Title	The challenge of ISO 9000 certification in higher education
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Source	*Quality Assurance in Education, 6*(3), 152-161
Published by	Emerald (www.emeraldinsight.com/)

The challenge of ISO 9000 certification in higher education

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Abstract

Addresses the question of how ISO 9000, the international standard for quality management systems, may best be applied to higher education. Begins with a concise but systematic description of the requirements of ISO 9000 for industry in terms of a simplified model of a factory. Argues that the product of higher education must be the actual learning of the students and not merely the provision of learning opportunities. Hence shows how the requirements of ISO 9000 for higher education may be interpreted in terms of a simplified model of a university. Highlights the key educational management issues raised and reviews how they are currently being addressed in practice.

Introduction

The ISO 9000 series is the international standard for quality assurance systems (British Standards Institution, 1987). Since its original publication in 1979 by the British Standards Institution under the code BS 5750, more than 70,000 companies worldwide have registered to the standard (BSI Quality Assurance, 1994). Although originally intended for manufacturing industry, ISO 9000 has attracted interest in service industries, including education. To date, a small number of educational institutions have registered to the standard (Lundquist, 1997), including Sandwell College (MacRobert, 1994) and the University of Wolverhampton (Doherty, 1995).

The literature on applying ISO 9000 to education is remarkably small, the only systematic accounts being those provided by Freeman (1993) and Ellis (1993a). Although all authors agree that identifying the product of education is crucial, there is no consensus on what it should be. Freeman (1993, p. 78) and Ellis (1993a, p. 20) take the product of education to mean the provision of learning opportunities and this was the definition adopted by the University of Wolverhampton (Storey, 1993, p. 47; 1994, p. 185). Sandwell College, on the other hand, defined the product of education to be the actual learning achieved by the students (MacRobert, 1994, p. 260) and this was subsequently adopted by the BSI in their *Guidance Notes on the Application of BS EN ISO 9001 for Quality Management Systems in Education and Training* (BSI Quality Assurance, 1995).

The aim of this article is to fill the obvious gap in the literature, namely to provide a systematic account of the application of ISO 9000 to education when the BSI definition of the product of education is followed. Although everything we shall say applies to education in general, we shall, for the sake of definiteness and because most of the existing literature is in this area, take higher education as our model. What we shall find is that the challenges encountered by any institution of higher education attempting to apply ISO 9000 according to the BSI definition are among the key issues currently being debated, most notably as a result of the Dearing Report (1997).

The remaining sections of this paper are organised as follows. First we review the basic

requirements of ISO 9000 for quality assurance in industry with reference to a simplified model of a factory. Then we explain how ISO 9000 intends that these requirements be achieved through what is known as a continuous improvement cycle. Next we discuss how to translate the simplified model of a factory into a simplified model of a university, according to the BSI definition of the product of education. After that we outline the corresponding requirements of ISO 9000 for quality assurance in higher education for this simplified model of a university. In the penultimate section we consider the issues raised by the ISO 9000 requirements for continuous improvement in higher education and examine how these are currently being addressed in the literature. We end the paper with some concluding remarks.

ISO 9000 requirements for quality assurance in industry

Consider the diagram shown in Figure 1, which represents a simplified model of a factory. Raw materials enter a process operated by workers to produce a product, according to a design, which then passes through a quality control before despatch to the customer. Items which fail the quality control are either discarded or reworked. The whole factory is watched over by a manager.

The basic requirements of ISO 9000 for this simplified model of a factory are summarised in the following paragraphs. For each component of the factory, certain actions are specified, the intention of which is to eliminate the causes of poor quality in that component. Although by its nature ISO 9000 confines itself to positively asserting what should be done, we shall introduce each of the requirements by giving some examples of how things may be going wrong in practice.

Figure 1 A simplified model of a factory
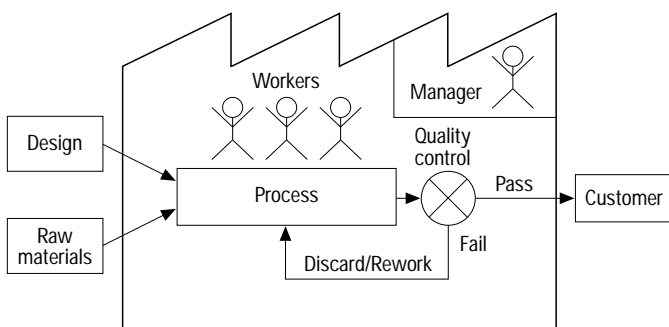
Customer
The product may fail to satisfy the requirements of the customer simply because it was never known what those requirements were. ISO 9000 therefore requires detailed customer requirements to be identified and incorporated into the design. This might be by means of direct negotiation, in the case of a single large customer, or through customer surveys in the case of a mass market.

Raw materials
A product may break down because the raw materials from which it was made were unsuitable for the purpose. For example, the steel used to manufacture a component may be too brittle and hence fracture in use. ISO 9000 specifies that incoming raw materials should be checked to ensure that they satisfy quality standards appropriate for the product to be made. It is interesting to note that raw materials supplied by the customer for incorporation into the product are specifically included in these requirements.

Design
A product may fail to work properly because the original design was inadequate for the purpose. For example, a vacuum cleaner may have a motor which is not in fact powerful enough to extract the dust from most carpets. ISO 9000 requires that the design should be checked to ensure that it meets the requirements of the customer, i.e. that the product, when made in accordance with the design, will actually work as the customer expects. This may be by means of prototyping, simulations, comparison with previously proven designs, etc.

Process
A product may fail because the production process is too loosely defined. For example, heat-treated components may fracture because they were bolted into place before they had been given sufficient time to cool, the minimum cooling time not having been specified, but rather left to the workers to decide. ISO 9000 requires that the process to be carried out should be specified at a sufficiently high level of detail to ensure product quality. The process should then be checked to ensure that it is being carried out as specified, by monitoring the process and by testing the product at suitable points.

Workers

The product may not function properly because the workers who assembled it lacked the skill or training required. For example, they may not know how to drill a hole accurately. ISO 9000 requires that workers should be assigned to tasks on the basis of appropriate training or experience, and that the training needs of workers should be identified and provided for.

Quality control

A product of a specified weight may not satisfy the customer, either because the weight was wrong and no one bothered to check it, or because the weighing machine used was not sufficiently accurate to detect the difference between what was and what was not acceptable to the customer. ISO 9000 requires that the quality control should check that the product actually meets the customer requirements before allowing it to be delivered. Test equipment should be capable of measuring to the accuracy required and should be calibrated against nationally recognised standards or, where no such standards exist, against specified standards. Defective products should not be used, but should be scrapped or reworked as appropriate. It is interesting to note that 100 per cent screening of every item is specifically not required, but instead statistical sampling methods may be used, if appropriate.

Management

Defective product may still end up with the customer simply because those who know what is going wrong lack the authority to do anything about it. ISO 9000 requires that those who are managing the system should be given clearly defined responsibility and authority to make the necessary changes. Management tasks should be assigned on the basis of appropriate training or experience, and the training needs of management should be identified and provided for.

ISO 9000 requirements for quality assurance in industry

A goal is useless without a plan for achieving it. ISO 9000 recognises this truth by outlining how it intends that its requirements for quality assurance, as summarised in the previous section, should be achieved. The mechanism which ISO 9000 specifies is continuous

Figure 2 ISO 9000 requirements for continuous improvement
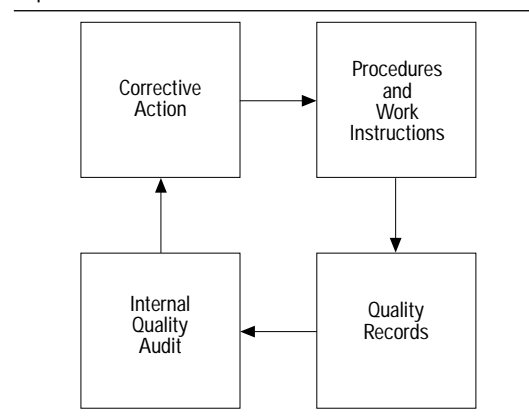
improvement through preventive action. The four steps required are shown in Figure 2, and their essential content is summarised below. These steps closely parallel the Shewart Cycle, as described in Deming (1986, p. 88) and Ishikawa (1985, p. 56).

Procedures and work instructions

These should be written for each of the requirements for quality assurance listed in the previous section, specifying how these requirements are to be satisfied. These documents should be in the form of "procedures", what is to be done, and "work instructions", how it is to be done. For example, under the requirement that raw materials be checked for suitable quality, the procedures might tell you what measurements are to be taken, where and how often, whereas the work instructions would specify the technical details of how the measurements are to be made and the results recorded.

Quality records

Documentary evidence should be kept which would allow someone to verify at a later date that the procedures have been followed and that the required quality standards specified in the work instructions have been achieved.

Internal quality audits

Someone, not directly involved in the activities in question, should periodically check the quality records to ensure that the procedures have indeed been followed, and that the quality standards specified in the work instructions have indeed been met.

Corrective action

If the quality audit should reveal that a defective product is being made, or that procedures

and work instructions are not being followed, corrective action must be taken. This consists of two steps. First, the immediate cause of the problem should be dealt with to prevent poor quality from continuing, e.g. taking a faulty machine out of production. Second, action should be taken to cure the root cause of the problem, to ensure that it does not recur. This might involve rewriting the procedures and work instructions, e.g. specifying more frequent maintenance checks in order to prevent machines from malfunctioning in the first place.

It should be noted that corrective action is not the same thing as discarding or reworking of defective products. That is dealt with under the quality control element, as we saw earlier. Corrective action applies not to the quality of the product but to the quality of the production system as a whole. For this reason, ISO 9000 is consistent with the general principles of total quality management (TQM).

It is appropriate at this point to address the question of whether or not a company can be ISO 9000 registered and still turn out defective product. This question is dealt with in some detail by Arnold (1994, p. 282), and the answer lies in the continuous improvement cycle. If defective product is being manufactured then there must be an underlying cause, and the requirements for corrective action specify that steps must be taken to rectify it. So it is not in fact possible for an ISO 9000 registered company to manufacture a defective product, except temporarily. How rapidly the cause may reasonably be identified and dealt with may, however, vary from case to case, and the ISO 9000 requirements for corrective action explicitly recognise this truth. The external auditors, who must periodically renew the ISO 9000 certification of the factory, are also not looking for miracles but for best business practice, so there is a certain amount of flexibility in how quickly the appropriate corrective action is taken. In the case of industry it would seem reasonable that problems could generally be dealt with quite promptly, since the production system should be under tight scientific control. As we shall see later, however, this issue becomes quite important in education, where the degree of scientific control is much less, and so the time taken to rectify problems may reasonably be much longer.

Fitting the industrial model to higher education

In this section we tackle the question of how to interpret, in the context of higher education, the simplified model of a factory which we introduced earlier. This essentially amounts to translating the technical terms (customer, product, quality control etc.) used in the previous two sections into the corresponding terms in higher education.

The two most important terms to be translated are "customer" and "product". The *Guidance Notes on the Application of BS EN ISO 9001 for Quality Management Systems in Education and Training* (BSI Quality Assurance, 1995) explicitly define the product of an education or training institution to be "the enhancement of competence, knowledge, understanding or personal development of the student resulting from the learning experience." The customer is defined to be any student, public organisation, or industrial body purchasing the service from the institution.

Translating the other technical terms contained in Figure 1 is now straightforward, the answers being implicit in the *Guidance Notes*, and we obtain the diagram shown in Figure 3. The raw materials entering the system are principally the students themselves. This is because the product, being the actual learning achieved by the students, is a modification of their own prior knowledge and understanding. To distinguish the students *qua* raw material from the students *qua* (satisfied) customers, we denote the former by the label "school leavers" and the latter by the label "graduates." The process they enter is the teaching carried out by the lecturers, according to the design of a syllabus. When the teaching is complete, a quality control in the form of examinations is carried out in order to verify that the students have actually learnt what the course was designed to teach them. Students who fail the examinations either leave the institution without the qualification or pass back into the teaching system to be re-examined. The whole system is watched over by the Dean, Principal, etc. according to the title used by the institution in question.

In order to keep the diagram in Figure 3 reasonably simple we have omitted a number of details. By labelling the customer box "graduates" we have suppressed the many other stakeholders mentioned by the BSI

Figure 3 A simplified model of a university
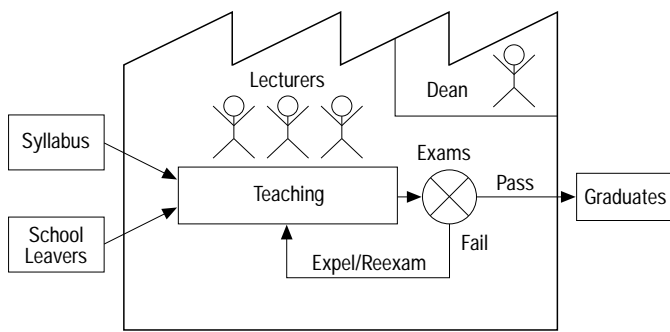
definition, who might include Government funding bodies, local education authorities, employers and parents. These are important, and we shall keep them in mind in the subsequent discussion. All the physical materials which are required to run an educational institution, ranging from textbooks and software down to heating oil for the buildings should also be included in the raw materials box. The application of ISO 9000 to these items, however, is quite uncontroversial, so we shall concentrate solely upon the "school leavers." A university employs more staff than just the lecturers, but again the industrial version of ISO 9000 handles this without any trouble. Rather more serious is the question of the process of education. By labelling it "teaching" we seem to be neglecting the very real sense in which it is the students themselves who do the learning, and that the teaching carried out by the lecturers is secondary. This point of view has been expressed very eloquently by Barnett (1992, Ch. 2) and Race (1993). To label the process "teaching and learning" or simply "learning" might, however, result in confusion with the product of education, that is, the "learning" achieved by the students. So in this paper we shall take "teaching" to mean the totality of the teaching and learning process, of which the learning is the more important part. Similarly, there are many ways to assess student understanding other than by written examinations, but for the sake of concreteness we label the quality control step "examinations" while having all the other forms in mind as well.

It is appropriate at this point to indicate briefly the principal changes to the above interpretation which would result should the product of education be taken to mean merely the provision of learning opportunities, rather than the actual learning achieved by the students. The most important change is to the

notion of quality control. If the actual student learning is not the product, then there is no requirement under ISO 9000 to assess it. So the quality control cannot be the examinations, but reduces to an assessment of the quality of the teaching materials (Freeman, 1993, pp. 78-80.) Similarly, the students cannot be considered to be raw materials, so this component of the model merely consists of the textbooks, software and heating oil mentioned above. As a result, the ISO 9000 requirements for checking the quality of raw materials cannot include selection criteria for the incoming students. Given all of this, the process can refer only to the construction of the learning opportunities, such as drafting teaching materials, in which the students are not involved at all. The actual delivery of the teaching to the students, including any assessment, would be included under the packaging and delivery of the product to the customer. Although our intention is not to compare the relative merits of the rival definitions of the product of education, and although we have not done justice in this brief summary to Freeman's careful treatment, it should be clear from the above that the requirements of ISO 9000 in the two cases would be quite different.

ISO 9000 requirements in higher education

In the previous section we translated the components of our simplified model of a factory into those of a university. In this section we interpret, in the context of the university, the requirements of ISO 9000 for quality assurance summarised earlier for the factory. Our aim is to parallel that previous discussion as closely as possible. So for each component we give an example of how poor quality may arise in practice and then say what the detailed requirements of ISO 9000 are in this case. We shall leave the consideration of the educational management issues raised to the next section.

Graduates
The course of study may fail to satisfy the requirements of the students, funding bodies or potential employers because it was never known what these requirements were. ISO 9000 therefore requires that the university identify the learning outcomes desired by these parties. This might be through detailed negotiation in the case of funding bodies or by opinion surveys in the case of students.

School leavers

Students may fail their examinations because they did not have the prerequisite skills or knowledge to successfully attempt the course in the first place. ISO 9000 therefore requires that incoming students be assessed to ensure that they satisfy appropriate entry requirements for the course. The argument that it is not the responsibility of the students if they enrol on a course which later proves to have been too hard for them, is specifically excluded by the ISO 9000 clause covering raw materials provided by the customer.

Syllabus

The course may fail to satisfy the students because the syllabus was incapable of achieving the detailed learning outcomes which they desired. For example, a course may be highly theoretical when what the students wanted to learn was practical skills. ISO 9000 specifies that the syllabus should be checked to ensure that it will result in the learning outcomes desired by the students. This may be by prototyping the course with a small group of test students, theoretical analysis of the learning outcomes, comparison with previously proven courses, etc.

Teaching

Students may fail to learn what they are being taught because individual lecturers are allowed to decide their own teaching methods, some of which may not be effective. ISO 9000 requires that the teaching process be specified and carried out at a level of detail sufficient to ensure that it is effective. Both the teaching and the learning outcomes must be monitored at suitable points in the teaching process to ensure that this happens.

Lecturers

Students may fail to learn, even when effective teaching methods are specified, because the lecturers do not have the skill or training required to put these methods into practice. ISO 9000 therefore requires that teaching duties should be assigned on the basis of training or experience, and that the training needs of lecturers should be identified and provided for.

Examinations

Students may graduate still not having learnt what they hoped to learn, either because they were not assessed at all in some areas, or because the assessment was incapable of distinguishing between satisfactory and unsatisfactory learning outcomes. ISO 9000 requires that students be examined in such a way as to ensure that the desired learning outcomes have actually been achieved before a degree certificate is awarded. The examination should be calibrated against nationally recognised standards of attainment or, where no such standards exist, against standards specified by the university.

Dean

Students who have failed to learn what they have been taught may still end up graduating simply because those who know what is going wrong lack the authority to do anything about it. ISO 9000 therefore requires that those responsible for administering the teaching system must be given clearly defined responsibility and authority to make the necessary changes. Educational management tasks should be assigned on the basis of appropriate training or experience, and the training needs of management should be identified and provided for.

Implications of continuous improvement in higher education

In this section we shall consider how to interpret in the context of higher education, the requirements of ISO 9000 for continuous improvement which were described earlier in the industrial context. The first three steps require that procedures be documented, quality records be collected and an internal quality audit be carried out. Experience shows that this can be very hard work (Storey, 1993, 1994), as the university is forced to be much more explicit about its activities than may have previously be the case. Nevertheless, no new specifically educational issues seem to arise.

The situation is quite different, however, in respect of the requirement for corrective action. Traditional procedures, even when adequately documented, may still fail to ensure quality learning outcomes. Failure to address this will result in the institution's attempt to register to the ISO 9000 standard to fail. In order to discuss the specifically educational issues raised, however, we must move from the generic to the specific. So, for the rest of this section, we shall consider each of the components of our simplified model of

a university in turn, reviewing to what extent traditional procedures may, in practice, fail to ensure the quality of the learning outcome, and what is actually being done to improve them. The issues raised are so fundamental, however, that even to attempt to provide a representative sample of the available literature would be a task far beyond the scope of this paper. Instead we shall largely confine ourselves to the very recent literature on quality assurance in education.

Graduates

In industry, the clearest indication that you are manufacturing the wrong product is when your customers stop buying it. Similarly, in higher education, there has been much concern recently over the falling enrolment in certain disciplines, especially the sciences and engineering (American Institute of Physics, 1996; Irvine, 1997, Jaraiedi and Ritz, 1994). A number of authors describe recent attempts to respond to student opinion. Hillmer *et al.* (1995), Jaraiedi and Ritz (1994) and Schauerman *et al.* (1994), provide case studies of the use of a total quality technique known as quality function deployment, while Pan (1995) describes a nation-wide survey of undergraduate opinion conducted in Singapore. The Dearing Report, (1997, Ch. 9) based a number of its recommendations on the views of employers' organisations which it had solicited during the enquiry period.

School leavers

Almost universally, universities have based their selection of students upon standards of attainment in public secondary examinations. Recently, however, doubt has been cast on the validity of this approach. Although performance in A level examinations in the UK has steadily increased, and examination boards assert that standards have not been relaxed (*Times Educational Supplement*, 1995), many UK professional engineering bodies have complained that incoming undergraduates are less well prepared than they were ten years ago (*Times Higher Educational Supplement*, 1995). Many universities have been forced to extend traditional three year honours degree courses to four years in order to bridge the ability gap, (Main and Priestly, 1997). This problem is far from new. The excellent account by Miller (1970, Ch. 2) demonstrated two important truths: that much of the variation in attainment in university examinations in the UK could not be predicted from A level grades

and that failure in university examinations was distributed right across ability levels. Clearly other factors must be taken into account if students capable of making the transition from secondary to tertiary education are to be more reliably selected. The Dearing Report (1997, Ch. 9) recommended that admissions procedures need to take more account of key higher order thinking and learning skills, and recalled an earlier report (Dearing, 1996) which suggested that a new certificate assessing these skills be introduced in the age range 16-19 to facilitate this. Since universities have little control over public secondary examinations, alternative approaches have been suggested. Geddes (1993) describes the decision at the South Bank University to accept a high first year drop out rate, but then constrain it to be much lower in subsequent years. This would in essence regard the first year of university study as probationary, an idea suggested much earlier by research at Keele University (Miller, 1970, p. 129).

Syllabus

The syllabus of a degree course may fail to satisfy the requirements of the students, even though the subject area of the degree may be correct, because the detailed learning outcomes are not. This point was made in the recent popular article (Osborne, 1997) which includes the case of a student in Germany suing his educational institution for providing an "irrelevant science education." Such an accusation could easily be made of any university degree course where the detailed content serves the needs of the minority of students who will continue on to research degrees rather than the majority of students who will not. The Dearing Report (1997, Ch. 9), while acknowledging the important role that continues to be played by courses where a single subject is studied in great technical depth, has also emphasised the need for greater breadth and the explicit introduction of key higher order thinking skills for the majority of students whose first job after graduation will not be in the speciality which they studied for their degree.

Teaching

The need to assess the quality of teaching and learning has recently been highlighted by Knight (1993). A comprehensive account is given by Nightingale and O'Neil (1994), who

stress the need for the learner to be the centre of attention, and includes a number of interesting case studies. The Dearing Report (1997, Ch. 9) also highlighted the need for much more detailed specification of the desired learning outcomes of a course of study, and that this should be complemented by an individual student progress file which outlines the student development and achievement throughout the course.

Lecturers

The principal hurdle to satisfying ISO 9000 for the teaching process is the requirement that teaching duties be assigned on the basis of training or experience. At present, the usual qualification for admission into the university teaching profession is a research degree. As Deming (1986, p. 173) argues, this is far from being nonsensical, as one obvious precondition for teaching well is to know your subject. Retaining this as the only criterion, however, is clearly untenable, and a number of institutions have responded to this issue by creating their own mechanisms to assess experience or provide training. Dallat and Rae (1993) describe the postgraduate certificate of teaching in higher education in the University of Ulster, while Ellis (1993b, p. 252) notes that staff at the same institution are now selected partly on the basis of a short demonstration of their teaching ability. Dearing (1997, Chs. 8, 14) lamenting the fact that research is currently the main basis for professional advancement, recommends not only that a professional Institute for Teaching in Higher Education be set up, but that attainment of the first level of achievement within this institute be made a condition for confirmation of new academic staff.

Examinations

Although a great deal of innovation has taken place over the years in the sphere of student assessment, the majority of universities still rely very heavily upon final written examinations. At first sight this would appear to satisfy the requirements of ISO 9000 very well, with the system of external examiners fulfilling the role of calibration against national standards. Nevertheless, there are many misgivings about the actual standards of attainment which a degree certificate guarantees, especially in the cases of the less able. As Eriksen (1995 p.25) points out, given the selectivity of university examinations and the traditional

choice of questions, it is perfectly possible for a student to successfully graduate having mastered only a fraction of the content of the course. The Dearing Report (1997, Ch. 10), while not saying much about the technical details of assessment techniques, has a very great deal to say on the subject of national standards in the UK. It mentions, among other issues, the deteriorating credibility among employers of the honours class system and weaknesses and inconsistencies in the practice of external examining. The key recommendations in this regard are, first, that national threshold attainment standards be developed, preferably by the universities themselves, that terminology and degree titles be standardised to aid transparency, and that external examiners be chosen from a list approved by the Quality Assurance Agency.

Dean

Of all the components of our simplified model of a university, this is the one where the research and debate is the least well developed. Nevertheless, a whole chapter of the Dearing Report (1997, Ch. 15) is devoted to the management and governance of higher education institutions. Two key recommendations are the following. First, that in cases where there is confusion, the identity of the governing body of an institution be made clear and undisputed. The second relates to the management authority of the UK Privy Council over individual universities (Ch. 16), so that in cases where degree standards have been abused, the degree awarding powers of a university may be removed.

No one would doubt that the issues described above are of great importance to the improvement of the quality of higher education. But do they really form part of the ISO 9000 quality management system? For example, how can ISO 9000 require a university to adopt effective teaching methods, when what constitutes an effective method of teaching is still the subject of research? Looked at from this point of view, ISO 9000 would seem to be asking the impossible. One of two conclusions might be drawn: either that it is impossible, so ISO 9000 does not in fact apply to higher education at all, or that the interpretation is wrong, and ISO 9000 should be applied in a much more restricted, administrative sense which avoids these hard problems.

We would argue that neither of these two conclusions is valid. To see that ISO 9000 is

not in fact asking the impossible, consider that ISO 9000 is a quality standard for the management of the whole educational system, not of the learning outcomes *per se*. For example, under quality control, where no national attainment standards exist for university examinations, universities should formulate their own, but nowhere does ISO 9000 specify what those standards should be. To see that ISO 9000 consists of more than efficient administration, consider that the continuous improvement cycle requires the university to perform an internal audit to determine whether the desired educational outcomes are actually being achieved. If not, the root causes should be identified and corrective action be taken.

As discussed earlier, however, the speed with which corrective action must be taken depends upon the difficulty of the problems faced and the current level of knowledge available. In industry, where there is a high degree of scientific control, corrective action might be expected to be quite prompt. In education, where scientific control is in its infancy, corrective action may take much longer to carry out. Looked at from this point of view, ISO 9000 begins to appear more reasonable. For example, it neither demands a 100 per cent pass rate, nor ignores examination failure, but rather it requires the university to investigate the causes of examination failure and then to take action to improve the situation, as far as is reasonably possible in the circumstances.

Conclusion

In this paper we have addressed the question of how ISO 9000, the international standard in quality assurance systems, should be applied to higher education when the definition of the product of education adopted by the British Standards Institution is followed. We have seen that ISO 9000 falls naturally into two parts. On the one hand it has detailed requirements for each of the components of a university, the intention of which is to eliminate the possible causes of poor quality arising in the teaching system. On the other hand, it has a requirement for continuous improvement applying to the teaching system as a whole.

When ISO 9000 is applied to higher education according to the BSI definition of the product of education, a number of key educational management issues must be faced, many of which are currently being debated in the literature. In particular it requires a university to: find out what the students want to learn and modify the course syllabus accordingly; adopt effective teaching methods and ensure that lecturers are trained to use them; develop approaches to assessment which will ensure that entrants are up to the course and that graduate have really achieved the desired learning outcomes; and commit the institutional authority to take action in implementing the above.

That the above issues are important is not in doubt but they may give rise to the impression that ISO 9000 is asking the impossible. In fact we have seen that the requirement for continuous improvement does not require immediate perfection, but does require the university to face up to the problems inherent in its teaching system, investigate the root causes, and then take action to improve the situation. This is the challenge of ISO 9000 certification in higher education.

References

American Institute of Physics (1996), *Bachelor's Degree Recipients Report*, College Park, MD.

Arnold, K.L. (1994), *The Manager's Guide to ISO9000,* The Free Press, Macmillan, New York, NY.

Barnett, R. (1992), *Improving Higher Education: Total Quality Care*, OUP, Buckingham.

British Standards Institution (1987), *British Standard Quality Systems BS 5750: Part 1, ISO 9001 – 1987, EN 29001 – 1987*, BSI, London.

BSI Quality Assurance (1994), *How BSI Quality Assurance Can Help You Build a Better Business,* BSI Quality Assurance, London.

BSI Quality Assurance (1995), *Guidance Notes on the Application of BS EN ISO 9000 for Quality Management Systems in Education and Training*, BSI Quality Assurance, London.

Dallat, J. and Rae, G. (1993), "Teacher training for university teachers?", in Ellis, R. (Ed.), *Quality Assurance for University Teaching*, OUP, Buckingham.

Dearing, R. (1996), *Review of Qualifications for 16-19-Year Olds,* SCAA Publications, Middlesex.

Dearing, R. (1997), *Higher Education in the Learning Society*, HMSO, London.

Deming, W.E. (1986), *Out of the Crisis: Quality, Productivity and Competitive Position*, Cambridge University Press, Cambridge.

Doherty, G.D. (1995), "BS 5750 parts 1 and 2/ISO 9000 (series): 1987 and education – do they fit and is it worth it?", *Quality Assurance in Education*, Vol. 3 No. 3, pp. 3-9.

Ellis, R. (1993a), "A British Standard for University Teaching?", in Ellis, R. (Ed.), *Quality Assurance for University Teaching*, OUP, Buckingham.

Ellis, R. (1993b), "The management of quality in the University of Ulster", *Higher Education*, Vol. 25, pp. 239-57.

Eriksen, S.D. (1995), "TQM and the transformation from an élite to a mass system of higher education in the UK", *Quality Assurance in Education*, Vol. 2 No. 1, pp. 14-29.

Freeman, R. (1993), Quality Assurance in Training and Education - How to Apply BS 5750 (ISO 9000) Standards}, Kogan Page, London.

Geddes, T. (1993), ¨The Total Quality Initiative at South Bank University", *Higher Education*, Vol.25, pp. 341-61.

Hillmer, S.C., Hillmer, B.H., Wilson, B. and Yochim, J. (1995), "Applying quality function deployment to improve an MBA education", in Roberts, H.V. (Ed.), *Academic Initiatives in Total Quality for Higher Education*, ASQC Quality Press, Milwaukee, WI.

Irvine, M. (1997), "Counting the cost after Dearing", *Physics World*, Vol. 10 No. 9, pp. 13-14.

Ishikawa, K. (1985), *What is Total Quality Control?*, Prentice-Hall, Englewood Cliffs, NJ.

Jaraiedi, M. and Ritz, D. (1994), "Total quality management applied to engineering education", *Quality Assurance in Education*, Vol. 2 No. 1, pp. 32-40.

Knight, P. (1993), "Turmoil in success: the assessment of teaching quality", *Quality Assurance in Education*, Vol.1 No.1, pp. 9-14.

Lundquist, R. (1997), "Quality Systems and ISO 9000 in Higher Education", *Assessment & Evaluation in Higher Education*, Vol. 22 No. 2, pp. 159-72.

MacRobert, I. (1994), "Sandwell College and BS 5750: a syncretistic pilgrimage?", in Doherty, G.D. (Ed.), *Developing Quality Systems in Education,* Routledge, London.

Main, P. and Priestly, M. (1997), "Universities welcome new degrees", *Physics World*, Vol. 10 No. 9, pp. 59-60.

Miller, G.W. (1970), *Success, Failure and Wastage in Higher Education*, Harrap, London.

Nightingale, P. and O'Neil, M. (1994), *Achieving Quality Learning in Higher Education,* Kogan Page, London.

Osborne, J. (1997), "You are charged with irrelevance...", *New Scientist,* 17 May.

Pan, D. (1995), "Assessing quality in higher education", in Lambert, J.L. and Banta, T.W. (Ed.) *Proceedings of the Seventh International Conference on Assessing Quality in Higher Education*, Indiana University, IN.

Race, P. (1993), "Never mind the teaching – feel the learning!", *Quality Assurance in Education*, Vol.1 No. 2, pp. 40-3.

Schauerman, S., Manno, D. and Peachy, B. (1994), "Listening to the voice of the customer", in Doherty, G.D. (Ed.), *Developing Quality Systems in Education,* Routledge, London.

Storey, S. (1993), "Total Quality Management through BS 5750: a case study", in Ellis, R. (Ed.), *Quality Assurance for University Teaching*, OUP, Buckingham.

Storey, S. (1994), "Doing total quality management the hard way: installing BS 5750/ISO 9001 at the University of Wolverhampton", in Doherty, G.D. (Ed.), *Developing Quality Systems in Education,* Routledge, London.

The Times Higher Educational Supplement (1995), "Maths failing engineering", 2 June.

The Times Educational Supplement (1995), "A-level pass rate hits record high", 18 August.