FORMATIVE EVALUATION OF THE CHINESE HIGH GIFTED EDUCATION PROGRAMME

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FORMATIVE EVALUATION OF THE CHINESE HIGH
GIFTED EDUCATION PROGRAMME

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ABSTRACT

The Chinese High School in Singapore set up a Gifted Education project in 1993 to provide gifted students with a challenging, differentiated and enriched curriculum in Mathematics, Science and Computer Science. The selected gifted students were placed in regular classes but were taught the differentiated Science, Mathematics and Computer Science curriculum in special pull-out classes, carried out within curriculum time. As this was an experimental project, formative evaluation had been carefully planned during the early stages. Classroom sessions were observed to see how students responded to the lessons. Lessons were also recorded and transcribed. Students provided feedback in both interviews and surveys on how they felt about the lessons and the enrichment sessions. Regular meetings were carried out with teachers to work through the problems of the pull-out programme and to formulate appropriate strategies in stretching the students' abilities. This paper reports the results of the formative evaluation of the programme.

Introduction

The Chinese High School, an independent school in Singapore, embarked on a pull-out gifted programme in January 1993. The programme is part and parcel of the academic opportunities provided by Chinese High to facilitate the learning needs of its students. The school aspires to foster in its brightest and best students a sense of social and intellectual responsibility. Each year a group of Secondary 1 (Grade 7) gifted students are selected using a package of instruments testing general

ability, numerical ability and logical skills. The selected gifted students are placed in regular mixed-ability classes but are taught the differentiated Science, Mathematics and Computer Science curriculum in special pull-out classes carried out within regular school hours. Additional enrichment is also conducted outside curriculum time. The enrichment programme lasts for four years, from Secondary 1 to Secondary 4 (Grade 7 to Grade 10).

The pull-out programme in Chinese High appears to provide the gifted students with the best of both worlds: they are able to benefit cognitively through working with their gifted peers (Feldhusen, 1989; Kulik and Kulik, 1984; Oakes, 1986) as well as becoming role models and leaders in their regular classes. They face healthy competition from peers in both their classes. They are thus able to develop a realistic appraisal of their own ability in their regular and enriched subjects and measure themselves with appropriate yardsticks (Fiedler, Lange and Winebrenner, 1993).

Formative Evaluation

At the initiation of the gifted programme, a carefully controlled, broadly conceived evaluation study was planned to determine whether the programme would have any significant positive effects on achievement, creativity and critical thinking skills of the students. The importance of having proper evaluation was pointed out by Callaghan (1993) after having surveyed the status of evaluation in gifted programmes in many countries. Callaghan concluded that programme evaluation had been neglected in gifted education. When the Chinese High gifted programme was set up, evaluation became a feature of the programme.

Evaluation was at both formative and summative levels: formative evaluation at the early stages in order to improve the programme and summative evaluation at the end of the year to determine the net effectiveness of the programme. In the qualitative formative evaluation, classroom sessions were observed to see how students responded to the lessons. Students and teachers gave feedback in both interviews and surveys on how they felt about the lessons, the enrichment activities and the programme as a whole.

A crucial component of the gifted programme was to provide a challenging and enriching curriculum in Mathematics, Science and Computer studies through extending the basic syllabus both
in breadth and depth (Feldhusen, 1991). The Chinese High programme emphasized ideas and themes within the enriched subjects using an interdisciplinary approach to curriculum design, as indicated in Witham (1991). Teachers were encouraged to teach students to use the computer to facilitate their learning. Higher-order thinking skills were emphasized and utilized in the classrooms. Questioning strategies were exploited to foster thinking in the classroom. Consequently, thinking skills would be infused into the enriched curriculum (VanTassel-Baska, 1991; Witham, 1991).

The teachers tried out innovative methods of teaching such as pupil-centred learning, the use of the discovery process with students playing the role of scientists and mathematicians, and the inquiry method. All methods stressed the interdisciplinary approach to integrate Mathematics, Science and the use of computers. As far as possible the teachers were encouraged to teach by the inquiry method in order to encourage students to think in class. However, students in Singapore tended to keep quiet unless they were confident that their answers were correct. As a result, they generally gave monosyllabic answers.

Table 1 presents an excerpt of a video-taped introductory science lesson on the Circulatory System for Grade 7. The questioning technique of the teacher was crucial. The teacher began the lesson with a simple question about how one could determine how fast the heart beats. His subsequent questions introduced the idea that one could feel the pulse in parts of the body far away from the heart. Unfortunately, the students gave monosyllabic answers, thus defeating the purpose of the questions. He then tried a more hands-on technique by making the students take their own pulses. Using their data, he showed them how to obtain the average heart rate. He then asked some "what if" questions designed to make the students think but got only monosyllabic responses (as shown in the excerpt of the transcript in Table 1). The class was then asked to investigate the hypotheses proposed and to change one variable at a time. Building on the scenarios, he got the students to reflect on would happen next. Apparently students needed encouragement to be more speculative and to contribute towards class discussions.
Feedback from students

As part of feedback on the gifted programme, students completed a free response-evaluation form where they were asked to state their likes and dislikes for each of the enrichment subjects (see Table 2). Each student's responses was coded; the group of 26 students gave 66 responses for likes and 46 responses for dislikes. In Mathematics, more than 20% of the favourable responses were on the Mathematics teacher and her interesting lessons; teachers play an important part in a gifted programme. Students appeared to like interesting Science experiments (30%), challenging Mathematics problems with innovative methods in solving them (9%) and opportunities to learn computer skills and programmes (24%). The computer was a new and interesting experience for some of the students. Favourable comments on the subjects included:

Fun and colourful, full of life and energy (in mathematics lessons).

Challenging computer programming problems and practice on the computer.

The hands-on sessions are fun and we are able to try out any programmes we want.

Although students liked challenging work, they detested extra work and difficult problems. Students disliked a lot of demanding Mathematics homework and tests (25%), complex Science tests (20%) and problematic computer science practicals and assignments (11%). Some students had a problem in understanding the explanations given by the Science teacher (22%). Others referred to "kiasu" classmates in the Mathematics programme (9%) (the word "kiasu" means "afraid to lose" in Hokkien, a Chinese dialect in Singapore). Kiasu students would be very achievement oriented and went all out to ensure that they did not lose out to their peers.

Students also gave feedback on individualised project work, an important feature of the gifted programme. Secondary 1 students learned research skills and carried out projects with their teachers.
Secondary 2 and 3 students were given opportunities to work with mentors. Recognising that gifted students needed to interact with mentors to achieve their potential (Zorman, 1993), Chinese High set up Mentor Link to assist gifted students to locate mentors from tertiary and professional institutions.

A group of three Secondary 2 students did a project on hydroponics (Cai, et al. 1994) with a mentor from the Singapore Polytechnic. They found that root aeration was vital to hydroponics tomato plant production. The students enjoyed the project and learned extensive research skills as well as how to work independently. Their mentor found them to be lively, enthusiastic and extremely inquisitive. Two Secondary 2 students did a feasibility study of a robot sweeper under a teacher’s guidance (Ong, Ng & Ilango, 1994). They researched the market for components such as motor, sensors, EPROM, compressors and other electronic devices. After successfully completing the feasibility study they realised that:

The hands-on has done us good.... we feel that the project has stimulated our thinking as we brainstormed for ideas, come up with possible combinations of various components and come up with possible solutions.

A secondary 1 student commented on how he started a project on glutinous rice balls:

I do it with my friend, because his father is the general manager of a food company. They sell this glutinous riceball. So he got interested in it, you know, and we two team up. So we investigate, find out the nutrition value, analyze what is inside and then maybe make improvement, add more things.

The socio-emotional well-being of the gifted students was considered in the formative evaluation process. Immediately after the selection at the beginning of the year, a teacher rating scale was sent to the primary school teachers to gather information and observations on the students. Subsequently, information on self-esteem, attitudes in learning Mathematics and Science and thinking styles were collected. The students also completed a personal profile, a survey on interests and study habits as well as some guided journal writings such as 'Journey to Oneself' (Betts, 1985). As part of this 'Journey', the students wrote letters to themselves outlining their plans for positive lifestyles. Examining the issues written on positive lifestyles - appearance, personality, organisational skills,
interests and fulfilment of talent - helped the teachers to understand the students (Lim, 1994a).

There were five underachievers in the group of 26 students. They appeared to know what was wrong with themselves (Lim, 1994b). Thus in his letter to himself, one student wrote:

I heard your lifestyle is not very positive. Let me tell you how to make it positive. The first thing you must do is to think positive. If you believe in yourself, there is nothing that you cannot accomplish. With that in mind, take a positive step towards achieving your goal. You must remember that if you fail once, it doesn't mean that you will always fail. As the proverb goes: If you don't succeed, try, try again.

Another underachiever advised himself:

I think you ought to organise your time more properly. You should try to control your temper when you are angry. You should learn to be more punctual in your work. You should not be so dirty-minded but you have your good points too. Try to give it your best at your tests and exercise more often. Your parents are complaining already.

Counselling strategies were worked out for the underachievers (see Lim, 1994b). Despite the fact that the boys knew they needed to be positive, to be organised and to do their work, they might not know what they had to do to be positive and organised. In a survey which asked them to elaborate on their current study methods and the study skills, the underachievers claimed that their study methods were not effective. They all felt they needed to learn study skills, ranging from time management to specific skills in learn subjects such as Chinese and Mathematics.

Feedback from Teachers

Regular meetings were carried out with the four teachers in the programme to work through problems of the pull-out programme and to formulate appropriate strategies in stretching students' abilities. The teachers completed the evaluation forms at the end of the year. They were happy to be working with the co-ordinator as a team and to be involved in planning. Some felt that collective
decisions needed to be made as part of group responsibility. They found most students to be analytical and critical thinkers. Some students had also done well in competitions due to the programme.

Moreover they believed that the strengths of the programme lay in the infrastructure and in the resources provided by the school (see Table 3). Both students and teachers had access to information sources. Generally, the teachers liked the pull-out system and felt that they provided students with challenging opportunities. They also discovered that students needed more exposure, both theory and practical; some students preferred to be learners rather than explorers.Weaknesses, listed in Table 3, included the small number of teachers in the programme, teachers facing constraints and having too many students under them for project work. They also felt that the school should give them more support to execute the programme. The teachers also felt that the programme was limited by the examination system in Singapore schools. As a result, they were less willing to take the time to examine and try out open-ended methodology. They would rather stick closely to the syllabus for the examination.

Insert Table 2 about here

As students appeared to be involved in too many activities, one teacher recommended that only Secondary 2 and 3 students needed to do projects; Secondary 1 students could concentrate on learning research skills (see Table 3). Another teacher found that while some students did very good projects, others did not put in the effort. On the whole, teachers wanted students who were not performing up to the mark to be withdrawn from the programme. They also requested more training for themselves - to attend conferences overseas for exposure to methodology of giftedness and to be informed of the latest technology.

Conclusion

The pull-out gifted programme, as set up in Chinese High, is able to combine the advantages of both full- and part-time programmes. Students were stretched in the pull-out gifted class in the
subjects that they excelled in. In their regular class, they were able to do their other subjects at the same pace as their non-gifted peers as well as being able to interact with them. Annual results of students in the enriched subjects showed that gifted students did very well. The teachers were generally happy with them.

On the whole, students were in favour of the programme. Many did not perceive themselves to be gifted or special in any way. Furthermore, they found topics within the enriched subjects to be challenging. Some students came up with interesting projects and enjoyed working with their mentors. In terms of curriculum, Chinese High will have to persuade the teachers to cover and extend the syllabus for the enriched subjects in order to stretch the gifted students to their fullest. There is also a need to make the non-programme teachers aware of the characteristics and needs of gifted students.

Qualitatively, the project appeared to be doing quite well. Summative evaluation is currently going on. A quasi-experimental design of an experimental class and a control class (both intact classes) was used for the quantitative summative evaluation. Instruments selected for the pre-tests included the Classroom Environment Scale (Moos and Trickett, 1974), Self Esteem Inventory (Coopersmith, 1981), Self-Description Questionnaire I (Marsh, 1988) and Test of Science-Related Attitudes (Fraser, 1981). Classroom learning environment and self-esteem scales were included to ascertain whether the programme could provide a better learning environment and enhance the students' self esteem. The post-tests had been carried out and the data is being processed.


Table 1 Transcript of an excerpt of a science lesson on the Circulatory System

Teacher: It goes up. Now the score goes to 68, 80 and just a little bit over a 100 and let's say over here (showing on the whiteboard). And what will happen if you continue to exercise?

Student: Go up a little high.

Teacher: Go up a little high, OK. Let's say it goes up to about 150. What will happen if it continues to go higher above 150?

Student: -- Pause --

Teacher: What else is changing besides the number of beats per minute as the heart goes faster and faster. What other factor in the blood is changing? Remember the diagram here (he draw the diagram on the whiteboard) the blood going through the artillery and the heart is beating faster and faster and what happens? What happens as the blood flows through?

Student: The blood pressure goes up.

Teacher: Good. The blood pressure goes up, and up and up and now if you have very tiny blood vessels located in your heart, brain and other vital organs what will happen to those blood vessels if the pressure goes up too high?

Student: Break.

Teacher: Break. And if the blood pressure goes up and finally it comes to a point where it can't take the pressure any more and they break. So what will happen to the heartbeat as you continue to exercise? If I had you exercise let's say 5 minutes, what will you think the rate will be? Will it keep on going up?

Student: No.

Teacher: No. So what will happen to it?

Student: Level

Teacher: OK, it will level off. And so the pressure does not go up too high. So the pulse rate levels off. So when you stop exercising what will happens.

Student: Pressure goes down.

Teacher: It will go down (showing on the whiteboard) and it begins to get back to the normal pressure, increases a little bit and finally back to normal and remains there.

Now what will happen if the pulse rate goes down, something like that? (showing on the board when the pressure goes lower than the normal pressure)

Student: Probably die.

Teacher: Now before you die what will you do?

Student: -- Pause --

Teacher: Now if you were standing up when you were exercising and your pulse rate suddenly drop very quickly, what will happen?

Student: Collapse, fainted.

Teacher: Faint. Not enough blood going to where?

Student: Brain.

Teacher: Brain, OK. So these two dotted lines (showing on the graph) can happen on the proper conditions of health. We can do this and we can do this. If these happens (showing on the pulse rate going higher) what happens to the body? What happen to the blood system?

Student: It breaks down.
Table 2  Students’ perceptions of the Mathematics, Science and Computer Studies Programmes

<table>
<thead>
<tr>
<th>Perceptions</th>
<th>No. of Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What students liked about the enrichment subjects:</strong></td>
<td></td>
</tr>
<tr>
<td>The mathematics teacher is relaxed and lessons are interesting.</td>
<td>14 (21%)</td>
</tr>
<tr>
<td>Challenging problems and interesting worksheets in the mathematics programme.</td>
<td>3 (5%)</td>
</tr>
<tr>
<td>Innovative methods used to solve mathematics problems.</td>
<td>6 (9%)</td>
</tr>
<tr>
<td>Interesting experiments and worksheets in the Science programme.</td>
<td>20 (30%)</td>
</tr>
<tr>
<td>Challenging problems in Science.</td>
<td>3 (5%)</td>
</tr>
<tr>
<td>Opportunity to learn computer skills and computer programmes such as QBasic.</td>
<td>16 (24%)</td>
</tr>
<tr>
<td>Challenging programming assignments.</td>
<td>4 (6%)</td>
</tr>
<tr>
<td></td>
<td>66 (100%)</td>
</tr>
</tbody>
</table>

| **What students disliked about the enrichment subjects:**                  |                  |
| Too much Mathematics homework with uninteresting problems.               | 5 (11%)          |
| Difficult Mathematics problems and tests.                                | 7 (15%)          |
| "Kiasu" classmates in the Mathematics programme.                         | 4 (9%)           |
| Difficult Science tests.                                                 | 9 (20%)          |
| Difficulty in understanding teacher’s explanations, particularly in Chemistry.| 10 (22%)         |
| Difficult Computer Science practicals and assignments.                   | 5 (11%)          |
| Location of the Computer Science laboratories.                            | 6 (13%)          |
|                                                                             | 46 (101%)        |
Table 3 Teachers’ perceptions of the Gifted Programme

Strengths:

A wide range of talents within the programme ... guidance from professionals and specialists and ample opportunities to work with external agencies ...

Excellent information provided for the teachers of the gifted. Materials are easily and readily available to both teachers and students.

Good infrastructure ... opportunities for research by students ... students selected for the subjects that they are good in.

Sufficient challenging activities offered to students in the programme.

Pull-out system is good.

Weaknesses:

Many students preferred to be learners rather than explorers ... students are involved in too many activities.

Students need more exposure, both practical and theory ... Teacher-advisors have too many groups under them for projects ... there should be a good spread of students doing projects under different mentors.

Too few teachers in the programme. Teachers cannot give their best to the programme due to constraints in the school.

Insufficient time and support from the school in implementing activities in the programme.

Recommendations:

Students need a refresher course in time management skills.

Train Secondary 1 students in project skills but only make Secondary 2 and 3 students do projects.

Students who are not performing should be withdrawn from the programme.

Teachers should be well trained and informed of the latest in gifted education. They need to attend conferences overseas.

Teachers in the programme require more autonomy to run the programme. They need more support from the school.