Quality Circle: An Approach to Solve Institutional Problems: A Case Study

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Abstract

This paper is to focus on the effective implementation of the Quality Circle (QC) in educational institutes. In this case study a group of seven students framed a quality circle in an educational institute and identified 52 problems related to teaching and learning process and their college premises. From those the “Improper laboratory conditions” is selected with the help of brainstorming, survey, feedbacks, categorization, stratification and Multi-voting. The problem analysis is done in multi dimensional aspects by flow-diagram, Benchmarking, 4W1H, Affinity diagram, Fishbone diagram and Pareto analysis. The solutions were found out by brainstorming and SMART Technique and implemented according to the planned Milestone chart. The implementation was supported with the tools such as PDCA cycle, 5W1H, FMEA analysis. The paper also highlights the results obtained. The case study witnessed the effective implementation of Quality Circle in an educational institute with positive results. This case study contributes to the mutual growth of institute and students.

Keywords
Quality Circle, Educational Institute.

Introduction
Quality Circles can be defined as a small group of employees of the same work area, doing similar work that meets voluntarily and regularly to identify, analyze and resolve work related problems. Quality Circle revolves around the principles of voluntary participation and collaborative decision making. In a few words, the QC group has to function effectively as a multi-disciplinary team, focusing on improving selected work processes. The outcome is usually to aid continuous quality improvement. In tracing the development of Quality Circles in the various countries, which implemented them, it is usually found that they are first introduced into direct manufacturing areas. Then as the benefits are publicized and expertise and confidence built up, they branch out the QC activity in other sectors.

The Quality Circles in educational institutes are much complex than those in manufacturing areas because in educational institutes the students are the most important element. The products of the educational institutes are measured by the student capabilities, student’s knowledge, values imparted to the students and all those which indicate the qualities of students towards the wellbeing of society. These qualities of the student are difficult to measure and analyze. So the level of complexity goes on increasing as they analyze them deeper. But with proper understanding of Quality tools and application of those at proper place can make the implementation and analysis much easier. Quality circle becomes more flexible when used in an educational institute with the active participation of students and give more surprising and positive results.

Formation and Operation of KANAD Quality Circle (KQC)
Each Quality Circle in industries is generally framed by the employees from grass root level. A leader and a director leader are selected among the group. A facilitator from department, a coordinator from management is elected. Whereas KANAD Quality circle consists of seven students as a member who chosen a leader among them, a Professor as a facilitator and a coordinator from administration of Student Association. This QC of seven students,

most of the time is involved in tackling the problems related to the teaching - learning process. The KANAD QC members meet regularly on Mondays and Thursdays for two and half hours after their regular college and academic activities.

Methodology adopted

As this is an initiation of Quality Circle activity in the College of Engineering Pune, the KANAD Quality Circle members strictly followed the standard steps and procedures given by QCFI (Quality Circle Forum of India) for the effective implementation of the Quality Circle. Following are the steps taken for accomplishing the better results from the case study:

1) Identification of Work Related Problems

Firstly with the help of *observation and discussion*, problems related to the teaching-learning and institute premises were identified. The total problems found out were 52.

2) Stratification of Problems Identified

The problems were stratified according to three groups' viz. Green Zone, Yellow Zone and Red Zone.

- **Green Zone** – Problems which can be solved by QC members.
- **Yellow Zone** – Involvement of Department authorities is necessary.
- **Red Zone** – Involvement of management authorities is necessary.

It is found that the 14 problems were from Green Zone (26%), 19 problems were from Yellow Zone (37%) and 19 problems were from Red Zone (37%).

The figure 1 shows a graphical representation of the stratification for better visualization:

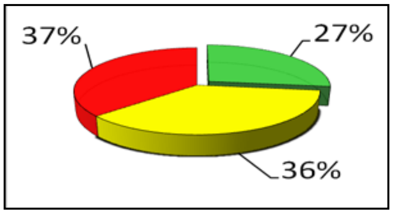

Figure 1: Graphical Representation of Stratification

3) Categorization of Problems Identified

The further organisation of collected problems was done as follows:

- Infrastructure – A (23.08%),
- Maintenance – B (9.62%),
- Students – C (11.54%),
- Teachers – D (1%),
- Resources and Facilities – E (17.31%),
- Health – F (13.46%),
- Academics – G (23.08%)

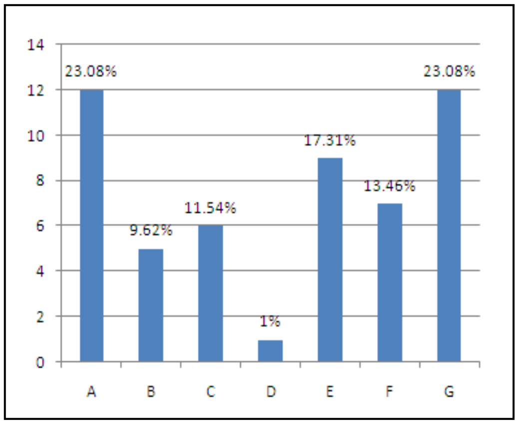

Figure 2: Histogram Showing Categorization of Problems Identified

The *Histogram* shown in Figure 2 shows that most of the problems were accumulated in Infrastructure, Academics and Resources & Facility.

4) Problem Selection

The problem selection is the most important part of any case study. The proper selection of problem leads to the positive results of the case study otherwise failures leads to the loss of confidence in the group. The basic conditions which KANAD QC members considered while selecting a problem for their case study among 52 identified problems were as follows:

- The problem should be selected from Green Zone problems. Because those problems needs involvement of QC members only, to solve them.
- While selecting the problem, benefits to the students should be considered as the student is an important element in any educational institute.
- The problem selected should serve the purpose for an overall development of students.

Following methodology was adopted by KANAD QC to select the problem from the bunch of 52 problems identified:

- **Brainstorming**

The *Brainstorming* session was carried out in which one by one all the problems were discussed, according to their importance, effect and benefits. It gives the broader information of each problem.

- **Multi-voting**

After getting well-known to each problem identified, KQC used *Multi-voting* tool to shorten the list of 52 problems to the sizable numbers. *Multi-voting* tool narrows a large list of possibilities to a smaller list of top priorities or to a final selection. With the help of this tool they narrowed our problems from 52 to 20. The procedure they followed was as follows:

- Firstly each QC member is allowed to select 20 problems from the list of 52 according to his priority,
- Then the member is allowed to rate each problem from the list of 20. The rating was to be given in the range of 1 to 10. As 1 for least priority and 10 for high.
- Then all data is combined and analyzed,
- Then the top 20 problems according to the ratings were taken out for further analysis.

a) Feedback From Students

After filtering the problems with *Multivoting*, they left with 20 problems of high priority according to the QC members and *Multivoting* tool. Then they went for the feedback from the students to find out the most pinning problem according to the student point of view. Figure 3 shows the graphical representation of the feedback taken from the students. It doesn’t arrive on any one final problem, so they took top 10 problems from the same feedback.

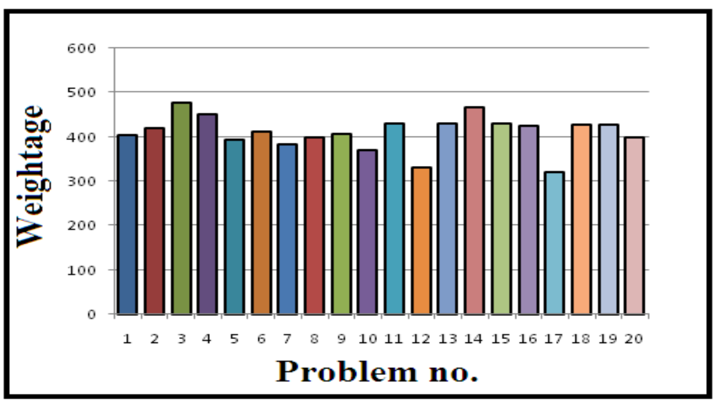

Figure 3: Graph showing the feedback from students on 20 problems filtered by Multivoting

Following are the top 10 problems filtered through above steps:

- Unhygienic conditions of boat club.
- Less number of safety equipments in the workshop.
- No common announcement system.
- Under utilization of summer vacation.
- Improper laboratory conditions.
- Less number of class rooms.
- Pigeon problem in drawing hall.

- Communication gap between students and teachers.
- Students lack in presentation skills
- Wastage of electricity.

Then finally in one of the Brainstorming session with special presence of our facilitator they finalized our problem for further case study. The problem was as follows:

"Improper Laboratory Conditions"

The reasons behind selecting this problem are as follows:

- o Improper utilization of existing lab facility.
- o Practical and analytical experimentation is a base of engineering curriculum.
- o Actual visualization and better understanding of different theoretical concepts.
- o To develop students' interest in experimentation.
- o Exposure to high end technological equipments.
- o Exposure to industrial equipments and methodology.
- o To increase confidence level and judicial skills.
- o To develop educational quality.

5) Defining the Problem

Defining the problem correctly considering its all aspects is the half problem solved. Therefore they defined our problem in proper manner as follows:

"Improper laboratory condition leads to bad effects on various aspects such as hands on experience, student knowledge and skills, student safety, practical performance and educational quality"

6) Analysis of the Problem

After defining the process, they collected the data regarding the problem from labs, lab in-charge, lab assistants and students. With the help of that data they analyzed the problem thoroughly. For analyzing the problem they adopted the following procedure:

- **Flow Diagram**

They drew a *Flow Diagram* of teaching and learning process. This diagram helped us to visualize the location of problem in it and its affect on the other elements in same process. From *Flow Diagram* they can conclude to the following effects of the problem:

- o Loss of interest of students in experimentation
- o Less exposure to industrial equipments.
- o Students are alienated from the practical and analytical experimentation.
- o Improper utilization of equipments.
- o Loss of knowledge and judicious skills.
- o Students miss the opportunity to practical application of theoretical concept.

The following figure shows the *Flow Diagram* of teaching and learning process:

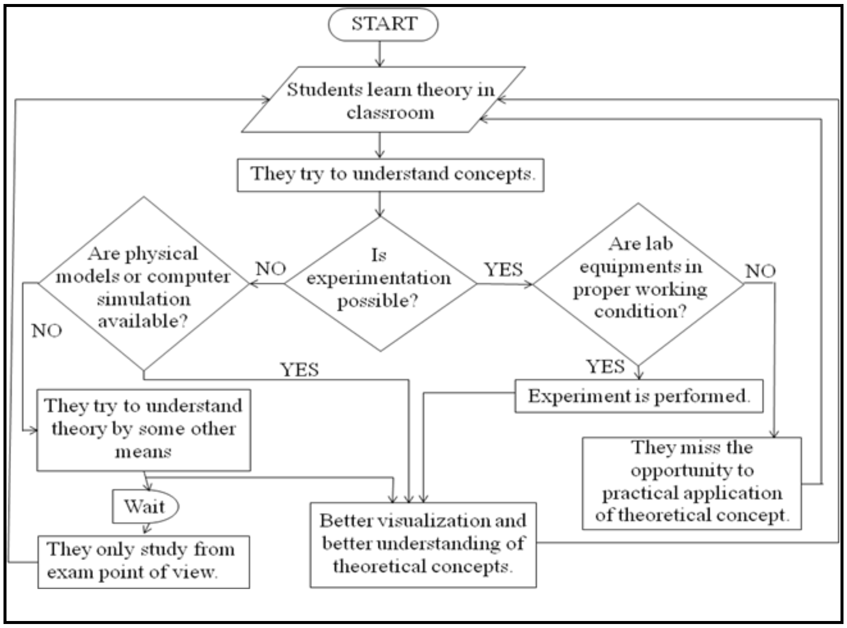

Figure 4: *Flow Diagram* showing teaching & learning process with location of problem

- **Benchmarking**

To scale our problem i.e. the *"Improper laboratory conditions"* they used a *Benchmarking* tool to scale the laboratories in the institute with comparison to the best institutes in the country. They divided the *Benchmarking* process in four steps as follows to have the clear picture of current condition of the laboratories.

- *Planning*:
  - What to benchmark? - Institutional laboratory.
  - Whom to benchmark? - Renowned engineering institutes.
  - How to benchmark? - By collecting information regarding their lab conditions through internet and professors.
- *Analysis* **:** Understanding the current practices of laboratories of our institute, as of those institutes being Benchmarked.
- *Integration* **:** Communicating the benchmark findings to lab in- charge and assistance
- *Action* **:** Developing and implementing solutions derived.

- **Analysis of Problem by 4W1H**

After getting well known to the current situation of the problem they moved to the detailed analysis of the problem to focus on the each aspect of problem. The *4W1H* helped us to see the problem in multi perspective view.

- WHAT? **:** *"Improper Laboratory Condition"*
  Theory of Machines Lab (TOM LAB)
- WHERE? **:** In the different laboratories of the institute.
- WHO? **:** Who can be considered responsible?
  - Students
  - Lab in-charge
  - Maintenance
  - Management
- WHEN? **:** From past two years.
- HOW? **:**
  - No maintenance
  - No proper housekeeping.

Total Equipments	21
Equipments working	14(66.66%)
Down Equipments	07(33.33%)
Old Equipments	16(76.19%)
Old and Not Working	07 (43.75)
New Equipments	05 (23.80)
Space Area	110 sq. m.
Student Batch	15
Weekly experiment Hours	24 Hours.

Table 1: Current Situation of Theory Of Machine laboratory

- Less funding as compare to other labs.

7) Finding Out Causes of the Problem

After analysis of the problem they got familiar with current situation of the problem. Now they are able to find out the causes of the problem. Another Brainstorming session was carried out and the causes were written on a board at random places. The various causes of the problem found out are as follows:

1. Careless handling of equipments.
2. Lack of experience and knowledge.
3. Lack of Belongingness.
4. Improper guidance.
5. Staff is giving incomplete information.
6. Faulty instruments.
7. Failed instruments.
8. Scheduled maintenance of machineries and infrastructure is not done.
9. Under-utilization of instruments.
10. Improper layout.
11. Loss of interest (involvement).
12. Negligence.
13. No manpower for housekeeping and equipment.

8) Affinity Diagram

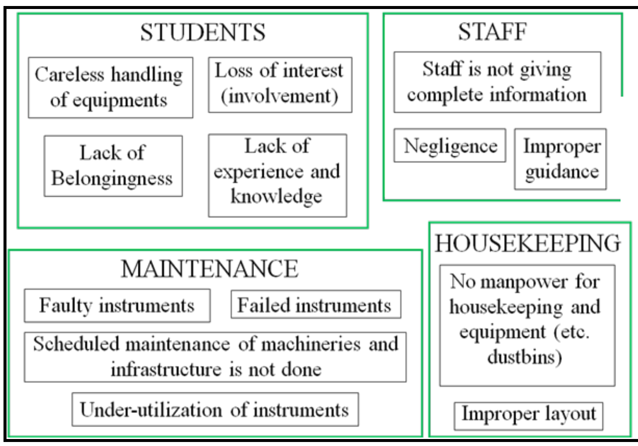

Figure 5: *Affinity Diagram* showing relation between causes.

9) Finding Out the Root Causes

Now they were with the main sources of the problem because of *Affinity Diagram*. Then they went for finding root causes with the help of *Why – Why Analysis*. With those main and root causes they drew the Fishbone Diagram as follows:

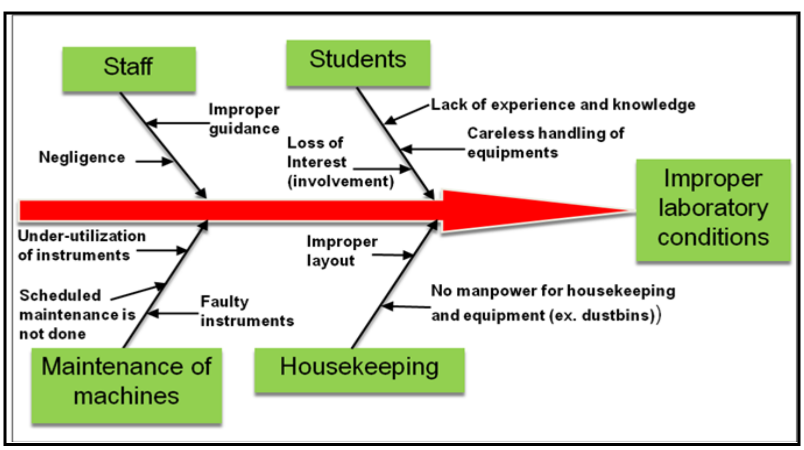

Figure 6: *Fishbone Diagram* showing causes and root causes of the problem

10) Analysis of Root Causes

To find out the most affecting causes from the list of causes they used *Pareto Analysis*. *Pareto analysis* is mostly used to found out *"vital few from trivial many"*. The following table shows the prioritization of the root causes done according to the ratings given to the causes by the all seven QC members:

Table 2: Table showing root cause and the ratings given to them by QC members

Sr. No.	Root Causes	1	2	3	4	5	6	7	Total
1	Negligence of lab assistant and lab in charge	4	5	6	6	3	6	3	33
2	Lack of technical knowledge	8	9	8	8	9	7	7	56
3	Funding	4	5	4	5	4	6	3	31
4	Basic infrastructure	3	3	2	4	3	4	2	21
5	Inadequate manpower	4	5	6	3	4	5	3	30
6	Compromise in Safety	8	8	7	6	8	9	7	53
7	Unaware of knowhow	9	7	9	9	8	8	7	57
8	Lengthy official procedure	6	6	5	5	6	7	4	39

On the basis of the prioritization shown in above table, they made a *Pareto Chart* as shown in Figure 6. From this chart they were able to conclude that the most vital root causes of the problem were student knowledge, maintenance and the housekeeping of the laboratory.

11) Finding Out Solutions

After knowing the critical areas where they need to focus, they found out various solutions. In one of the *Brainstorming* session they found out the solutions to strike the vital causes filtered by *Pareto chart.* Then they check the possible solutions with *SMART technique*. In *SMART*,

S - Simple & Specific
M - Measurable & Manageable
A - Achievable & Acceptable
R - Reasonable & Realistic
T - Time bound & Tested

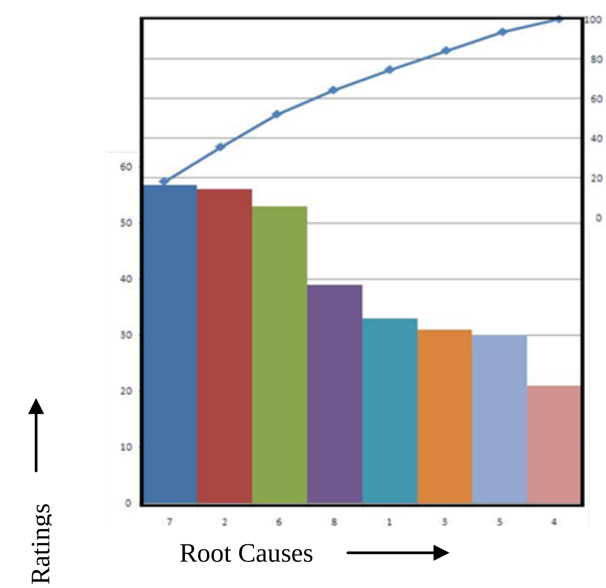

Figure 7: *Pareto chart* of root causes.

The final solutions after *SMART technique* are as follows:

1. Charts of Do's and Don'ts
2. Preventive Maintenance charts
3. 5S's implementation
4. Awareness charts
5. Induction tours for 2nd year students
6. Mini Projects
7. Best lab competition
8. "Learn and Earn" in lab
9. Safety and health issue

12) Foreseeing Probable Resistances

While implementing the solutions they may come across the resistances, so to know those resistances and their magnitude they used *Force Field Analysis* tool. Figure 8 shows analysis:

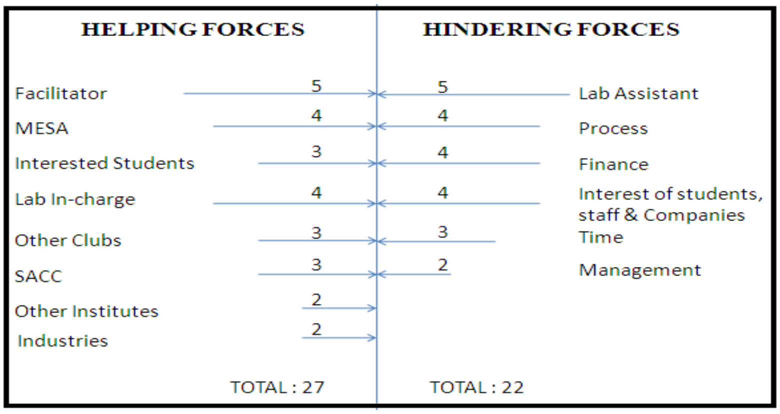

Figure 8: *Force Field Analysis* showing helping and hindering forces

As the solutions are filtered by *SMART technique* so there was no objections they faced for implementing them. Whereas Force Field analysis also explored the helping forces to implement our solutions.

13) Trial Implementation and Checking Performance

The solutions were first implemented on trial basis. The performance was checked and following indications were found out.

Table 3: Results of Trial Implementation

Parameter	Before	After
Experimental results	Not good	Good
Effective handling	No	Yes
Students interest	No	Yes
Faulty instruments	More	Less
Condition of equipment(PM chart)	Bad	Maintained
Environment	Bad	Good

14) Regular Implementation

After getting good results from the trial implementations done, they decided to go for regular implementation. For the effective implementation they used *PDCA (Plan – Do – Check – Action) cycle.* Table No.4 shows the action plan for the regular implementation by using *5W1H* tool.

Table 4: Action plan for regular implementation using *5W1H*

Action Plan (P of PDCA cycle)					
WHAT	WHY	WHO	WHEN	WHERE	HOW
Charts (Do's and Don'ts)	To improve students' knowledge & skill	Hanumant & Devdatta	11-Aug-09	TOM lab	With the help of books, manuals and internet
Preventive maintenance chart	To prevent instrument failure	Swapnil & Kunal	14-Aug-09	TOM lab	By common practice and equipment manual
5 S's Implementation	For effective workplace organization	5 S's Team & Kunal	12-Aug-09	TOM lab	By learning techniques from any industry
Mini Projects	To improve students' knowledge & skill	Ankur & Sourabh	13-Aug-09	TOM lab	By selecting instrument to be designed or repaired
"Learn and Earn" in lab	Social work with improvement in lab.	Rushikesh & Sourabh	17-Aug-09	TOM lab	By taking information from library
Safety and Health	To create safe environment	Devdatta & Hanumant	15-Aug-09	TOM lab	By preventing accidents and Implementing 5 S's

15) Follow Up and Review

To check the performance of the regular implementation they decided to take a follow up and review of the activities. The tool used for the same was *Formative Follow Up* technique. The *Formative Follow Up* includes the *Surveys, interviews, data collection, experiments and number point rule*.

16) Recurrence Prevention

To sustain the effects and results of the implementation done, the need is to sustain it. For that very reason they used a FMEA (Failure Mode and Effect Analysis). The purpose of using FMEA was to identify all the possible failures in future with current practices of implementation. The figure x shows a FMEA sheet. Firstly all possible failure modes are found out and rated as follows:-

S – Severity rating,
O – Occurrence rating,
D – Detection rating

Then RPM (Risk Priority Number) is calculated by

$$RPN = S \times O \times D$$

Figure 9: *FMEA* sheet for recurrence prevention

Failure Mode Effect Analysis (FMEA)		
	Case 1	Case 2
Function	Convey information through charts (Dos and don'ts)	Improve lab condition through mini projects
Failure mode	1. Charts torn away	1. Costly projects
	2. Outdated information	2. Possibility failure of working instruments
	3. Fedding of ink	
Effects	Dos and Don'ts are not properly conveyed	All equipments are not modified.
S (severity rating)	7	8
Cause(s)	1. Avilability of new information	1. lesss commitment of students
	2. Passage of time	2.Haphazard method of conduction of mini project
O (occurrence rating)	2	6
Current controls	Charts on basis of thorough information	Proper selection method
D (detection rating)	8	8
CRIT (critical characteristic)	N	N
RPN (risk priority number)	112	384
Recommended actions	1. Regular checking of new information	1. Proper planning for project distribution so that maximum equipments are improved
	2. Monthly Inspection of charts	2. Developing effective and project specific methodology through formative evaluation
	3. Put new charts	
Responsibility and target completion date	Lab Assistance and Quality Circle (After every one month)	Lab In-charge, students and Quality Circle (3 months)

17) Future Plans

The future plans of the KANAD Quality Circle are as follows:

a. Continuation of present implementation and evaluation.
b. Extending the current practice to other labs.
c. Intradepartmental Best Lab competition and incentives.
d. Learn & Earn program on broader level.
e. Consultancy jobs and testing to increase utilization of lab equipments.

18) Contribution of Quality Circle

The benefits gained by the students as well as QC members are as follows:

- Gains for the students:
  a) Technical knowledge of students is increased.
  a) Motivation for practical and analytical experimentation.
  b) Proper utilization and handling of laboratory equipments.
  c) Improved maintenance and housekeeping capability.
  d) Clean and safe laboratory environment.
  e) Improved sense of belongingness and satisfaction.
- Gains for the QC members:
  a) Experience of teamwork.
  b) Methodical problem solving skills.
  c) Improved Organizing & Presentation skills.
  d) Happiness through continuous learning and development.
  e) Satisfaction through voluntary work.
  f) Ability to perceive probable consequences.

19) Conclusion

Quality Circle is one of the employee participation methods. It implies the development of skills, capabilities, confidence and creativity of the people through cumulative process of education, training and participation. In industries Quality Circles have emerged as a mechanism to develop and utilize the tremendous potential of people for improvement in product quality and productivity. Quality Circles are not limited to manufacturing firms only. They are applicable for variety of organizations where there is scope for group based solution of work related problems. In educational institutes the solutions are easy to implement as the student are working for their own development. The development of educational institutes lies in the students overall growth. The concept seems simple and it is, but the implementation and the effort needed to keep the circles functioning effectively require strong support and commitment from the group members and the authorities.

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