Quality tools and techniques for improving learning in higher education

G M Steyn
University of South Africa

ABSTRACT

In pursuit of quality, educators and learners must be continuously engaged in a process of finding opportunities for improving the learning process, the quality of the learning experience and the way it is delivered. In this article the following three principles of how QM can help to improve the quality of learning are discussed: (1) Focusing on the needs and expectations of customers; (2) Being committed to continuous improvement; and (3) Managing with facts and data using quality tools and techniques.

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INTRODUCTION

Ideas of quality were originally developed in the 1930s and 1940s, primarily by W Edwards Deming, a statistician who was best known for helping postwar Japanese business to become foremost in quality in the world (Sallis 1993:15). Deming supplied a simple answer to the dilemma of poor quality: find out what customers want. The resultant approach is popularly known as Total Quality Management (TQM).

The literature reveals that there is a growing interest in the application of the quality management (QM) philosophy to the education sector. The Baldrige Award, for instance, instituted in 1987 in the United States, has set a national standard for quality, and hundreds of organisations, including service organisations such as educational institutions, use the criteria to pursue ever-higher quality in systems and processes (Swift, Ross & Omachonu 1998:351). Being quality and service minded in education means relating to and caring about the goals, needs, desires and interests of customers and making sure they are met (Whitaker & Moses 1994:76).

According to Horwitz (1990:56), one has to ask why education should strive to apply the QM paradigm. In his opinion, the answer is simply because QM enables organisations to become effective and focused. Thus it can also help educational institutions to cope with poor quality and systematically bring about change by using tools for data analysis and decision-making (Wiedmer & Harris 1997:315). Quality management in education provides a structured and systematic delivery system which has inter alia led to an increase in learner performance, self-esteem, motivation and self-confidence, a decrease in learner drop-out, enhanced staff morale, less conflict between staff members, and a decrease in costs due to less need to redo tasks (Bonsting 1996; Blankstein 1996; Quong & Walker 1996; Weller & McElwee 1997). Quong and Walker (1996:223) believe that institutions that do not shift to the quality paradigm will be unable to cope with the demands placed on them. Increasingly, quality makes the difference between success and failure in education.

Demonstrating quality education is vital to today's educational stakeholders, who expect and demand positive returns on their educational investments (Weller & McElwee 1997:201). It is important to know that all processes in any organisation contribute directly or indirectly to quality as the customer defines it (Swift et al 1998:93). Applying this principle to education means that the learning process needs to be assessed in the light of quality as defined by the learner. This will determine whether learners' needs have been met (Arcaro 1995:24).

The QM approach is also applicable to distance education, where teaching and learning are separated in terms of time, place and space. A constant danger in distance education is that the "faceless" numbers of learners may become invisible to educators (Wilcott 1995:41).

However, these "unseen" learners are a most important category of customer. Learners' views offer crucial information to educators, and their expectations need to be considered, respected and met (Van Niekerk & Herman 1996:44). Ramsden and Dodds (1989:16) regard learners' perceptions of content and teaching as central to the evaluation of a learning programme, because the effectiveness of their learning is not related only to the educators' interpretation of the course but to the learners' own experiences. Recent policy developments in higher education in South Africa are likely to lead to increased assessment of learning programmes through learner evaluation. So when implementing a QM perspective, a focus on the customer should shape the way things are done in distance education (cf Fields 1993:96).

In pursuit of quality in distance education, educators and learners must therefore be continuously engaged in a process of finding opportunities for improving the learning process, the quality of learning experience and the way it is delivered (Schön 1983:49; Schargel 1994:3; Greenwood & Gaunt 1994:156; Wilcott 1995:39). Since quality refers to every process in a system, a review of any process constitutes a valuable indicator of whether quality has been attained. Examples include the quality of assignments, the marking of assignments, the quality of the learning material and contact with learners.

It should be noted that QM is not a quick fix or a simplistic recipe for success (Carlson 1994:14; Beavis 1995:4; Dupey 1996:37). Nevertheless, QM can constitute a significant part of an initiative to restructure and continuously improve all education processes for the benefit of all stakeholders in general and learners in particular.

RESEARCH PROBLEM AND AIM OF THE ARTICLE

In order to address this question, it is important to explore how a focus on the customer, continuous improvement and managing with facts and data could address quality in learning. Related issues are: What is quality? What is quality management? Which tools and techniques can be used to implement quality in learning programmes?

WHAT IS QUALITY?

Despite the importance of quality, it seems to be an enigmatic concept. A literature survey indicates that the majority of authors define quality as continuously meeting and exceeding the needs of customers. Juran (1999a:2.1,2.2) and Goetsch and Davis (1995:3), however, add another focus that has met with general agreement.

> • "Quality" means those features of products and services which continuously meet or exceed customer needs and thereby provide satisfaction. Customer satisfaction is a vital goal and is considered as the absolute test of an organisation's effectiveness (Daugherty 1996:85; Oakland & Oakland 1998:188).

> • "Quality" means freedom from deficiencies – freedom from errors that require rework, customer dissatisfaction, customer claims, and so on. Table 1 provides an overview of these meanings of quality (Juran 1999a:2.2).

Table 1: The meaning of quality

Product and service features that meet customer needs	Freedom from deficiencies
Higher quality enables institutions (including departments and learning programmes) to:	Higher quality enables institutions (including departments and learning programmes) to:

• Increase customer satisfaction	• Reduce customer dissatisfaction
• Make "products" saleable	• Reduce error rates
• Meet competition	• Reduce rework
	• Reduce inspection
	• Improve delivery performance
The major effect is on sales (learner enrolment).	The major effect is on costs.

Authors have tried to create a phrase that would clearly and simultaneously define both of the meanings of quality. The phrase being suggested is "fitness-for-use", in other words conforming to a predetermined specification (Sallis 1997:15; McClaskey & Owens 1997:1-20; Juran 1999a:2.2). The question that is usually asked is, "Does this product or service do what is asked or expected of it?' (Sallis 1997:15).

WHAT IS QUALITY MANAGEMENT (QM)?

Quality management focuses firstly on achieving quality and can be defined as a philosophy and a set of guiding principles that intend to meet and exceed the needs and expectations of various external and internal customers through an integrated system of tools, techniques and training (Bradley 1993:169; Herman 1993:2; Pike & Barnes 1994:24; Greenwood & Gaunt 1994:26). The second focus is on the acceptance and pursuit of continuous improvement as the only useful standard of attaining quality of all processes, resulting in high-quality products and service and reducing wastage and rework (Williams 1994:5; Schargel 1994:2).

IMPROVING QUALITY IN LEARNING

Customer focus first

QM advocates that all stakeholders should become so customer focused that they continually find new ways to meet or exceed customers' expectations (Weller & McElwee 1997:209). Doing this creates not only customer satisfaction but also customer loyalty (Barry 1991:5). Quality is unlikely to improve without this recognition. Asking customers what they want, by employing QM tools and techniques, provides data for making effective decisions (Lewis 1993:95; Weller & McElwee 1997:209). Basing decisions on experience and intuition is unfortunately not enough.

Colleagues within an educational institution are customers and rely upon particular internal services of others to do their work effectively (Sallis 1997:32). According to Sallis, the best way of developing the internal customer focus is to assist individual staff members to identify the people to whom they provide services. This is known as the "next- in-line analysis". The people next in line are the direct customers and may be internal or external (Arcaro 1995:31; Sallis 1997:25). Internal customers refer to people within the institution, which includes the teaching, support and administrative staff, learners, the institution's council and the student representative council. Downey, Fraser and Peters (1994:10) strongly believe that the learner is the primary and ultimate customer in any decision within the educational institution. External customers are "end-users" and include people external to the institution such as society in general, the government and the labour market (Greenwood & Gaunt 1994:27; Downey et al 1994:24; Pike & Barnes 1994:35; McClaskey & Owens 1997:3-6).

In the case of internal customers, staff complete a task, add value and deliver the output to another internal customer. A customer-supplier chain is thus formed in which each work step

performed adds value to the process (McClaskey & Owens 1997:3-6). It is the responsibility of customers to clearly identify expectations and these expectations need to be translated into supplier specifications (Arcaro 1995:31). Responsibility for the chain's success depends on the service to and from each link (Fields 1993:23). For example, if an educator of Master's learners expects incoming learners to possess certain research skills and learners are lacking these, the educator has to adjust the teaching programme to accommodate learners' learning needs. This might require some additional work that should have been covered on the previous level. This example demonstrates how everyone depends on someone else to ensure his or her success and everyone's success in turn depends on resources, services and goods he or she is provided with to meet customer needs.

It is possible that the needs of the different customers do not always coincide (Sallis 1993:33). In this case it is necessary to listen to all stakeholders, to treat them fairly and to look for the core issues that unite them. The primary focus, however, should be on the needs of learners because they are the reason for the institution's existence. There are various ways of determining the needs of customers. The different tools and techniques that can be employed are explained later.

Quality improvement

Quality Management focuses on the continuous improvement of all processes on all levels and views no process as perfect (Rinehart 1993:262; Arcaro 1995:9; Beavis 1995:4; Daugherty 1996:86; Bonstingl 1996:16; Weller & McElwee 1997:209). The process consists of discovering the root causes why some of the products meet the goal and others do not, and applying remedies to remove the causes.

Probably one of the most difficult challenges in QM is convincing an already successful institution, department or learning programme to focus on quality improvement (cf Barry 1991:25). Yet on the path to quality, processes must be continuously improved by altering, adding to, subtracting from and refining them (Williams 1994:3). Achieving quality is a journey and not a destination. Furthermore, learners' needs and society's needs are ever changing and therefore the products and service provided must continually change to meet these needs (Downey et al 1994:47).

There is no shortage of improvements for educational institutions to work on. Moreover, choosing what to work on is part of the planning process (Leddick 1993:42). Areas for improvement in educational institutions could include improving educator and learner contact; improving telephone services at the office; improving communication between learners and the institution; and improving learning through learners' monitoring of their work.

Improving quality of products or services encompasses various strategies which are interlinked. These strategies include the PDCA cycle, diagnostic and remedial journeys, storyboarding, benchmarking and SWOT analysis.

The PDCA cycle

Shewhart perceives improvement as a continuous cyclical effort based on four steps (Fields 1993:31). The PDCA (Plan, Do, Check and Act) cycle, as illustrated in figure 1, is used for this process (Downey et al 1994:49; Goetsch & Davis 1995:211).
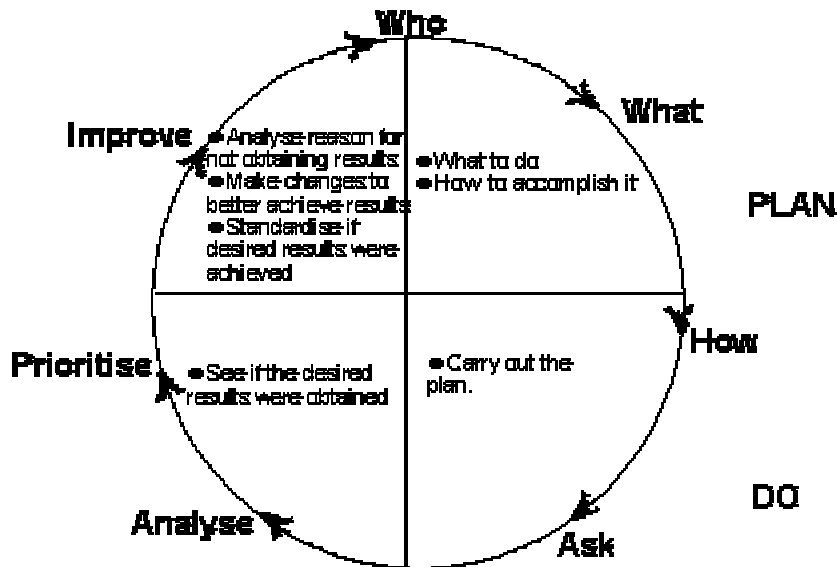
Figure 1: The PDCA cycle The four steps of PDCA cycle are the following (Fields 1993:31):

Step 1: Plan. This is the planning element of the PDCA (Early & Coletti 1999:3.16).

The first step entails a plan or process to study and analyse a situation: for example, the reason why learners misinterpreted an assignment (cf Schmoker & Wilson 1993:18). It includes identifying and defining a problem, collecting valid data from a sample and analysing the data to identify causes and solutions (Downey, Fraser & Peters 1994:11). Questions such as the following need to be asked: What can be done to improve the situation? What data are available? Which customers will be surveyed? How will information be obtained? What questions will we ask? Which data are available? What additional data will be needed to assess the improvement? How will the data be used? It is imperative to proceed with a plan and to seek the input of customers, suppliers, staff and top management (Schargel 1994:48).

Step 2: Do. Carry out the plan (Early & Coletti 1999:3.16).

In this step the plan should be carried out, preferably on a small scale (Schargel 1994:48). Administer the feedback mechanism: for example conduct a survey, hold focus group interviews, send questionnaires, make telephone calls, conduct in-person interviews, pay personal visits to learners or track learner complaints and letters (Early & Coletti 1999:3.16).

Step 3: Check. Check or study the data on the effects of the improvement or innovation (Early & Coletti 1999:3.16).

It is necessary to determine whether the changes have worked well and what needs to be improved in order to do a better job (Schargel 1994:48). Observe what happened when the plan was put into action. Analyse the results. Review the results for accuracy, consistency and data relationships. Determine whether the action taken produced the desired results. Prioritise key strengths, areas for improvement and resources needed.

Step 4: Act (or adjust). Act on what the small-scale programme shows (Early & Coletti 1999:3.16).

Take action on the results of the study. Implement remedial actions and confirm results. The innovation can either be instituted on a permanent basis, be discarded or be referred back to Step 1 by modifying the innovation and gathering new data on its effectiveness as adjustments are made (Schmoker & Wilson 1993:18).

Repeat the PDCA cycle continually for as long as the product is made, the process is used or the project exits to ensure continuous improvement.

Diagnostic and remedial journeys

According to Juran (1999b:5.39) there is a sequence for quality improvement. It may seem obvious that diagnosis should precede the remedy, yet biases or outdated beliefs often get in the way. The sequence includes a series of steps which are grouped into two journeys, illustrated in figure 2 (McClaskey & Owens 1997:1-44):

> • The diagnostic journey: from symptom to cause. This encompasses analysing the symptoms, theorising on possible causes, testing these theories and collecting and analysing data to establish true causes. According to Juran (1999b:5.41) all progress in diagnosis is made theory by theory, by denying or affirming the validity of the theories about the possible causes.

> • The remedial journey: from cause to remedy. This journey includes developing alternatives for the remedy, selecting and implementing the remedy and establishing controls to hold the gains.

Figure 2: Diagnostic and Remedial Journeys (McClaskey & Owens 1997:1-44)

Storyboarding

McClaskey and Owens (1997:5-11) use storyboarding to depict the systematic quality improvement process. According to Juran (1999b:5.42) and Swift et al (1998:313) storyboarding is a visual, orderly arrangement of theories about causes and possible solutions which lead to implementing solutions, determining whether the problem has been solved, standardising the process and identifying future action. The storyboard depicts the following steps for solving a problem (Swift et al 1998:314):

> • Identify the problem area.

> • Observe and identify causes of the problem.

> • Analyse, identify and verify root cause(s) of the problem.

> • Plan and implement preventative action.

> • Check effectiveness of action taken.

> • Standardise process improvement.

> • Determine future action.

The relationship between storyboarding and the PDCA cycle is depicted in figure 3.
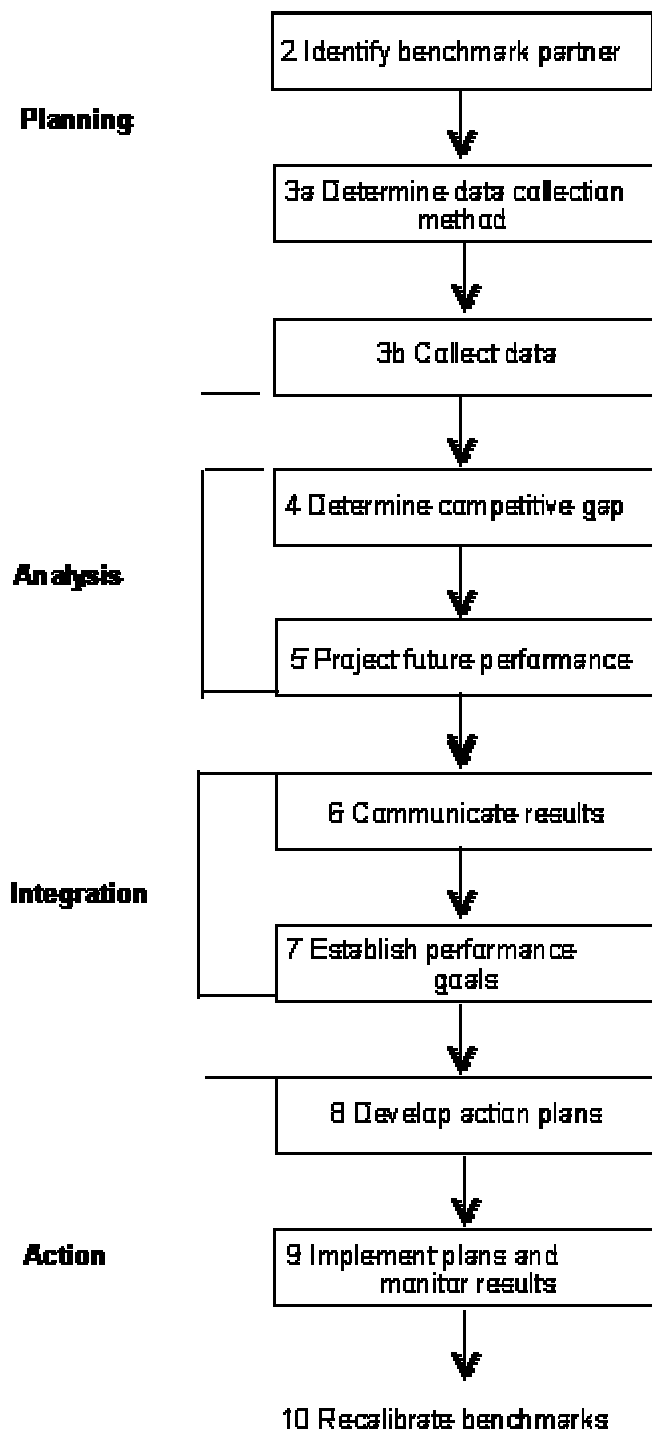

Figure 3: Relationship between storyboarding and the PDCA cycle (Swift et al 1998:314)

Apart from the relationship between storyboards and the PDCA cycle, the diagnostic and remedial journeys discussed above also form part of storyboarding by identifying root causes and appropriate solutions. Table 2 outlines the quality improvement process through storyboarding.

Table 2: The quality improvement process through storyboarding (Gallegos 1996:27; McClaskey & Owens 1997:5-9-5-12; Swift et al 1998:315)

1 Linkage to institutional needs/priorities • Select an opportunity or problem area linked to the institution's needs/ priorities. • Identify the most important opportunity/problem.	2 Select targeted project with problem statement • Select a specific, actionable problem. • Observe the present status of the opportunity/problem. • Set a measurable goal. • State the problem as a gap between the current level of performance and the goal.
3 Analyse, identify and verify the root cause • Analyse data to determine the root cause(s) (not symptoms). • Select the potential root cause(s) that will have the greatest impact. • Verify the main root cause(s) that have the greatest impact on closing the gap by collecting additional data.	4 Determine alternative solutions and select solutions • List alternative solutions. • Establish criteria and evaluate and select solution(s) that best address the verified cause(s).
5 Plan and implement action • Develop a project plan that identifies the major tasks needed to implement the solution. • Obtain resources needed to carry out the project plan and implement the solution.	6 Check if the action was effective in solving the problem ! Determine if the gap has closed. ! If the gap has not closed, repeat steps on root cause identification, select solution and implement solution.
7 Standardise process improvement • Eliminate the cause of problem permanently by replicating and documenting action taken in Step 6. • Clearly identify who, what, when, why and how within the new standard. ! Revise procedures, training and policies to ensure effective implementation.	8 Determine future action • Document lessons learned and incorporate into next improvement effort. • Evaluate remaining improvement opportunities for possible future improvement.

Another way of improving outputs is through using benchmarking.

Benchmarking

When pursuing benchmarking, the best practices in other organisations or institutions are uncovered, adopted and implemented (Downey et al 1994:49; Swift et al 1998: 144; Camp & DeToro 1999:12.2). Because the external environment changes so rapidly, goal setting, which is usually internally focused, often fails to meet customer expectations. It is important to know that customer expectations are driven by standards set by the best suppliers in education, as well as by good experiences with suppliers in other organisations and institutions (Camp & DeToro 1999:12.2).

Lewis (1993:190-194) and Camp and DeToro (1999:12.3) suggest a 10-step process for conducting a benchmarking investigation (see figure 4).

Phase 1: Planning what to benchmark

1 Identify the problems. Decide what has to be benchmarked. All functions have outputs, services or products which could be processes to benchmark to improve performance. The following questions serve as examples of processes to be focused on: "Is there a problem with learners dropping out of the learning programme? Is the assessment of learners as good as it should be?" Processes that will bring the most benefit should be targeted for benchmarking (Swift et al 1998:146).

2 Identify benchmark partners. This is a major step in benchmarking (Swift et al 1998:148). A successful approach includes internal, competitive and functional benchmarking. Internal benchmarking looks at similar practices within the same institution. Competitive benchmarking is the comparison with the best direct competitors, while functional benchmarking refers to a comparison with functional activities in dissimilar organisations that hold the best potential for discovering and stimulating innovative practices.

3a Determine the measurement method. Plan, determine data collection method and conduct the investigation.

3b Collect data. Various sources can be used, such as internal electronic searches and observing the best practices. Conducting a site visit requires extensive preparation to make the visit mutually useful and productive.

Phase 2: Analysis of the performance gap

4 Premeasure the institution's (department's or learning programme's) own performance. This should be done before comparing it with external institutions (Swift et al 1998:150). Examine the best practices from other institutions and measure the performance gap. Examples of performance gaps include lack of research on views of customers, a poor assessment system, poor feedback on assignments or poor contact with learners. The analysis should include which inputs, outputs, processes or steps within a process are superior and to what extent each of these components is superior. Once the cause of the gap is determined through problem analysis, alternative courses of action to close the gap become necessary (Swift et al 1998:150).

5a Determine future performance levels. Comparing the performance levels objectively can help to determine how to achieve a performance edge.

Phase 3: Integration of functional goals

5b Redefine goals and incorporate them into the planning process.

6 Communicate benchmark findings and gain approval from management (heads of departments, learning programme coordinators, et cetera). In some cases a written report is required with detailed supporting documentation, while in other instances only a one-page executive summary or informal discussion is required.

7 Revise performance goals after management approves the recommendations.

8 Integrate targets and strategies into action plans and operational reviews Update them as needed.

Phase 4: Develop action plan

9 Implement best practices and monitor the progress made. Periodically readjust as needed.

10 Recalibrate benchmarks. Re-evaluate and update the benchmarks to ensure that they are based on current performance data.
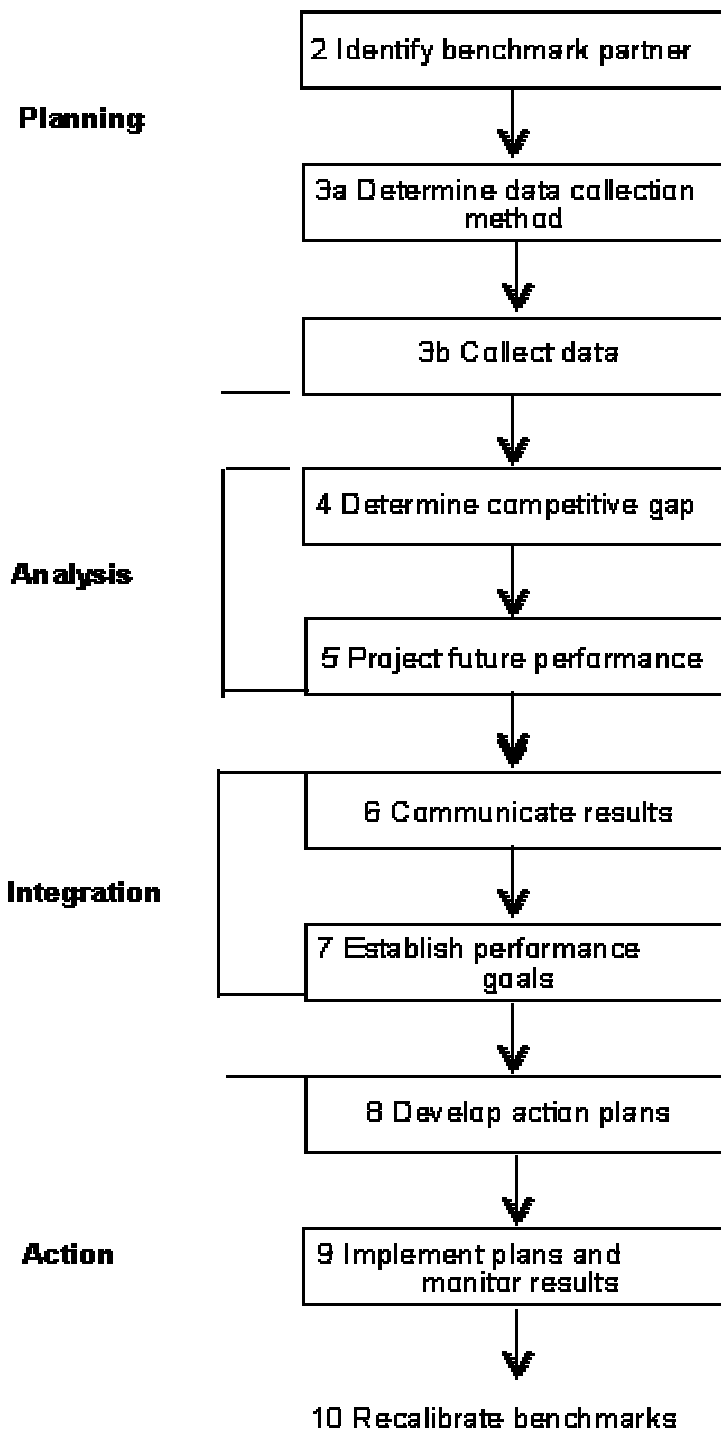
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                    ┌─────────────────────────────┐
                    │ 2 Identify benchmark partner │
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Planning                          │
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                    │ 3a Determine data collection │
                    │          method              │
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Analysis                          │
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Action              │ 9 Implement plans and        │
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                       10 Recalibrate benchmarks
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Figure 4: The benchmarking process (Camp & DeToro 1999:12.4)

The SWOT analysis

The SWOT analysis can be divided into two elements: an internal analysis, and an external analysis focusing on the outside environment (Sallis 1997:110). The strengths and weaknesses are essentially an internal audit on how effectively the institution, department or learning programme is performing, while the opportunities and threats concentrate on the external environment in which the institution, department or learning programme functions (Sallis 1997:110).

The SWOT analysis indicates the following (McClaskey & Owens 1997:2-30):

- Potential internal Strengths

- Potential internal Weakness

- Potential external Opportunities

- Potential external Threats

Figure 5 serves as an example of a SWOT analysis done in a faculty.

Internal Strengths	Internal Weaknesses
A strong enrolment Qualified staff Enthusiastic management team Relevant learning programmes	High average age of staff Lack of car parking Long processes for appointing new staff
External Opportunities	**External Threats**
Merging with local institution with mediocre reputation The excitement of establishing a new institution The opportunity to enlarge staff expertise to increase range of offerings	Loss of identity, strengths and reputation Risk of losing experienced staff The ethos of the other institution may become dominant

Figure 5: SWOT analysis (Sallis 1997:111)

For QM to be effective in its striving towards continuous improvement, training of all stakeholders is indispensable. The planning and implementation of training programmes are at the heart and soul of QM (Rappaport 1993:19; Swift et al 1998:83).

Manage with facts and data

One of the major differences between QM and other improvement efforts is the use of a rational measurement system (Daugherty 1996:85; Frazier 1997:12). Lewis (1993:19) advocates a system that will allow institutions, departments or learning programmes to determine systematically the degree to which they please customers and then focus on internal process improvement. In QM there are a number of quality tools for measuring customer satisfaction which will be dealt with in more detail in the next section.

It is important to note that although quality tools and techniques provide more and better information, merely using them does not ensure a high-quality process. Quality tools and techniques do help to solve problems, gather information, analyse data and make decisions about the process. Decision making to improve learning practices is a complex process. The ultimate aim in QM is, however, to consistently improve decisions and take better actions (Redman 1999:9.3). Murgatroyd (1993:275) and Blankstein (1996:68) warn that it is possible that if QM is launched only as a strategy for measurement, it will lead to many charts, tables, models and indicators, but may not change the processes that lead to quality learning.

QUALITY IMPROVEMENT TOOLS AND TECHNIQUES

There are a number of tools and techniques that can be used to help to form conclusions from data. Most problems can be analysed by using these tools and techniques. The results should then be incorpated into the PSCA cycle, diagnostic and remedial journey, storyboarding, benchmarking and the SWOT analysis. The next few paragraphs provide a brief outline of some of these tools and techniques.

Control charts

A control chart shows the sequential or time-related performance of a process and is used to determine when the process is operating in or out of statistical control – using the upper and lower limits defined on the chart (Latta & Downey 1994:82; Swift et al 1998:146).

Figure 6 depicts a control chart indicating a department's extra monthly income of R5 000 from business partners over the past two years; the department has become dependent on it for giving extra discussion classes (cf Latta & Downey 1994:82). To monitor the situation, upper and lower spending levels are established: upper limit = R6 000 and lower limit R4 000.
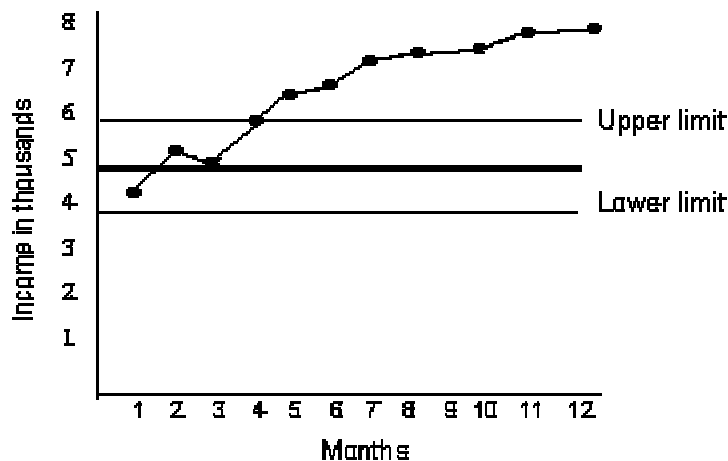
Figure 6: Control chart of 1998-1999 income plotted against the income's upper and lower limits

The long-term average, upper and lower limit levels can be determined and then used to plot, for instance, the following (Latta & Downey 1994:82):

• Absenteeism of staff in each month of the year

• Number of assignments marked each week or month over the year

• Arranged contact time (discussion classes, video conferences, internet chat boxes) with learners each month over the year

• Number of phone calls from learners received each week over the past month

Pareto charts

A Pareto chart is a type of bar chart prioritised in descending order from left to right, and is used to identify the "vital few" opportunities for improvement (Latta & Downey 1994:37; Swift et al 1998:253). Usually 80% of the problems come from 20% of the reasons (Swift et al 1998:253). If one works on the 20% of the reasons causing 80% of the problems, energy is

focused on things that make the most difference (Latta & Downey 1994:37). There are two kinds of Pareto charts:

Pareto chart by phenomena

The following Pareto chart (Figure 7) shows the number of learners failing a module in a B.Ed learning programme. The chart reveals that 75% of learners failed Philosophy of Education, 55% of learners failed School Management and 52% of learners failed Education Law. No other module has a higher than 50% incidence of learner failure.
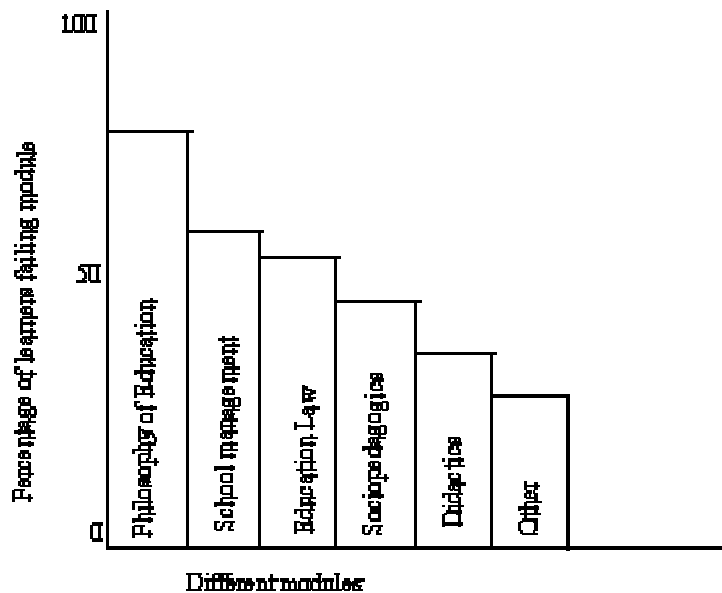

Figure 7: Pareto chart about percentage of learners failing learning programmes

Pareto charts by causes

This chart represents the department's study of why learners are failing Philosophy of Education. The chart reveals that many learners failed owing to a poor reading level. The second highest level is that of learners with poor assignment marks. These two bars represent the "vital few". The other bars represent failures because of not submitting assignments, not attending group discussion classes, and other causes. These are the "trivial many". The chart tells the educators that by concentrating their efforts on improving reading skills, they will have the best chance of reducing learner failures in Philosophy of Education.
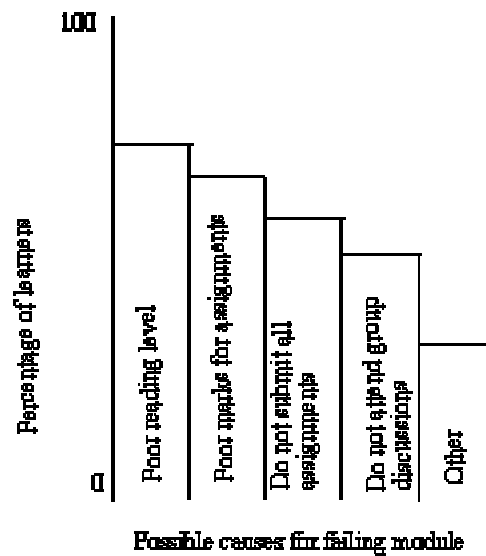
Figure 8: Pareto chart by causes: Causes of learner failures in Philosophy of Education

Histogram

A histogram is a bar (column) graph showing the frequency of distribution of data collected on a given variable (Downey et al 1994:84; Swift et al 1998:253). The height of the bar indicates the frequency (number) of a given measurement.
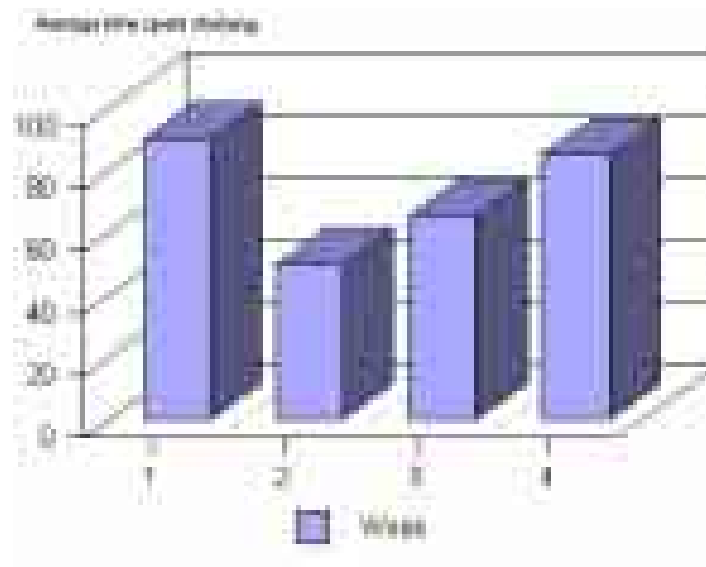

Figure 9: Histogram indicating the average time learners spend on studying per week

The following are examples of the kind of data histograms can be used to illustrate in educational institutions (Latta & Downey 1994:36):

• The drop-out of learners over the past five years

• The decrease in learner numbers in a particular department or learning programme

• Monthly contact time with learners

Scatter diagram

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A scatter diagram is used to test for a cause-and-effect relationship (Latta & Downey 1994:41). In the chart one variable is plotted against another to determine if there is a correlation between the two variables (Downey et al 1994:84). The direction and tightness of a cluster show whether a relationship exists and also indicate the strength of the relationship between the variables (Latta & Downey 1994:41). It is important, however, to know that one factor does not cause the other, but that the chart simply indicates the strength of the relationship (Latta & Downey 1994:41). Figure 10 indicates that a positive relationship could be present between marks learners obtain in the examination and the number of hours spent on the module.
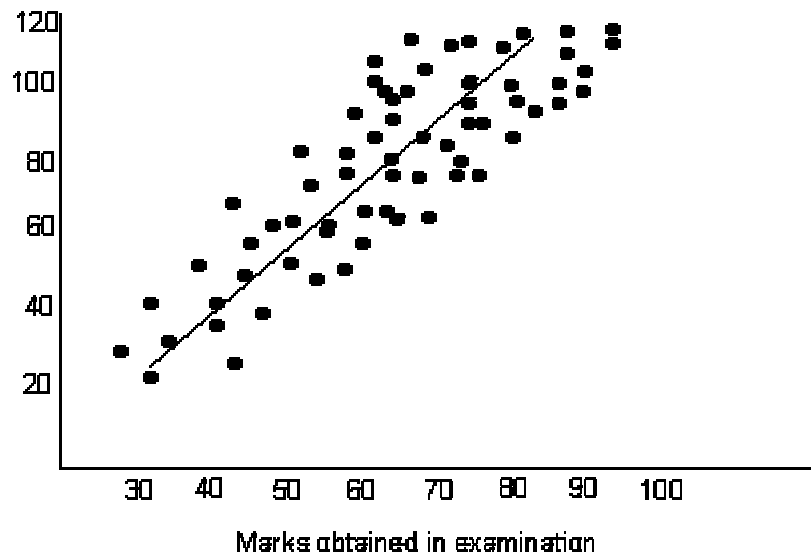
Figure 10: Hours spend on module vs marks obtained in examination

Figure 11 indicates different forms of relationships between variables.
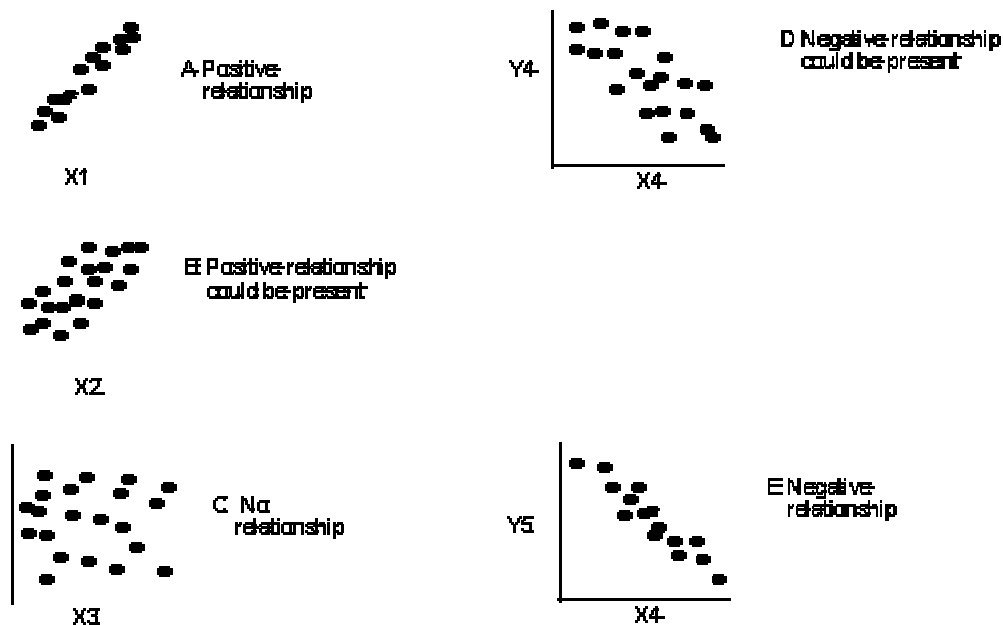
Figure 11: Scatter diagrams (Swift et al 1998:263).

Scatter diagrams could be used, for instance, to determine the potential relationships between the following (Latta & Downey 1994:42):

- The submission of assignments and passing of the examination

- Number of years' teaching experience and teaching effectiveness

- Age of learners and pass rates

- Grade 12 results and pass rates during first year at university

Run (trend) chart

A run chart is a graphic plot versus time of a measurable characteristic of a process (Latta & Downey 1994:43). This chart is useful when there is a system or process important enough to warrant continuous monitoring. It is useful to know if there are critical times when something is occurring. However, no statistical conclusions can be drawn from this chart (Swift et al 1998:250).
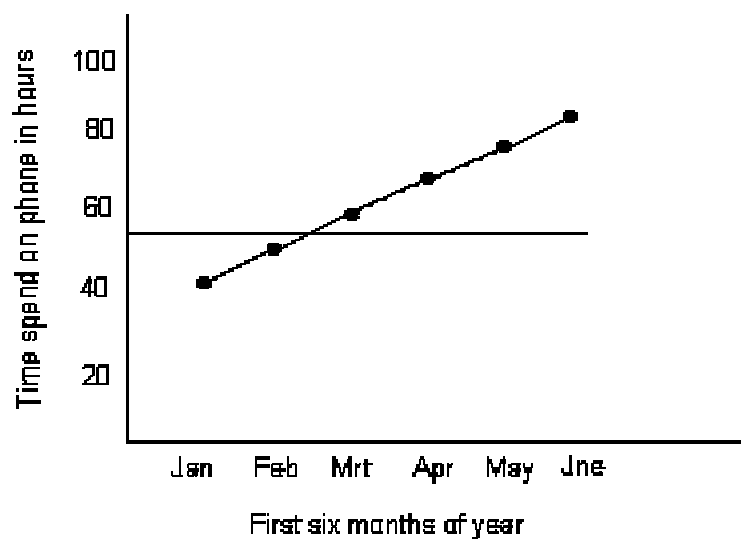
Figure 12: Number of hours spent on the phone the first six months

Examples of uses of run charts in educational institutions include the following (Latta & Downey 1994:45):

- Absenteeism of staff each month over a year

- Arranged contact sessions with learners each month over a year

- Learner telephone calls received each month of the year.

Cause-and-effect/fishbone diagram

The cause-and-effect/fishbone diagram is a structured form in which brainstorming graphically shows the relationship of possible causes and subcauses directly related to an identified effect/problem (Latta & Downey 1994:49; Swift et al 1998:262).
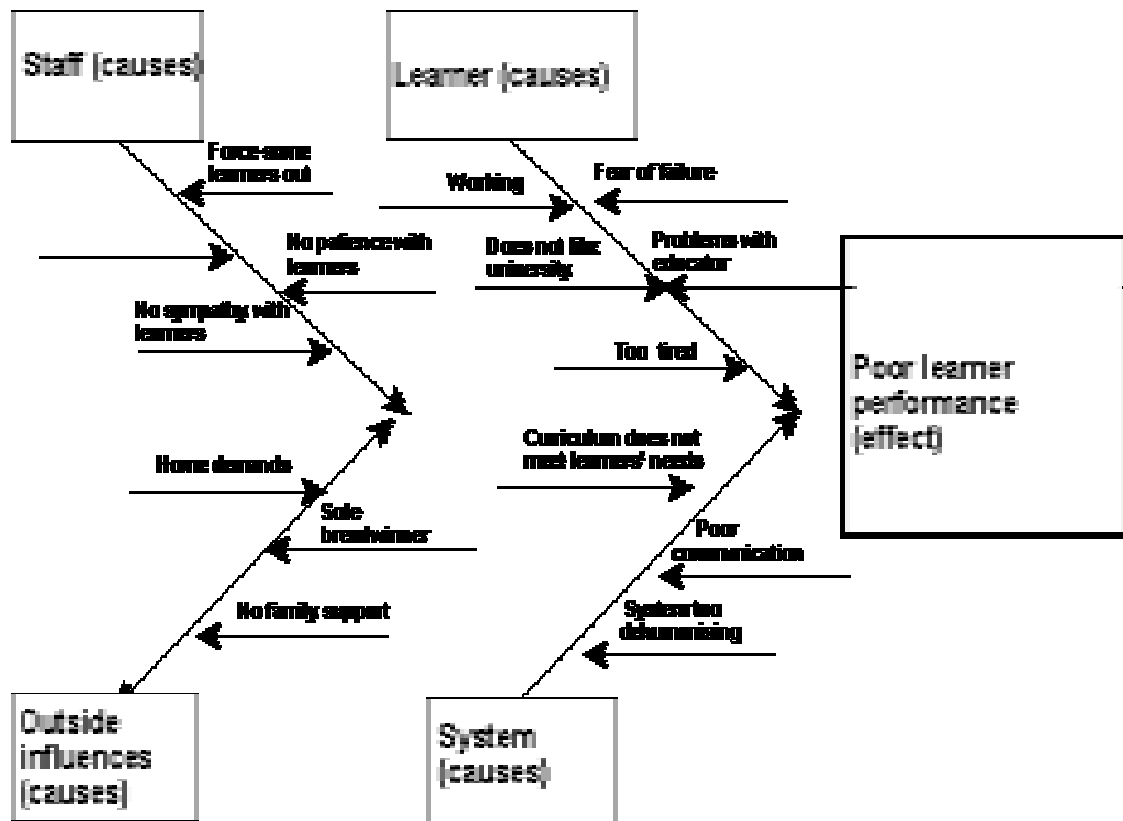
Figure 13: Cause-and-effect/fishbone diagram of the causes contributing to poor learner performance

Flowchart

A flowchart is a graphic representation of a process which details the sequencing of materials, work activities, operations and decisions that make up the process (Downey et al 1994:85; Swift et al 1998:247). It identifies the components of a process and serves as a guide in identifying problems or possible areas of improvement within a process (Swift et al 1998:248). Figure 14 indicates a flowchart of a photocopying process.
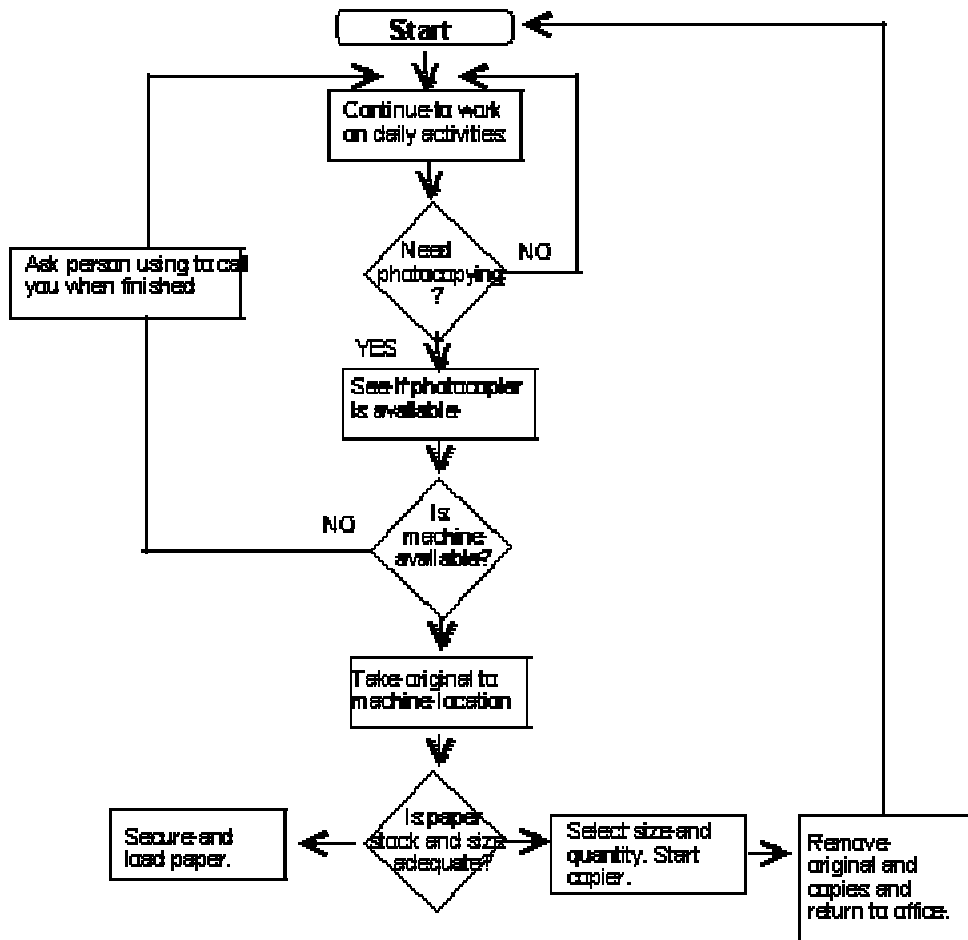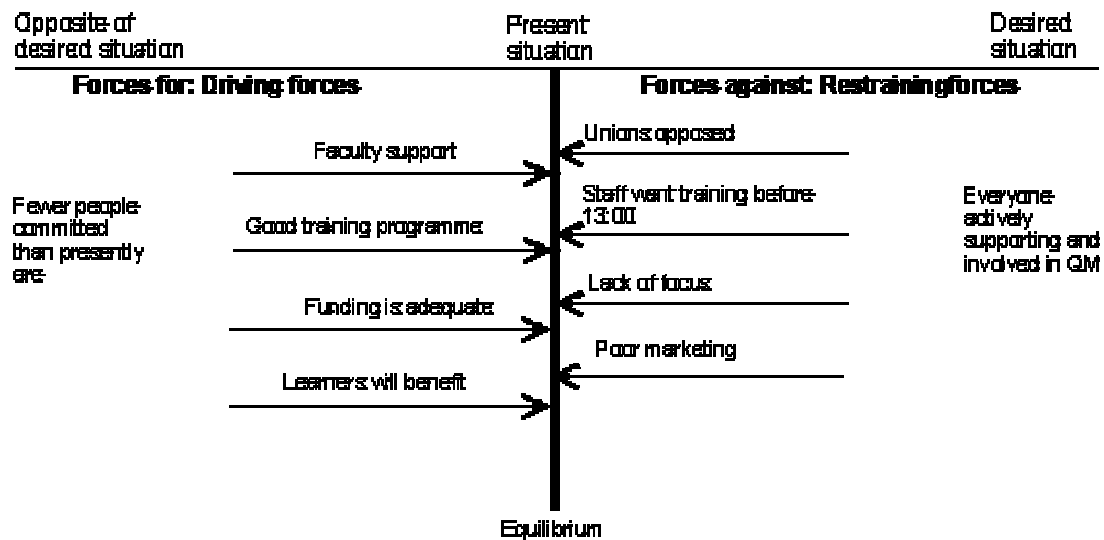
Figure 14: Flowchart of the photocopying process

Force-field analysis

Force-field analysis is a useful tool for studying a situation calling for change (Sallis 1997:97). It is a problem-solving tool for helping change to occur and identifying possible strategies for change (Downey et al 1994:91). A distinction is made between driving forces that help change occur and restraining forces that resist change (Sallis 1997:44). Figure 15 depicts an analysis of a faculty's QM situation.

Opposite of desired situation | Present situation | Desired situation

Forces for: Driving forces

Forces against: Restraining forces

Fewer people committed than presently are

Faculty support

Good training programme

Funding is adequate

Learners will benefit

Unions opposed

Staff went training before 13:00

Lack of focus

Poor marketing

Everyone actively supporting and involved in QM

Equilibrium

A force-field analysis could be used to identify the driving forces and restraining forces in the following situations (Downey et al 1994:94):

• High drop-out rate of learners

• Staff resistance to QM

• Staff dissatisfaction with appraisal system

Matrix diagram

A matrix diagram is a simple chart, usually two dimensional, that shows the relationships of several factors along one side (horizontally) with other factors listed along the other side (vertically) (Latta & Downey 1994:78). A matrix can also indicate how strong the relationship between the variables is (Ohle & Morley 1994:62). Matrix diagrams are very useful for prioritising causes and solutions.

Table 3 serves as an example for designing a matrix diagram. In this exercise a department has to make a choice between five ways of implementing QM in the department (cf Latta & Downey 1994:79). A representative group meets and comes up with the following results.

1 Five solutions to the problem are identified.

2 Five quality characteristics against which each option must be measured are identified.

Table 3 Matrix diagram in order to rank solutions

Alternative solutions	Cost	Acceptance by staff	Effectiveness	Time to get started	Time to implement	Total	Rank
1. Hire a trainer	Moderate:2	Low: 1	Low: 1	Low: 1	Moderate:2	7	5

2. Buy and deliver packaged programme	Moderate:2	Moderate:2	Low: 1	Moderate:2	Moderate:2	9	3
3. Develop own programme	High: 3	High: 3	Moderate:2	High: 3	Moderate:2	13	1
4. Form partnership with other school, hire trainer and deliver programme jointly.	Low: 1	Moderate:2	Moderate:2	Low: 1	Moderate:2	8	4
5. Form partnerships with local business who have already implemented a quality programme.	Low: 1	High: 3	High: 3	High: 3	Moderate:2	12	2

Apart from using this matrix diagram to determine the best solution, it is crucial to decide on the impact and ease of implementation too. Another matrix diagram is used, but this time the ticks indicate the number of votes for each alternative solution. Suppose there were six members in the group. Table 4 presents the outcome.

Table 4 Matrix diagram to determine the impact and ease of implementation of each solution

Solution	Criteria					
	Impact			Ease of implementation		
	Low	Medium	High	Low	Medium	High
1. Hire a trainer	1	1111	1		11	1111
2. Buy and deliver packaged programme	111	111			11	1111
3. Develop own programme		11	1111	1	1111	1
4. Form partnership with other school, hire trainer and deliver programme jointly.	11	111	1	111	111	

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5. Form partnerships with local business who have already implemented a quality programme.	11111	1			111	111

These votes could be also be mapped on a measurement map.

Measurement map

In this measurement map, possible solutions are plotted on a visual grid showing the relationship between ease of implementation and impact for each solution identified (Ohle & Morley 1994:63).

Using the example above, the same solutions are used to show the relationships between ease of implementation and impact of solution. This relationship is depicted in figure 16.
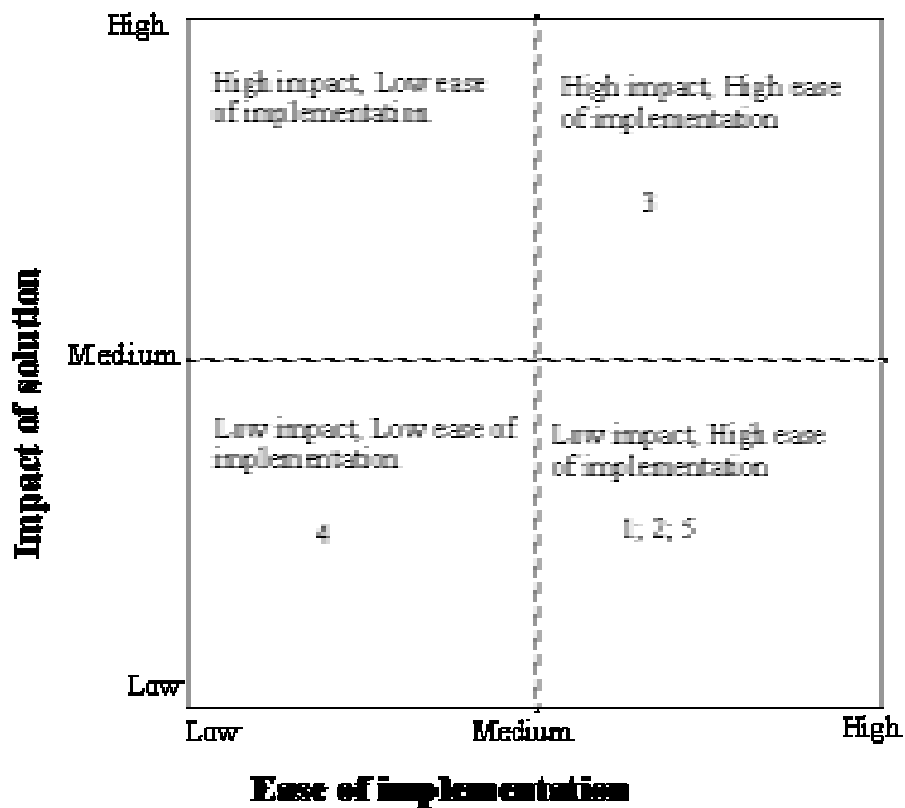

Figure 16: Measurement map: numbered suggestions showing votes for particular solutions

It is now relatively easy to see which is the most feasible solution. The best solutions will lie in the top right quadrant and the poorest solutions in the bottom left quadrant. According to this map, solution 3, "Develop own programme" seems to be the best solution.

Another way of choosing which solution to select is to consider the advantages and disadvantages of each solution before making a choice.

Advantages and disadvantages of solutions

If the identified solutions in the above example are considered, the following advantages and disadvantages for each solution can be brainstormed. The following table indicates a few possibilities.

Table 5: Advantages and disadvantages of solutions

Solution	Advantages	Disadvantages
1. Hire a trainer	1. Enough experts are available. 2. Relatively easy to use the expertise of a experienced trainer. 3. Less time-consuming to arrange for a trainer.	1. Can be very costly. 2. Trainer might not be that familiar with problems in education. 3. Feedback on the problem is limited unless built into the programme, with more costs involved.
2. Buy and deliver packaged programme	1. Fairly cheap, as it is a one-off payment for package. 2. Packages can be evaluated to select the best for the school.	1. Presenter has to internalise material before it can be presented. 2. Few people like to work on other people's material. 3. Material has to be adapted for own circumstances, which could take a lot of time.
3. Develop own programme	1. Programme is "tailor-made" for the school. 2. More people assume ownership for the programme. 3. Programme can easily be adapted should changes occur. 4. People in the school become experts. 5. Relatively cheap.	1. It is time-consuming. 2. People need to study the programme to be presented in detail.
4. Form partnership with other school, hire trainer and deliver programme jointly.	1. Could be cheap to share costs. 2. Experiences between schools which are beneficial for both.	1. Not all schools are interested in this type of training. 2. To find appropriate dates for the two schools and the trainer might be difficult.

| 5. Form partnerships with local business who have already implemented a quality programme. | 1. Schools are in many cases run as businesses and business could offer a objective perspective on problems.

2. Forming partnerships could be to the advantage of both business and school in the long run.

3. If it is a local business the help could be free or presented at a lower cost. | 1. Problems in business differ from those in schools.

2. Everybody that attended a school is not an expert on problems in schools.

3. Businesses often do not understand the tight budgets of schools when offering assistance. |

CONCLUSION

Quality Management has assisted business organisations to compete globally. It is a promising approach for improving various processes, including learning processes, in higher education. This approach aims at continuously meeting and exceeding customer needs and expectations by employing a measurement system consisting of various quality tools and techniques.

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ABOUT THE AUTHOR

Professor Trudie Steyn is an associate professor in the Faculty of Education at the University of South Africa. She is responsible for the modules on Personnel Management in the BEd specialisation course: Educational Management, and acts as co-ordinator for the Further Diploma in Education: Educational Leadership. She has published widely on various topics on education and educational management and has presented many paper on national and international conferences.