Quality Improvement in the Classroom using Total Quality Management Tools and Inter-term Student Questionnaires: A Case Study

Christopher J. Good

Abstract

A case study was undertaken to address instructor based methods of quality improvement in the classroom. Of concern was the identification and improvement of problem areas in the teaching and learning process. Total Quality Management (TQM) tools were used and these included the Plan-Do-Check-Act cycle, the cause and effect diagram, brainstorming, questionnaires, observation, interviews, check lists, and Pareto diagrams. A new intra-term questionnaire was devised and its use is discussed in detail. Results of the study showed that very valuable information and changes can be obtained using TQM tools. This process not only improves the quality of a class but also empowers and enthuses teachers and students.

Key words: education, chiropractic, teaching, questionnaires, Total Quality Management tools

Introduction

Quality improvement in the classroom can take an immense amount of courage, especially if it is initiated and undertaken by the class instruc-

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part of the quality assurance process. Instructor orchestrated classroom quality improvement aligns itself with the trusting, empowering, ownership and staff development goals of TQM. As a teaching professional the onus is on the instructor to address this issue, if for no other reason than for the sake of the students.

In this case study a chiropractic college's attempts to address quality in the classroom were addressed. While student examination results and informal feedback from students gave some indications of various teaching weaknesses and strengths, there was no process in place to specifically determine which teaching methods were useful and which were not. The only device which was used to evaluate any type of quality was an end of course student questionnaire. This primarily used somewhat vague closed form questions which yielded only general feedback. The only open form question on this questionnaire did not inspire students to comment in depth and there was little access to those comments. Also, students' written comments were vetted so that the teacher did not know the number of students making the same comment or the specifics of a comment.

Additionally these questionnaires had been criticized by the college's faculty as being both invalid and unreliable. Many staff had questions concerning poor design, low percentage of responses, lack of a representative sample, poor understanding of the instructions (students regularly rated areas of a class which did not exist in that class), and timing (questionnaires were given directly before or after formal exams). While these criticisms resulted in some changes to the student questionnaires, improvement and alternative sources of information for teachers were still needed.

This study attempted to address the issue of how to systematically obtain valid information about a class in order to make quality improvements for that class. This was done with a view towards changing the college's current process. A variety of quality improvement tools were used to meet these goals. This included the standard Plan-Do-Check-Act (PDCA) cycle, the cause and effect diagram, brainstorming, questionnaires, observation and interviews, check lists, and Pareto diagrams. An interim student feedback questionnaire was designed to address specific areas of teaching so substantial changes could be made during the present course. The fact that it was 'intra-term' and not 'end of course' allowed for the present class to reap the benefits of their own ideas. Also, different student cohorts have different personalities and needs which may change between cohorts from year to year. It would therefore be important to know how to improve the classroom quality for that particular cohort.

To illustrate the use of these strategies a 2nd year clinical biomechanics and technique (CB/T) class was used. The first course aim of CB/T was to have the student obtain an in depth knowledge of the cause, analysis and treatment theories associated with the biomechanical model of spinal dysfunction. The second was to have the student obtain the psychomotor skills necessary to analyze and treat spinal biomechanical dysfunction. The presentation format consisted of practical technique laboratories (70%), didactic lectures (25%), and structured tutorials (5%). This class was taught for one entire academic year to the same cohort of students by the same instructor and 4 assistant instructors.

**Evaluation of attitudes and opinions**

There are many possible ways to collect data on student attitudes, opinions and practice habits. These include interviews, polls, surveys, questionnaires, logs, journals, diaries, reports and observation. The information from these devices can then be used to evaluate an entire class, a specific teaching method, or help identify factors which

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influence motivation. However, when there is a large respondent size and a limited opportunity to collect the data it, a well designed questionnaire can be very useful.

Closed form questions

Closed form questions can offer greater specificity than open form ones. However open form questions let the respondents address issues not thought of by the investigator and serve a very useful purpose when trying to identify problem areas. In the present study closed and open form questions were used so that very specific as well as more wide ranging information could be obtained.

A series of closed form questions using agreement scales which ask the respondent to choose how much he/she agrees or disagrees with a statement can be one tool. In all cases the agreement scale statement must have responses which are located at the ends of a continuum. Also it is important to be aware of the ‘acquiescence response set’ -- the tendency of respondents to agree irrespective of item content simply because agreeing ‘feels better’. Fortunately this phenomenon is related to the level of education of an individual and tends to be of lesser effect as education increases. As the class used in the case study were second year students in chiropractic college, the acquiescence phenomenon was not deemed relevant.

A semantic differential scale is a fill-in-the-blank type statement with two opposite words or phrases situated at the end of a numerical scale used to fill in the blank. These types of questions can help pinpoint an individual’s opinion. In general the agreement scale and semantic differential scale type questions were found by the author to be quick and easy devices for obtaining large amounts of data on specific topics, general attitudes, a subset of attitudes or on the intensity of an opinion.

Open form questions

Open form questions must motivate students to comment on specific areas of the class if they are to be of use, and teachers must have access to the information. The value of an instructor designed student questionnaire is that very specific questions could be asked about teaching methods, topic areas or any other aspect of the class. More general questions could also be used to try to gain information in the affective domain as well.

Methodology and Results

It is important to remember that this case study was designed to develop and analyze a system of self-evaluation of any college course by an instructor. As such the Methodology and Results sections are combined so that there is a clearer understanding of the system used. The reporting here is not meant to be a comprehensive analysis of the results obtained for this particular CB/T class. Instead selected results are presented to highlight the usefulness of the system.

The PDCA cycle was the framework under which the classroom quality improvement case study was done. In the Planning stage, the first step was to design a cause and effect diagram (fish bone diagram) identifying the factors which contribute to a quality class. A diagram based on the work of Hau appears in figure 1 (page 38) and encompasses the factors encountered in the class.

Once the factors had been identified, further data had to be collected to see if there were problems in particular areas. Intra-term Student Feedback Questionnaire 1 (ISFQ 1) was developed for this task (appendix 1). It was composed of two sections, section A which had 21 closed form questions and section B which had 10 open form questions. The closed form questions either made a statement and used an agreement scale (5 to 1) or made a partial statement and used a semantic
Figure 1. Cause and Effect Diagram for a Quality Clinical Biomechanics and Technique Class

(adapted from Hau, 1991)
differential scale between two words (again 5 to 1). The open form questions were either general or specific in nature. They were about various aspects of the lectures, assessment, technique laboratory or specific teaching methods.

ISFQ I was distributed to the class in a lecture, filled out by the students and returned immediately (N=80). The students did not identify themselves on the questionnaire and this blinding was considered essential so that the free exchange of information could occur. Within the next week fifteen minute private interviews were held with students of the class to confirm and expand upon the findings of the questionnaire and discover new areas of concern. Interviewees were chosen randomly from the class roster.

The data collected from section A (closed form questions) on ISFQ I was tallied on the Statview and Graphics statistical software program and descriptive statistics (mode and frequency distribution) were obtained. The mode and frequency distribution were used to identify a potential problem area. An example is seen in Table 1.

The desired value of a mode was dependent on the way a question was formatted, so each mode had to be analyzed relative to its question.

Table 1. Frequency Distribution Table. Closed form question 1. Pace of the technique Lab. (1=too slow, 5=too fast) Mode=3

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0.0 %</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>3</td>
<td>46</td>
<td>59.0</td>
</tr>
<tr>
<td>4</td>
<td>26</td>
<td>33.3</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>5.1</td>
</tr>
</tbody>
</table>

The frequency distribution was used to determine where the responses congregated and to identify if there was an important subgroup which had a particular problem area.

From section B (open form questions) a simple tally sheet was used to record different written responses to the open form questions. Any problem area identified by more than four students was considered significant. A Pareto chart (figure 2) was made to identify the most common problem areas identified from this section.

Figure 2. A Pareto chart identifying the most common problems in Clinical Biomechanics and Technique.

![Pareto chart]

Closed form question 6. Usefulness of course lab manual. (1=very poor, 5=very good) Mode=4

<table>
<thead>
<tr>
<th>Response</th>
<th>Count</th>
<th>Percent</th>
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<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0.0 %</td>
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<tr>
<td>2</td>
<td>2</td>
<td>2.5</td>
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<tr>
<td>3</td>
<td>11</td>
<td>13.6</td>
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<tr>
<td>4</td>
<td>41</td>
<td>50.6</td>
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<tr>
<td>5</td>
<td>27</td>
<td>33.3</td>
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</tbody>
</table>
From the Pareto chart and student interviews the list of problem areas can be seen in Table 2.

Table 2. Problem Areas in Clinical Biomechanics and Technique.

- Tutors are not useful in lab.
- More personal feedback is needed in lab.
- More time is needed in lab.
- More review time is needed in lab.
- Too many students/ not enough tutors available in lab.
- More practical cases presented.
- Better audiovisuals needed in lecture.
- Better assessment guidelines needed for tutors in practical examinations.
- Too much discussion by tutors in lab.
- Course textbook was not useful.
- The pace of lab was too fast.

The information from the interviews was used to corroborate the tallies from both sections and helped identify the nature of the problems and their possible solutions. In particular the technique lab was concentrated on.

A list of many possible solutions (Table 3) was then constructed based on what were the most common problem areas identified in the ISFQ I results, the results from the interviews, and the importance of a problem. This was a team effort between students and faculty. A solution to each particular problem was chosen by the course instructor after consideration for the above and based on what was feasible. These were implemented on a trial basis in accordance with the Do stage of the PDCA cycle. Those problems which could not be addressed this academic year were discussed with the class in detail.

Informal interviews with individuals were used to assess the implemented changes (Check stage). A more formal check was done as part of Intra-term Student Feedback Questionnaire II (ISFQ II) (Appendix 2). Its questions were designed to specifically follow up issues raised in ISFQ I and to determine the effectiveness of implemented changes in technique lab. Descriptive statistics as described above were used to analyze the results of the closed form questions. The responses to the section B open form questions were used to confirm improvements as well as identify still existing problem areas. These results were tallied on a check sheet, and a Pareto chart was used to identify the major areas of concern.

The results of ISFQ II helped to fine tune the attempted solutions and to assure that changes were effective. Those which were useful were implemented permanently (Act stage). The new areas which needed to be addressed had solutions devised as per the methods already mentioned. These were implemented as part of their own Do stage. The results of this will be assessed and the PDCA cycle will be run on a regular basis.
Discussion

The PDCA process began with the formulation of a cause and effect chart. This was an important and interesting undertaking because it specifically identified the different factors influencing teaching and learning in a class. Naturally, modifications to this diagram would be made for other classes depending on individual circumstances. In general, the chart provides a good opportunity for instructor introspection. Once it is devised, a teacher can begin to self-evaluate the class they are responsible for. Often, problem areas become readily apparent. This introspection informed the making of the questions for ISFQ I. In retrospect, it probably would have been useful to perform some initial interviews with students to help formulate the questions on ISFQ I. In any event, ISFQ I can serve as a useful basis to develop similar questionnaires for other classes.

The analysis of the results was relatively easy and very informative. Concerning the closed form questions, depending on how the semantic differential was phrased, it could be determined whether the mode response indicated a potential problem area or not. For example, in closed form question number 1 'the pace of the technique lab', the semantic differential used was between 'too fast' (5) and 'too slow' (1). The mode was 3 and the frequency distribution showed that there was a significant number of students who chose 5 (5%) and 4 (33%), indicating that for over 1/3 of the class the pace was faster than they would like. Other closed form questions would preferably have a higher mode and greater percentages of students choosing response 5 and 4. For example, question 6, 'usefulness of course lab manual' had a semantic differential scale from 'very good' (5) to 'very poor' (1). The mode was 4. When looking at the frequency distribution 33% chose (5) and 51% chose (4), indicating that 84% of the class had a favorable opinion of the lab manual.

From the results of ISFQ I possible solutions were devised based on what was important, common and feasible. It was important to include student views in formulating the solutions, because not only did they have better insight into the problems, but it also ingrained a sense of empowerment within the students. For example, one student wrote, "I think the things mentioned in the last questionnaire were considered and acted upon well." This showed that the pupil saw first hand that students made a difference in the quality improvement of their course. At the very least, they felt empowered.

Being 'feasible' was the practical application of the PDCA cycle. As stated earlier, not only must a problem be identified, but any solution must be able to be put into practice. For example, it was noted that in technique laboratory teacher supervision was not structured enough. This meant that some students did not receive enough feedback when learning a new task. Therefore the teacher supervision was restructured so that all teachers had a designated area of the technique room under their supervision. Informal interviews confirmed that this improved the situation. The problem was important and the solution was simple.

Other problems in technique lab were noted, such as needing more hours or lowering student/teacher ratios. The solutions to these were not under instructor control but were under the administration's jurisdiction. In these cases the problems needed to be reported to the appropriate administrator. It must be remembered however, that there are inherent limitations on time and resources in any educational establishment which may prevent certain changes from being made. This must be explained to the faculty and students. Also, some problems which related to class content were not able to be addressed because it was not within the scope of the class. Again, this needed to be explained to the students in detail.
It was apparent that ISFQ I was designed well enough to elicit very specific responses on particular problem areas. Both section A and section B, the closed form and open sections respectively, had specific and general questions. These prompted the students to think in both terms, and induced them to give specific answers to open form questions. This was an important distinction from the end of course questionnaire in use by the college previously.

Finally, it was an important point that the intra-term questionnaires were designed by the course instructor. This allowed for specific questions to be very relevant. Particular areas of concern could be addressed or not, as the case warranted. For example, all previous end of course questionnaires showed that students were well motivated by the CB/T class. This was confirmed by ISFQ I so further questions in this area were no longer necessary on ISFQ II.

Conclusion

The PDCA cycle and other tools for quality improvement have general usefulness in improving quality in the classroom. The ISFQs, when designed by the course instructor, can also be used to address very specific teaching methods and are an important factor in quality improvement. Some of the written student responses were quite bold, and it took a certain amount of detachment and understanding not to be overly affected by them. There is always the possibility that students will use this opportunity as a chance for anonymous retribution. It is important to concentrate on the trends of the majority and not dwell on the those responses which are clearly extremist in nature. With experience and the right attitude this should not be a problem.

In the end, using the TQM tools for quality improvement will result in a more rewarding, high quality educational experience for all concerned. However, for this to become a useful part of the educational process, it will need to be embraced by the administration and the whole of the faculty. Simply having isolated instances of quality improvement may cause disgruntlement within the college community—students could see wider variations in teaching quality and faculty members could feel the pressure associated with this. Lastly, it must be remembered that quality improvement strategies are meant to be part of an ongoing process. They must become part of the institution's culture and its future if they are to be truly effective.

References

# Appendix I. Intra-term Student Feedback Questionnaire

Course title: 2nd Year Clinical Biomechanics and Technique  
Teacher:  
Academic year and date: 93/94, 7 Jan 94

This questionnaire gives you the opportunity to express your views about this course. Your responses will be totally anonymous. The results will be used as part of an overall assessment of the effectiveness of this course and for present and future course improvement.

Please answer all questions. For those questions which use numerical scales, please circle the number closest to your view. Where written responses are asked for, try to give constructive criticism and refrain from making personal or insulting comments.

<table>
<thead>
<tr>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
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<tbody>
<tr>
<td>1. The pace of the technique lab (too fast ---&gt; too slow)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>2. Inspiring excitement or interest in the course (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>3. Selecting materials and activities which are thought provoking (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>4. Usefulness of course handouts (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>5. Usefulness of course textbook (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>6. Usefulness of course lab manual (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>7. Usefulness of course reading lists (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>8. Usefulness of course dictated notes (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>9. Usefulness of course A/V aids (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>10. Teacher feedback on progress (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>11. Standard of formal assessment (too hard ---&gt; too easy)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>12. Type of formal assessment (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>13. Feedback of formal assessment (constructive, helpful comments) (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>14. Overall, how would you rate course content? (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>15. Overall, how would you rate the organization of the course? (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>16. Overall, how would you rate the quality of teaching? (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<td>17. Overall, how would you rate the quality of the assessment? (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>18. Overall has the course exceeded your expectations? (exceeded all expectations ---&gt; very short of expectations)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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<tr>
<td>19. Overall, how would you rate this course? (very good ---&gt; very poor)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>20. Overall, how much have you learned compared to other subjects taught here? (much more ---&gt; much less)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
21. Overall, how would you rate the effectiveness of the teacher(s) in technique lab compared to others here? (very effective <-> not effective)
   Teacher A
   Teacher B
   Teacher C
   Teacher D
   Teacher E

   x x x x x 21
   x x x x x 22
   x x x x x 23
   x x x x x 24
   x x x x x 25

B. Written questions

What are the good features of this course?

What are the bad features of this course?

How could this course be improved?

What did you particularly like about technique lab?

What did you particularly dislike about technique lab?

What did you think about chirobics?

What would you like to see more of in lecture, technique lab, tutorials?

What would you like to see less of in lecture, technique lab, tutorials?

Please list anything extra (other topics) you would like to see in lecture, technique lab, tutorials.

Other comments:
Appendix II. Intra-term Student Feedback Questionnaire II

Course title: 2nd Year Clinical Biomechanics and Technique
Teacher: 
Academic year and date: 93/94, 4 March 94

This questionnaire gives you the opportunity to express your views about this course. Your responses will be totally anonymous. The results will be used as part of an overall assessment of the effectiveness of this course and for present and future course improvement. Please answer all questions.

For those questions which use numerical scales, please circle the number closest to your view. Where written responses are asked for, try to give constructive criticism and refrain from making personal or insulting comments.

1. There have been greater amounts of revision in lab (strongly agree <-> strongly disagree) 5 4 3 2 1
2. The amount of revision in lab is now (too much <-> not enough) x x x x x 1.
3. I receive more feedback in lab now (strongly agree <-> strongly disagree) x x x x x 3.
4. Teachers are more useful in lab now (strongly agree <-> strongly disagree) x x x x x 4.
5. The teacher-student ratio is lab seems about right (strongly agree <-> strongly disagree) x x x x x 5.
6. The pace of the lab is about right (strongly agree <-> strongly disagree) x x x x x 6.
7. The pace of the technique lab (too fast <-> too slow) x x x x x 7.
8. I feel I need more time in lab (strongly agree <-> strongly disagree) x x x x x 8.
9. The ratio of discussion to hands on practice in lab is about right (strongly agree <-> strongly disagree) x x x x x 9.

B. Written questions

What are the good features of this course?
What are the bad features of this course?
How could this course be improved?
What did you particularly like about technique lab?
What did you particularly dislike about technique lab?
What would you like to see more of in lecture, technique lab, or tutorials?
What would you like to see less of in lecture, technique lab, or tutorials?
Please list anything extra (other topics) you would like to see in lecture, technique lab, or tutorials.

Other comments: