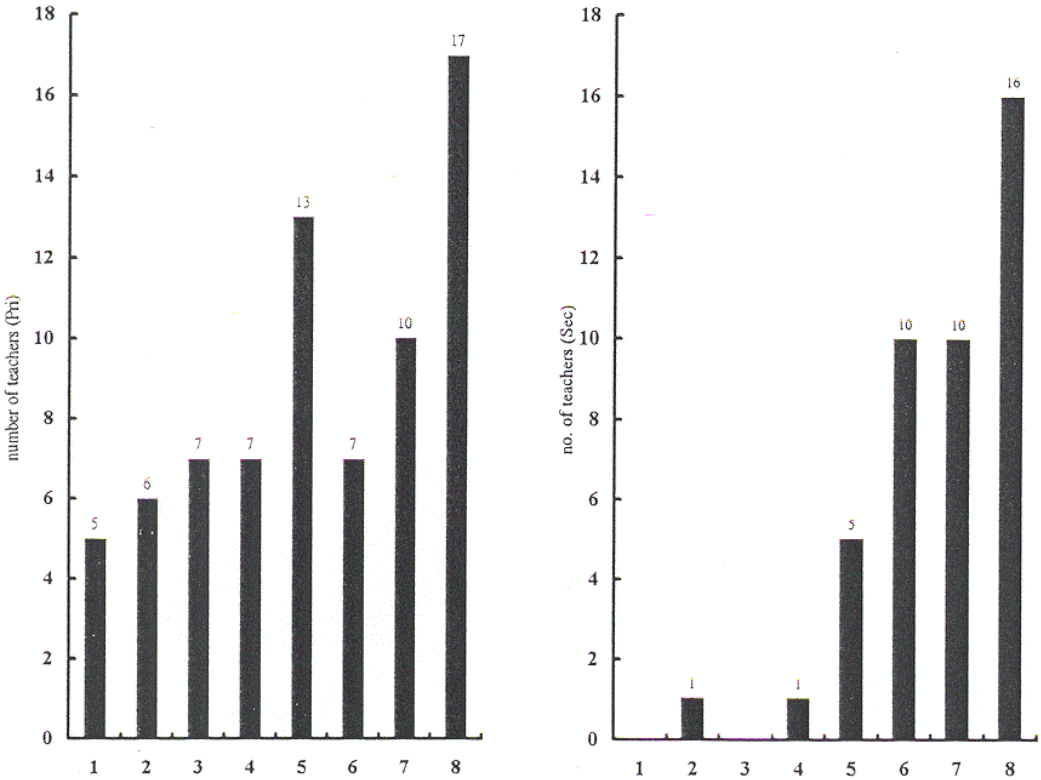


Fig. 36 Number of mathematics teachers in school

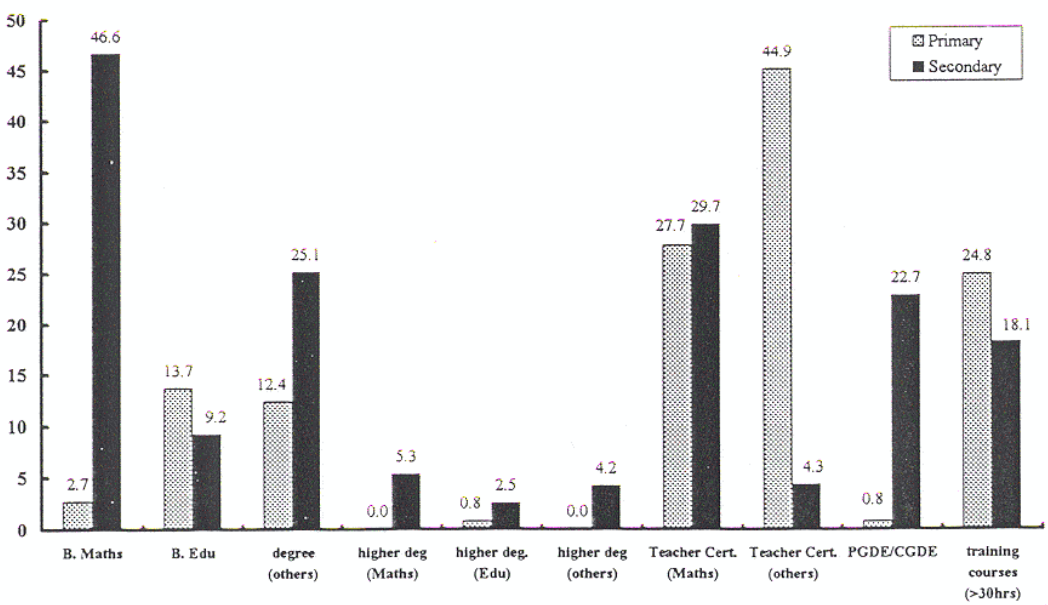


Fig. 37 Teachers' educational background

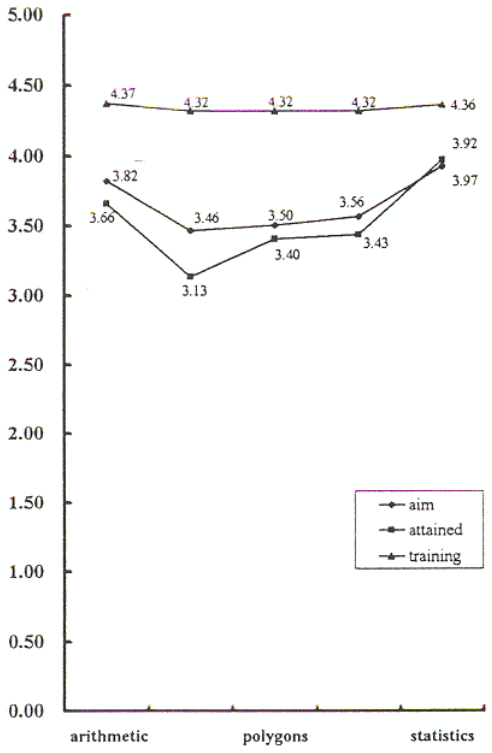


Fig. 38 View of the curriculum (P.1-3)

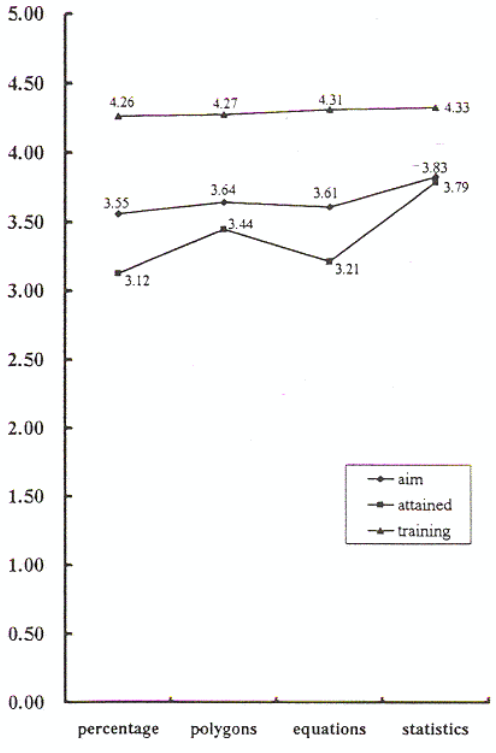


Fig. 39 View of the curriculum (P.4-6)

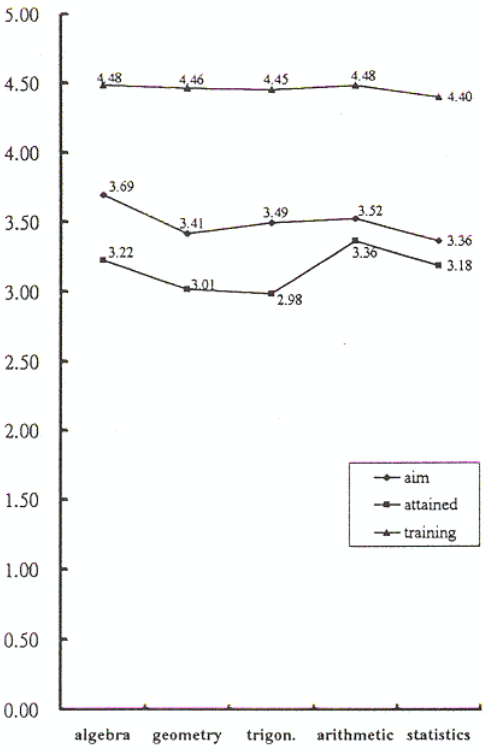


Fig. 40 View of the curriculum (S.1-3)

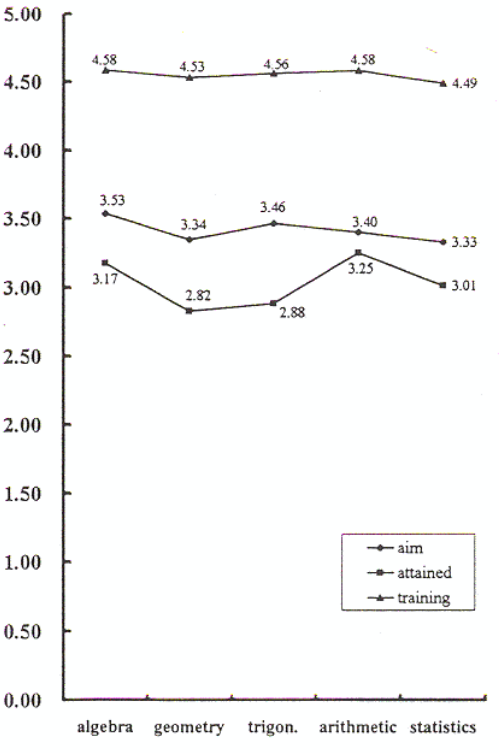


Fig. 41 View of the curriculum (S.4-5)

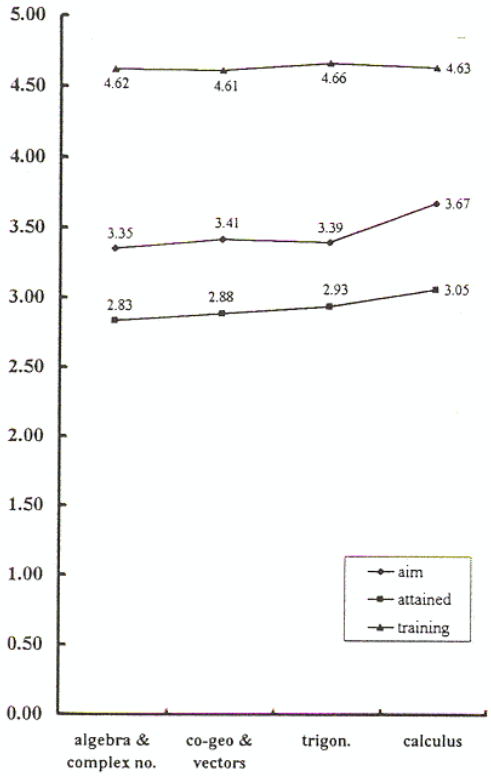


Fig. 42 View of the curriculum (Additional Mathematics)

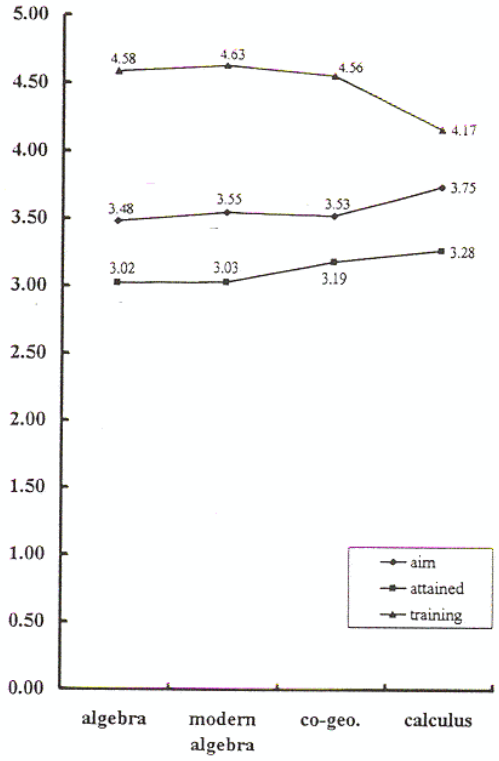


Fig. 43 View of the curriculum (Pure Mathematics)

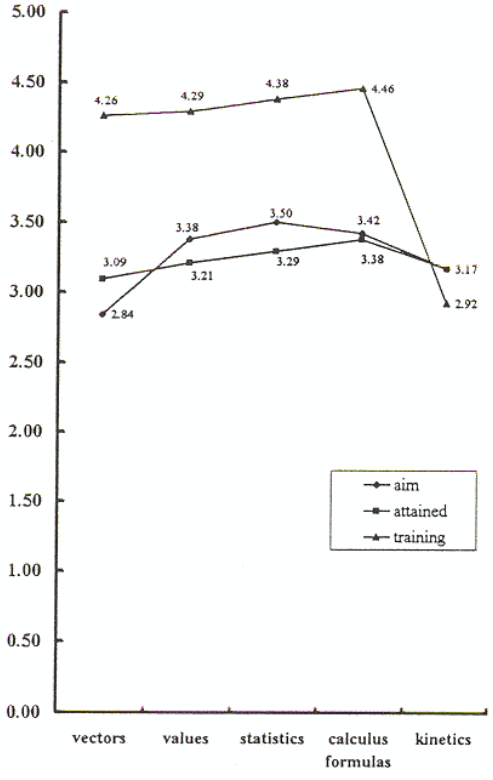


Fig. 44 View of the curriculum (Applied Math)

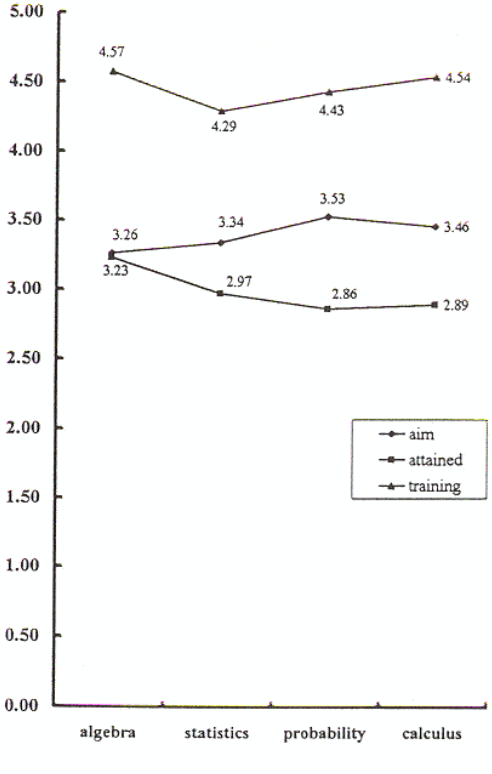


Fig. 45 View of the curriculum (Mathematics & Statistics)

9.3.3. Views on teacher education

Primary mathematics teachers thought that what helped them most were interactions with their peers (mean = 3.89 across a 5-point scale), their own school learning experience (3.79), textbooks (3.54) and reference books (3.53) (in that order). The least helpful ones were seminars (3.16), learning experience at universities (3.16) and the curriculum document (3.17).

For secondary mathematics teachers, the most helpful means were their own school learning experience (4.08), reference books (3.83) and interactions with peers (3.78). Least helpful ones were seminars (2.92), curriculum document (3.13) and short courses (3.16) as perceived by teachers (Figure 46).

9.3.4. Major problems

The major problems in mathematics education as perceived by teachers were very consistent across primary and secondary levels. The extents of seriousness perceived were more or less the same too, except for the three items "low student motivation", "students knowing nothing of ways of thinking" and "students unable to understanding mathematical concepts". These problems became more and more serious as we moved up the grade levels.

More problems appeared in senior primary than in junior primary. At junior primary level, the most salient problems as perceived by teachers were "too much non-teaching duties" (mean = 4.13 across a 5-point scale), "mixed ability of the students" (3.92) and "parents stressing too much on examinations" (3.85). The least disturbing problems were "inadequate teacher training" (2.04), "curriculum too hard" (2.46) and "goals of curriculum not clear enough" (2.46). For senior secondary, the most serious problems were "too much non-teaching duties" (mean = 4.22), "curriculum unable to cater for individual difference" (3.90) and "parents stressing too much on examinations" (3.78). The least disturbing ones were "inadequate teacher training" (2.12), "goals of curriculum not clear enough" (2.57), "curriculum too hard" (2.84) and "standard of textbooks too low" (2.84).

As for the secondary level, on the contrary, more problems existed in junior forms. For junior secondary, the most serious problems as perceived by the teachers were "too much non-teaching duties" (mean = 4.21 across a 5-point scale), "mixed ability of the students" (4.09) and "curriculum unable to cater for individual difference" (3.98). The least disturbing ones were "inadequate teacher training" (2.03), "standard of textbooks too low" (2.49) and "curriculum too hard" (2.87).

For senior secondary, the most serious problems were "too much non-teaching duties" (4.09), "mixed ability of the students" (4.06) and "curriculum unable to cater for individual difference" (3.98). The least disturbing ones were "inadequate teacher training" (2.03), "standard of textbooks too low" (2.47) and "curriculum too hard" (2.67) (Figure 47).

9.3.5. Catering for individual differences

The most popular method to address individual differences was that teachers handled it by themselves in teaching (50.8%, 52%, 65.5%, 55.6% for junior primary, senior primary, junior secondary and senior secondary respectively). Remedial teaching was popular too, except for senior secondary (51%, 64.1%, 46.9%, 11.9%). Grouping students of like abilities into different classes was frequently used in senior primary (50.2%) and junior secondary (59.4%). The junior secondary was the grade levels at which most of such means were used (5 of them over 30%). They were found to be effective in the schools where these means were taken, except for the use of different test papers at the primary level (Figure 48).

9.3.6. Use of information technology

Calculators, including scientific calculators, were frequently used for mathematical instruction at the secondary level. Over 50% did. As for programmable calculators, 27.8% and 45.9% were used in junior and senior secondary schools respectively. Other forms of information technology were rarely used and none had a response figure exceeding 15%. For those who used them, most said that they were not effective, except for calculators at primary level and graphic calculators for junior primary schools. The most effective means were perceived to be calculators [Figure 49 (a - d)].

9.3.7. Beliefs on mathematics learning and instruction

The conception of mathematics learning as a transmission dropped slightly from 2.57 to 2.75 (across a 5-point scale) as the grade level moved from primary to secondary schools. At the same time, the child-centredness also dropped slightly from 3.78 to 3.69. In general, the conception that mathematics was learned by transmission was still strong.

The results are listed in Appendices 24 to 25.

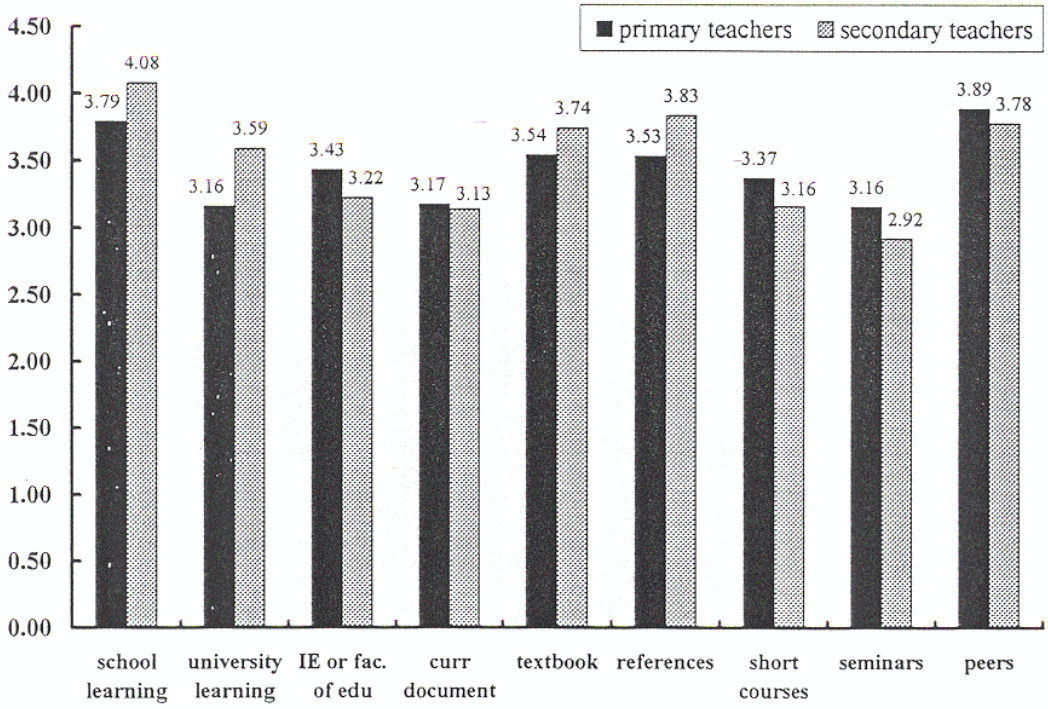


Fig. 46 Perceived usefulness of teacher support

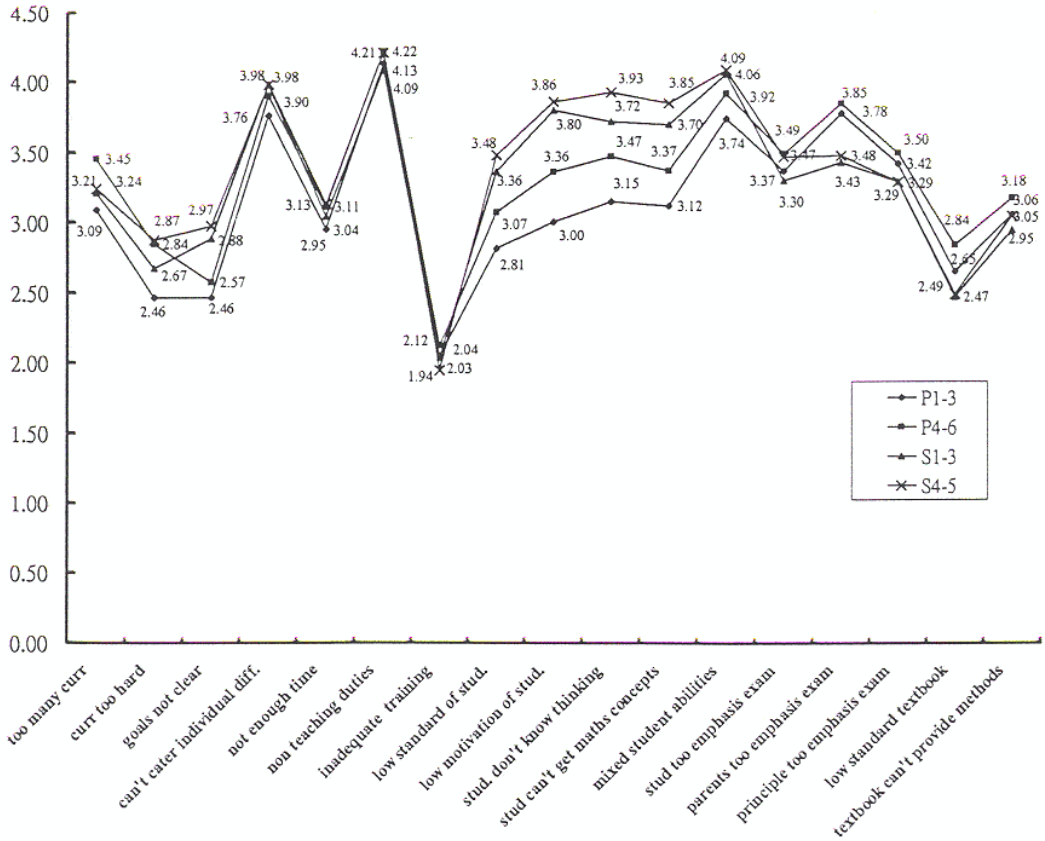
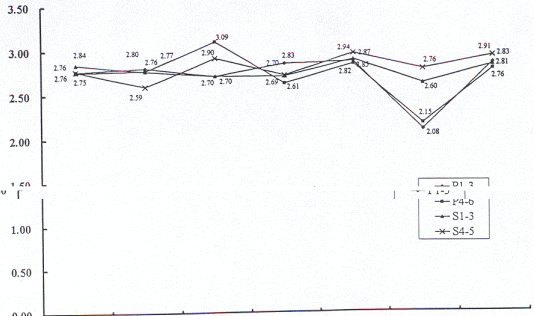
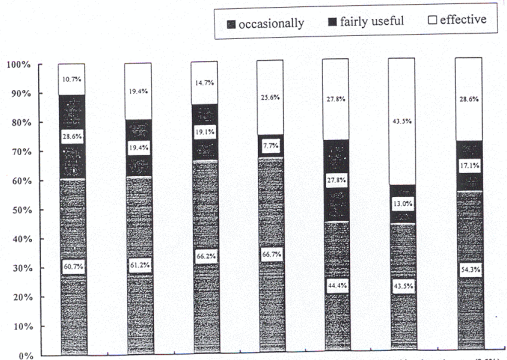


Fig. 47 Major problems in mathematics education



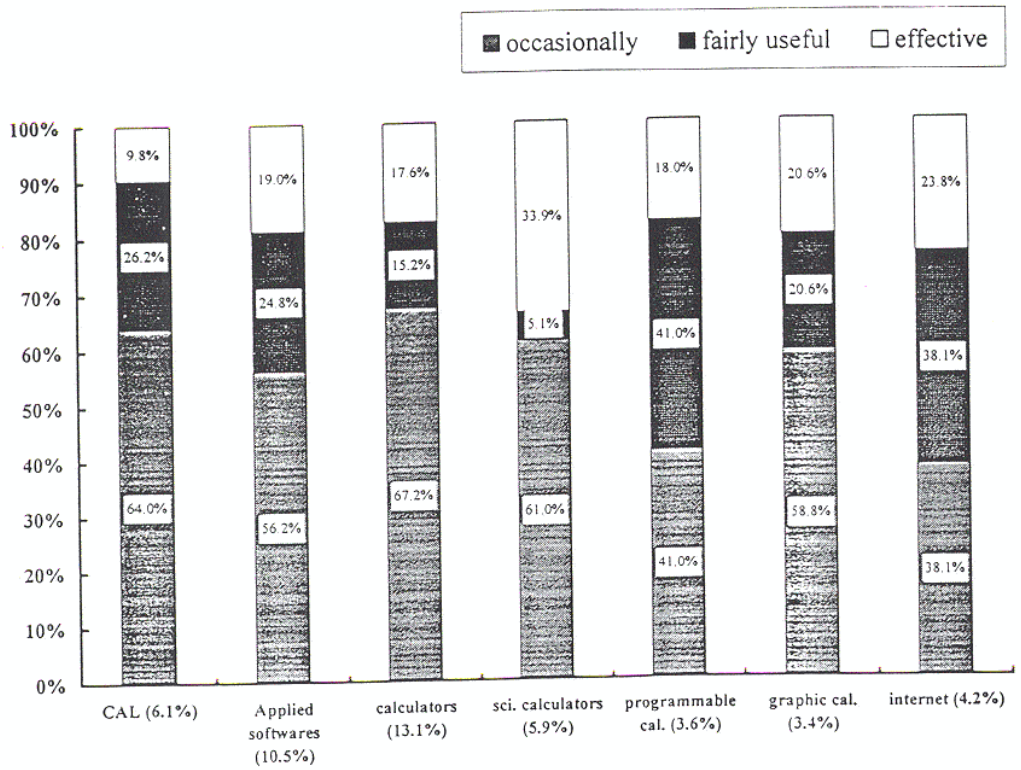
(sample %)	diff ability classes	remediate classes	diff progress	curr tailoring	diff teaching materials	diff test papers	up to teachers
P1-3	29.4%	51.0%	6.3%	23.8%	22.7%	3.8%	50.8%
P4-6	50.2%	64.1%	7.4%	21.1%	23.8%	4.2%	52.0%
S1-3	59.4%	46.9%	21.8%	34.3%	39.6%	9.0%	65.5%
S4-5	36.4%	11.9%	17.7%	25.8%	29.8%	10.8%	55.6%

Fig. 48 Perceived usefulness of means to cater for individual differences



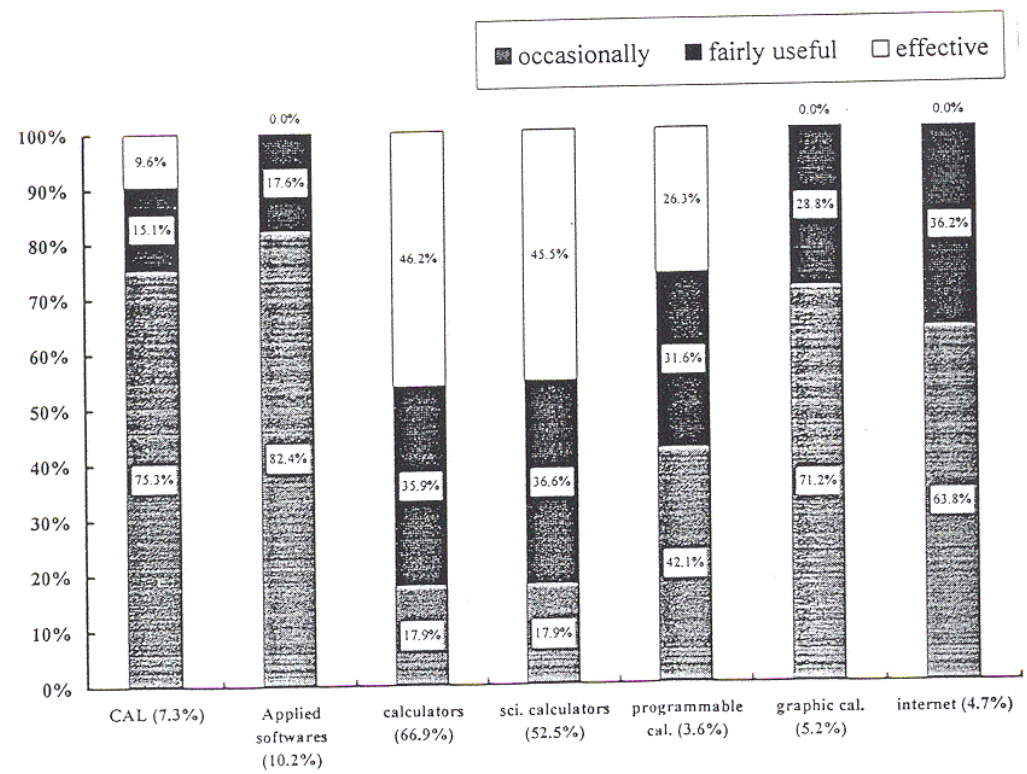
( ) percentage of use

Fig. 49(a) Perceived usefulness of information technology (P.1-3)



( ) percentage of use

Fig. 49(b) Perceived usefulness of information technology (P.4-6)



( ) percentage of use

Fig. 49(c) Perceived usefulness of information technology (S.1-3)

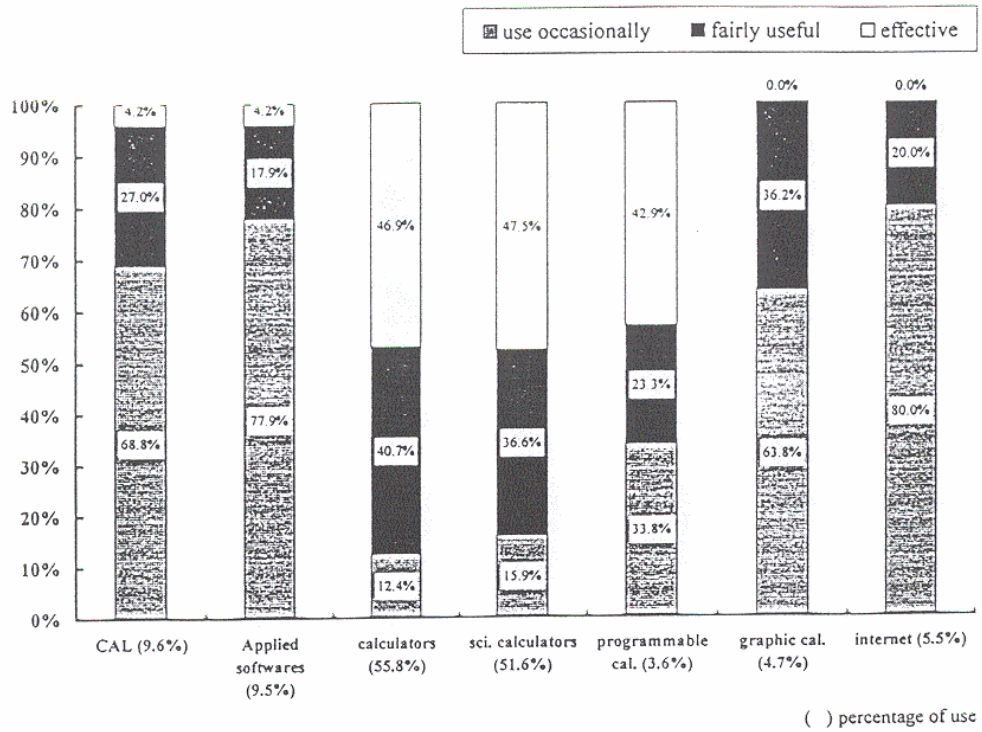


Fig. 49(d) Perceived usefulness of information technology (S.4-5)

9.3.8. Responses to open-ended questions

262 primary and 226 secondary mathematics teachers made responses to the open-ended questions. As mentioned above, the four open-ended questions asked were (a) the major difficulties their students faced in learning mathematics, (b) the strengths and weaknesses of the current mathematics curriculum, (c) their suggestions for the future mathematics curriculum and (d) their anticipations of the support system in order to implement the future curriculum.

9.3.8.1. The major problems

At the primary level, the most frequently stated problems were "students do not like thinking" (N = 86), "students unmotivated" (67), "poor understanding abilities" (54), "curriculum has too much content and has to be taught in a quick pace" (38), "not enough time for teaching" (27) and "mixed abilities of the students/ large class size" (24). As for secondary mathematics, the most frequently stated problems were "students unmotivated" (76), "weak foundation" (50), "not involved in learning/do not care to devote time" (50), "students having no thinking skill" (29) and "lazy" (22).

9.3.8.2. The strengths and weaknesses of the curriculum

The strengths of the current curriculum as perceived by primary mathematics teachers were "students possess strong computation skill" (25), "curriculum structured and systematic" (15) and "rich content" (11) whereas those perceived by secondary teachers were "the scope of the curriculum too wide" (18), "curriculum structured/ having clear instruction" (8) and "mechanical training" (8).

The weaknesses perceived by primary mathematics teachers were "content too rich" (33), "does not emphasise thinking and appreciation aspects" (29), "not enough time for student to digest" (15), "not sufficiently related to real life" (12), "not enough time for teaching" (12), and "not enough resources including computers" (12). Those from secondary teachers were "not sufficiently related to real life" (35), "content too rich" (26), "does not emphasise thinking and appreciation aspects" (15), "lack continuation and flexibility" (14) and "content too hard" (13).

9.3.8.3. Recommendations for the future curriculum

Primary mathematics teachers made the following recommendations for the future curriculum: "delete the unnecessary parts of the curriculum" (39), "add in practical or interesting topics" (34), "trim down the curriculum" (32), "add in content that stresses concepts or that can provoke thinking" (22) and "introduce information technology into mathematics teaching" (20). Those given by secondary school teachers were "add in practical and interesting topics" (38), "delete unnecessary topics" (36), "trim down the curriculum" (25), "introduce information technology into mathematics teaching" (19), "introduce challenging or investigative problems" (12) and "introduce flexibility and choices into the curriculum" (10).

9.3.8.4. Anticipations on the supportive system

Primary mathematics teachers expressed the following anticipations on the Education Department and related supportive systems: "provide teaching materials and teaching aids" (39), "reform the curriculum and goal of education" (38), "provide in-service courses" (26), "provide software for computer-assisted learning" (19) and "listen to the teacher/officials in the Education Department should experience the situation themselves" (10). Those coming from the secondary sectors were "provide teaching software and resources" (36), "reform the curriculum and goal of education" (27), "provide in-service courses" (14), "lower teacher-student ratio" (13), "reduce non-teaching duties" (13) and "reduce teachers' workload" (10).

Details of the above results can be found in Appendices 26 to 27.

9.4 Summary

Teachers were generally satisfied with the current curriculum though there were some discontents on the Applied Mathematics and the Mathematics & Statistics curricula. They felt that they possessed adequate mathematical knowledge for their teaching but we should note that this was only the teacher's perception and they were not referring to their competence to teach. It is also note-worthy that around 1/3 of the teachers admitted that they had inadequate knowledge to teach classical mechanics in the Applied Mathematics syllabus.

Those topics not well-attained by the students in the eyes of the teachers were fraction, time, capacity and money for junior primary, percentage and equations for senior primary, and trigonometry and geometry for junior secondary. These were quite consistent with students' and parents' perceptions. We notice that most of these topics (except possibly geometry) involved tedious calculations. Results from an inventory also indicated that teachers were more inclined to take mathematics instruction as a form of transmission rather than self-discovery.

Teachers directed most of the current problems in school mathematics onto the students' side. Low student ability and motivation (including thinking skill, basic knowledge, etc.) were stated as the major problems at all levels. Too much non-teaching duties remained high in the list. Not much discontent was directed to the curriculum or to other parties as reflected in the questionnaire, except that primary mathematics teachers did complain about parents emphasising too much on examinations. Teachers did mention their views on the current curriculum in the open-ended questions. The general picture of the current curriculum was that it was bulky, (computational) skill-based and lacked thinking, real-life and cultural components. The curriculum lacked flexibility but its clear structure and instruction were welcomed by the teachers. Teachers' hope for the trimming down of the curriculum was quite unanimous.

Mixed ability, large class size and individual differences were perceived as major problems too, and it seems that teachers did not rely on systematic ways of handling it. Rather, they tended to handle individual differences by adjusting the teaching themselves, though remedial teaching was another popular mechanism existing in the school system. Nevertheless, most of these means were perceived as effective. However, it would not be of too much help if students in different

classes were tested again by the same set of standards even though different teaching strategies were taken to cater for individual differences. The limited use of different test papers could be due to the fear of extra workload (in setting more than one test paper) and "fairness" which was so highly regarded in the community. This should be carefully tackled in the investigation of means for handling individual differences.

The use of information technology was only in its initial stage. Besides ordinary and scientific calculators, which were "standard equipment" in public examinations, other means in information technology were rarely used. However, not many resisted their use (see Appendices 24 to 25), and for those who used, most of them found it effective. With the provision of equipment (including readily available software) and guidance, it is foreseeable that more teachers would be willing to incorporate information technology into the teaching of mathematics.

Inevitably, teacher quality is the key to any curriculum reform. In particular, subject content knowledge is as important as pedagogical knowledge. It is quite disturbing that most primary mathematics teachers did not possess a strong mathematics background in their formal teacher training, and most teachers, be they primary or secondary, relied on their own school experience in their teaching. If the existing school mathematics teaching contained various problems, including strong examination-orientation and relying too much on rote learning, this could indicate a possibility of a vicious circle. As discussing with colleagues and other mathematics teachers was another popular way to seek for help, collegiate exchange within the circle, including seminars and workshops, could offer a potential means to enhance teacher professionalism. However, as teachers indicated that seminars were not so welcomed, we need to explore whether teachers need more spare time to get themselves involved in such activities. Furthermore, as curriculum documents are becoming more sophisticated as well as complicated these days, and in fact the above results revealed that teachers seldom referred to the curriculum, we should create other more "user-friendly" channels such as various curriculum materials to advocate the spirit of future curricula.

Reduction of teachers' workload and communication with colleagues in the education departments were what teachers hoped to see in the future curriculum implementation. Provision of more resources and teacher training courses would be important too.

(This is a blank page)