
Introduction

We included a total 7 schools in our study. Twelve teachers participated in this project, using QCA with the Personal Response System (PRS) in their teaching. Three hundred and sixty-one students were involved in this project.

This report includes two evaluation methods.

(1) The first method involves analyzing the questionnaires collected from teachers and students, which focus on the effectiveness of this project. The questionnaire was separately designed for teachers and students.
(2) The second method involves analyzing the academic results of students who used PRS and those who did not. In this analysis, self-increment in their academic results of Integrated Science over a year is used for the comparison between students using and not using PRS.

I. The Questionnaire

The questionnaire for teachers

A questionnaire on the QCA was designed to seek the views of teachers on the effectiveness of this project, with particular reference to its operational difficulties, its impact on teaching experience, class discipline, learning of students in class, and their understanding of students’ learning abilities, and possible directions of a future revision.

On 10 July 2001, the questionnaire was sent to nine participating teachers who used QCA in their classes. All questionnaires were returned before 27 September 2001. The response rate was 100%.
A. Operational difficulties

This project has two aspects of operations. They are the operation of the PRS device and the techniques of using the question-centered approach teaching method.

1. The use of PRS

Question 2 asked teachers to comment on the difficulties of the operation of PRS. Findings reflected that most of the teachers agreed that the PRS is easy to operate (5 strongly agree [56%] and 4 agree [44%]). This shows that PRS is more or less an easy tool for them to use in class. Nevertheless, according to the findings from question 17i, 8 teachers (89%) disagreed that using PRS in questioning could save time on preparing teaching materials before the lesson. For 17ii, 5 teachers (56%) agreed that using PRS could save time in questioning during the lesson. This shows that teachers need to do extra preparation before the lesson compared to the ordinary teaching method. Compared with the ordinary teaching method, using the question-centered approach, as its name implies, requires many questions to guide students to learn. Therefore, teachers spent a lot of time on preparation of questions. This definitely increased their workload before the lesson.

2. The effect of using PRS

Question 29 concerned the benefits of using PRS. Teachers indicated that PRS is a tool that indicates the responses of all students very quickly. The burden of asking questions was reduced. Therefore more students could be involved in answering questions. One teacher indicated that students were curious about the PRS device, therefore increasing their interest in learning in class and the whole learning atmosphere was improved. The weaknesses of using PRS (question 30) are mainly the limitations on the required softcopies of questions and the large amount of workload before the lesson.
3. Improvement on PRS device

In Question 21, suggestions for improvements of the PRS device in software and hardware were collected. Most of the teachers suggested that it would be better if the software could support more graphics formats. One teacher mentioned that it would be even better if the receiver could be wireless. Then it would reduce the limitations of where PRS could be installed. Most teachers did not have any problems when they used PRS in class (Question 31). Also, in Question 32 most teachers indicated that there is no limitation of the places that use PRS. This means PRS can be installed in many different parts of a school, for example, classrooms, laboratories and halls.

4. The new teaching method

In Question 14, 3 teachers indicated that they faced problems while they were setting questions. The problems they indicated are:

(1) It was time consuming in designing questions to raise students’ interest or attention.
(2) It was difficult to set answers apart from the correct one.
(3) Sometimes teachers wanted to include graphics in their questions, but it was time consuming to prepare the softcopies.

In addition, Question 28 asked about the limitations of using PRS to ask questions. Five teachers (56%) have indicated the limitations in their questionnaires. (1) The questions must be multiple choice. (2) It has significant effects on students’ understanding of materials if the choices were similar. (3) Some topics are difficult in designing questions that raise students’ attention. An example is the topics that relate to the procedure of doing experiments. This shows that the main difficulty in using the question-centered approach is the setting of questions. Whether questions are useful greatly depends on what goals the teachers want to achieve.
Therefore, a set of questions was developed in this project for other teachers as a reference. Other teachers can access the web and download the questions for their use. This greatly reduces the time that teachers need to redesign the questions.

B. Impact on teaching experience

In Question 5, most teachers agreed that with the help of PRS, they could ask questions more easily and have more notable responses from students after questioning them. For Question 9, most teachers agreed that using PRS could help them to know more about their students’ learning abilities. In Questions 11 and 13, teachers even increased their interest in teaching Integrated Science and the communication between them and students after using the question-centered approach.

Findings in Questions 22 and 23 showed that all teachers (100%) would adjust the schedule of teaching and give additional help to those students who were weak in answering the questions after obtaining the statistics of the students’ answer.

Question 26 asked for different applications of PRS in the teachers’ teaching schedules. They mainly use PRS in raising students’ interest in new topics, revisions, concept clarifying and sensitive questions. Three teachers have even used PRS to do quizzes and multiple choice tests.

According to Question 33, all teachers (100%) indicated that it would be very helpful for teachers to exchange experiences and teaching materials during meetings and forums on the web.

C. Impact on the class discipline

Findings of Question 24 showed that class discipline was more or less the same as before, but three teachers (30%) indicated that the class discipline was improved.
D. Impact on the learning of students in class

According to Questions 1, 3, 4, 6, 7, 8, 10, 12, 25, the impacts can be generalized into the following points:

(1) Using PRS to ask questions could improve the learning atmosphere during lessons.
(2) Increasing the proportion of time asking questions could increase students’ interest in learning.
(3) Increasing the proportion of using questions could help students concentrate in class.
(6) Using PRS helped to lessen the embarrassment of students when they were answering questions.
(7) Increasing the proportion of using questions could help students understand the content of the textbook much better.
(8) Using PRS could increase the critical thinking of students in class.

E. Teachers’ understanding on students’ learning abilities

According to the result of Question 18, most teachers (67%) indicated that PRS could explicitly show the learning abilities and learning progress of students.

F. Project assessment

Question 19 showed that all teachers (100%) were willing to introduce PRS to secondary schools. For Question 20, nearly all teachers (89%) were willing to introduce PRS to all classes.

Question 15 asked their overall view of this project. Their views could be generalized into the following advantages of the approach:

(1) Raised students’ interests, concentration in learning in class.
(2) Improved the learning atmosphere in class.
Appendix C

(3) Increased the participation of students in answering general questions.

(4) Particularly increased the participation of students in answering some sensitive questions.

(5) Provided a chance for teachers to design some interesting questions for their students, which would have contributed to the teaching skills of teachers themselves and students’ learning interest.

Summary

In general, the question-centered approach, with the help of PRS, had a positive effect on both the teaching and learning abilities of teachers and students. For those teachers who use the approach for the first time, the preparation time before class is increased.

Questionnaire for students

A questionnaire on the QCA was designed to seek the views of students on the effectiveness of this project, with particular reference to their learning abilities.

The questionnaire was sent to three hundred and sixty-one participating students on 10 July 2001 though their teachers. Two hundred and twenty-five questionnaires were returned before 27 September 2001. The response rate was 62%. The low response rate is due to uncompleted questionnaires and missing data from two classes.

This questionnaire had a total of 9 questions, with all questions focusing on the impact of QCA in their learning in class. The results are summarized below:
In questions except 5 and 7, over 70% of students agreed that there was a positive effect of using QCA with PRS on their learning, concentration, understanding, activeness, participation level and interest in attending class. Question 7 showed that over 80% of the students agreed that using PRS could improve the learning atmosphere in the classroom.
Summary

Almost over 70% students indicated that question-centered approach and the PRS device were useful.

II Analysis of academic results

We found that different schools have very different forms of measurement on students’ academic results. Therefore, we suggested using only the examinations of the first and second terms to do the comparison. However, the topics in the second semester were much more difficult than those in the first. Therefore, we expected the question-centered approach would not have a great effect on the analysis of academic results.

Students were divided into two categories. The first category of students came from classes that used PRS with QCA, and the second from the control classes without using PRS with QCA. The self-increment of each student in these two categories was measured by the percentage difference between the first term and second term final exam results in Integrated Sciences. By comparing the average self-increment percentage of each category in one school, we could see whether QCA had an impact on their academic results. The analysis is attached to this report.

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\% \text{ increment in academic result of Integrated Science of each student} = \frac{\text{normalized marks in 2nd term final exam} - \text{normalized marks in 1st term final exam}}{\text{normalized marks in 1st term final exam}} \times 100\%
\]

\--------Equation 1

After obtaining each student’s increment percentage of each school, we averaged them and obtained the following table:
### Table 2: Average increment percentage of each school (Date comes from teachers of the seven schools: Kung Lee College, Rotary Secondary School, Yen Ching College, Kei San Secondary school, Kei Yuen College, Hoh Fuk tong College, Pui ying Secondary School)

<table>
<thead>
<tr>
<th></th>
<th>Class with using PRS</th>
<th>Class without using PRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-18.66</td>
<td>-26.75</td>
</tr>
<tr>
<td>2</td>
<td>-31.05</td>
<td>-21.39</td>
</tr>
<tr>
<td>3</td>
<td>-11.14</td>
<td>-12.80</td>
</tr>
<tr>
<td>4</td>
<td>0.70</td>
<td>0.01</td>
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<tr>
<td>5</td>
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<tr>
<td>6</td>
<td>-1.35</td>
<td>4.25</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>-6.44 34.39</td>
</tr>
</tbody>
</table>

Average 7 schools: -10.36 -4.90

Standard deviation: 11.17 20.47
The results of the above table are plotted as a bar chart below:

From Table 2, the standard deviation of the classes did not use PRS is larger than those using PRS. This means that even without using PRS, the learning ability of students are distributed over a very large range across the seven schools. Therefore the results of the academic analysis might not accurately reveal our project’s impact on the general learning ability of students.

Conclusions

The results are inconclusive about the impact of QCA on the improvement of the academic results of students, and the sample variations account for this result. The difficulties of different topics could vary by a large scale and students’ learning abilities are very different across classes and schools. Besides, as we could not use the same exam paper for each school, the level of difficulty of the examinations could not be controlled. Finally, the importance of QCA focuses not only on their learning abilities, but their interest and activeness of participation in lessons. Our project has successfully showed a positive impact on the latter two aspects by the findings of questionnaires and interviews.