

**Consolidation and Redevelopment (C&R) Work  
on QEF Projects on Mathematics Education**

**Final Report**

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## **Consolidation and Redevelopment (C&R) Work on QEF Projects on Mathematics Education**

### **Executive Summary**

For almost two decades since the establishment of Quality Education Fund (QEF) in 1998, it has spent billions of dollars funding thousands of projects which have claimed to promote quality education in Hong Kong. In order to better understand the effectiveness as well as the impact of those QEF projects, and to make them useful in some ways to whoever wants to make further developments within the compass of QEF initiative, it is expected that, with a selection of some good QEF projects, consolidation and redevelopment (C&R) work could lead to better understanding and conceptualisation of the major issues and themes of a particular field in education.

In the present case of mathematics education, C&R work has been done with a selection of 65 QEF projects (provided by QEF Secretariat) which are all mathematics-related. Starting with a review based on the Context, Input, Process, Product (CIPP) evaluation model that focuses on the context, input, process and product of each of the projects, we studied the project proposals, their final reports and, if available, the deliverables. Together with a questionnaire survey which has a response rate of 41.5%, the study has come up with an overall understanding about some particulars (including self-assessment of the success, the continued development after the project ends, the perceived success factors, difficulties encountered, etc.). Despite the serious difficulties in getting back to the personnel of the selected QEF projects for interviews, we managed to understand better the particular kinds of needs being addressed by the QEF projects in a few cases as well as the project experience and achievement in follow-up interviews with teachers in 4 schools (related to 5 of the selected projects). Findings of the interviews echo the results of the questionnaires. In particular, despite various limitations and constraints in terms of resources (including available time and colleagues with heavy workload), most project participants confirm that the major success factors are related to the people – such as their enthusiastic involvement and collegial support. Regarding problems and difficulties, workload (e.g. extra project commitments without much reduction of normal teaching load) is one thing. But there are also concerns about the sustained development of the project initiative, from the familiarization to the continued development after the project ends, which should take very

long time. Undoubtedly, practical problems (such as loss of the deliverables and technology-based deliverables gone outdated) have negative effect on the continued impact of a QEF project.

Based on the review of the 65 projects on mathematics education, the C&R work also set out to produce a resource package which should be informative and helpful to mathematics teachers and curriculum leaders on the major themes and issues relevant to development of quality mathematics education. The 6 themes are: (1) mathematical concepts, (2) mathematical thinking, (3) tools and tasks, (4) curriculum innovation, (5) assessment, and (6) teacher professional development. For each of these six themes, the resource package provides explanations and illustrations by examples taken from a few of the selected projects as well as online resources from well-known websites. It is recommended that further developments may focus on a certain theme.

There is also a final recommendation regarding the way forward from the perspective of QEF Secretariat. Having recognized the importance of teacher professional development (in terms of their knowledge, teaching, leadership, and teachers as a professional community), and given that QEF Thematic Network (QTN) has been established in other areas such as Chinese Language and English Language, we also make a recommendation to QEF Secretariat that QTN on mathematics education should also be established so that mathematics teachers would have opportunities to build professional development community in which similar concerns and interests can be shared and worked on for the betterment of mathematics education.

The C&R work also includes a Dissemination Seminar which this report also covers. Suffices to note in this summary that the feedback collected at that seminar was encouraging and supportive of the ideas to be included in the Resource Package.

# 1. Background

The Quality Education Fund (QEF) was established in January 1998 with the objective of financing projects initiated by the education sector for the promotion of quality education in Hong Kong. To date, the QEF has granted over \$4 billion to support more than 8,200 projects from which successful experiences and quality deliverables have been generated. The QEF has all along been engaged in attempts to identify the success factors from quality projects for wider dissemination and recently wishes to commission external professional services for “mathematics education” as a new theme of consolidation and redevelopment (C&R) work financed by QEF for more effective dissemination.

There are a considerable number of QEF projects on Mathematics Education and related themes which have generated various deliverables such as teaching packages, booklets, CD-ROMs and websites. These deliverables contain exemplars of good teaching and learning practices worthy of dissemination. A selection of 64 QEF projects related to mathematics education was provided by QEF Secretariat in December 2013 (with one more added to the selection later in 2014, thus making up a total of 65 covered in this project), which should provide a good starting point for such C&R work.

Upon the completion of the C&R work, a resource package should be prepared so that teachers at school can have an opportunity to capitalize the good QEF projects in the past. Moreover, recommendations are expected to be made to the QEF Secretariat on future developments of mathematics education in Hong Kong within the scope of QEF aims and purposes.

## 2. Project Overview

### 2.1 Objectives and Scope of C&R Work

Against the background described in the previous section, the C&R work aims to:

- i. Understand and conceptualize the major concerns for mathematics education in schools, the works done to address the concerns accordingly, and the resulting effects and impacts thereof, as revealed by the selected QEF projects related to mathematics education;
- ii. Produce a resource package for mathematics teachers (and related curriculum leaders) in schools, who want to make good use of past QEF projects, providing them with guiding principles, examples of good practices, exemplars of learning and teaching resources, together with general recommendations about possible developments for quality mathematics education in their own schools;
- iii. Make recommendations to the QEF for further developments (such as setting up of QEF Thematic Network (QTN) and possible enhancements or build-on projects) on mathematics education; and, all in all,
- iv. Contribute to the ongoing curriculum development for mathematics education within the compass of QEF initiatives.

In order to achieve these objectives, the C&R work will fall within the scope as outlined by the following list of tasks:

- (a) study the 65 selected projects funded by QEF on “Mathematics Education”, including a questionnaire survey to the corresponding schools or organisations;
- (b) select worthwhile project outcomes, deliverables, exemplars for further research and development with reference to well-established criteria and research framework and methodology;
- (c) interview project leaders concerned whenever necessary;
- (d) conduct research and development work on the selected project deliverables with a view to producing a resource package for teachers with guiding principles, good practices, exemplars, teaching resources and user guide, etc.

- (e) based on (d), produce a resource package of marketable/saleable quality ready for printing or production by QEF;
- (f) make recommendations to the QEF on the setting up of a QEF Thematic Network (QTN) on the theme of “Mathematics Education”;
- (g) advise on the enhancements to be made for running built-on projects aiming to encourage grantees of projects with potential impact to submit proposals on wider applications across schools; and
- (h) conduct at least one territory-wide seminar to disseminate the good practices and exemplars consolidated and developed from the QEF projects concerned.

The list of the 65 QEF projects selected by QEF Secretariat can be found in **Appendix A**.

## **2.2 Project Approach**

Given the objectives stated above, the C&R work set out to review the 65 selected QEF projects on mathematics education completed within the period of more than a decade (between 1998 and 2013). Drawing on the literature on general evaluation (to be further elaborated in the next section) as well as the academic knowledge and professional expertise in mathematics education, the Project Team conducted the review which should be instrumental in constituting an empirically grounded picture of the current developments of the school mathematics education in local context. For this purpose, focuses of the review conducted on the 65 selected projects were set on the following aspects:

- Needs perceived in specific contexts for quality mathematics education;
- Works conducted in order to improve or enhance the mathematics education in specific contexts;
- Effects or results achieved in specific contexts, and perceived impact in the wider community;
- Further developments envisioned (if any);
- Sustainability of the effects and impacts;
- Difficulties and obstacles experienced in implementing the projects and achieving the project aims;

- Applicability of the deliverables (e.g. teaching resources) and/or generalizability of the good practices (e.g. particular classroom organization, instructional approaches or pedagogical strategies) for other schools and teachers.

Empirical evidence came from analyses of the data collected from:

- Project proposals and reports;
- Project deliverables such as teaching packages, booklets, CD-ROMs and websites (whenever retrievable and accessible);
- Questionnaire survey supplemented by interview with project leaders (whenever necessary) or other teachers involved in the projects.

While the review would provide a refined, empirically grounded understanding and conceptualization of the conditions (including strengths and needs) of the school mathematics education in local context, as well as the major concerns of the stakeholders involved, it should thus give rise to consolidation and redevelopment of the QEF projects in two different ways:

1. Resource Package (for mathematics teachers and related curriculum leaders) which should serve at least two purposes: (i) provide readily accessible resources for learning and teaching, and (ii) provide recommendations and insights about possible developments in curriculum and curriculum resources for quality mathematics education. For such purposes, this Resource Package should include the following components:
  - Guiding principles of good practices, with illustrative examples taken from the QEF projects;
  - Exemplars of resources for mathematics learning and teaching extracted from the QEF projects;
  - Descriptions and/or explanations that should show the structure and organization of the recommendations and resources in terms of the categories (with respect to both the mathematical contents, i.e. topic areas and levels, and/or general educational concerns) generated from the review.

2. Recommendations to QEF regarding its future developments which should cover the following two aspects:
  - Possible enhancements of certain QEF projects (e.g. suggestions of built-on projects that would materialize potential impact or lead to wider applications across schools);
  - Setting up of QTN in mathematics education (given that QTNs on various themes or areas have been established since 2006 with a view to disseminating good practices derived from QEF projects and promoting professional sharing among networked schools/educational organizations).

Good practices for quality mathematics education and exemplars of learning/teaching resources, as illustrated by the Resource Package, will also be disseminated through a territory-wide seminar.

Members of the Project Team are convinced that the C&R work on the QEF projects will be a significant contribution to the ongoing curriculum development (particularly the directions and strategies of further developments, as well as the development of curriculum resources) for quality mathematics education within the compass of QEF initiatives.

## **2.3 Project Team Information**

The Project Team is comprised of 4 academic members of staff and one research assistant of Faculty of Education, The University of Hong Kong. They are:

- Mr WONG Ka Lok, Senior Lecturer (Project Leader)
- Dr Arthur M S LEE, Lecturer
- Prof Frederick K S LEUNG, Professor
- Dr Ida A C MOK, Associate Dean (Local Engagement) and Associate Professor
- Mr Steve H C TSANG, Research Assistant

All the academic members possess relevant professional and research qualifications and previous experience in educational research, including international studies.

Their long years (more than 15 years for each of them) of involvement in teacher education and various consultancy and professional support services grant substantial grounds for comprehending the needs of local mathematics teachers and envisioning further developments of local mathematics education.

Mr Wong's research work has been concerned mostly with (1) learning and teaching of mathematics, particularly assessment for learning and the pedagogical use of technology; (2) mathematical literacy (based on Programme for International Student Assessment (PISA) research); (3) curriculum development and (4) professional development of mathematics teachers.

Dr Lee's research work has been focusing on development and evaluation of instructional design in general and use of technology in particular for quality mathematics education.

With very rich research experience in a wide range of topic areas, Professor Leung has his expertise in Trends in International Mathematics and Science Study (TIMSS) research and thus the implications to learning and teaching based on TIMSS results.

Dr Mok's research work has been mainly concerned with (1) learners' perspectives of mathematics lessons; (2) tasks for mathematics learning, particularly those catering for individual differences; (3) mathematics teachers' pedagogical content knowledge and (4) quantitative literacy.

### 3. General Evaluation Using the Context, Input, Process, Product (CIPP) Evaluation Model

QEF is meant to bring forth quality education through improvement of the current educational situations. Just as the QEF projects consume public funds, they are supposed to be accountable to various stake-holders. While we tried to gain a general understanding of the nature of the improvement intended as well as the effectiveness (i.e. the resulting improvement) of the selected QEF projects, we started by following the well-established classical CIPP Model. Formulated by Professor Daniel Leroy Stufflebeam at The Ohio State University Evaluation Centre for the purpose of evaluating educational programmes in public schools in the late 1960s, the model focusses on four aspects of the project or programme under evaluation, namely, Context, Input, Process, and Product, and thus the acronym CIPP is coined. In addition to its original purpose of systematically providing evaluative information for use in decision making, the CIPP Model, as Stufflebeam (1971) himself has claimed, “also affords an adequate means for accountability”. That is to say, while CIPP “is intended to facilitate educational improvement through a *proactive* approach to evaluation”, it also concerns “a *retroactive*, as opposed to proactive, use of evaluation.” It provides educators with “a powerful tool ... for *post hoc* accounting for those decisions and actions [performed in the past]” (Stufflebeam, 1971, *original emphasis*). In short, it is concerned with improvement and accountability, and it can be used to evaluate projects and programs. We thus tried to evaluate the selected projects based on the four aspects:

- Context – what needs to be done?
- Input – how should it be done?
- Process – is it being done correctly?
- Product – did the project succeed?

#### 3.1 Context

Looking at the needs of the schools and the objectives of the projects, we can see that the selected projects are mostly tackling with typical needs as listed below – in order of popularity (number of projects that have tried to tackle the respective need as

described is put in brackets). Naturally, improvement of learning and teaching is one of the major concerns. Based on different perceptions of the situation and the issues arising thereof, there are different emphases of their work. For example, some projects focused more on particular kinds of teaching strategies (such as those encouraging more interaction with students in general and others using games in particular). Some others had more explicit concerns with the development of school-based curriculum whereas others with the development of effective methods of assessment (for learning). Certainly, just as learning and teaching situation and/or the curricular circumstances confronting a school is complicated (even if we are concerned with the subject area of mathematics within the scope of our work), the needs as the projects were catering for cannot be easily categorized. To say the least, the descriptions serve more to provide a general picture than an exclusive categorization.

- (a) Improving learning and teaching (56)
  - Interactivity (games, role play, interactive whiteboard)
  - Projects, e-learning, competitions and campaigns
  - School-based curriculum(13)
  - Assessment (6)
- (b) Catering for learning diversity (13)
  - Remedial (8)
  - Gifted education(3)
  - Non-Chinese speaking students (4)
  - Special Education Needs (SEN) (2)

## 3.2 Input

We tried to identify the input for the selected QEF projects, particularly some basic facts about the planning and implementation. There are the following observations:

- (a) Amount of grant received has a median of HK\$311,000.
- (b) Time input (i.e. duration of the project) was mostly one year. Only a few lasted for 2-3 years.

- (c) There were 9 projects initiated by universities/research centres; others were all initiated by schools.
- (d) Among those projects initiated by schools, there were 18 of them which employed consultants or experts from outside (such as educators in the universities).
- (e) Most of the projects involved one school.
- (f) The number of core team members ranged from 5 to 10.
- (g) Most of the projects (48) employed extra members of staff (teaching assistants, supply teachers, etc) during the project period.

As expected, the above factual particulars reveal that we could only limit ourselves to material input when we tried to understand the input to the wide range of projects in the past. However, they are suggestive of short-term input (e.g. for one year) within the bounds of the local context of a single school in most cases (e.g. less than one-third of the 56 projects initiated by schools did not reach out for external consultants or experts, nor collaborate with other schools). Given that tens of thousands of Hong Kong Dollars were injected, and thus supportive and helpful assistants were employed to relieve the workload of the original members of teaching staff during the project period (one year in most cases), the influence might have lasted for a limited period of time.

### **3.3 Process**

It is about the implementation. Apart from the basic facts as listed above for “input”, it should be understood with reference to more details such as procedural barriers, unanticipated events and, more importantly, in-process project adjustment (e.g. that due to logistic factors) (Zhang et al., 2011). Undoubtedly, these details should have made significant impact on the success or failure of a project. However, based on the proposals, the final reports and, for some projects, limited collection of the project deliverables, there is little information about the implementation process in detail. It was expected that the questionnaire survey and particularly the interviews can help showing more about the process.

### 3.4 Product

It is concerned with the project outcomes – both tangible and intangible. Nevertheless, by looking at the written reports and the deliverables in some cases, we could have access more to the tangible outcomes than to the intangible ones. Tangible outcomes, part of which were made as deliverables, range from lesson plans, worksheets, and PowerPoint files to websites, software, etc. Intangible outcomes may include the enhanced collaboration of the teachers, more effective pedagogical strategies, better teachers' self-efficacy, etc. While the latter kind of outcomes could be packaged as experience sharing in public occasions (such as dissemination or sharing sessions as usually organized upon the completion of QEF projects). In any case, such growth of experience and professional insights are not easily transferrable. Actually, if we were to evaluate in detail the products of the projects, the evaluation could be based on (i) readiness to share, (ii) accessibility, (iii) reusability, (iv) sustainability, and (v) beneficiaries. Many projects among the selected 65 do not have the deliverables available for such analysis. While 32 projects get only the Proposals and Final Reports, some others have only part of the deliverables. Moreover, some of the deliverables are outdated software which can no longer function in modern operating systems. It is thus not any fair comment if the analysis would be based on only partial information about the products of the selected projects.

## 4. Project Results

### 4.1 Questionnaire survey

In order to understand better how the project personnel at the schools perceive the success of the project and the difficulties (e.g. resources available, workload of the project team members, support from other parties, etc) in its implementation, we did a questionnaire survey in January 2015. Regarding the perceived success of the project, the questionnaire also probes the developments after the completion of the project. However, in order not to create much burden to the teachers filling in the questionnaire, we try to make the questionnaire as simple as possible. To say the least, instead of seeking for comments and responses to open questions, we have tried to make the best use of different types of closed questions such as rating and multiple-choice responses. An electronic version was also provided online – if the respondent would prefer, email return was accepted. (Please refer to **Appendix B** for the Questionnaire, together with the covering letter, in both English and Chinese.)

We sent questionnaires to all the persons-in-charge of schools/organisations which hosted the 65 selected QEF projects. With follow-up calls made after the two-week return period, we eventually received 29 completed questionnaires in the few weeks that followed. These 29 questionnaires corresponded to 27 selected projects, because on each of two particular projects (see the list in **Appendix A**), another teacher (also as a user of the project outcome) filled the questionnaire – in addition to a core team member/teacher. Thus, the response rate, in terms of the number of projects, is 41.5%. More than half (62.1%) of the responses were filled out by the Project Leaders, whereas almost 30% by core team members on the projects. It is thus believed that the reported details should be reliable. Unless otherwise stated and justified, we take 29 questionnaires as the reference in working out the percentages, although they refer to 27 projects.

In general, the respondents were positive about the projects they had undertaken, as revealed by the encouraging responses to some of the questions listed below:

Statements (Question No. in brackets)	Mean*	Standard Deviation
Overall, the project was successful. (Q7)	4.1	0.44
The project was implemented smoothly. (Q4)	4.1	0.49
The project was carried out on schedule. (Q5)	4.3	0.53
The project can enhance teacher professional development. (Q18)	4.0	0.76
* The mean (N = 29) shown here is based on a 5-point Likert scale, with “strongly disagree” equal to 1 and “strongly agree” equal to 5.		

Regarding the factors that would have significantly contributing to the success of the projects, we asked the respondents (Question 8) to choose a maximum of three factors from a given list. We come to the following list of factors in decreasing order of the number of respondents making the choice (numbers in brackets indicate the number of respondents, out of 29 of them, making the choice):

- Enthusiastic involvement of project team members (22)
- Cooperation and support from the school and the colleagues (18)
- Reasonable project schedule (9)
- Expert advice and support for project team or teachers (8)
- Acceptable workload for project team members and teachers (7)
- Project support provided by supply teacher(s) / teaching assistant(s) / research assistant(s) (7)
- Reasonable division of labor (7)
- Training workshop(s) / seminar(s) for project team or teachers (6)

If there were any problems that had hindered the success of the projects, respondents were asked (Question 9) to choose a maximum of three problems from a given list. Only 4 of the 29 respondents gave indication of the problems they had seen. The perceived problems are listed, together with the very small number of indications (in the brackets attached to each item below) of the 29 respondents:

- Lack of expert advice and support for project for project team members or teachers (2)
- Lack of project support provided by supply teacher(s) / teaching assistant(s) / research assistant(s) (2)
- Very tight project schedule (2)

- Heavy workload for project team members and teachers (2)
- Lack of cooperation and support from the school and colleagues (1)

The overall results of Questions 8 and 9 above show that, although resources and support (in terms of expert advice, professional training, assistance to release the workload, etc) are important, enthusiastic involvement and cooperativeness amongst colleagues, i.e. collegial support and collaboration, carry far more significance. Having said that, the respondents tended to agree (mean = 3.4 on 5-point Likert scale, with standard deviation = 0.94, in Question 11) that the teachers involved in the core team had very heavy workload due to the project. In Question 10, most of the respondents (21 out of 29, 72.4%) reported that there was no reduction of teaching hours for the teachers in the core team. Among those 8 who claimed a reduction, the mean was 3.4 hours per week/cycle, ranging from 1 hour to 5 hours.

We are also concerned with the developments *after* the completion of the QEF projects. Among the 29 respondents, 25 (86.2%) of them reported (in Question 12) that the activities (e.g. pedagogies or extra-curricular activities) developed out of the project had continued to be practised after finishing the project. The number of years of continued practice, as reported, was reasonably long but varied quite much (mean = 6.6 years, standard deviation = 4.6 years). It suggests the very different impact that a QEF project may bring to a school – in terms of the length of time of the impact at least. Reasons for not continuing the practices, as reported by four other respondents, include the fact that the technology used in the project has become outdated afterwards, and the lack of financial or human resources. This may explain why we do not get a very high rating (mean = 3.4 on 5-point Likert scale, standard deviation = 0.95) in response to the question (Question 13) whether the product(s) or deliverable(s) developed in the project has/have been in use after the completion of the QEF project.

The impact that the QEF project had brought to the school was also considered (Question 15) in terms of further developments or other projects generated after the completion of the QEF project. We have positive replies from 16 (out of 29), i.e. 55.2% of the respondents, which include continued revision of the lesson designs, extension of the ideas to other grade levels or areas (or even subject areas in cases of general pedagogical approaches), further investigation (e.g. taking the form of other

projects or collaboration with other organisations), more participation in relevant activities (such as competitions), etc.

When being asked (Question 16) about the best part of the project, some respondents were brief (e.g. “teaching material” or “teaching method, enhancing the effectiveness of teaching”), whereas many more could give very specific descriptions. Such specific descriptions referred to the particular activities (be they learning activities for the students or professional development opportunities for the teachers) or learning/teaching/assessment materials due to the projects. However, while almost all respondents (28 of them) managed to identify the best part of the project, a few less of them (23 of 29) could suggest (Question 17) very specific part(s) of their respective project to other schools for further development. Similar to the responses to Question 16, the suggestions made in Question 17 were specific to the projects concerned. Nevertheless, in addition to a couple of explicitly negative responses (“nothing”), a few other responses particularly pointed out that the thing (be it technology or teaching method/model) had either gone outdated or become commonplace. For example, “student-based cooperative learning” was considered as an innovative attempt of a project more than ten years ago; but the respondent at that school now regarded it as nothing new. Likewise, when referring to the e-learning project developed more than ten years ago, it was commented that the technology available at that time had been far behind what we could do nowadays, despite an acknowledgment that the project had provided a “stepping stone” for the current developments. This echoes the fact that more than half (16 out of 29, in Question 14) reported that the products or deliverables are no longer available to the public or different schools. For those who were positive on Question 14, some pointed out that the deliverables had been submitted to the QEF Resource Centre whereas some others referred to certain methods of access which were not easy (e.g. visits to the school library or enquiries to the school).

## **4.2 Interview**

We tried to get in touch with the schools and/or persons-in-charge of some of the QEF projects in order to:

- i. understand better something we considered as interesting but not very clearly understood based on the reports and limited materials available; or
- ii. get the missing materials which we considered as good and worthy of further investigation while there were only the proposals and reports at the QEF online resource centre.

With these criteria, we wanted to meet the project members on 22 projects at the beginning. At a later stage – after the questionnaire survey, it was obvious that we should try only those persons-in-charge who had responded to the questionnaire. To say the least, only when there was a contact person named in reply to the questionnaire could we approach for an interview. However, it was not easy to get in touch with the teachers for they appeared to be extremely busy. In some cases, we called the teachers every day for two weeks before we could finally get in touch with them. Arrangement of an interview was difficult because a number of the project leaders had become panel-chair/department head or vice-principal so that their very tight schedule could not afford any interview before the Easter holiday (2015). We tried to get back to about 15 schools for an interview; but eventually we managed to conduct interviews with only *four* schools (covering *five* projects).

Project No.	Project Title	School
2004/0323	Teaching Mathematically	Sheng Kung Hui Mung Yan Primary School
2004/0580	Assessment for Learning: An Exploratory Study on School-based Assessment in Junior Form Mathematics	Christian Nationals' Evangelism Commission Lau Wing Sang Secondary School
2005/0462	School-based Assessment Alternatives in Junior Secondary Mathematics - A Topic and an Investigative Approaches	
2005/0651	Web-based Mathematics Learning Platform	Yuen Long Public Middle School Alumni Association
2011/0224	Strategies to Enhance Learning Motivation	Tai Po Old Market Public School (Plover Cove)

In each of the interviews, we discussed the implementation details and difficulties encountered, whether and how the project had continuously developed, the long-term impact of the project on the school, and suggestions on how other schools can make use of their project results/deliverables. A summary of the interview findings with the teacher-in-charge at each of the four schools (covering five projects) as listed above can be found in **Appendix C**.

Just as these interviews allowed more in-depth communication, we considered that these few cases as revealing on some interesting points about what was perceived as problems and difficulties, and what as achievements in their QEF projects. Without a case-by-case summary, the following list provides a summary of these points, with the relevant Project Number(s) included in square brackets:

- Despite very few core team members, great success of the QEF project did not come from the project itself but the long years of preparatory works (collaboration with the consultant) prior to the project. [2004/0323]
- Similarly, success of a QEF project did not come easily with the completion of the project, especially when it was expected that the relevant pedagogy to be adopted by other colleagues not on the project. It took 10 years to convince the others and to gradually refine the project ideas and materialize them in everyday classroom teaching. [2004/0323]
- The project created opportunities for teachers to expose to new ideas as well as new ways of professional sharing amongst colleagues. [2004/0580; 2004/0462]
- The web-based platform, developed out of a QEF project, was very useful. In particular, a mathematics-specific online tool [namely, the equation editor] was created. However, the software CD was lost; the one held by QEF was also lost. There was also the fact that the software would become outdated some time. It is a problem of sustainable development in the case with information technology. [2005/0651]
- In the case of a certain pedagogical strategy, even if there are the teaching materials to be shared, it would not be easy for the others to

see how the classroom could actually work with the pedagogical practice. [2011/0224]

- A pedagogical strategy may not be very effectively bringing impact on students' learning if it is limited to the classroom teaching of only one subject. It is a matter of consistent and persistent usage of the strategy in other subjects. [2011/0224]

### 4.3 Discussion of the Findings

Generally speaking, the questionnaire results collected from the 29 respondents appear to be quite positive (in terms of the satisfaction with the implementation and the general success – including teacher professional development), despite the various extent to which the QEF project might have brought impact to the school and the broader community with other schools.

Assume that we did have a general success across these project schools/organisations. Regarding the success factors, noteworthy is the overwhelming recognition of the “enthusiastic involvement of the project team members” as well as the importance given to “cooperation and support from the school and the colleagues” (22/29 and 18/29 respectively). This is understandable indeed. It appears that the most important thing that would contribute to successful improvements or materialization of quality education at schools is collegial relationships and mutual commitment as well as commitment to work. By the same token when talking about problems and difficulties, as revealed by one of the informant teachers in the interview, the most difficult thing in carrying out a project is to convince the colleagues that the new thing/idea would work. In short, what matters more is *people* instead of material resources. What makes a successful project is the people who are supportive and involved, and/or those who can offer expert advice.

Similarly, what would become valuable output of a project is the change of the people. It may take the form of change in the patterns of collaboration among people. Or it may be concerned with change in beliefs or attitudes of the people at a workplace where the work conditions remain largely unchanged after the project has ended. This refers more to the importance of professional teacher development at

both individual level and at the group level (i.e. as a professional community). While the responses from both the questionnaire and some of the interviewees are explicit about the very limited impact of a project (particularly in cases with such material deliverables as installation CDs) beyond the project period, it puts to question the long-term impact and/or sustainable development of a project initiative. However, if we would acknowledge the development of people and their constructive relationship involving mutual sharing and support, such intangible outcome would be even more valuable than the material deliverables or products. Valuable though, such intangible outcome can hardly be transferred to other schools or workplaces.

Without neglecting the importance and usefulness of the material outcomes and tangible products for all practical reasons, it is perhaps simply highlighting the rather commonsense point that capacity building of the teacher together with the professional community in which he/she thrives should be one of the expected outcomes and thus there should be more considerations given to the assessment or even measurement of such outcomes.

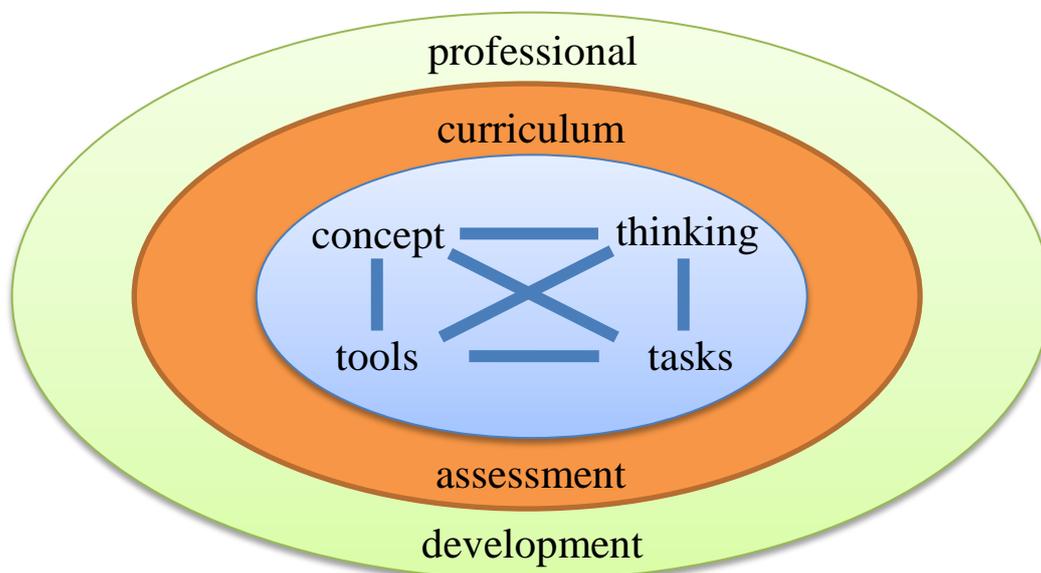
Outcome is one thing. There is another point about the process of development. As one of the interviewees pointed out clearly, the successful project she had engaged in did not turn into anything good within a short project period. It had taken years of preparation and familiarization of the background ideas, then it took another row of years for working among different opinions of the colleagues. Once again, it puts to question the effectiveness of the short-term projects.

Of course, we have to bear in mind the possible biasness of the responses collected in this questionnaire survey. Even if we had tried very hard for weeks to contact the schools for responding to the questionnaire survey, the response rate was less than half. Those who readily responded to this survey might have had so good experience with their QEF projects that they made very positive comments.

## 5. Resource Package

With a view to constructing a resource package that is based on the good works constituted by the selected QEF projects and aligned with the current needs and developments of the school mathematics education in local context, we have tried to understand the needs perceived in specific contexts for quality mathematics education and the kinds of works so conducted to improve or enhance mathematics education. This is revealed partly by the general evaluation as described above, and partly – to a much greater extent indeed – by looking carefully into the mathematical contents involved in the projects and particularly the project deliverables. We have also drawn on the literature as well as our academic knowledge and professional expertise when we try to interpret what would be helpful to mathematics teachers both in their classroom teaching and in their conception of improvement of mathematics education in its more general sense and in longer term. As a result, we come up with a resource package that comprises of the following six modules, each representing a major aspect or theme of mathematics education:

1. Mathematical Concepts (The Big Ideas)
2. Mathematical Thinking
3. Tools and Tasks
4. Curriculum Innovation
5. Assessment
6. Teacher Professional Development



The choice of the modules here, though prominent themselves in the field of mathematics education, reflects more the themes as we have interpreted the selected QEF projects than an exhaustive coverage of the common themes usually considered as important in mathematics education. We have to admit that the resulting framework and thus the examples subsequently chosen to be included in the Resource Package are much constrained by the fact that only about half (33 out of 65) of the projects include their deliverables in addition to their proposals and final reports. However, only 19 projects include some useful deliverables whereas 14 others include deliverables that are inaccessible, outdated (e.g. software no longer compatible with the current operating systems), or not very useful or worthwhile to our interpretation.

## 5.1 Mathematical Concepts (The Big Ideas)

Most QEF projects involve specific mathematical topics that provide the contents for the development of learning and teaching strategies. Although it is not always clear why certain topics have been chosen for the project work to develop, it is not difficult to see that those chosen topics are often considered in the literature of mathematics education. They often draw the attention of mathematics teachers. Difficulties they are likely to bring to learning and teaching are one thing; their central importance to various mathematical topics at different levels is another. They are usually considered as “big ideas” or “key ideas”, when they can be explicit mathematical concepts (e.g. fractions), standard computational methods (e.g. rate and ratio), or certain kinds of reasoning (e.g. proportional reasoning). Mathematically speaking they are not separate topics found in a mathematics textbook but appear in the mathematical study at different levels, constituting a connected and continuing development of a mathematical way of conception or thinking. As Martin (2011, p. 1) puts it, such “*Big Ideas ...* run under the surface of everything we do, consciously and unconsciously, when working mathematically.” While the mathematical contents in the school mathematics curriculum are always organized by topics, this perspective provides a useful approach to handling the mathematical contents in the process of learning and teaching (Martin, 2011; Newell, 2016; Ollerton & Sykes, 2012, Watson, Jones & Pratt, 2013).

With this perspective, we appreciate the suggested teaching methods or learning materials generated out of different QEF projects in handling the learning and teaching of certain mathematical topics. Following the basic premise of Askew, Brown, Rhodes, Johnson & Wiliam (1997) on the importance of a “connectionist orientation”, we are concerned with the

connections of various kinds to be constructed among different aspects of the same key concept. Rich connections can be emerging from considerations or activities focussing on, for example:

- the relationship between the concept itself and the related computational technique;
- the relationship between an abstract concept and the use of a certain tool, representation or illustration;
- the integration or isolation of the concept and the context;
- the inter-relationship among the mathematical definition, the standard mathematical method and the intuitive idea;
- the extension and linkages of different concepts;
- the special character of an illustrative example and the generality of another;
- the different ways of understanding of the same concept by different students.

A few examples have been selected from the past QEF projects to illustrate the effective ways to tackle some of the “big ideas”.

## **5.2 Mathematical Thinking**

Obviously, mathematical thinking is another major aspect of what is to be taught and learnt in the mathematics classroom. With full recognition of the importance of mathematical thinking in considering the advancement of mathematics education, the Resource Package suggests to make mathematical thinking one of the major themes for consolidation and further developments.

It is not easy to have a precise definition of what mathematical thinking is. When stating the aims of the secondary mathematics education, our mathematics curriculum (Curriculum Development Council, 1999, p.4) refers to “the ability to conceptualize, inquire, reason and communicate mathematically, and to use mathematics to formulate and solve problems in daily life as well as in mathematical contexts” which appears to be characterizing a wide range of abilities granted by the general capacity to thinking mathematically. In another curriculum document (CDC, 2002, p.2) covering mathematics for Key Stage 1 to Key Stage 3, there is a description of mathematics as “an intellectual endeavour and a mode of thinking” and as “a creative activity in which students can be fully involved and through which they can

demonstrate their imagination, initiative and flexibility of mind” when the essential role of mathematics is recognised. The allusion to “imagination, initiative and flexibility of mind” highlights the difficulties in capturing the essence of mathematical thinking, not to mention the impossibilities of doing so for a casual reader. Mason, Burton & Stacey (2010) and Watson & Mason (1998) have made very good attempts to characterize mathematical thinking and suggest related strategies (for both mathematics teachers and for mathematics learners), e.g. questioning in the mathematics classroom. Various other resourceful websites, including those hosted by well recognized institutions as listed below, also provide very good ideas and practical suggestions about mathematical thinking in mathematics education. We have recommended these websites in the Resource Package:

- (a) Standards for Mathematical Practice (SMP), as part of the Common Core State Standards in United States of America (USA)  
<http://www.corestandards.org/Math/Practice/>
- (b) Common Core Standards for Mathematical Practice (SMP), with Illustrations  
<http://mathpractices.edc.org/>
- (c) Using, Applying and Reasoning about Mathematics, suggested by NRICH Project in United Kingdom (UK)  
[http://rich.maths.org/public/leg.php?group\\_id=8](http://rich.maths.org/public/leg.php?group_id=8)
- (d) Working Mathematically, at Mathematics Centre, UK  
<http://mathematicscentre.com/taskcentre/work.htm>
- (e) Using and Applying Mathematics, prepared by the National Strategies to support the National Curriculum Framework in the UK, focusing on how using and applying mathematics can be embedded in the primary mathematics curriculum, available at The National STEM\* Learning Network, UK  
<https://www.stem.org.uk/elibrary/resource/29224>

\* STEM = Science, Technology, Engineering and Mathematics

On the other hand, there are some other generic skills which are very much related to mathematical thinking. While some of the QEF projects under our review have tried to incorporate problem solving activities, exploratory activities, and mathematical games, which usually find their way in the form of extra-curricular or co-curricular activities, some others have paid due consideration to the very important point that effective development of conceptual understanding in mathematics (e.g. understanding of the Big Ideas as highlighted in the previous sub-section 5.1) should go along with the development of mathematical

thinking. This idea aligns with the fundamental role of Big Ideas (discussed in the previous sub-section 5.1) and is reminiscent of the classic distinction made by Richard Skemp (1976) between relational and instrumental understanding in learning and teaching of mathematics. In other words, putting an exclusive focus on activities that claim to be conducive to mathematical thinking may cause extraneous burden on teachers and students who have already enough to handle in the curriculum. Instead of considering mathematical thinking as a distinctive component of mathematics learning and teaching, we propose to have this mathematical thinking in mind while working on the learning and teaching of the topics included in the curriculum from a more *mathematical* (as opposed to *mechanical*) point of view. For example, while primary kids are learning the basic operations of whole numbers, it is not only the rules of computation or standard algorithms (e.g. the column arithmetic) to follow, but also the structure and relationship among numbers (e.g. the place value in the number representation) to be learnt.

Examples taken from the QEF projects under our review and included in the Resource Package help illustrate the use of various strategies to support the learning of certain mathematical concepts, and at the same time, to encourage, directly and indirectly, mathematical thinking on the part of the learners. Strategies include the following:

- visualization of abstract concepts;
- generalization of a few examples;
- multiple representations of the same concept and their inter-relationship.

### 5.3 Tools and Tasks

Tasks have increasingly been recognized as playing a very crucial role in students' learning as well as teachers' instructional design. This is not only the case of mathematics education but also of many other subjects ranging from language subjects (e.g. English), to humanities subjects (such as history and geography), and to science education (Sullivan, Clarke & Clarke, 2013; Thompson, 2015). Tasks does not only support activity-based learning (allowing students to work hands-on) but also provide the venue where students are engaged with the knowledge development as well as conceptual understanding. In the case of mathematics, a task "initiates mathematically fruitful activity" which engages students' attention to the critical aspects of what they are supposed to learn and thus creates a learning opportunity for the students to develop a better understanding of the objects they are working on (Mason &

Johnston-Wilder, 2004). Such learning opportunities are particularly relevant to the learning of mathematics which is very often about general properties and relationships, as revealed in the words of Mason & Johnston-Wilder (2004, p. 5):

The purpose of a *task* is to initiate *activity* by learners. In such activity, learners construct and act upon objects, whether physical, mental or symbolic, that pertain to a mathematical topic. This activity is intended to draw learners' attention to important features, so that they may learn to distinguish between relevant aspects, or recognize properties, or appreciate relationships between properties.

Just as tasks are important to mathematical learning and teaching, we can find numerous websites informative and resourceful as regards mathematical tasks, some of which are well grounded in very successful projects. In the Resource Package, we have made recommendations of the following websites:

- (a) Reasoning and Sense Making Task Library, National Council of Teachers of Mathematics, USA  
<http://www.nctm.org/rsmtasks/>
- (b) Mathematics Assessment Project (MAP), Shell Centre of Mathematics Education, The University of Nottingham, UK, in collaboration with University of California at Berkeley, USA  
<http://map.mathshell.org/index.php>
- (c) Inquiry Maths, a website first created by Andrew Blair, and is now being developed in collaboration with teachers from around the world  
<http://www.inquirymaths.org>
- (d) PRIMAS, a project across several European countries to promote inquiry-based learning in mathematics and science at both primary and secondary levels  
<http://www.primas-project.eu/en/index.do>

To start with, we also make a few suggestions for the design of a good mathematical tasks:

- easy starting point, but allowing enough room to become challenging;
- open in a way relevant to the learning objectives;
- flexible in terms of the both the content and the processes involved, thus accommodating different ways of thinking and seeing by different students;
- allowing room for teacher-student and student-student interaction;

- creating opportunities for learning from misconceptions;
- encouraging students' working on the mathematical contents in multiple representations;
- encouraging students' reflection on different aspects at different points of their work.

There is one more important point about tasks. Mathematical tasks constitute one important area of mathematics education that has drawn serious attention because they are very instrumental in *both* the process of students' mathematical learning and the development of teachers' professional knowledge for mathematics teaching. When a teacher designs a mathematical task, adapts or simply use a mathematical task designed by others, he/she is exercising very much of his/her knowledge about (a) the mathematical content, (b) the curricular objectives as regards the mathematical content, (c) the students' possible responses to the questions set on the mathematical content, (d) the possible representations of the mathematical content comprehensible by the students, and (e) the practical arrangement in the classroom.

When talking about tools, most people may be considering those supported by modern technology, namely, computer technology. Despite the close connection between computer technology and the available tools for learning and teaching (especially in classrooms nowadays well-equipped with modern technology and with students also well equipped with mobile technology), we should notice the relevance of tools in terms of the dynamic characteristics and/or the manipulable features of the tools. Both are particularly relevant to mathematical learning because such characteristics and/or features can support both the direct interaction between the learner and the object of learning, and the meaningful interrelationships among different representations of the same mathematical concept. From this point of view, we do not necessarily need computer technology. A geoboard or as simple as a paper printed with squares or square grid points can be a very powerful tool that supports geometric reasoning and conceptual development in learning about shapes. Effective use of number lines printed on a worksheet can also facilitate learning through tasks with numbers and operations. With full awareness of the need of very young (primary) students for direct manipulations with real objects such as a rubber band that make lines on a geoboard, appropriate use of computer technology may enhance the learning through the dynamic mathematical objects on the computer screen. For example, good manipulable and dynamic

tools are available at the following websites recommended in the Resource Package, the first one being available in Chinese and particularly useful for primary mathematics classroom:

- (a) Magic Board, hosted by Graduate School of Education, Chung Yuan Christian University, Taiwan  
<http://magicboard.cycu.edu.tw/index.asp>
- (b) National Library of Virtual Manipulatives, hosted by Utah State University, USA  
<http://nlvm.usu.edu/>

In short, appropriate use of tools and good design of relevant tasks are crucial to effective and meaningful learning of mathematics. Moreover, developing instructional design that incorporates relevant tools and tasks is instrumental in the development of the professional capacity of a mathematics teacher. Due to the close connection between their use in developing conceptual understanding as well as mathematical thinking, examples found in the previous two sub-sections 5.1 and 5.2 also have their relevance to the present theme of tools and tasks.

## 5.4 Curriculum Innovation

Undoubtedly, we are very concerned with the improvement of learning and teaching of mathematics. But the mathematics is mostly delineated by the current curriculum – or more precisely speaking, by the curriculum topics listed in the curriculum guides covering different grade levels ranging from primary to secondary. Actually, the educational approach adopted in Hong Kong often encourages a school-based curriculum development which can explore the curriculum opportunities within the bounds of general curricular requirements. As we all know, a school-based curriculum take into consideration (i) the needs (say, of the students); (ii) the strengths (say, of the teachers) and (iii) the available resources at the school. However, most important of all, what makes a school-based curriculum initiative successful and innovative hinges upon the curriculum opportunities created which are relevant to something at the core of mathematics – for example, the rich connections of mathematics with various other sectors of our world and/or our learning experience. This leads to inter-disciplinary inquiries and/or the development of generic skills that are promoted in mathematics and beyond.

In this regard, included in the Resource Package are a few examples selected from the QEF projects under review that illustrate the curriculum opportunities granted for

- fascinating studies and hands-on experimentation on the connection between mathematics and art (when most students see these two areas as very different);
- extended readings related to a selection of mathematical topics covered in the curriculum (when most students read no more than mathematics textbooks for their mathematics-related studies);
- assessment activities focusing on conceptual understanding and problem-solving skills (when most assessment items in schools are geared towards routine procedures and solution to standard problems).

In view of the latest developments of STEM education, curriculum initiatives that would promote cross-disciplinary integration seem inevitable (CDC, 2015; Education Bureau, 2016). It should be noted that good and meaningful integration of classroom mathematics with other areas of learning is not totally new. As with deep learning of mathematical concepts with rich connections, mathematics educators in particular traditions have been advocating similar ideas. For example, realistic mathematics education (advocated by the Dutch mathematics educator Hans Freudenthal) and mathematical modelling (emphasized by the mathematics curricula in various countries including mainland China) are noteworthy. There are a few more resources suggested on this theme in the Resource Package.

## 5.5 Assessment

Assessment has long been recognized as an integral part of learning and teaching. Recent emphasis on proper development of assessment literacy for teachers at all levels in all subject areas has helped to shift the attention from *assessment of learning* to *assessment for learning*, which is crucial to bringing the learning and teaching on the right track. Assessment is certainly an area that has its connection with a range of QEF projects striving for the improvement of mathematics learning and teaching.

Assessment *for learning* is concerned mainly with

- appropriate integration into the learning and teaching process (for example, taking the form of questions in classroom teaching or systematic observation)

so that timely feedback can be provided to allow a good chance to enhance the learning and re-adjustment of the teaching;

- various forms of alternative assessment which would encourage student participation and demonstration of different kinds of competence and performances;
- effective use of the assessment results which are not only meant to be an indicator of the level of performance but also suggesting areas for improvement.

School-based mathematics assessment was usually considered as useful in providing different learning opportunities and assessment methods other than those largely shaped by traditional written tests on typical and/or routine problems (which, for the sake of public examinations, have dictated the learning and teaching in schools). Mostly emergent from concerns with school-based assessment, a few examples of QEF projects have been selected for inclusion in the Resource Package. Brief descriptions and sections of these few selected QEF projects help to illustrate various possibilities of assessment methods in an attempt to make good use (e.g. diagnostic use) of the assessment results for formative purposes and, more generally, to integrate assessment into the learning and teaching of mathematics. Apart from a few other projects that are included in other sections of the same package and may have some elements of assessment, there are three more QEF projects that have made more explicit attempts to materialize the notion of assessment *for* learning in the case of mathematics in very different ways:

1. Exploration of possibilities of school-based assessment, at junior secondary level, focusing on problem solving (tackling non-routine and/or open-ended problems) and the relevant assessment rubrics.
2. Learning from mistakes – based on a collection of common mistakes committed by students at Secondary 1 to Secondary 3 levels, worksheets for students were designed to encourage students to notice the problems and mistakes themselves instead of being told by teachers. (Interestingly, this aligns very well with the emphasis in recent years on enhancing students' capacity of self-regulated learning.)
3. Operational mathematics learning of pre-school children – one of the rare QEF projects supporting the mathematical learning and teaching of very young children at Kindergarten Years 1 to 3. With assessment well taken into

consideration, the integrative, structural and operational nature of mathematics learning at the very young age has been systematically incorporated into a series of learning, teaching and assessment activities. A manual including guidelines on the learning and teaching activities, together with assessment rubrics in detail, provides a good reference for those who would take seriously the development of mathematical understanding at kindergarten levels.

## 5.6 Teacher Professional Development

In a certain sense, most developments in learning and teaching would have created opportunities for teachers to develop professionally. It is thus true that, in the final reports of virtually all QEF projects which are meant for the betterment of mathematics education, there are statements in retrospect regarding the professional growth of the mathematics teachers involved in the projects. However it is not common to have a QEF project that considers teacher professional development as its primary goal and puts explicitly concerns about the growth of a mathematics teacher in focus. Teacher professional development is thus included as a major theme because of the central importance of the teacher (if not only that of the students) in all learning and teaching activities as well as the professionalism of teachers that safeguards quality education at the level of implementation.

If professional development is considered in relation to two different levels, namely, individual and institutional level, we can see the development of a mathematics teacher in his/her natural growth (e.g. in professional knowledge and pedagogical competence) as an individual teacher as distinguishable from that in tandem with the development of a school where he/she teaches and, in a broader context, with the development of education in the society. It is particularly important to see the relevance of teacher professional development at the institutional level especially when we want to put teacher professional development as a major theme of quality education. For that matter, both the growth of professional knowledge and the growth of the professional community should be put at the forefront.

Despite the fact that many QEF projects have resulted in growth of professional knowledge and development of professional competence of the teachers in separate schools, there is an example of a QEF project, titled “Parallel Lessons”, which created opportunities for teachers to see alternative lesson designs in a very different context and thus opportunities for teachers

to examine closely their own practices with an awareness of the possible assumptions taken for granted in the context with specific social, cultural and curricular conditions. Such reflection is believed to have a long-term impact. As a matter of fact, for more than a decade, the major idea of that particular project has sustained without the QEF funding. Activities of the same kind have continued to create collaboration and communication across different schools with very different needs but sharing the common goal of bringing opportunities for teachers to reflect on their own practices.

The above sub-sections give the outline of the Resource Package, particularly explaining the principles and major concerns underlying each of the chosen themes and the corresponding selection of past QEF projects, together with recommendation of relevant resources (especially those available online) that would help support better understanding and further development of those themes. The final version of the Resource Package was submitted to QEF Secretariat in December 2016.



## 6. Dissemination Seminar

A dissemination seminar was organised by the Project Team on 5 July 2016. An invitation letter (**Appendix D1**) was sent to all primary and secondary schools, including the schools and institutions that hosted the selected QEF projects under the present C&R work. The objectives of the seminar were set to:

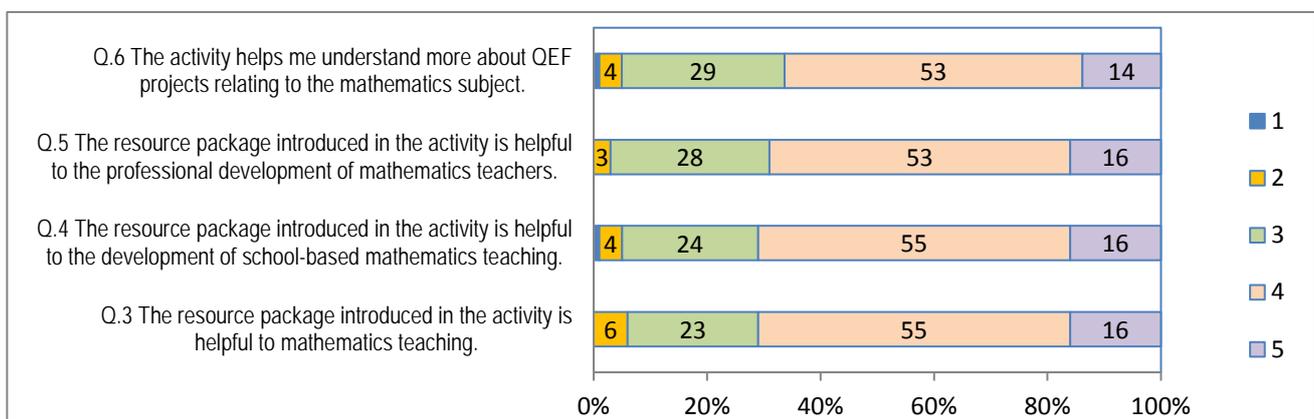
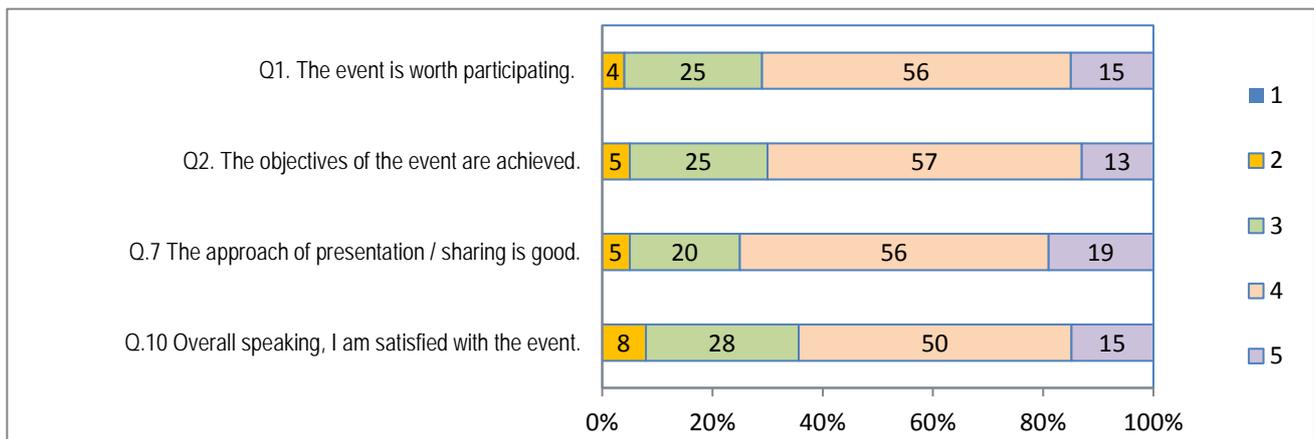
- introduce the ongoing C&R work on the past QEF projects;
- disseminate the good practices derived from the selected QEF projects on mathematics education;
- introduce the major themes of the Resource Package, with related examples and recommendations for the betterment of mathematics education;
- provide an opportunity for the sharing of experiences with fruitful development supported by some QEF projects.

To achieve the objectives listed above, the seminar consisted mainly of three parts: (1) an introduction to the present C&R work, including its aims and scope, and the findings out of the general evaluation of the selected QEF projects as regards their implementation and achievements (e.g. success factors of the implementation); (2) an introduction to the Resource Package derived from the deliverables of the selected QEF projects under review, particularly highlighting the six major themes with which the Resource Package was organized; (3) sharing of good practices and experiences with fruitful development supported by certain QEF projects. The Programme Rundown of the dissemination seminar can be found in **Appendix D2**.

The Resource Package was not yet ready before the dissemination. To help promoting the Resource Package to the participants and their colleagues at their schools, a 4-page A4 colour-print leaflet made by A3 folded in half was distributed at the Dissemination Seminar. Refer to **Appendix E** for images of the four pages of the leaflet.

There were more than 150 participants at the seminar, about half of them came from secondary schools and the other half from primary schools (with a few from special schools). A few EDB officials concerning mathematics education and/or school development, in addition to members from QEF Secretariat, also attended the seminar.

The evaluation, based on the completed Evaluation Form (**Appendix F**) collected from 104 respondents (Response Rate = 67%) at the end of the seminar, was generally good. On a 5-point Likert scale (with “1” as the minimum level of satisfaction and “5” the maximum), the overall satisfaction scored 3.71 points whereas the scores on various other aspects ranged from 3.38 to 3.89 points. With the general achievement of the objectives (Score = 3.78), the Resource Package as introduced in the seminar was found helpful – scores ranging from 3.81 to 3.82. The following two charts show the distribution of the ratings in response to the eight questions (out of the original set of ten) put into two categories – the first one of general evaluation of the seminar and the second one focusing on the general understanding of QEF projects and the Resource Package as introduced.



In addition to the ten questions probing the ratings by the participants, there were four open-ended questions that tried to invite more elaborate comments on both the seminar itself and the Resource Package which was by then having room for improvement. A summary of the responses to the whole set of questions in the Evaluation Form can be found in **Appendix G**.

Regarding the seminar itself, as revealed by numerous comments made in response to the open-ended questions, particularly useful was the sharing of the successful experiences with the implementation of QEF projects. To the question (Question 11, **Appendix F**) on the part(s) that has/have brought most benefits, 44 written comments were made, 39 of which explicitly (with or without reference to specific contents) referred to the sharing of experiences. Except for numerous positive comments on the very stimulating and inspiring suggestions for classroom teaching and assessment methods, and on their practical relevance, a few responses (original in Chinese, please refer to **Appendix G**) are noteworthy:

- *the experience sharing allows more concrete understanding of the relevant project and its rationale*
- *the stories of the work of colleagues in schools on the development of teaching and learning resources*

To some extent, this couple of comments echoed another comment (made in response to the same question) that colleagues “*should heed ... the intangible outcome*” of the QEF project works.

There was one particular question (Question 13) that probed the interest of the teacher participants with regard to the 6 proposed themes if there would be follow-up professional development activities in future. A respondent could opt for more than one theme. Among the 104 respondents, findings are as follows:

- |   |    |         |
|---|----|---------|
| ▪ Mathematical concepts (The big ideas) | 52 | (50.0%) |
| ▪ Mathematical thinking                 | 46 | (44.2%) |
| ▪ Tools and tasks                       | 34 | (32.7%) |
| ▪ Curriculum innovation                 | 30 | (28.8%) |
| ▪ Assessment                            | 24 | (23.1%) |
| ▪ Teacher professional development      | 24 | (23.1%) |

The figures show significant proportions (ranging from 23% to 50%) of teacher participants interested in the themes we proposed. We may consider that the figures above are also indicative of the teachers’ need (or their perceived need) for further professional development as well as their perception of the relevance of the themes to their commitments to school mathematics education. In particular, the first three figures (about 1/3 to 1/2 of the

respondents) are suggestive of the need for more content-based (i.e. mathematics-related) developmental activities.

In summary, the responses to the dissemination seminar were encouraging and showed their recognition of the good practices developed out of the past QEF projects, not least those on classroom teaching approaches and assessment practices much elaborated by the speakers in their experience sharing. The feedback collected by the Evaluation Form also showed the teachers' interest in the forthcoming Resource Package with the major themes of development in mathematics education even though it was not totally desirable, as indicated by some comments, that the Resource Package could not be made available at the seminar. In any case, professional development has to be sustained as a long term development rather than a one-off event and a collection of printed materials. In light of these good responses and the positive feedback (especially that with regard to the major themes as highlighted by the Resource Package), it would be more fruitful if the delivery of the Resource Package, be it a printed copy sent by mail or an electronic version made available at QEF Cyber Resource Centre (<http://qcrc.qef.org.hk>) in the near future, would go along with an official note announcing the possible follow-up professional development activities based on the major themes and concerns raised by the Resource Package. This brings us to the next section on our way forward upon the completion of this consolidation and redevelopment work.

## 7. Conclusion and the Way Forward

QEF has granted various opportunities for many colleagues in the field of mathematics education, mostly mathematics teachers on the frontline, to materialise their best ideas and to bring some possible educational changes to their workplace. While the number of students or classes so benefited directly from all their good work would be naturally limited to the immediate access of each of the school-based projects, there is always the issue of scaling up. Meanwhile, when scaling up tends to be considered from a perspective of productivity or outcome, more important – particularly in the field of education – is the building of a professional learning culture (Loucks-Horsley, Stiles, Mundry, Love & Hewson, 2010). More sustainable development that would bring the most benefit in the long run should take learning of both teachers and students into due consideration. Loucks-Horsley et al. (2010) has rightly pointed out that the following four *inter-connected* outcomes support the goal of enhanced student learning:

- Enhancing teachers' knowledge;
- Enhancing quality teaching;
- Developing leadership capacity;
- Building professional learning communities.

The professional development of the teachers is as important as the learning of the students. According to Loucks-Horsley et al. (2010, pp. 161-162), these four inter-connected outcomes should form the basis of whatever professional development plans or structures.

As with the notion of “learning circles”, what makes the professional development work is the small communities of learners who come together to support each other in the process of learning, thus effecting the conditions for changes to both the schools and the professionals themselves – in particular, the conditions are building community, constructing knowledge, supporting learners, documenting reflection, assessing expectations, and changing cultures (Collay, Dunlap, Enloe & Gagnon, 1998). In general, professional development structures should be in place to help build such communities, starting from a few teacher participants, then extending to more colleagues (perhaps including the principal), then going beyond the boundaries of schools and districts, and finally bringing the enriched professional learning culture “back home” (Loucks-Horsley et al., 2010). Aligned with these general notions of “professional learning culture”, “learning circles” and professional development “clusters” or

“structures”, the establishment of a network such as QTN on Mathematics Education is a possible strategy to capitalise on the past QEF mathematics education projects and make further developments based on the current C&R work.

Generally speaking, the QTN, first initiated in 2006 by the Quality Education Fund, has contributed to more organized forms of the dissemination of good practices derived from QEF projects and the promotion of professional sharing through networking different schools and educational bodies (Quality Education Fund Cyber Resource Centre, 2016). Like those QTNs established in recent years on different areas (either Key Learning Areas of the curriculum such as Chinese Language and English Language, or general areas of educational concern such as parent education and students’ positive attitudes and values), a QTN on mathematics education should help relevant teachers and/or curriculum development personnel at different levels to

- build a professional development community of teachers of similar concerns and interests;
- work on a specific theme (e.g. one of the six themes proposed by the present C&R work);
- consolidate and extend the good ideas and practices generated out of related (QEF) projects on the chosen theme;
- set up a knowledge and resource hub on the chosen theme;
- formulate and develop further project(s) to enhance the learning and teaching of mathematics; and
- sustain the continuing professional development for the betterment of mathematics education.

Just as the present C&R work has identified several major themes that align well with the latest developments of mathematics education, the themes may serve as the focus concerns of such a QTN on mathematics education. It would help providing a coherent structure and organisation of a wide range of developmental works catering for various needs arising from very different school contexts.

Although we can make the best use of the connectivity and depository capacities granted by the internet technology, such network should create opportunities for human interaction which is at the core of mutual professional support and effective collaborative work. Dependent on



the nature of the problems to be tackled and the needs to be addressed in specific contexts, collaborative and/or professional development activities may take different forms ranging from study group, to workshop, collaborative lesson planning meetings, lesson observation and evaluation, and to public seminar. QTN should allow considerable flexibility for the collaboration and sharing as long as the goals and objectives of the networking can be achieved.

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## Appendix A List of 65 QEF Projects

The last two columns show (with “X”) the projects of which the relevant personnel responded to the Questionnaire Survey (27 projects covered by 29 completed questionnaires) and subsequently to the Interview (5 projects covered by 4 interviews).

No.	Project No.	Project Title	Level	Questionnaire	Interview
1	1998/0004	Application of Statistics (A Teaching Method)	Secondary school	X	
2	1998/0008	Meeting the Technology Challenge: From Vision to Reality	Secondary school	X	
3	1998/0052	Implementing IT to Enhance the Quality of Teaching and Learning	Secondary school		
4	1998/0587	Developing Software Packages for Mathematics (Primary 2)	Primary school	X	
5	1998/1105	Strengthen Learning and Eliminate Failures - Support Programme on School-based Curriculum and Teaching Design	Primary school		
6	1998/1351	Design and Development of a Series of Computer-assisted Learning of Mathematics (CALM) Packages for S1 Students	Secondary school		
7	1998/1449	Using Multimedia in Teaching Science and Mathematics	Secondary school		
8	1998/1760	School-based Information Technology Education Development Project	Primary school	X	
9	1998/2024	Multimedia Statistics Courseware for Secondary Schools in Hong Kong	Secondary school		
10	1998/2182	Development of Multimedia Computer-assisted Teaching/Learning Software	Secondary school	X	
11	1998/2247	A Project to Enhance the Use of IT in Teaching and Learning in Secondary Schools through the Development of Intranets, Computerized Courseware, and Student Forums on Internet Web-sites	Secondary school		
12	1998/3023	Remedial Teaching for Parents and Students	Primary school	X	
13	1998/3224	A Multimedia Environment for Interactive Teaching and Learning in Mathematics	Secondary school	X	
14	1998/3343	Using Computer to Assist Learning in Resource Class Project	Primary school		
15	1998/4022	Strengthen Learning and Eliminate Failures - Support Programme on School-based Curriculum and Instructional Design (Second Stage)	Primary school		
16	1999/2059	On-line Mathematics Education in Secondary Schools: An Exploratory Study	Secondary school		
17	1999/2933	School-based Changes in Teaching and Learning	Primary school	X	
18	1999/3033	Computer-aided Learning Centre	Secondary school	X	
19	2000/0010	The Hong Kong-PISA Project : Monitoring the Quality of Education in Hong Kong from an International Perspective	Secondary school	X	
20	2000/0221	Motivated Mathematics Learning	Secondary school	X	
21	2000/0680	Effective Learning in Mathematics for Non-Chinese Speaking Children	Primary school		



No.	Project No.	Project Title	Level	Questionnaire	Interview
22	2000/1773	Inter-school Mathematics e-competition	Secondary school	X X	
23	2000/2172	Operational Mathematics Learning in Pre-schools	Kindergarten		
24	2000/2693	A Breakthrough in I.T. Learning	Primary school		
25	2002/0619	School-based Curriculum Reform in P4 Mathematics Education through Action Research	Primary school		
26	2002/0790	School Online Teaching Consultancy and Online Teaching Resources for Junior Secondary Schools	Secondary school		
27	2003/0258	A Program for Enhancing Learning and Teaching: F.1 - F.3 Mathematics School-based Syllabus, Teaching Softwares and Test Bank	Secondary school		
28	2003/0496	MOSTT Interactive Learning Platform – A City for Challengers	Secondary school		
29	2003/0589	Quality Teaching Courseware	Primary school	X	
30	2003/0624	Experiential Play in Mathematics: Effective Teaching and Learning Programme 2004-2005	Primary school		
31	2003/0678	Learning and Teaching - a New Stratum	Primary school		
32	2003/0696	AGD Streaming Programme of Junior Mathematics	Secondary school		
33	2003/0739	Promoting Problem-solving Practices among Teachers and Pupils in Primary Mathematics	Primary school		
34	2004/0323	Teaching Mathematically	Primary school	X	X
35	2004/0447	The Matrix? So Easy!	Secondary school	X X	
36	2004/0480	Quality Learning and Teaching - E-campus Project	Primary school	X	
37	2004/0512	Thematic Virtual Teaching: Interactive Intelligent Learning	Secondary school	X	
38	2004/0527	School-based Learning Outcome Framework	Secondary school		
39	2004/0580	Assessment for Learning: An Exploratory Study on School-based Assessment in Junior Form Mathematics	Secondary school	X	X
40	2004/0938	Professional Assessment for Learning Mathematics (PALM)	Secondary school		
41	2005/0012	Da Vinci's Mathematics Lessons - Creative Curriculum Development for Mathematics through Art-in-Education	Secondary school		
42	2005/0016	Student-based Co-operative Learning Project in Primary Mathematics	Primary school	X	
43	2005/0035	A Wireless Interactive Networking for School-based Enrichment Programmes (WINSEP)	Secondary school		
44	2005/0076	School-based Gifted Development Programmes	Primary school	X	
45	2005/0095	Multiple Intelligences in Learning and Teaching	Primary school	X	
46	2005/0137	Use 'Problem Solving' to Solve the Problem of Learning Differences	Primary school		
47	2005/0178	Development Schools of Learning Studies for Inclusive Classroom	Primary school		
48	2005/0181	Starting from Assessment	Secondary school		
49	2005/0199	Operational and Integrated Mathematical Learning in Preschools	Kindergarten		



No.	Project No.	Project Title	Level	Questionnaire	Interview
50	2005/0204	Gifted Education in School-based Curriculum	Primary school	X	
51	2005/0237	Let Me Fly	Primary school		
52	2005/0298	Curriculum Construction and Adaptation of Mathematics, Liberal Studies and Chinese as a Second Language for Bridging Junior Secondary Non-Chinese Speaking Students to NSS Core Subjects	Secondary school		
53	2005/0312	Revamping Teaching Practices of Hong Kong Teachers through Reflective 'Parallel Lessons'	Secondary school		
54	2005/0445	Development of Chinese, English and Mathematics Scaffolding Curriculum for Lower Forms of Secondary Schools	Secondary school		
55	2005/0462	School-based Assessment Alternatives in Junior Secondary Mathematics - A Topic and an Investigative Approaches	Secondary school	X	X
56	2005/0504	Power Upgraded	Primary school	X	
57	2005/0651	Web-based Mathematics Learning Platform	Primary school & Secondary school	X	X
58	2005/0778	Developing School Based Assessment in Alignment with Mathematics New Senior Secondary Curriculum	Secondary school		
59	2006/0136	Identifying Abilities, Maximizing Potential': A Joint University-School Collaborative Project to Develop an Assessment System for Intellectual Disabled Pupils Based on Mainstream Curriculum Framework	Special School		
60	2006/0140	Built-on Project Curriculum Construction and Adaptation of Mathematics, Liberal Studies and Chinese as a Second Language for Bridging Junior Secondary Non-Chinese Speaking Students to NSS Core Subjects	Secondary school		
61	2007/0460	Construction and Adaptation of School Based Curriculum (Intermediate Chinese Language, Mathematics and Basic Liberal Studies) for Junior Non-Chinese Speaking Students	Secondary school		
62	2007/0662	Bridging the Gap between Learner Differences in the Junior Mathematics Curriculum	Secondary school	X	
63	2007/0727	Learning Study to Improve Teaching and Learning of Secondary One Mathematics	Secondary school		
64	2009/0217	Enhancing Collaborative Learning and Thinking Skills with the use of Interactive Whiteboard	Secondary school		
65	2011/0224	Strategies to Enhance Learning Motivation	Primary school	X	X

# Appendix B Questionnaire Survey



優質教育基金  
Quality Education Fund



## SURVEY FOR QEF C&R WORK IN MATH

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«School»  
«Address1»  
«Address2»

8 January 2015

Dear «Recipient\_Eng»,

### **Questionnaire for Consolidation and Redevelopment Work on QEF Projects on Mathematics Education**

We are researchers from the Faculty of Education at the University of Hong Kong. Currently, we are working on the consolidation and redevelopment (C&R) of past QEF projects on mathematics education. This project is commissioned by the Quality Education Fund. The objectives of the C&R work are to understand and conceptualize the major concerns with mathematics education in schools and to consolidate the effective pedagogies and learning/teaching resources as developed from the past QEF projects. After the consolidation, a resource package will be produced so that more mathematics teachers in other schools can make good use of those projects. A number of good projects, including the following one undertaken by your school in «Year», were selected for further analysis and consolidation:

#### **«Title»**

To facilitate the analysis, a questionnaire is enclosed and you are invited to complete it with reference to the above-mentioned project. Please pass the questionnaire to the project leader or, in case he/she is unavailable, any person who is familiar with the project, such as a project team member. We would be grateful if the questionnaire could be completed by **23 January 2015**. The soft copy of the questionnaire is available at [http://web.hku.hk/~klwong3/qef\\_c&r\\_questionnaire.pdf](http://web.hku.hk/~klwong3/qef_c&r_questionnaire.pdf). You may choose to complete the electronic version and send it to the email address **hchtsang1@hku.hk**. You can also return the completed questionnaire by post to **Room 318, Runme Shaw Building, Faculty of Education, The University of Hong Kong, Pokfulam, Hong Kong**, or by fax to **2858 5649** (Attention: Mr WONG Ka Lok).

Upon receiving the completed questionnaire, we may contact your school again for a follow-up interview. Should you have any inquiry, you may contact Mr TSANG Hing Chung, the research assistant of this project, by emailing to **hchtsang1@hku.hk** or by phone at 2219 4944. Thank you very much for your help.

Yours sincerely,

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WONG Ka Lok (Mr)  
Project Leader  
C&R Work on QEF Projects on Mathematics Education  
Senior Lecturer  
Faculty of Education, The University of Hong Kong

Enclosed document: Questionnaire

«School\_Chi»

«Recipient\_Chinese»鈞鑒：

有關優質教育基金數學科「總結及再發展計劃」問卷調查

我們是香港大學教育學院的研究人員，現受優質教育基金委託進行一項數學科的「總結及再發展計劃」的研究。本計劃旨在檢視過去受優質教育基金資助有關數學科的計劃，歸納有效的教學法和教材，從而製成資源套，讓更多數學老師受惠於過去基金計劃的成果。優質教育基金選取了部分較為優秀的計劃作歸納及研究之用，包括 貴校於«Year»年進行的以下計劃：

«Title\_Chi»

為促進是次研究，我們現誠邀 閣下根據 貴校所進行的上述計劃填寫問卷（見附件）。請將問卷交由計劃的負責人填寫。倘若計劃負責人已經離職，請將問卷交由熟悉該計劃的一位同工填寫，例如計劃的其中一位主要成員。希望 閣下可於一月二十三日前完成問卷。另外，此問卷的電子版本亦可於互聯網地址 [http://web.hku.hk/~klwong3/qef\\_c&r\\_questionnaire.pdf](http://web.hku.hk/~klwong3/qef_c&r_questionnaire.pdf) 下載。 閣下可將已完成的問卷電郵致 [hctsang1@hku.hk](mailto:hctsang1@hku.hk)，亦可郵寄致香港薄扶林香港大學教育學院邵仁枚樓 318 室或傳真至 **2858 5649**（黃家樂先生）。

於收集完成的問卷後，我們可能會約見 貴校的有關老師，以作進一步的訪談。如有任何查詢，歡迎電郵致 [hctsang1@hku.hk](mailto:hctsang1@hku.hk) 或致電 2219 4944，與本計劃的研究助理曾慶忠先生聯絡。感謝閣下的寶貴時間。謹頌

教安

優質教育基金數學科總結及再發展計劃項目負責人  
香港大學教育學院 高級講師

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黃家樂 謹啟

二零一五年一月八日

附件：問卷



請根據 貴校於«Year»年進行以下的優質教育基金計劃填寫此問卷。

«Title\_Chi»

Please fill in the questionnaire about the following QEF project undertaken in the year «Year»:

«Title»

1. 於是次計劃中，您擔當什麼角色？

What was your role in the project?

- 計劃負責人 project leader                       主要成員 core team member  
 實行計劃的老師 teacher who executes the project    其他 other : \_\_\_\_\_

2. 是次計劃中有多少位主要成員？你認為成員數目是太多、適中、還是太少？

How many core members were there in the project team? Was it too many, just appropriate or too few?

主要成員的數目 Number of core team member : \_\_\_\_\_ (位)

- 太多                       適中                       太少  
too many                      just appropriate                      too few

3. 有多少位計劃的主要成員仍然在 貴校工作？

How many core team members of the projects are still in the school?

\_\_\_\_\_

4. 是次計劃的實施過程是順利的。

The project was implemented smoothly.

- 非常同意                       同意                       中立                       不同意                       非常不同意  
Strongly agree                      Agree                      Neutral                      Disagree                      Strongly disagree

5. 是次計劃能夠按照原定的進度完成。

The project was carried out on schedule.

- 非常同意                       同意                       中立                       不同意                       非常不同意  
Strongly agree                      Agree                      Neutral                      Disagree                      Strongly disagree

6. 是次計劃得到的資助金額是足夠的。

The funding obtained for the project was enough.

- 非常同意       同意       中立       不同意       非常不同意  
Strongly agree      Agree      Neutral      Disagree      Strongly disagree

7. 總體來說，是次計劃是成功的。

Overall, the project was successful.

- 非常同意       同意       中立       不同意       非常不同意  
Strongly agree      Agree      Neutral      Disagree      Strongly disagree



請跳答第 8 題

Please go to Question 8



請跳答第 9 題

Please go to Question 9

8. 下列哪項是導致是次計劃成功的主要因素？（最多可選三項）

Which of the following is/are the most significant success factor(s) of the project?

(May choose **at most THREE** items)

- a. 專家為計劃成員或老師提供諮詢、支援  
Expert advice and support for project team or teachers
- b. 工作坊 / 研討會為計劃成員或老師提供培訓  
Training workshop(s) / seminar(s) for project team or teachers
- c. 計劃成員和老師的工作量是可接受的  
Acceptable workload for project team members and teachers
- d. 計劃安排的代課老師 / 教學助理 / 研究助理所提供的支援  
Project support provided by supply teacher(s) / teaching assistant(s) / research assistant(s)
- e. 學校及同事的合作及支援  
Cooperation and support from the school and the colleagues
- f. 合理的計劃時間表  
Reasonable project schedule
- g. 適當的分工安排  
Reasonable division of labor
- h. 計劃成員的投入  
Enthusiastic involvement of project team members
- i. 其他 Others（請註明 please specify）：

9. 下列哪項是導致是次計劃不太成功的主要因素？（最多可選三項）

Which of the following is/are the most significant problems to the success of the project?

(May choose **at most THREE** items)

- a. 缺乏專家為計劃成員或老師提供資詢、支援  
Lack of expert advice and support for project team or teachers
- b. 缺乏工作坊 / 研討會為計劃成員或老師提供培訓  
Lack of training workshop(s) / seminar(s) for project team or teachers
- c. 計劃成員和老師的工作量過重  
Heavy workload for project team members and teachers
- d. 計劃未有安排適當的代課老師 / 教學助理 / 研究助理以作支援  
Lack of project support provided by supply teacher(s) / teaching assistant(s) / research assistant(s)
- e. 缺乏學校及同事的合作及支援  
Lack of cooperation and support from the school and colleagues
- f. 太緊密的計劃時間表  
Very tight project schedule
- g. 不適當的分工安排  
Unreasonable division of labor
- h. 計劃成員不太投入  
Lack of involvement of project team members
- i. 其他 Others（請註明 please specify）：
- 

10. 參與是次計劃的主要成員於計劃進行期間的教學時數是否有所調低？

（如答是，請註明平均每星期或每循環週減少多少小時。）

During the project period, was the number of teaching hours of teachers in the core project team reduced?

(If yes, please specify the average number of teaching hours reduced in one week/cycle.)

是（調低的時數：每星期 / 每循環週\* \_\_\_\_\_小時）  否

Yes (number of hours: \_\_\_\_\_ per week / cycle\*) No

\* 請刪去不適用的項目 delete as appropriate

11. 因為是次計劃，有關主要成員老師的工作量十分沉重。

Due to the project, the teachers involved in the core team had very heavy workload.

非常同意  同意  中立  不同意  非常不同意  
Strongly agree Agree Neutral Disagree Strongly disagree

12. 完成是次計劃後，貴校是否繼續實行由該計劃引進的活動（例如：教學法或課外活動等）？

After finishing the project, did the activities developed (e.g. pedagogies or ECA) continue to be practised?

- 是 Yes （繼續實行了多少年？For how many years did it continue? \_\_\_\_\_）  
 否 No （為什麼？Why? \_\_\_\_\_）

13. 是次計劃的產品或成果於計劃完成後仍然於校內繼續使用。

The product(s) or deliverable(s) developed in the project has/have been in use after finishing the project.

- 非常同意       同意       中立       不同意       非常不同意  
Strongly agree      Agree      Neutral      Disagree      Strongly disagree

14. 現在，公眾或其他學校是否仍然能夠取得是次計劃的產品或成果？

The product(s) or deliverable(s) is/are still available to the public or to other schools.

- 是 Yes （取得的方法 method of obtaining :  
\_\_\_\_\_）  
 否 No

15. 是次計劃完成後是否繼續發展 / 催生其他的計劃？

The project, after its completion, was further developed / led to other projects.

- 是 Yes （請略述該發展 Please briefly describe the development: \_\_\_\_\_）  
\_\_\_\_\_）  
 否 No

16. 您認為是次計劃的哪一個部分是最好的（例如：教學法、教材、教師培訓工作坊、評核方法等）？為什麼？

What is the best part of the project (E.g. pedagogy/teaching materials/teacher training workshop/assessment method)? Why?

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17. 是次計劃有哪一部分值得建議給其他學校繼續發展？

Which part of the project will you suggest other schools for further development?

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18. 是次計劃有助提升教師專業發展。

The project can enhance teacher professional development.

非常同意       同意       中立       不同意       非常不同意  
Strongly agree      Agree      Neutral      Disagree      Strongly disagree

19. 請提供一位聯絡人資料，以便我們聯絡 貴校以取得關於是次計劃的其他資料。

Please provide the contact information of a contact person, in case we need to contact the school for further information of the project.

姓名 Name : \_\_\_\_\_ 職位 Position: \_\_\_\_\_

電郵 Email : \_\_\_\_\_ 電話 Tel : \_\_\_\_\_

20. 其他意見 Any additional comments:

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二零一五年一月  
January 2015

感謝您提供寶貴意見！  
**THANK YOU VERY MUCH!**

## Appendix C Interview Questions

With various difficulties as explained in Section 4.2 of this report, we conducted only 4 interviews which covered 5 projects under review.

Project No.	Project Title	School
2004/0323	Teaching Mathematically	Sheng Kung Hui Mung Yan Primary School
2004/0580	Assessment for Learning: An Exploratory Study on School-based Assessment in Junior Form Mathematics	Christian Nationals' Evangelism Commission Lau Wing Sang Secondary School
2005/0462	School-based Assessment Alternatives in Junior Secondary Mathematics - A Topic and an Investigative Approaches	
2005/0651	Web-based Mathematics Learning Platform	Yuen Long Public Middle School Alumni Association
2011/0224	Strategies to Enhance Learning Motivation	Tai Po Old Market Public School (Plover Cove)

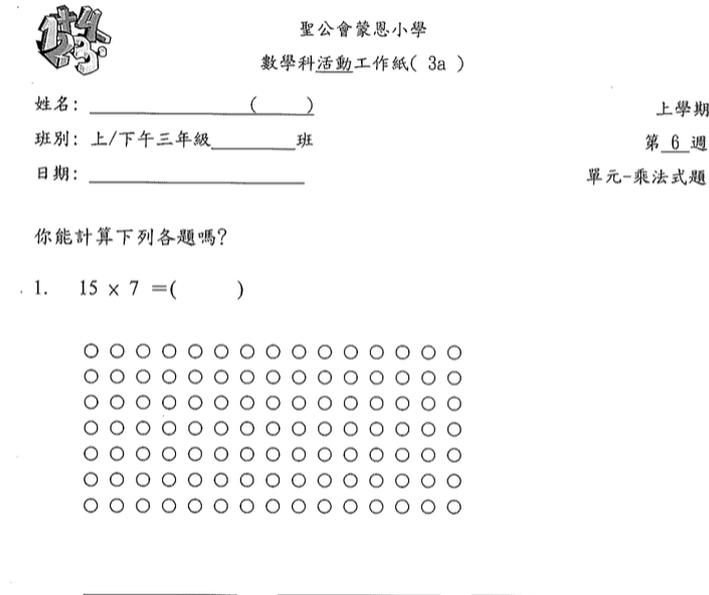
Basically, the interview at each of the schools sought to

- clarify something we would like to find out in greater detail about the project;
- find out, in personal conversation (i.e. elaboration injected with emotion), the best things that the teachers involved might have experienced in the project;
- understand the difficulties the teachers encountered in the project;
- identify relevant developments as a consequence of the project.

Summary notes on each of these four interviews are produced in the following pages.

## 2004/0323 Teaching Mathematically

1. Since some of the worksheets do not have explicit instructions/lesson plans to guide others how to use them, we have asked some **questions regarding how they use the materials in lessons**. E.g. in the following worksheet, the teacher will guide the students to discover different ways of doing multiplication by partitioning the small circles.



聖公會蒙思小學  
數學科活動工作紙( 3a )

姓名: \_\_\_\_\_ ( )  
班別: 上/下午三年級 \_\_\_\_\_ 班  
日期: \_\_\_\_\_

上學期  
第 6 週  
單元-乘法式題

你能計算下列各題嗎?

1.  $15 \times 7 = ( \quad )$

\_\_\_\_\_

Originally, we cannot be certain about how they will make use of this worksheet. Similarly, they have the following worksheet in the deliverable:

姓名: \_\_\_\_\_ ( )  
班別: 上/下午 3 年級 \_\_\_\_\_ 班  
日期: \_\_\_\_\_

下學期  
第 13 - 15 週  
單元 分數

A.

兩人一組，利用「神奇橡皮筋」製作分數表示圖，並填上顏色。

1.  $5 \frac{1}{10}$

2.  $\frac{5}{3}$

3. ( )個(——)

After their explanation and demonstration, we then know what a “magical rubber band” is.

2. How did they manage to work out the project with just 2 core members (including the project leader)?

They had worked with a university professor (the consultant of this project) *before* starting the project. Therefore they had already got good ideas about how to *teach mathematically* in lessons. During the project period, they mainly focussed on producing the teaching materials. At present, many of the materials can be found in a series of textbooks because, along with the subsequent developments of the general notion of “teaching mathematically”, a textbook publisher has involved some of the people involved in this project and incorporated the basic ideas of *teaching mathematically*.

3. Any difficulties encountered?

The most difficult part was to convince and encourage the other colleagues to follow this pedagogy. In 10 years’ time, the project leader managed to convince the teachers and had demonstrated the advantages of this pedagogy, e.g. it took more time at the beginning, but students generally got a better understanding of the topics learnt and thus could handle the learning at a later stage, in their P.4 – P.6, much easier than before. They have also continued to develop the teaching materials and now have a special room full of teaching materials for many different topics. Teachers can just grab one box of materials and walk into a classroom to teach a certain topic. They believe that most of the colleagues now understand and agree with the pedagogy.



## **2004/0580 Assessment for Learning: An Exploratory Study on School-based Assessment in Junior Form Mathematics**

*and*

## **2005/0462 School-based Assessment Alternatives in Junior Secondary Mathematics - A Topic and an Investigative Approaches**

1. Did the school continue to use the developed materials after they know that SBA will not be implemented in HKDSE Mathematics?

The school has continued to do the SBA after a few years and now discontinued for making room for project learning. They think that the SBA tasks designed are interesting and provide valuable opportunities to the students even when SBA will not be implemented in HKDSE.

2. What were the difficulties encountered?

They originally would like to hire a teacher to share their teaching workload. However, the QEF only granted an amount that was sufficient for hiring a Teaching Assistant only. Therefore, the project teachers still had to carry out all of their normal lessons and developed the project materials at the same time.

The 5 teachers involved did not have previous experience in designing such tasks and they usually did not discuss their math lessons or teaching practice with each other. During the first project, they have to put in a lot effort in finding the resources and designing the tasks.

The way they worked was that each teacher would prepare about *two* tasks and then kept discussing and modifying the tasks until the tasks were suitable to be used. The most valuable part of the project to them was the way the 5 teachers had worked together, shared their experience, commenting on each other's work and refining the materials. After finishing the project, this kind of professional sharing continued among those teachers.

3. Has there been any update on the materials?

No update. The materials suit the students and the products of the project have been put to work smoothly for about 8 years.

4. Would there be any recommendation for other schools?

Sudoku may be too easy and task with unit fractions may be too difficult for students. Other than these two, all the other tasks are appropriate and interesting. Since SBA will not be implemented, if the other schools want to focus on the CDC curriculum and the DSE syllabus, they can choose the tasks: Pascal triangle, polygons in grid and experimental probability.

## 2005/0651 Web-based Mathematics Learning Platform

For this project, we did not have anything except the proposal and final report. The 3 CD-ROMs submitted to the QEF appeared to have been lost and we did not have the details about this project.

### 1. Further details of the project

They have developed a web-based platform with discussion forum, online test and self-learning zone. One good thing about the forum is that they have developed (with a software company) a web-based equation editor for students and teachers to enter math symbols, equations and simple geometric shapes in the forum. The students can use the mouse to write and draw their questions and can even take audio-record of their questions. The teachers will then try to organize the questions into different categories or for different purposes before answering them. Other students may also answer and discuss the questions by using the forum.

### 2. Can we have the installation CD-ROM?

No. Because one copy is lost and the other copy was submitted to the QEF (which seemed to have been lost as well). Therefore, if their school server, now with the web-based Forum installed, would have any problems, then the whole system would be lost forever.

### 3. Did the teachers and students continue to use the system?

The Forum has not been used for quite a while because there must be someone employed to manage it, to filter and answer the questions raised by students there. They do not have such resources after finishing the project. The online test is still in-use, but only limited to Secondary 1 students. When the Secondary 1 students got admitted to the school, they are required to do this online test so that their teachers can have a rough idea about their general mathematics ability. In the past, students are also required to read the materials and complete a few worksheets in the self-learning zone.

### 4. Difficulty encountered?

During the project, the QEF suggested a salary to employ a graduate with mathematics major for developing the materials. However, the suggested salary was too low for employing such a person and the school had to subsidize the salary before someone could finally be employed.



5. Can other people have access to the web-based platform?

If a person applies for an account, he may gain access to the platform. However, the server is less stable now and the students at the school cannot get access to it sometimes. They have also given us a teacher account so that we can get some of the materials. However, since the installation CD-ROMs are lost, it is very difficult, if not impossible, for others to install the web-based platform. So, they suggest that there would be the need to find a replacement for the online equation editor.

## 2011/0224 Strategies to Enhance Learning Motivation

This is the project newly (last) added to the original selection by QEF and we can only find their proposal. After interviewing the teachers concerned with the project at the school, we gain better understanding of the project. However, they mentioned that the materials and the final report had been submitted to QEF in January 2015, yet, QEF could not find the report and the deliverables.

### 1. Details of the project

It is more like a pedagogy and instructional practice. They encouraged students to do self-learning in Chinese, English and Mathematics. E.g. students were asked to self-learn and complete some exercise before the lesson. The teacher mentioned that even the weakest students could complete some exercise. Moreover, students were encouraged to finish related materials and to share among themselves during the lesson. For example, when they taught “discount”, they would ask students to collect the prices before and after discount in a supermarket and would ask them to discover how to calculate it. After two years, the weak students were also willing to share what they found in daily life with other classmates.

Actually, the main focus of the project was Chinese, but they also applied the same pedagogy to English and Mathematics lessons.

### 2. Difficulty encountered

Since they had to let each student to talk about their finding, it would be quite time consuming. But they think that it is worthwhile because now the students are more involved in the lessons and the students feel that the lesson is built upon their knowledge.

### 3. Recommendation to other schools

Since this project developed a general instructional practice, even if other school would obtain the teaching materials, they might not be able to follow their practice and to make good use of the materials. What they believe is that the project help create a self-learning and sharing atmosphere in the school and that is the most important part. Moreover, the project would not have been very successful if it were limited to mathematics lessons only. Therefore, a whole-school and all-subject approach has to be adopted.

## Appendix D1 Dissemination Seminar: Invitation Letter



IN-SERVICE TEACHER EDUCATION PROGRAMME  
FACULTY OF EDUCATION, THE UNIVERSITY OF HONG KONG



POKFULAM ROAD, HONG KONG  
Tel: 28591936 22415773 Fax: 28579564  
Email: instep@hku.hk

致貴校校長、數學科主任及各數學科老師：

### 邀請參加「優質教育基金計劃數學教育資源套」發佈會

香港大學教育學院獲香港特別行政區政府教育局委託及資助，進行了一項有關優質教育基金數學科的「總結及再發展計劃」，期間檢視了六十多個數學科的優質教育基金計劃，製作了上述資源套。本資源套旨在整理和重點介紹過往有關數學教育的優質教育基金計劃的成果。當中提供一個框架，以方便教師了解不同類型的計劃特色，選取合適的素材作為發展校本數學教學之用。從日常教學到整體課程發展，教師都可透過精簡事例，認識有效的設計，改善教學，尤其是對於重點概念的建立、數學思維的發展、工具和課業的善用、課程與評核的革新及教師專業發展的方向。

另外，有意申請優質教育基金發展數學教育的學校亦可參考這資源套，延續和深化過往計劃的成果。但更重要的是，無論老師是否以優質教育基金計劃為發展目標，我們期望這個資源套能給予老師在教學和課程的發展方面提供一些方向性的建議。

本學院現誠意邀請貴校提名老師出席是次發佈會，一起交流經驗和探討數學教育的發展。發佈會詳情如下：

**日期：**2016年7月5日（星期二）

**時間：**下午2時30分至4時30分

**地點：**香港薄扶林道香港大學明華綜合大樓 (Meng Wah Complex) T1 演講廳

(校園地圖網頁地址: <http://www.maps.hku.hk/>)

#### **[備註: 惡劣天氣的特別安排**

若八號或以上颱風訊號警告或黑色暴雨信號於上午 11 時 30 分或以後仍然生效，發佈會將會被取消並另安排於 2016 年 7 月 7 日（星期四）下午 2 時 30 分至 4 時 30 分進行而不作另行通知]

由於名額有限，每校最多可提名**兩位**老師出席。隨函附上發佈會報名表。如貴校有興趣參與此發佈會，請於**2016年6月27日或以前**填妥報名表，傳真至香港大學教育學院，傳真號碼：28579564。

除發佈會已滿額外，本學院將接納貴校的提名而不作另行通知。如閣下對是次活動有任何查詢，請與鍾小姐聯絡（電話 28591936）。

即頌  
教安

莫雅慈 黃家樂  
梁貫成 李文生  
香港大學教育學院謹啟

2016年6月8日



請於 2016年6月27日(星期一) 或以前遞交

致：香港大學教育學院在職教師發展計劃組〔電話：2241 5773〕  
傳真號碼：2857 9564

「優質教育基金計劃數學教育資源套」發佈會  
報名表

日期：二零一六年七月五日（星期二）

時間：下午二時三十分至四時三十分

地點：香港薄扶林道香港大學明華綜合大樓 (Meng Wah Complex) T1 演講廳

本校欲提名以下老師出席上述分享會：

老師名稱：(英文) \_\_\_\_\_ 中文 \_\_\_\_\_

老師名稱：(英文) \_\_\_\_\_ 中文 \_\_\_\_\_

學校名稱： \_\_\_\_\_

校長姓名： \_\_\_\_\_

校長簽署： \_\_\_\_\_

學校電話： \_\_\_\_\_ 傳真： \_\_\_\_\_

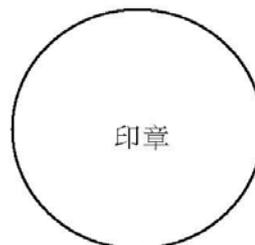
日期： 2016年 月 日



覆函  
(只適用於報名未獲接納的學校)

致： \_\_\_\_\_

很抱歉，你的報名未獲接納。



香港大學 教育學院

日期： 2016年 月 日

## Appendix D2 Dissemination Seminar: Programme Rundown

### 優質教育基金 數學科「總結及再發展計劃」 「數學教育資源套」發佈會

#### ※※※※ 流程 ※※※※

日期：2016年7月5日（星期二）

時間：2:30pm – 4:30pm

地點：香港大學明華綜合大樓 T1 演講廳

時間	內容	講者
2:30 – 2:40	登記	
2:40 – 2:55	介紹是次「總結及再發展計劃」及已檢閱的優質教育基金(QEF)計劃	黃家樂先生
2:55 – 3:35	介紹「數學教育教育資源套」 ➢ 六個主題及示例	李文生博士 / 黃家樂先生
3:35 – 4:20	經驗分享 ➢ 分享一 ➢ 分享二 ➢ 分享三	周惠英老師 (聖公會蒙恩小學)  黃仲良副校長 (中華傳道會劉永生中學)  莫雅慈博士 (香港大學教育學院副院長)
4:20 – 4:30	總結 ➢ 填寫回應問卷	黃家樂先生

# Appendix E Leaflet on the Resource Package

## 6 教師發展





例七：透過一課兩講促進香港教師反思教學理念及過程，建立校本性的教學實踐提升。

【一課兩講】  
遠海總教師教學交流會  
PARALLEL EDUCATION – Exchange Programme  
Hong Kong & Macau Teachers  
課程：三項核心素養主題的應用  
主講老師：劉志輝  
(天主教香港教區英文書院)  
地點：天主教香港教區英文書院  
日期：2016年10月28日

數學老師的專業發展至少可以有兩個層面，大概是個人和機構組織兩個面向：(一)老師個人的數學知識、教學技巧以至專業素養；(二)老師因著學校的校情或課程以至一般數學課程發展所能作出的配合，個別教育計劃固然有不同目標，但透過計劃的執行，不論是促進初中數學學習的校本評估，又或是不同模式校本評估的探索，老師們都發展了交流合作的工作模式，幾個有關「數學化教學」的計劃是一群老師懂得的將一些想法具體地嘗試、落實執行，再漸漸擴展到更多老師，這也是一個專業群體的確立。

### 聯絡我們

如有任何查詢，請聯絡：

黃家樂先生 (項目負責人)  
高級講師  
香港灣仔林道 香港大學教育學院 邵仁枚樓318室  
電郵: khong3@hku.hk  
辦公室電話: (852) 2857 8397 傳真: (852) 2858 5649

何樂志先生 (研究助理)  
電郵: hetsang1@hku.hk

二零一六年六月

Faculty of Education  
The University of Hong Kong



## 優質教育基金 總結及再發展計劃 (數學科)

香港大學研究團隊：  
黃家樂先生 (項目負責人)、梁實成教授、莫雅慈博士、李文生博士  
2014-2016 | 由優質教育基金資助

在我們檢視的六十五個優質教育基金計劃中，與數學教育有關的項目都各有特色。在這資源套內，我們將會從六個主題分析及推介其中部分計劃，以它們部分內容作為事例，突顯其中可供參考的意念和想法，讓大家善用這些計劃的成果，從而按著各校所需，進一步發展新的計劃。這六個主題分別是：數學概念、數學思維、工具與課業、課程革新、評估、教師發展。

### 1 數學概念

大部分計劃都有特定課題為內容以發展教學的策略，雖然未必每個計劃都清楚提出為何挑選某些課題，但我們可假定這些課題應該受到教師關注。數學上有一定數量，或被視為關鍵概念(key ideas / big ideas)，以下例子代表一些眾多計劃中明顯受關注的課題，而且代表著背後深層且相連的概念，例如當中包括各種數的概念 (如分數)、運算的方法和理解、比例推理。



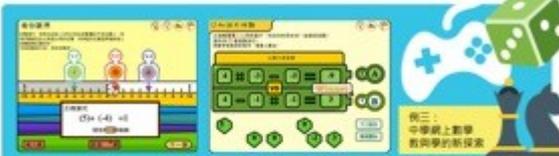
例一：專題數學研習「理解分數」，有效學與教計劃



例二：數學化教學

## 2 數學思維

數學思維也是很多計劃關注的重點，雖然表述各有分別，理論上，有效的概念學習應同時達至豐富數學思維的發展，有些計劃明顯透過特別的教材和活動發展數學思維，例如常見的解題(problem solving)、探究(exploration)或遊戲。這些通常都被視為常規課堂以外的嘗試。然而，很多平日教學的策略和元素都能同時鞏固概念學習和拓展數學思維。本舉例反映在各種教學設計中，教師都直接或間接地鼓勵學生善用數學化的思考，較明顯的例子有將概念視覺化(visualization)、抽象(abstraction)和推廣(generalization)、正向與逆向操作(doing and undoing)、善用多重表徵(multiple representations)。



例三：中學網上數學教育學的新探索

## 課程革新 4

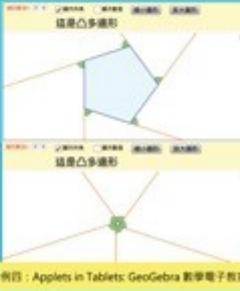
部分優質教育基金計劃提供很好的例子，讓我們進一步思考一般現行課程以外的可能性，尤其是作為校本課程的發展，我們更會按校本所需、老師所長及所能動用的資源，去創設更適合學生和老師的一些課程部分。本節挑選的三個事例中，有課程內容相連的延伸閱讀、跨學科的研習，以概念、解題為基礎的評估活動，設計各有特色，值得我們參考。正在推廣的STEM教育也在推動一些校本數學課程發展，其重點之一是學科之間的融合。



例五：達文西的數學教室

## 工具與課業 3

數學教學中，工具(tools)的應用與課業(tasks)的設計十分重要，直接影響概念的學習和思維的培養。工具的運用和設計跟科技的發展關係密切，跟數學教學尤為相關的，有呈現動態(dynamic)和可操控(manipulable)的圖像或計算的工具，但另一方面，很多傳統或簡單、非科技化的工具亦應多加善用。例如釘板(geoboard)或格點(square grid)構建其實可提供靈活而且豐富的學習體驗。有效的工具亦很可能地繫到有意義的表徵，將抽象的數學概念具體地呈現，例如數線上的活動同時依賴可操作的工具和構成內化的表徵。要真正善用教學工具，相關課業的設計也不容忽視，只有讓學生投入趣味的活動，從具體到抽象的概念和思維才能逐漸形成。



例四：Applets in Tablets: GeoGebra 數學電子教室

## 5 評估

評估在教學和課程發展中佔有重要位置，學生方面固然看重評估的結果，以至很容易就變成評估(考試)導向的學習，這樣就令老師方面就更應在評估方面認真考慮，究竟評估的是甚麼？評估的內容和方法是否恰當？評估所得是否有助於教學？是否為學生提供回饋資訊(還是就只是一個分數結果)？

本舉中的幾個例子，讓我們考慮一些在評估方面的可能性(尤其是形成性評估和更一般地促進學習的評估)，和其中值得注意的地方(例如在較為開放的問題之評分準則或規範)。



例六：初中數學科校本評估不同模式初探：主題式及研習式



# Appendix G Summary of Evaluation Results: Dissemination Seminar

## 優質教育基金 數學科「總結及再發展計劃」 「數學教育資源套」發佈會

### 問卷調查

2016年7月5日

出席人數：155

問卷回答人數：104

職銜：	%	[回應人數]
科主任	43	[29]
教師	57	[38]

是次活動：	非常同意		非常不同意			平均分*
	5	4	3	2	1	
	%	%	%	%	%	
1. 值得參與。	15	56	25	4	0	3.82
2. 目標能達到。	13	57	25	5	0	3.78
3. 所介紹的資源套對數學教學有幫助。	16	55	23	6	0	3.81
4. 所介紹的資源套對發展校本數學課程有幫助。	16	55	24	4	1	3.82
5. 所介紹的資源套對數學老師的專業發展有幫助。	16	53	28	3	0	3.82
6. 能讓我更了解與數學科有關的QEF計劃。	14	53	29	4	1	3.74
7. 講者講授 / 分享的方式效果良好。	19	56	20	5	0	3.89
8. 給予我與其他教師交流意見及經驗的機會。	12	35	37	15	2	3.40
9. 所派發的講義及資料有用。	9	39	37	14	2	3.38
10. 整體而言，成效令我感到滿意。	15	50	28	8	0	3.71

\* 平均分：非常同意 = 5分；非常不同意 = 1分

11. 請列出此發佈會中，你認為最獲益的部分/環節及原因。

- 教師經驗分享。(回應人數：14)
- 經驗分享(小學)。(回應人數：3)
- 經驗分享，較實用(在教學上)。
- 經驗分享環節，因可參考真實事例。
- 經驗分享部份，較實在了解有關的計劃及理念。
- 經驗分享環節，接近教學內容。
- 中學經驗分享，資源分享。
- 注意教師教學態度！
- 了解教材套的發展概念及目標。
- 老師分享具體的教學經驗，有助自己的教導。
- 蒙恩小學的分享(因我們是小學老師)。
- 分享(蒙恩小學)，以課程內的內容如何數學化去教，實用。



- 聖公會蒙恩小學和劉永生中學的講者分享精彩。
- 小學環節，教師實戰的分享。
- 小學老師教學及工作紙設計分享；中學老師的設計分享很好，給予我不同的靈感。
- 1) 了解資源套內的內容；2) 中小學教師的分享環節
- 「數學化教學」的經驗分享，實在貼近實際課堂面臨的難處及挑戰。
- 介紹QEF。
- 認識數學化教學。
- 數學學習的聯繫是重要的。
- 簡介資源套主題時著同工注意事項及 Intangible Outcome.
- 同工在校發展教學資源的故事。
- 算額的評估方式有趣。
- 不同的教學方法，例子可引發思考教學方法。
- 提升教師專業發展。
- 教師分享部份，實際、落地、可應用。
- 評估：喚起老師對評分準則的嘗試；Rich tasks: promote group work with collaboration.
- Rich Task.
- 周老師的分享呈現了數學化教學的具體例子及意義，很精彩；黃副校展示的教學例子能引起教學思考，很欣賞該校教學團隊的用心；莫博士的Rich Task是新接觸的，相信有助教學提升。

12. 是次活動所介紹的「數學教育資源套」，你認為有甚麼須改善的地方？

- 很好，內容豐富。
- 1) 多介紹實際內容；2) 內容介紹較零碎，例子多集中在中學，較少小學例子，對小學老師得著較少，可分開小學和中學進行發佈會；3) 當日分享的例子已經在很多年前建立，宜用較新的例子，以配合今日的科技發展。
- 更多例子。
- 如資源套含有今年的數學資源內容更好。
- 資源套的例子都年代久遠，有些放在網上的資料是死link，用不到，又或者不太切合現時的需要。
- 內容較舊，宜教授新的教學內容、方法。
- 多關注今年教育發展趨勢，例如STEM.
- 不用太仔細介紹，略略介紹後可先分享，中途再詳細一點介紹，再分享會較易消化。
- 希望可提供更新的QEF計劃（有關數學科）資料。
- 1) 時間的控制；2) 多一點「資源套」的資訊/內容，會較能吸引聽眾的專注力。
- 講解太急。
- Overrun.
- 背景介紹太多，長。
- 可提供講者的PowerPoint.
- By the way, how can we access the resource package? It's not listed in the leaflet.
- 會否有網上下載softcopy,以作校本修訂，更有效運用。
- 未有，很難評論。

13. 倘若日後會按是次活動所介紹的下列六個主題作進一步的專業發展，哪一個你會最感興趣？（可選多於一項）

	<u>回應人數</u>
數學概念	52
數學思維	46
工具與課業	34
課程革新	30
評估	24
教師發展	24

14. 其他意見或建議

- 期待教材套的發佈，感激研究團隊的努力與付出，促進教育界的交流，謝謝！Rich Task (有興趣了解更多)
- 加強前線老師的經驗分享。
- More experience sharing, less theories; Better time estimation/management.
- 可先解釋什麼是QEF.
- 1) 由於教材套仍未發佈，老師較難了解當中內容，建議教材套發佈後才出發佈會，可在9月進行；2) 老師的分享很有價值，宜多花時間。
- 中、小學可分開發佈會的舉行日期，內容重點對焦中/小學。
- 來之前想著會有很多資源分享，但從講座中聽到的只是一些很久以前的經驗，有點失望。
- 最好能即場提供相關資源套及PowerPoint.
- 1) 今日的簡報/分享内容可否上載/傳送給參與教師？2) 資源套有沒有電子版本供下載？
- 希望能依時開始。
- 地點偏遠難找，應提供地點的地圖及說明香港大學站的哪一個出口較近！
- 活動地點不便尋找，建議改於九龍塘教育局資源中心舉辦，或租用其他較便利或易找的地方舉行。