

University of Alberta

Application of ISO 10001 and ISO 10002 in Engineering Courses

by

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MASTER OF SCIENCE DISSERTATION

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Abstract:

An application of ISO 10001 and ISO 10002 customer satisfaction standards to enhance students' satisfaction in engineering courses is studied. An ISO 10001-based Code Management System (CMS) is used to improve the satisfaction of students through offering promises regarding course delivery. A Feedback Handling System (FHS) based on ISO 10002 is developed to systematically respond to unsolicited comments of the students. The methodology to develop the system processes and resources based on these two standards is explained. The CMS was used by the professors in eight different courses in an engineering department of a university in western Canada. The FHS was applied by one professor in two courses in the same department. The results of the implementation are discussed. Moreover, an application of ISO 19011 in auditing the systems against ISO 10001 and 10002 is investigated. Overall, the study showed that the students are satisfied with the systems implemented on the basis of these two customer satisfaction standards and that ISO 19011 can be used to audit such systems.

PREFACE

This thesis is based upon studies conducted during four academic terms (fall 2008 to fall 2009) in the Department of Mechanical Engineering, University of Alberta, Canada.

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Glossary of Terms and Abbreviations:

Audit – *“Systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled”* (ISO 9000, 2000, Clause 3.9.1)

Audit criteria – *“Set of policies, procedures, or requirements”* (ISO 9000, 2000, Clause 3.9.3)

Auditee – *“Organization being audited”* (ISO 9000, 2000, Clause 3.9.8)

Auditor – *“Person with the demonstrated personal attributes and competence to conduct an audit”* (ISO 9000, 2000, Clause 3.9.9)

Code Management System [CMS] – System based on ISO 10001 *“to enhance customer satisfaction [...] by planning, designing, developing, implementing, maintaining and improving customer satisfaction codes of conduct”* (ISO 10001, 2007, clause 1)

Codes of conduct – *“Promises made to customers by an organization concerning its behavior, that are aimed to enhanced customer satisfaction and related provisions”* (ISO 10001, 2007, clause 3.1)

Customer satisfaction – *“Customer’s perception of the degree to which the customer’s requirements have been fulfilled”* (ISO 9000, 2000, clause 3.1.4).

Effectiveness – *“Extent to which planned activities are realized and planned results are achieved”* (ISO 9000, 2000, Clause 3.2.14)

Feedback Handling System [FHS] - System based on ISO 10002 *“to enhance customer satisfaction by creating a customer-focused environment that is open to*

feedback, resolving any complaints received, and enhancing the organization's ability to improve its product and customer service" (ISO 10002, 2004, Clause 1)

Higher Education [HE] – *"Education beyond the secondary level, especially education at the college or university level"* (Merriam-Webster dictionary, 2009)

International Organization for Standardization [ISO] - *"Network of the national standards institutes of 159 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system"* (ISO Website, 2010).

MSS - Management System Standard

Process audit – *"Audit that determines if process requirements including methods and procedures are being met"* (Russell, 2005, Page xxiii).

Product or service audit – *"Audit that determines if product or service requirements are being met"* (Russell, 2005, Page xxiii).

Quality Management System [QMS] – *"Management system to direct and control an organization with regard to quality"* (ISO 9000, 2000, Clause 3.2.3)

Quality improvement – *"Part of quality management focused on increasing the ability to fulfill quality requirements"* (ISO 9000, 2000, Clause 3.2.12)

System audit – *"Audit that determines if system requirements are being met"* (Russell, 2005, Page xxiii).

Chapter 1: Introduction

1.1. Overview

Educational organizations are moving toward more customer-oriented organizations (DeShields et al., 2005; Seeman and O'Hara, 2006; Lam and Zhao, 1998). There have been many attempts to improve the services of educational organizations, ranging from quality to environmental aspects (Doherty, 1995; Sohail et al., 2003; Taddei-Bringas et al., 2008; Siu et al., 1999). Students, as one of the customers, and their satisfaction with the services provided define, in part, the quality of educational organizations. Student perception of the quality of services could be better managed by influencing their expectations and meeting them.

ISO 10001:2007 is an international standard that helps organizations define expectations of their customers, and convert those expectations into promises. The standard can also help an educational organization establish QMS to meet those promise(s) (ISO 10001, 2007). ISO 10002:2004, on the other hand, is a set of guidelines for designing and implementing a complaint-handling system (CHS) (ISO 10002, 2004). It can help educational organizations to establish a complaint-handling system to deal with its customers and systematically respond to each feedback or complaint (Karapetrovic and Doucette, 2009).

1.2. Statement of purpose

In this thesis, an application of ISO 10001 and ISO 10002 in a higher education environment is analyzed. The effectiveness of the applied systems is investigated. The applicability of ISO 19011 in auditing against these two standards is discussed. The goal of this research illustrated in this thesis is to develop the resources and processes for the CMS and FHS and to provide support for the application to the professors.

Overall, this research is searching for a quality management system that can help professors define customer expectations and, with the help of international customer satisfaction standards, achieve those expectations.

1.3. Methodology

The methodology used in this thesis consists of:

- Developing system processes based on ISO 10001 to improve the quality of course delivery.
- Developing system processes based on ISO 10002 to address students' feedback during the semester.
- Investigating the integration of these two systems.
- Applying the ISO 19011 audit systems to audit the implemented systems against the two standards.

A flowchart of the system processes that could meet all the standard guidelines is developed. A copy of the flowchart is given to the professors to help them establish their systems. The professors are asked to implement a system to achieve their promises set by each code and address the students' feedback. The effectiveness of the systems in achieving the promises and handling student feedback is evaluated. An audit is conducted in selected courses to investigate the compliance of those systems with ISO 10001 and ISO 10002.

The results of the implementation of these systems, the findings of their applicability in the higher education environment, and the difficulties encountered during the application are explained.

Although the system developed was generic and is applicable in different courses, but the overall flowchart and the resources used was only implemented in 8 different Engineering courses.

1.4. Thesis structure

Chapter 2 looks into the literature review of QMS and its definitions. It also identifies different customers of educational organizations and discusses means suggested in the literature to identify and satisfy the students' needs as one of the customers of educational organizations. A brief study of the ISO standards and their application in the higher education environment is explained. The last part of chapter 2 defines the quality-auditing processes and briefly describes the ISO 19011 in auditing against standards.

Chapter 3 describes the methodology used to develop and implement a system based on ISO 10001 in higher education environment. A system flowchart, which explains the processes including defining the codes (promises made to students), preparing the implementation of the codes, and implementing and maintaining the system is developed.

Chapter 4 illustrates the results of the implementation of the CMS in eight courses by five different professors. In this study, 590 students participated and there are four different codes developed. The results of the code implementation and the professors' performance in implementation of the codes are explained. The students' satisfaction with the system is evaluated with surveys. The study shows that the system could help the professors to address students' concerns from different aspects, based on the codes defined.

Chapter 5 explains the steps taken to address students' feedback with the feedback handling system developed based on ISO 10002 requirements. The integration of this system with ISO 10001 based system is studied. A flowchart of a system processes is developed based on the requirements of ISO 10002. Then, the students' feedback is handled with the system designed in two different courses, and their satisfaction with the systems is measured with surveys. Information regarding the students' feedback and corrective actions are documented for future use in improving the teaching quality of the course. If students' feedback forms are documented and made available to other professors, they can use them to address different aspects of their courses even if they are

not implementing the system. The use of a feedback handling system in different courses is studied. The study showed that the system can be used to improve the process of handling students' feedback and the courses delivery based on the comments made by students.

Chapter 6 investigates the applicability of ISO 19011 methodology in auditing systems against augmentative standards specifically ISO 10001 and ISO 10002. The steps required by the ISO 19011 standard are studied. These steps are used to audit the systems, which are implemented in five different courses against the requirements of ISO 10001 and ISO 10002. Moreover, the audit results are explained. The case study shows that although ISO 19011 was originally developed to audit management systems against ISO 9001 and ISO 14001, its methodology can also be used for auditing systems against the ISO 10001 and ISO 10002 standards. The audit findings show that the systems developed require minor adjustment to satisfy the ISO 10001 and ISO 10002 standards' requirements.

Chapter 7 concludes all the findings of this study and discusses the achievement of its objectives, contributions, limitations, summary of the work done, and suggestions for future research.

Chapter 2: Literature review

2.1. Introduction

In this chapter of the thesis, the author looks at the literature on the field of quality and customer satisfaction to illustrate the studies conducted prior to this research. Section 2.2 explains the definitions of quality and identifies customers of educational organizations and methods of measuring their satisfaction. Section 2.3 illustrates the methods of improving the quality of product or services in organizations and provides examples for application of those methods in educational organizations as well as other industries. Section 2.4 is focused on the application of ISO 10001 and ISO 10002 in different sectors as these two standards are the focus of this study. Section 2.5 illustrates the auditing steps and provides information on ISO 19011 as one of the auditing MSSs.

2.2. Quality in higher education

In this section, the definition of quality in higher education is studied, and some of the reasons why quality is important and should be considered in this environment are discussed. For any QMS to succeed in improving the quality of the organization's product, recognizing the organization's customers and using efficient methods to gather their needs are essential. Therefore the main customers of the educational organizations are identified.

2.2.1. Definitions of quality in higher education

There are many different definitions for quality. Deming defines quality as "*the degree in which the product or service satisfies the customer's needs or expectation*" (Green, 1994). He believed that the customers or users of the product or service are the ones who define the quality (Green, 1994). Based on Juran's definition, quality is defined as "*fitness of use*" (Hoyer et al., 2001). He believed that quality "*consists of meeting the needs of customers therefore provides product satisfaction*" and "*freedom from deficiencies*" (Hoyer et al., 2001). Fitness of use means "*an essential requirement of [...] products that meet the needs of those members of society who will actually use them.*"

(Burrill and Ledolter, 1999). If we use Juran's quality definition as fitness of purpose, quality in education should be the level of quality that the customers want and think is acceptable (Green, 1994). For example, if we consider the industry as customers of universities, the students are one of the products of the universities since they should know how to perform tasks that the industry hires them to do (Jaraiedi and Ritz, 1994). On the other hand, if we consider students as the customers of universities, the level of service provided to them should meet their expectations (Jaraiedi and Ritz, 1994).

In general, the main "two levels" to define quality can be "*producing products or delivering services whose measurable characteristics satisfies a fixed set of specifications*" and "*products or services that satisfy customer expectations for their use or consumption*" (Hoyer et al., 2001).

Brown and Marshall defined quality in education based on the four dimensions identified by American Society of Quality (ASQ). These four dimensions are:

- 1) *Accountability [...A systematic method to assure stakeholders that an organization is producing the desired results or outcomes...]*
- 2) *Curricular alignment [...the process by which educators design courses to address program outcomes...]*
- 3) *Assessment [...the identification of individual and collective needs and results...]*
- 4) *Student satisfaction [...providing what is needed when it's needed, including faculty availability and learning/remediation resource accessibility...]*

(Brown and Marshall, 2008)

Quality in educational organizations is "*a multi-dimensional, multi-level, and dynamic concept that relates to the contextual settings of an educational model, to the institutional mission and objectives, as well as to specific standards within a given system, institution, programme, or discipline*" (Vlăsceanu et al., 2007).

2.2.2. Reasons for quality management in higher education

Quality standards have been used in different manufacturing and service industries (Opre and Opre, 2006). Education organizations, specifically universities, have recently started to implement quality assurance standards and improve the services that they offer (Opre and Opre, 2006). Some examples of those organizations, which made some efforts to continuously improve the quality of their academic administrative system and academic programs, are Oregon State University, Babson College, and Northwest Missouri State University (Temponi, 2005). One of the reasons for the establishment of these systems is the goal of educational organizations to increase their share in the higher education marketplace, for example by having more applicants apply to their programs (Green, 1994; Owlia and Aspinwall, 1997). This increase in market share requires educational organizations to become more customer-oriented (DeShields et al., 2005; Seeman and O'Hara, 2006; Lam and Zhao, 1998). Such improvements, which help to improve the satisfaction of students as one of the customers of educational organization, could also help to decrease the number of dropouts from the universities (Aldridge and Rowley, 1998).

Another reason for improvement in educational organization is to address some of the concerns that they face (Mariun, 2005). Some examples of these concerns as Mariun (2005) identified are “*meeting the needs of industry and other employers, maintaining academic standards and financial accountability to the government and funding bodies*” (Mariun, 2005). Solving these concerns can attract more students to the educational organizations (Mariun, 2005).

Therefore, although educational organizations are “*not for profit and are non-profit organizations*”, they should work like any other businesses and try to satisfy the needs of their customers to be able to capture more students in the future (Reisman, 2005).

2.2.3. Customers of higher education

Higher education has many different customers. “*Students, government, and private institutions who hire graduate students*” can be identified as customers (Jaraiedi and Ritz, 1994). Jaraiedi and Ritz (1994) looked at the two sides of the educational organizations’ customers and argued that if industry is the customer of higher education, then what they teach in classrooms and the students’ knowledge, when they graduate from the university, would be considered the product. On the contrary, if the students are considered as customers of educational organizations, then the quality of teaching and the methods used in teaching the courses or providing services to the students would be considered the product (Jaraiedi and Ritz, 1994). Based on Jaraiedi and Ritz’s (1994) paper, we can conclude that the methods by which the material is presented to the students would be considered as the product.

On the other hand, Bateman and Roberts (1993) suggested that students should be considered as “*co-producers*” rather than customers. They argue that students cannot be the same as customers of other industries (Bateman and Roberts, 1993). They also explained that if students are considered as the customers, it gives the professors more responsibility to improve the quality of teaching and gives them “*responsibility for its success rather than blaming it on poor student performance*” (Bateman and Roberts, 1993).

Therefore, aspects of quality in higher education change based on who the customer is (Green, 1994). Although there are different stakeholders in higher education, our focus will be on the students and satisfying their needs in the context of teaching courses and course delivery. The customer is defined in ISO 9000:2005 (clause 3.3.5) as the “*organization or person that receives the product*”. Since students are the recipients of the course delivery services, this thesis considers students as the main customers. As a result, promises are made to students (acting as customers) by professors (analogous to the organization) regarding course delivery (representing the product) (Karapetrovic, 2009).

2.2.4. Factors defining students' satisfaction

Since students are the most “*influential stakeholders*” of higher education (Seeman and O'Hara, 2006), and quality is defined from the students' perception of service and their experience with the service (Aldridge and Rowley, 1998), the system for improving the quality of product, of which students are considered as customers, should be based on criteria defined by students. Therefore, the next step would be to find out what the students need. One of the reasons that improvement attempts fail is because customers' expectation is different from the service provider's idea of quality (Ho and Wearn, 1996). This would result in improvement in some aspects of product or service that is not important to the customer (Pariseau and McDaniel, 1997). Because of the five gaps that exist in the process of defining customer needs and addressing those, the overall gap between the customer's expected quality and perceived quality increases (Ho and Wearn, 1996). This is illustrated in Figure 2-1.

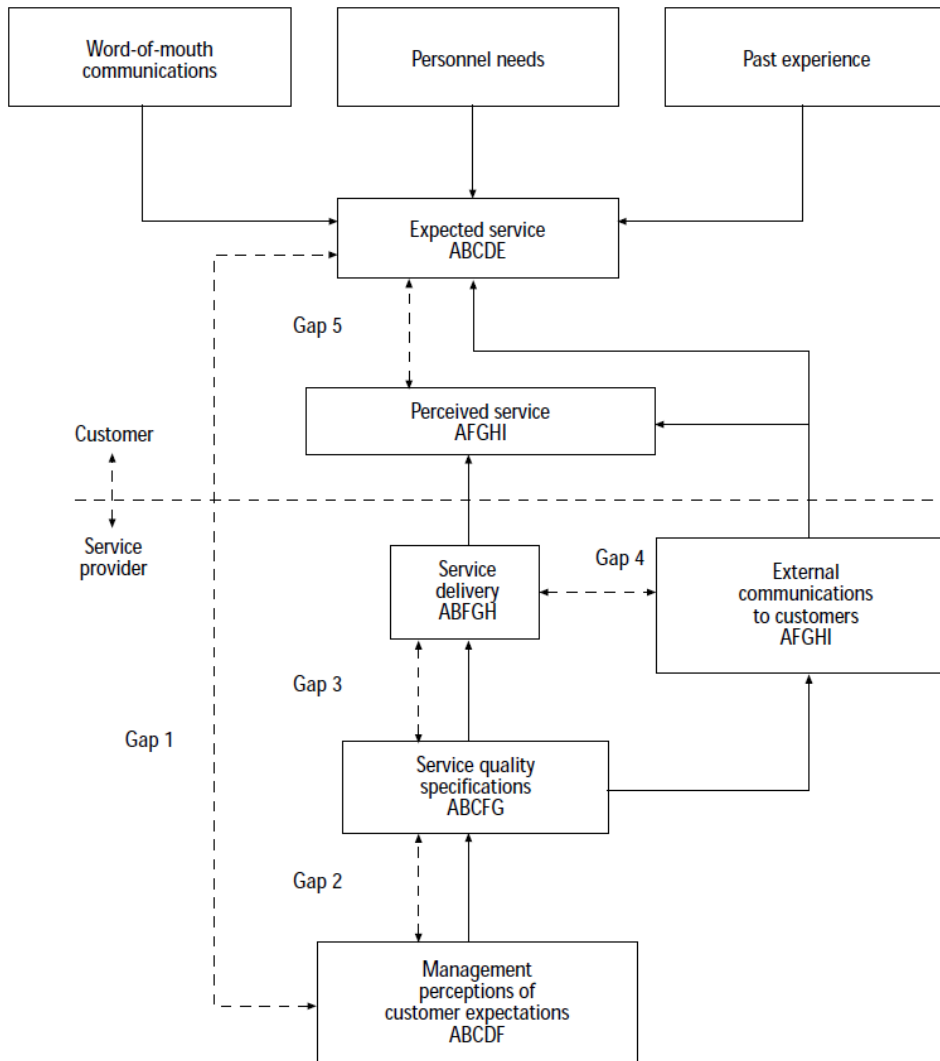


Figure 2-1: Gap creation in defining customer satisfaction (Ho and Wearn, 1996)

When talking about students' satisfaction, Alves et al. (2007) argued that students' expectation has a high influence on satisfaction. A survey conducted in 2002, which categorized students' experience with educational organizations into six different dimensions - "*Curriculum, Teaching, Analytical skills, Communication skills, Social skills, and Personal growth*" – showed that curriculum, teaching, and analytical skills have a higher influence on students' satisfaction (BCMAE, 2003).

Different people have different categories for students' expectation. Pariesseau et al. (1997) categorize expectations in to "*assurance, tangibles, reliability, empathy, and responsiveness*". Williams (1995) divided expectation into three different groups. These

three aspects are “*Design and delivery of programs of study, Briefing, and Support*”. Based on his definition, design and delivery of program addresses the “*students intellectual development needs*”, briefing includes “*students’ pre-required or basic knowledge of the material and the whole teaching and learning structure*”, and support deals with other parts of their higher education experience and services provided to them (Williams, 1995). Despite all these differences, students’ expectations can be categorized into (Aldridge and Rowley, 1998):

- “*What is being thought in classrooms [content of the course]*”
- “*How their whole experience in higher education is [services of educational organizations]*” (Aldridge and Rowley, 1998)

In measuring customer satisfaction, Aldridge et al. (1998) believed that “*we evaluate perception of the quality which is customers’ opinion of the quality of services and not the expectation*”. Therefore, the students perception of the service and the quality level of the services provided to them shape the quality of educational organizations (Aldridge and Rowley, 1998). Pariseau et al. (1997) argued that it is important that the customer and the service provider both agree “*on what the acceptable quality level of the service is*”. Therefore, for improving any system so that it can meet the customer’s requirements, a systematic approach for gathering customer’s requirements should be in place.

2.2.5. Measuring student satisfaction

Mizikaci (2006) found out that one of the biggest problems with QMS is the “*lack of program evaluation dimensions*”, meaning that usually the curriculum and the system processes are not being evaluated.

Based on Harvey and Green (1993) (quoted in Mizikaci, 2006), in assessing the quality of any system, certain criteria should be identified and then the system quality should be measured. Agreed on by the majority of the stakeholders, some of the criteria that have an effect on the quality of teaching and learning were “*Adequacy of physical and human resources, Clarity of the aims and objectives, relevance of subjects and their content to*

program's aims and objective, objectivity in assessment [...]"(Harvey and Green (1993), quoted in Mizikaci, 2006)

There are many methods to measure students' satisfaction. Some of these methods are "*instructional development and effectiveness assessment, the student instructional rating system, the student's evaluation of educational quality, instructor and course evaluation system*" (Marsh 1987, quoted in Guolla, 1999). These data gathering methods should include all four frameworks of evaluation defined by Mizikaci (2006), which are "*context, input, process, and product*". These frameworks deal with all the components of a system, including "*inputs [what should be taught in higher education classrooms], system itself [structure and the process of teaching - how it should be taught] and outputs [how educated the students are at the end of course]*" (Jaraiedi and Ritz, 1994). As student's involvement in education increases, educational organizations can design a system that can obtain their needs and based on those needs, adjust the system of teaching to address and meet those needs (Mizikaci, 2006). Different measuring models could be used to evaluate the quality of education, such as:

- SERVQUAL: "*[measures] service quality by comparing the perceptions of the service received with expectations*".
- HEdPERF (Higher Education PERFORMANCE): "*a new and more comprehensive performance-based measuring scale that attempts to capture the authentic determinants of service quality within the higher education sector*"
- SERVPERF: "*measures only the perception of service quality*" (Abdullah, 2005).

These methods were compared to each other to find the most efficient method to identify the improvement opportunities. For example, Abdullah (2005; 2006) compared HEdPERF with SERVPERF, while Brochado (2009) and Nejati et al. (2008) compared SERVPERF with SERVQUAL.

Cuthbert (1996a) suggested using SERVQUAL as a way of evaluating students' expectations and their perception of service quality in higher education, and analyzing the quality based on the difference between expectation and perception of service. He found

out that this method is the most practical method of evaluating service quality, but there were some disadvantages of using this method in educational organizations, such as “*the five dimensions of the SERVQUAL instrument may well not be the appropriate dimensions for measuring service quality in higher education*” (Cuthbert, 1996b). Therefore, SERVQUAL may not be as useful as it is in other service sectors (Cuthbert, 1996b).

Enhancing student satisfaction in the classroom has positive effects on learning (Guolla, 1999). Therefore, Instructors should pay more attention to what students perceive as service quality and what their expectations are (Hill et al., 2003). As Hill et al. (2003) concluded this could help instructors to enhance the teaching quality, which results in more student satisfaction in the classrooms.

Different people have tried to set up a system to gather feedback from students. Voss (2009) and Douglas et al. (2008) applied CIT (Critical Instance Techniques) to define the criteria that have an effect on the student’s satisfaction or dissatisfaction in higher education classrooms. They defined some criteria by doing surveys among students and lecturers and defined the influence of those criteria on students’ satisfaction. Douglas et al. (2009) compared the CIT method with the traditional student satisfaction methods that are being used by university administrators. Voss et al. (2007) used another method, “*means–end chain approach*”, to get the students’ criteria for satisfaction and the reasons behind them. He found out “*teaching skills, teaching methods, communication skills, approachability, enthusiasm, expertise, humor, and friendliness*” are important criteria in student satisfaction in higher education classrooms (Voss et al., 2007).

Zwijze-Koning et al. (2007) and Hayes (2008) identified two methods of gathering customer feedback. These two methods were communication or customer satisfaction questionnaire (CSQ) and critical instance technique (CIT). Customer satisfaction questionnaires are used in many situations and industries to gather information about customers’ satisfaction with the service or product and it could provide a good idea about customer perception of the service (Baker, 1990; Poulton, 1996; Hallowell, 1996; Su,

2004; Ooi et al., 2007). This Approach could be used in academia and gathering students' satisfaction with the teaching and higher education quality (Elliott and Shin, 2002; Ramsden, 1991; Wilson et al., 1997).

Rowley (1997) used SERVQUAL to manage and improve the students' satisfaction but she argued that in order to better manage the service quality, "*internal contracts*", which could be formal or informal, could be used to better manage the students' expectations. An example of an internal contract is "*students expect lecturers to turn up to class and to mark and return their work within a reasonable period in response to the formal requirement on them to submit their work to a specified deadline*" (Rowley, 1997). She argues that certain characteristics of the education services, such as the "*psychological contracts - unwritten or unspoken expectations*" could have an effect on satisfaction, and therefore they should be focused on (Rowley, 1997).

The voice of the customers (VOC) could also be helpful in providing long term quality improvements (Goodman et al., 1996; Mazur, 2003). In-class feedback could help instructors to gather information about what student's expectations are (Brocato and Potocki, 1996). Brocato and Potocki (1996) used student's feedback forms to gather the students' satisfaction after each class and studied the changes in each lecture to get a better idea about what students expect or perceive as better quality in classroom teaching.

2.2.6. Feedback from students

Students are the most common source of gathering information about the teaching quality in higher education (Keane and Mac Labhrainn, 2005). Although they are not competent enough to leave feedback in curriculum design, grading practice, or course design, the student's feedback on "*the quality of the delivery of instruction*" could be helpful (Coughlan, 2004). Research studies have shown that student feedback could have a great impact on teaching quality and should be focused on and used in educational organizations (Murray, 1997; Brew, 2008; Rokade et al., 2008; Murdoch Eaton and Levene, 1997)

The feedback could be used in different parts of higher education, from classroom level to educational organizations in general (Brennan and Williams, 2004). Depending on the purpose of the feedback, it could have different details or questionnaires (Keane and Mac Labhrainn, 2005). Brennan et al. (2003, page 10) identifies four different purposes for feedback, which are:

1. *“Feedbacks for effectiveness of teaching*
2. *Feedbacks for administrative decision making*
3. *Feedbacks for student to select courses and instructors*
4. *Feedbacks for use in research on teaching”* (Brennan et al., 2003)

Of these four, this thesis is focused on the first and fourth purpose, and specifically, on the feedback gathered from students. For the first purpose, the author is trying to set up a system that gathers students’ feedback and addresses them. Addressing the feedback would affect and make changes to the professor’s teaching process, thereby improving the teaching. The second purpose of this study is to understand how effective the system of gathering feedback and using this feedback to improve the course is, and whether this feedback system can make a contribution to the teaching and learning process.

Most of the feedback gathered from the students would go through a process to evaluate the results (Fry et al., 2009). Hounsell (Quoted in Fry et al., 2009) suggested the process illustrated in Figure 2-2 for that purpose.

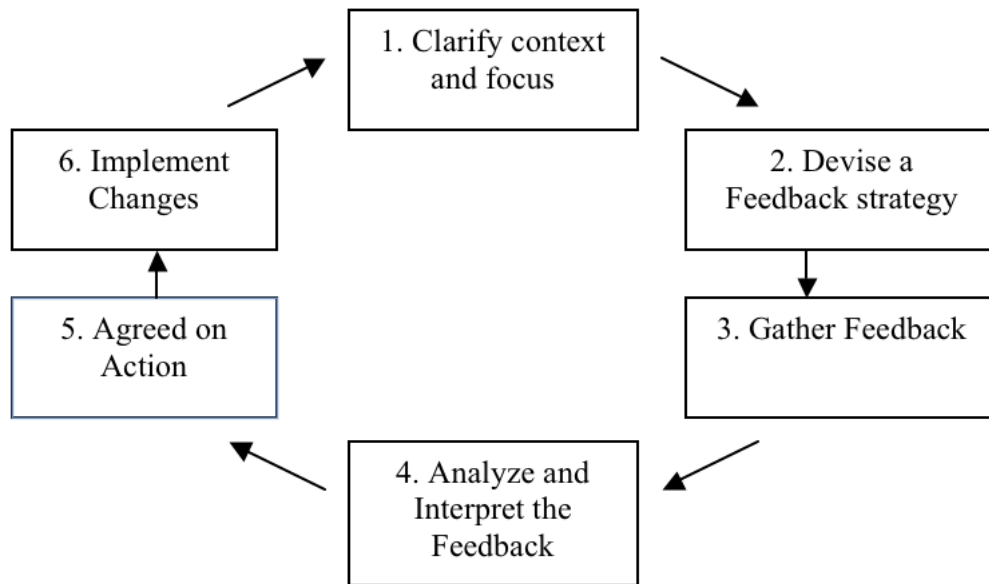


Figure 2-2: The Evaluation Cycle (Fry et al., 2009, p. 208)

The literature also showed that giving feedback results back to the students and notifying them of the changes implemented, motivates them to leave more comprehensive feedbacks in the future (Keane and Mac Labhrainn, 2005).

2.3. Application of QMSs in higher education

After discussing the main definitions and the reason behind why higher education should improve its education quality, more specific studies on attempts to improve the quality are explained.

2.3.1. TQM in educational organizations

A QMS approach can be used to achieve all of the above mentioned dimensions, and by addressing each one of them, it could also be used to continuously improve the quality by using methods like the PDCA (Plan-Do-Check-Act) approach (Brown and Marshall, 2008). As an example, total quality management (TQM) has been adopted in higher education to improve the quality of education, especially in curriculum development (Lam and Zhao, 1998; Andreu et al., 2006).

Total quality management has been used in different industries to improve the quality of their products or services (Zairi, 1994). One of the essential factors in the success of any TQM project is the effective quality leadership of management groups in the organization and the methods used by them (Zairi, 1994). Application of TQM in higher education requires the same leadership and management practices for a successful application in the educational organization (Osseo-Asare et al., 2007).

In the planning stage, sets of criteria, “Critical success factors (CSF)” should be defined (Martz et al., 2001). As Martz et al. (2001) explained these criteria are “*performance expectation, attainable goals, measurement, involvement, and feedback*”. Lo et al. (1996) suggest that a group of professionals can define these criteria, prepare work instructions, and audit the system to check the compliance with the system. Using students, as one of the customers to enhance the quality of education, in the planning of the criteria, is a necessity in the application of TQM (Barnard, 1999). As measurement of quality in HE is difficult, students could be used to evaluate the teaching quality they receive (Sakthivel and Raju, 2006), and their feedback is a powerful element in enhancing the achievement (Marzano et al., 2001).

TQM has been used to improve the classroom teaching quality (Miller et al., 1996; Dimitrova and Tshevska, 2004; Hughes, 2004). Some examples are the application of TQM in the engineering department of the New Jersey Institute of Technology (Miller et al., 1996), the application of quality assurance in a Bulgarian teacher training context (Dimitrova and Tashevskaa, 2004), and quality management system in a Spanish secondary school (Hughes, 2004).

According to Bolton (1995), in order to move toward applying Total Quality Management (TQM) principles in higher education, educational organizations need to change their concept of quality, which means that they have to focus on students’ satisfaction and their needs, rather than the quantity and quality of the researches. For example, because of the tenure process in educational organizations, which rewards the professors on the basis of research, the instructors are less interested in students’ ideas

(Helms et al., 2001; Matthews, 1993). Therefore, according to Helms (2001), the existence of the tenure process brings difficulties in the application of TQM in the classroom.

2.3.2. QMSs in educational organizations

Many educational organizations have implemented quality improvement principles at the administrator and curriculum levels (Lam and Zhao, 1998; Andreu et al., 2006), but not all the organizations that implemented continuous improvement processes were successful (Owlia and Aspinwall, 1997). An example would be Virginia University's attempt to implement TQM, which failed because of a low management commitment and a lack of strategic planning (Owlia and Aspinwall, 1997).

Some models that can provide a framework and help the organizations to build an effective quality improvement system are:

- EQUIS, a "Quality assurance scheme" that could be used by educational organizations to better understand its procedures and improvement opportunities (Temponi, 2005). This model uses self-assessment reports to gather stakeholders' needs and address them (Temponi, 2005).
- "*Improvement decision model for teaching quality*" is used to measure and improve learning satisfaction (Chien, 2007).
- 360-degree assessment method in measuring teaching quality (Andreu et al., 2006).

2.3.3. Quality assurance and management standards

Any management system needs a set of rules to make sure that it is moving toward being a more efficient system. One set of rules that can be used by any organization to help them move toward their goals is that of quality management standards. One of the organizations that sets and publish these standards is ISO.

ISO or International Organization of Standardization is “*a federation of national standards bodies of 161 countries, which provides guidelines and practical solutions for all industries based on their needs*” (ISO, 2010). These standards help organizations develop systems to assure better quality and more efficient products or services (ISO, 2009).

ISO 10001, ISO 10002, ISO 10003, and ISO 10004 of International organization of standardization (ISO) deal with customer satisfaction. These standards were designed to provide guidelines for planning, designing, developing, maintaining, and improving different aspects of customer satisfaction (Hughes and Karapetrovic, 2006):

- Codes of conduct (ISO 10001), which “*helps organizations to develop sets of promises to be made to the customers to enhance the customers’ satisfaction*”(ISO 10001, 2007)
- Internal customer complain-handling system (ISO 10002) “*provides guidance for the design and implementation of an effective and efficient complaints-handling process*” and helps organizations to internally address each one of the complaints, and keeps track of those for future use (ISO 10002, 2004).
- External customer complaint-handling system (ISO 10003), which helps the organization to find “*the resolution of disputes regarding product-related complaints that could not be satisfactorily resolved internally*” (ISO 10001, 2007).
- The new standard in Customer satisfaction - Guidelines for monitoring and measuring (ISO/Technical Specification 10004), which “*provides guidance in defining and implementing processes to monitor and measure customer satisfaction*” (ISO/TS 10004, 2010).

The first edition of ISO 10001 was published in 2007. This standard “*can be used by any organization regardless of their type, size, or product*” (ISO 10001, 2007). Using this standard to improve the customers’ satisfaction can “*decrease the likelihood of complaints arising later*” (Dee et al., 2004). This standard includes guidelines for developing and defining the code(s), which are “*the promises made by organization to its*

customers to enhance the customer satisfaction” (ISO 10001:2007, Clause 3.1). The codes suggested by ISO 10001 should have five components. These components are:

- *“The promise*
- *The key terms*
- *How and to whom enquiries should be directed*
- *The scope or limitation of the code*
- *The action if the code promises are not fulfilled”.*

Moreover, the standard includes:

- Guidelines that help the organization in the preparation of the codes’ implementation (e.g., the communication plan for each code),
- Guidelines for implementing activities to assure the customer that the codes will be met (e.g., the identification of resources required), and
- Guidelines for the maintenance and improvement of the code, its performance, and customer satisfaction with the code (e.g., management review).

Although these standards are not designed for certification, they can be used separately or together with other standards to improve the QMS in each organization (ISO 10001, 2007).

ISO 10001, as used in this thesis, helps the professors to investigate and satisfy the students’ needs, and improve teaching quality. This can be achieved by developing codes or promises to students about the level of service, and managing and measuring the code implementation and satisfaction with the help of standard. The standard helps professors with what they should consider when they are defining the codes and what kind of resources they would need to use (ISO 10001, 2007). The standard guides the professors to prepare for all the aspects of the codes and their implementation. With the help of ISO 10001, the professors can assure the students that the codes’ promises can be met.

On the other hand, by using ISO 10002 guidelines, a system to gather the students’ feedback about the teaching quality could be designed (Karapetrovic and Doucette,

2009). ISO 10002:2004 includes guidelines for the general characteristics of a complaint-handling system and information about how to design and operate it.

ISO 10002:2004 can be used to increase customer satisfaction and systematically deal with the gathering of customer complaints and addressing those (ISO 10002, 2004). It helps the organization “*enhance customer satisfaction by creating a customer-focused environment that is open to feedback, resolve any complaint, and improve the product or service*” (ISO 10002, 2004).

After the complaint-handling processes are designed and the responsibilities, objectives, and resources are assigned, the information about the system should be communicated to the customers (ISO 10002, 2004). The standard includes guidelines for designing a complaint-handling system. The standard describes processes from receiving the complaint, investigating it, responding to it, and provides information about the maintenance and improvement of the system (ISO 10002:2004). The system based on the standards can be integrated and provide a framework for customer satisfaction (ISO 10001:2007).

2.3.4. Quality aspects in higher education

For a better understanding of the topic to be studied, there is a need to investigate whether the quality improvement systems have been used in higher education and what they were. Therefore, a brief literature review on QMSs in education was conducted, and samples of different international quality standards that were used in the higher education environment to improve different aspects of the higher education was discussed.

There are two quality aspects in educational organizations, academic programs and facilities services (Sirvanci, 2004). These two aspects are shown in Figure 2-3 (Sirvanci, 2004).

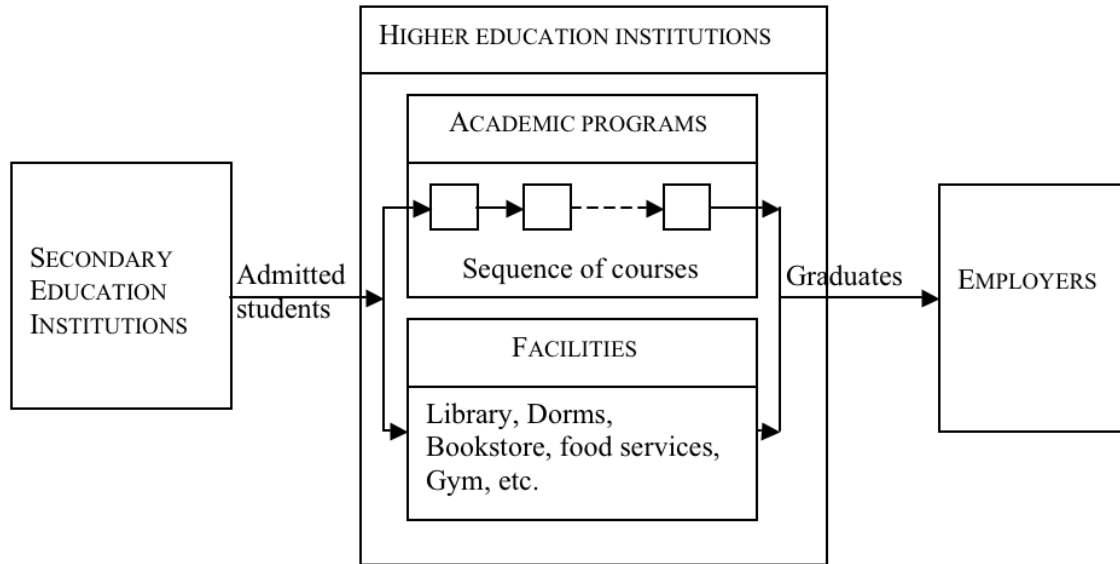


Figure 2-3: Student flow in higher education (Sirvanci, 2004)

Kaplan and Owings (2001) divided the quality of education in the classroom into two different quality aspects:

- “*Teacher quality*”, which is the quality of teacher’s knowledge about the subject.
- “*Teaching quality*”, defined as how the professors teach inside the classroom and what approaches they use to help the student learn the material more effectively. (Kaplan and Owings, 2001).

There have been many attempts to implement quality concepts in the educational organizations in order to improve the services offered to the students. Some of these attempts include:

- Application of BS EN ISO 9001 in the University of Wolverhampton and its registration in 1994 (Doherty, 1995).
- Application of ISO 9002 at the Pahang state college of professional development and its certification in 1998 (Sohail et al., 2003).
- Application of ISO 9002 in laboratories services at city university of Hong Kong (Siu et al., 1999).
- Application of an ISO 14001 - Environmental management system in educational organizations:

- University of Glamorgan, Leeds Metropolitan University, and the University of Wales School of Medicine (Price, 2005).
- University of Sonora (Taddei-Bringas et al., 2008).
- New Zealand tertiary college (Fisher, 2003).
- Application of ISO 9001 in the research project section of the University of South Australia (Gorringer and Hochman, 2006).

There have been a few attempts to improve the quality of in-classroom programs. Some of these attempts include:

- Curriculum design:
 - Application of ISO 9001 in the industrial and engineering managers program (Lo and Sculli, 1996)
 - Application of supply chain management in Eastern Michigan University (Sauber et al., 2008)
 - Improvement of the MBA curriculum at the University of Tennessee ((Fogging, 1997), quoted in Lam and Zhao, 1998).
 - Using Kaizen in improving the business school program at Rensselaer Polytechnic Institute (Emiliani, 2005).
- Teaching and learning improvements:
 - “*Teaching network experience*” at the University of Alicante in which a few instructors used “*critical friends*” (i.e., using other instructors to assess their performance in the classroom), interviews with stakeholders, and self-assessment techniques to improve the teaching and learning aspect of their courses (Andreu et al., 2006).
 - Application of QFD (Quality Function Deployment) in the National Institute of Technology in Taiwan to get student expectations and improve the course teaching style to meet the expectation through the decision model for teaching quality (Chien, 2007).
- Other attempts include defining sets of rules or indicators that help the instructor analyze and improve the teaching style. Examples of these attempts are:

- Application of statistical tools to analyze the teaching and learning performance issues (Grygoryev and Karapetrovic, 2005).
- Application of ISO 9001:2000 and UNE 66931:2005 in designing codes of good teaching practices at three different departments of the University of Zaragoza and the Technical University of Catalonia by seven different instructors with the main objective being to apply quality concepts in the classrooms (Marcuello et al., 2008).
- The application of ISO 9000 series in business information systems courses at the Open Learning Institute of Hong Kong, which showed that, with some modifications, standard could be applied in the educational organizations (Elliot, 1993).

A study conducted at the Curtin University of Technology showed that educational organizations have implemented ISO 9001/2 in non-teaching areas more than they did in teaching areas (Lundquist, 1997). Moreover, most of the organizations implemented TQM in non-academic aspects (Koch, 2003).

2.4. Application of ISO 10001 and ISO 10002

During the literature review, a few examples of the application of ISO 10001 and ISO 10002 were found. Some examples of the applications of ISO 10001 include Dubai Customs, which received the first certificate of ISO 10001:2007 for its Client Service Charter in July 7, 2009 (EODN, 2009). Although there is no indication of using ISO 10001 standard, The University of Regina has used the code to guarantee the students that they would find a job within six months after completion of their degree or the student will get up to one year of free additional education (UR connected, 2009; University of Regina, 2009).

ISO 10002 has been used in different organizations. Some of the examples of the standard application are shown below:

- Integrated call center department of the Hong Kong government (PSR, 2007).

- Canadian electrical utility (Hughes and Karapetrovic, 2006).
- Australian Prudential Regulation Authority (APRA, 2007).
- Queensland transport system (Queensland Government Policy, 2008).
- KLPS group, a Hong Kong property company, which actually registered to ISO 10002:2004 in September 2006 (KLPS group, 2006).

The HKUST (College of Lifelong Learning) developed its complaints-handling system (CHS) to deal with students' complaints regarding the quality of teaching and learning (HKUST, 2007). In addition, a CHS was designed to handle students' complaints regarding the library services at Auckland University of Technology (AUT, 2009). Although neither of these organizations used ISO 10002 to design the system, the processes developed were similar to the ones suggested by ISO 10002.

ISO 10001 and ISO 10002 have been used to improve the students' satisfaction and improve the course delivery (Karapetrovic and Doucette, 2009; Karapetrovic, 2009; Karapetrovic, 2008a). In these studies, since the system was not analyzed in detail, a further investigation of the system processes and applications in more courses are required.

2.5. *Auditing*

Like any other change or improvement attempt, QMSs should be checked to see if they are doing what they were set to or implemented to achieve, or not. One way to recognize the effectiveness of the system is through auditing. An audit can not only check the effectiveness of the system, but also its efficiency and can give suggestions for improvement opportunities (ISO 19011, 2002, clause 6.2.2). Therefore as part of this study, an application of QMS audits has been evaluated. A brief introduction to QMS audits, their advantages and disadvantages, and implementation steps are discussed.

2.5.1. Audit definitions

There are different definitions for quality audit. Quality audit is a “*systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled*” (ISO 19011, 2002). CSA-Q395-1981 (quoted in Karapetrovic and Willborn, 2001; Mills, 1989) defines audit as “*human evaluation process to determine the degree of adherence to prescribed norms (criteria, standards) and resulting in a judgment*”. ISO 10011 defines quality audit as “*a systematic and independent examination to determine whether quality activities and results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable for achieving objectives*” (ISO 10011, 1991).

Lee et al. (1999) and Van der Wiele and Brown (2002) (quoted in Rajendran and Devadasan, 2005) have concluded that QMSs would not exist without quality audits. Quality audits are not only used to find the system compliance with the minimum standard requirements, but also to find the improvement opportunities for the QMS (Arter et al., 2003). These two purposes could be categorized as “*accountability (i.e., check to see if the requirements are met) and enhancement (i.e., how well it is done and how it can be improved)*” (Jackson, 1996).

There are three types of audits based on what is being audited (Russell, 2005, p. 16).

These three types are:

- “*Product or service audit, which investigates if the product and service meets the requirements.*”
- “*Process audit, which verifies if the processes are working within established limits.*”
- “*System audit: This audit type analyzes the objective evidence to check if the elements of the system are appropriate and effective*” (Russell, 2005, p. 16).

Audits can also be categorized based on who is requesting the audit. The audits can be internal (first party audits) or external audits (second- or third- party audits) (ISO 19011, 2002).

The audit type in this thesis is the system audit which tries to investigate the effectiveness of customer satisfaction codes and the feedback handling system in place against the ISO 10001 and 10002 management system standards' requirements. This research considers the auditor as an internal auditor (first-party audit).

2.5.2. Quality audit in higher education

Auditing can help these organizations evaluate the fitness of use and the effectiveness and improvement opportunities of the organizations' QMSs (Jackson, 1996). Quality audit in higher education can be viewed from different aspects. Hussey *et al.* (2008) mentions auditing "*learning outcomes*" meaning what was taught to the students during their program as an indicator of the quality of the program. On the other hand, Massy (2003) believed that in order to have a better quality in educational organizations, teaching and learning processes should be evaluated and the auditor should be more focused on finding improvement opportunities in the process of teaching and learning. Jackson (1996) defines the focus of quality audit in educational organizations as to figure out "*the extent to which the procedure and conditions, which results in appropriate level of quality are present, followed, and effective in meeting the intended purposes*". Webb (1994) argues that quality audit in educational organizations "*will not concern itself with the validity of and institution's objectives but with the ways in which that institution manages those aspects of its work that impinge on quality*"

Audits in educational organizations could have three objectives (Jackson, 1996; Massy, 2003):

1. "*To identify the required course material for each course or each program*" (Massy, 2003). The auditor could look at whether the content of the course covers the knowledge that a student will need in the future (Massy, 2003). In this audit,

- the auditor is auditing the product, rather than the system of teaching (Massy, 2003).
2. *“Determine whether the students who finish the program can achieve the program objectives or not”* (Massy, 2003). For example, the auditor in this audit would look at whether the teaching of the course will result in the knowledge that the students need in the future (Massy, 2003).
 3. *“Determine the effectiveness of the design and organization of the teaching and learning process”* (Massy, 2003). For instance, the audit would look into how the professors are answering emails and addressing students concerns (Massy, 2003).

From the three audits mentioned above, the first two audits would be the product or service audit, and the third audit is the system audit (Russell, 2005, Page xxiii). Another type of an audit would be the process audits, in which the auditor would look at the process of teaching and investigate if the requirements of the teaching are being met (Russell, 2005, Page xxiii). An example of the requirements for process audit in educational organizations would be the attendance of the professor at lectures based on Russell (2005, Page xxiii).

A higher education quality audit based on its objectives could be divided into different scopes (HEQC, 2004):

- “(1) Auditing the fitness of purpose of institutional mission and its goal and objectives or basically, Links between planning, resource allocation, and quality management*
- (2) Auditing teaching and learning aspect, research aspect and community engagement”* (HEQC, 2004).

Based on the Higher Education Quality Committee (HEQC, 2004), the teaching and learning component of HE, which would be studied in more detail in this thesis, could be divided into the following aspects: *“(1) teaching and learning, (2) program development and review, and (3) student assessment and success”*. HEQC (2004) also defines general audit criteria for each of these three aspects of higher education.

2.5.3. ISO 19011

ISO 19011:2002 helps organizations to design and implement and manage quality and environmental system audits and provides guidelines for auditor's competency (ISO 19011:2002). The main sections of the standard are the "4. *Principles of auditing*", "5. *Managing an audit program*", "6. *Audit activities*", "7. *Competence, and evaluation of auditors*" (ISO & IAF, 2009).

The standard includes the steps required to conduct an audit in any organization, and explains what each audit process should include. This standard contains information about a systematic procedure to conduct an audit. The standard explains the processes needed to (ISO 19011, 2002):

- Initiate and plan the audit (Clause 6.2);
- Conducting the document review (Clause 6.3);
- Preparing for the on-site activities (Clause 6.4);
- Conducting the audit (Clause 6.5);
- Reporting the results and follow-ups of the audit (Clause 6.6, 6.7, 6.8); and
- Auditor competency (Clause 7) for assimilative standards auditing (ISO 9001 and ISO 14001).

This thesis is trying to implement the same methodology to conduct system audits against the guideline standards (i.e., ISO 10001 and ISO 10002).

ISO 19011 has been used in most of standard auditing against ISO 9001 and ISO 14001. Based on the study conducted by Karapetrovic et al. (2006) in Spain, as of the 353 companies implemented ISO 9001, 34% and 38% of those companies used ISO 19011 for external and internal audits, respectively. As 176 companies implemented both ISO 9001 and ISO 14001, these percentages were 31% and 40%, respectively (Karapetrovic et al., 2006). This standard can be used to audit systems against other types of standards

with minor changes applied to them, for example, the use of ISO 19011 in auditing the system against ISO 10002 standard (Hughes and Karapetrovic, 2006).

2.5.4. Quality audit planning and execution

ISO 19011:2002 defines the knowledge and experience that auditors require. An auditor should be able to not only audit the system against the standard requirements, but also suggest improvement opportunities (Rajendran and Devadasan, 2005). During the audit planning, the objectives of an audit, which defines “*What is to be accomplished by the audit*”, should be determined (ISO 19011, 2002, clause 6.2.2).

One of the important parts of an audit is to efficiently plan and execute the audit. An audit is an audit that not only meets all its objectives (audit effectiveness) but also an audit that finds the results in an affordable cost and time (audit efficiency) (Beckmerhagen et al., 2004).

The next step in planning an audit is to define the criteria to measure the performance and the effectiveness of the management system (Karapetrovic and Willborn, 2001; Gramling and Hermanson, 2009). The audit criteria helps the auditor to establish when the process or an activity, that is being audited, meets the standard requirements (Gregory et al., 2008) or assesses the achievement of the targets set for the system, like performance measurement indicators (Chen et al., 2009). The auditor should plan and define the criteria so that they are easily measurable (Gramling and Hermanson, 2009) and should be appropriate for the audit (ISO 19011, Clause 6.2.2).

Based on Clause 6.2.2 of ISO 19011, the scope of quality audit should be defined. The scope of the audit describes “*the extent and boundaries of the audit*” (ISO 19011, 2002, clause 6.2.2)

During the execution of the audit, the auditor should inform the auditee about the audit objectives, scope, and criteria as it is explained in the auditing standard (ISO 19011,

2002, clause 6.4.1). A better communication between the auditee and the auditor could result in a more effective audit. For improving the communication of the audit, an auditor could explain the advantages of the auditing to the auditee (Smith, 2005; Elliott et al., 2007). The opening meeting could be used to inform the auditee about the objectives of the audit (ISO 19011, Clause 6.4.1).

The audits process includes identifying and understanding the criteria that an audit is conducted against, and by collecting and verifying the audit evidence (ISO 19011, 2002). Examples of methods to collect the evidence are (ISO 19011, 2002, Clause 6.5.4; Jackson, 1996):

- Interview: “*the process of obtaining information from another person in response to questions*” (Russell, 2005, page 82).
- Document review: “*auditor’s examination of the client’s documents and records*” (Lemon et al., 1987, page 182).
- Observation of activities (Product sampling): “*An auditor gains knowledge by monitoring a process being performed to see how the work is being done*” (Russell, 2005, page 87).

During the audit interview, the auditor should avoid asking specific and to-the-point questions (questions that “*elicit yes-no responses*” (Kausek, 2008)) and should ask more open-ended questions at the beginning and let the auditee explain the process (Russell, 2005, page 82; Arter et al., 2003, page 105; Kausek, 2008). This would give the auditor more information at the beginning of the audit and by helping clarify the understanding of the management system, the auditor could move to close-ended questions and clarifying questions in order to close the gaps (Kausek, 2008). Moreover, Kausek (2008) suggests that the auditor should verify the auditee’s answers so that the findings of the audit are not based on miscommunication between auditors and auditee. This approach is called “*the funnel approach*” (Kausek, 2008).

During the audit, the auditor evaluates the system to investigate the level of compliance of the system to the specific standard (ISO 19011, 2002). The auditor needs to “*verify the*

information by requesting objective evidence” (Kausek, 2008). What is important to remember is that verification does not mean that the auditor has to check every aspect of the system to be sure that the whole system meets the requirements, but “*collecting sufficient data to convince at least the auditor*” that the system is working based on the system designed (Mikkichamp, 2002).

The use of a survey to gather information from stakeholders and customers could help the auditor to get a better picture of the system effectiveness and usefulness because the audit might not find out all the weaknesses of the system (Ramsden, 1991; Rajendran and Devadasan, 2005). This method could be used in this research to evaluate the effectiveness of the communication of plan setup in each classroom since this research deals with students’ satisfaction. Moreover, it could gather information about how well the system meets their needs.

After the evidence data were gathered, the audit team compares the evidence data and criteria together. As a result, audit findings and improvement opportunities are generated (ISO 19011, 2002; Karapetrovic and Willborn, 2001). The next sub-section explains the reporting of audit findings.

2.5.5. The audit report

Reporting the audit findings is the last phase of auditing (Russell, 2005). The audit report is the document that discusses the findings of the audit and may suggest improvements (ISO 19011, 2002, clause 6.6.1). It provides a comparison of the audit evidence and audit criteria (ISO 19011, 2002; Karapetrovic and Willborn, 2001). This report is the primary means of communication between the auditor and the auditee and other stakeholders (González, 2008). As Gonzalez argued, the report should effectively “*communicate the results of the audit*” and “*motivate the auditee to implement changes to the system for improvement*”. The organization or audit client could use this report and any follow-up action required to make decisions about the QMS (Arter, 1994). The audit report is one of the most important steps in quality management audits (Dittenhofer, 2001).

The audit report should contain certain information that is “*complete, accurate, clear, and concise*” (ISO 19011, Clause 6.6.1; González, 2008; Russell, 2007). The generic form of report is widely used by most of the auditors but auditors are required based on ISO 19011:2002 to have some training or skills to write a report (Russell, 2007).

ISO 19011:2002 (Clause 6.6.1) describes the content of the audit report. It gives minimum requirement and adds on other information that could be used to report the audit more effectively. Russell (2007), Arter (1994, Pg. 65), and Williams (1991) defined the same components for an audit report. These components are:

- *“The cover page: Contains information about the audit report, which should include audit client, audit team, and audit time and place in which it happened.*
- *The background information: Contains information about the system being audited, the scope and criteria, the audit planned and other information about the audit itself including the audit criteria*
- *The result: This section of the audit report gives information about the overall results of the audit and recommendations. In this section, the overall audit conclusion and whether the system satisfies the requirements are briefly explained.*
- *The detailed results: Contain detailed information about the compliance or nonconformity of system components. In this part of the audit, the detailed of how each part of the audit criteria is being met and where it needs to be improved and gives detailed explanations about conformities and non-conformities.*
- *Appendix: Includes supplemental information that could clarify the content of the audit report as an example; it could contain the audit plan.”* (Russell, 2007)

The audit report provides sufficient background information on the QMS, and should specify the findings with evidence that lead to those findings (Kausek, 2008). The audit report can be used to provide confirmation on meeting the certification requirements or improvement opportunities (Russell, 2005). The organization uses the audit report to improve the audited QMS.

Based on the aforementioned process, the author prepared the audit reports, which will be discussed in detail in chapter Six. The following section discusses the motivation for this research.

2.6. Motivation

The motivation for doing further work on this research came from the literature survey and an existing research opportunity on the subject of applying ISO 10001 and ISO 10002 in engineering courses. Although the QMSs have been used to increase product quality in different industries and educational organizations, there is a lack of extensive studies regarding the application of ISO 10001 and ISO 10002 to improve students' satisfaction with educational organizations. Therefore, the need for further investigation of the application of those two standards in education is required. This research is a part of a broader study to investigate the application of international quality management standards in engineering education at the University of Alberta.

Two different categories of benefits would be obtained as a result of pursuing this work: research benefits and implementation benefits. These two are discussed below.

2.6.1. Research benefits

Motivation related to the research benefits includes:

- Further development of a CMS based on the ISO 10001 standard through the development of the main components of the system: processes and resources. Process flowcharts and various required forms in engineering courses would be developed. The designed system would likely assure students of quality in the course delivery.
- Further development of an FHS based on the ISO 10002 standard to assure the students that their feedbacks on the course or the system would be dealt with.

- A study on the integration of the CMS and FHS processes was conducted (Karapetrovic and Doucette, 2009), but further examples and data on the usage of the integrated system are required.
- The developed systems need to be applied in courses taught by various instructors in order to investigate their effectiveness.
- As mentioned in the literature survey, the ISO 19011 was designed to guide organizations to conduct systematic audits against ISO 9001 and 14001. This research would look into adapting the ISO 19011 methodology to further develop an auditing system. This system could be used to audit the QMSs mentioned above against ISO 10001 and ISO 10002 standards. The auditing system developed was implemented in the selected courses.

As the literature review showed, the implementation of ISO 10001 and ISO 10002 in engineering education has not been studied in detail. There were some examples of ISO 10001 and ISO 10002 applications in different industries, but a few examples of their implementation in educational organizations were found.

2.6.2. Implementation benefits

Implementation of a QMS based on the ISO 10001 and ISO 10002 standards in undergraduate and graduate engineering courses could address some of the students' concerns in the courses in which the standards were implemented. Such implementation could also increase students' satisfaction with the course delivery.

Moreover, application of an integrated system based on these two standards in different courses would provide more information on how effective the system is and how it could be improved.

The auditing of the system against the two standards, based on ISO 19011, could show the effectiveness of adapting the ISO 19011 methodology for auditing against augmentative standards, especially ISO 10001 and ISO 10002.

2.7. Objectives

This research is trying to achieve the following objectives:

- Investigate the applicability of ISO 10001 in in both graduate and undergraduate courses.
- Investigate the applicability of ISO 10002 in addressing students' feedbacks.
- Develop the necessary processes and resources of a code management system based on the ISO 10001 standard.
- Develop the necessary processes and resources of a feedback handling system based on the ISO 10002 standard to systematically address student feedback.
- Analyze the application of an integrated CMS and FHS in engineering courses.
- Study the application of the ISO 19011 methodology to audit systems based on augmentative standards.
- Adapt and use the ISO 19011 guideline in auditing against ISO 10001 and ISO 10002.

Chapter 3: CMS development

3.1. Introduction

QMSs can be used to continuously improve the quality of teaching. ISO 10001 is one of the standards that can help professors define students' needs and use a standardized QMS to meet those needs. This chapter describes the steps taken to develop CMS processes and resources for use in engineering education. CMS can be used to develop and implement codes for students' satisfaction and monitor professor performance against these codes (ISO 10001, 2007).

The following chapter first introduces the pre-defined codes used in this study. Then, the process of developing the CMS processes and information regarding each of these processes are explained.

3.2. Purpose of study

The purpose of this study is to investigate the application of the ISO 10001 standard in graduate and undergraduate engineering courses. This chapter demonstrates the processes required for the planning stages and implementation aspects of the CMS. These processes include:

- Defining the codes to improve the course.
- Preparing to implement codes (e.g., communication of the codes and identifying the resources needed).
- Implementing the codes.
- Maintaining the system (e.g., conducting surveys).
- Evaluating the performance of the system (e.g., gathering code implementation data).

3.3. Methodology

In this section, three pre-defined codes are illustrated. The steps in developing the CMS processes are explained. The supporting activities and resources (e.g., documentation) for the implementation of the system are developed.

3.3.1. Defining the codes

ISO 10001 requires the organization to define codes and communicate those to the customers. Clause 6.4 of the standard requires the codes to include specific characteristics, such as the promise and their limitations. Three codes were developed based on the students' feedback during the courses prior to this study. Those codes are provided below (Karapetrovic and Doucette, 2009; Karapetrovic, 2009; Karapetrovic, 2008a):

- The “Response code” assures that the students' questions were answered in a timely manner.
- The “Review code” assures that the students' material are being marked and handed back to them in a specific time.
- The “Schedule code” assures that the students have been taught the course materials before the assignments or exams are due.

The codes are further explained below, based on (Karapetrovic and Doucette, 2009).

3.3.1.1. “Response code”

This code was introduced so that the students can have a prompt response from the professor if they encounter a problem or a question regarding the course or the material covered in the course. When students are focusing on the course, a fast response to their questions would help them to not lose their chain of thought and enhance the process of learning. A promise of responding to any question in a timely manner would provide assurance to the students that they get their question answered when needed.

The code states:

“I will respond to any enquiry regarding the course within 24 hours of receiving it or I will provide an explanation, the response and a chocolate bar or another type of a snack, as selected by the enquirer.

- *Although this code is valid 24 hours a day, 7 days a week, I cannot guarantee the 24-hour response during the statutory holidays or in cases of natural or technical events outside of my control.*

- *Please let me know through e-mail in the case that I did not respond to your inquiry within the promised time.”*

The promises, made to the students, were different between the professors who took part in this study. As an example, one of the professors promised a response within 48 hours while others used the 24-hour response time. The redress of the code was different between some of the professors. For example, one of the professors promised to sing a song in class in case he does not meet a response code promise rather than offer chocolate bars or snacks. In addition, the limitations of each professor’s response code were different based on their ability to respond to the emails during the semester. As an example, some of the professors did not promise to answer the emails during weekends. In this case, to define key terms of the code (as required by the standard), the professor had specific times of the day defined in the code, stating when the weekend starts and when it ends.

3.3.1.2. “Review Code”

This code was introduced to enhance the process of learning. If the students get the results of their work earlier, they would get a better idea of what mistakes they have made. This would result in better learning of the already-covered material and understanding of the material that follows.

The code states:

“If the results of the quizzes and assignments are not reviewed during the first and second class following the quiz and the assignment due date, respectively, then an explanation will be provided in class and the corresponding reviews will be conducted in the class following the announcement.”

The same limitation related to “unforeseen events” and the same manner in which the students can contact the professor were stated in all codes.

The professors’ promises were different based on the number of students in class, number of lectures per week, and the availability of teaching assistants to help the professor mark the course work. Based on the availability of resources, the professors decided whether to include assignments, projects, or term exams in their review code. Some professors promised that the results of marked coursework would be returned in the next lecture if a class is taught once a week and other professors promised that they will return the material within three lectures if there are three lectures each week. Some of the professors made different promises for each of the course work. For example, they promised to review the assignments by the next lecture, but review the projects within two lectures. One of the professors defined the review code promise as the time that the correct answers to the questions are reviewed in the class, while others defined it as the time that the course material is marked and passed to the students.

3.3.1.3. “Schedule Code”

This code assures the students that the materials being questioned in the assignments and exams are covered before their due dates. It also provides confidence that the whole material in the course syllabus is being covered and the students would have a better idea of what is being taught in the classroom on each specific date.

This code is defined as below:

“If any lecture is more than one lecture topic behind or ahead of the schedule given in the course outline, the gap will be closed within the following class.”

All of the professors implemented this code without making any changes to the promise or limitation of the code.

As it was mentioned above, the codes were suggested to the professors. They could then decide whether they want to promise these codes to their students, make changes to the codes, or define a new code. Although not all of the professors participating in this study implemented all three of these codes, this study gathered data to investigate the application of the ISO 10001 in the improvement of students' satisfaction. The codes, defined by each professor, were designed to address the students' need in those aspects. Each professor defined their codes with few changes to the codes' conditions and different limitations or the redress actions. The main components of each code are (ISO 10001, 2007, clause 6.4):

- *“The promise*
- *The key terms*
- *How and to whom enquiries should be directed*
- *The scope or limitation of the code*
- *The action if the code promises are not fulfilled”*

After the professors developed their codes, the communication of the codes to the students was done during the first class. The definition of the promises and other components of the codes were handed out to the students with the course outline and on the course website, if applicable. The codes and the research ethics were also explained in the class verbally.

The codes were implemented in eight courses by five professors during four academic semesters (Fall 2008, Winter 2009, Spring 2009, and Fall 2009). It should be noted that five of these eight courses represented different sections of a single large undergraduate course taught in three different terms by various professors.

3.3.2. Developing system flowcharts

For a better way of introducing the CMS to the professors, the system flowcharts and its supporting documents, such as the documentation forms for tracking the resources used or tables to track the performance of each professor in implementing the codes, have been developed (Honarkhah and Karapetrovic, 2010a). The flowcharts of the code development, implementation, maintenance and improvement processes were prepared based on the ISO 10001 requirements. The steps in the flowcharts follow the specific elements of the standard. These elements or clauses of ISO 10001 were identified on the flowcharts by placing clause numbers in brackets where they related to a step in the flowchart. Although the higher-level flowchart was developed previously (Karapetrovic, 2008a), the flowcharts developed in this thesis contain much more detail and illustrate the lower-level sub-processes and activities.

These flowcharts were given to each of the professors. The professors then modified the flowcharts to match the actual process that they used to implement the codes. The modified flowcharts were subsequently used to audit the systems that the professors implemented during each course against the standard guidelines. Further explanations of the audit processes are provided in Chapter Six of the thesis.

3.3.2.1. Overall system flowchart

The overall QMS flowchart was first drawn by identifying the required processes to develop the system (Figure 3-1). Based on the processes and the ISO 10001 and ISO 10002 standard requirements, the detailed activities of each process were then developed. Each process was further developed by identifying the main activities and providing a detailed list of these activities and their connections.

The overall system flowchart addresses different aspects of the designed CMS. It includes:

- The development of the code.
- Preparing the system to meet those promises.

- Steps required to address each of the three codes defined.
- Steps for measuring the customers' satisfaction with the code.
- Conducting management review of the codes and the implementation processes.

Figure 3-1 shows the connections between the processes of the QMS, including both the CMS and the FHS. The flowcharts for the entire system and its processes are included in Appendix A.

The overall system flowchart and resources developed are generic. The flowchart and the resources developed are applicable in courses outside of engineering and are not specifically developed for engineering courses. Therefore, any professor could use the overall system flowchart to develop his or her code management system or feedback handling system. The system could be modified so that it is applicable in other courses. For example, in courses that responding in 24 hours is not possible due to the context of the course, the flowchart could be modified so that the response code promise is still feasible and the flowchart steps show how the professor could address those.

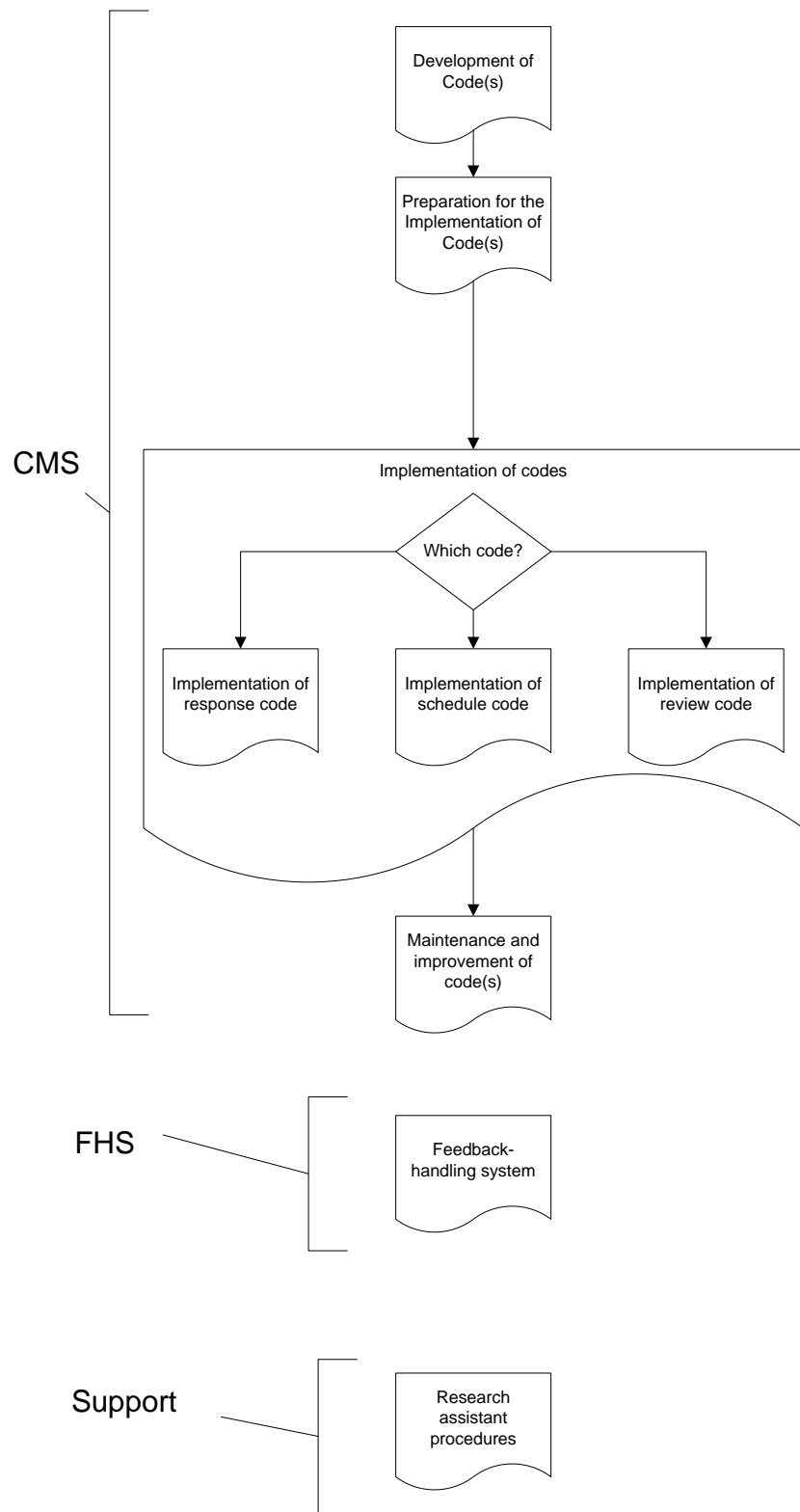


Figure 3-1: Overview of the QMS

The flowchart contains the required steps with reference to the standard clauses that each step relates to. For example, the step, which requires the professor to determine the needed resources, satisfies clause 6.8 of the ISO 10001 standard. The flowchart also includes information regarding each step and what it requires the professors to do. For example, the step mentioned above has a note that explains what the professor needs to consider for resources needed. For instance, in the “determine communication plan with students and TAs” activity, which was developed to satisfy the clause 6.7 of ISO 10001, the flowchart explains that the professor should consider how the students can access the standard and how TAs can access the standard. The information would tell the professor what he/she should consider while developing the CMS.

Information about each professor’s performance against the code is sent to the Research Assistant (RA). The RA monitors each professor’s performance and provides reports to each professor regarding the code implementation performance monthly, where applicable.

Specific CMS processes are explained below. The clauses of the ISO 10001 standard corresponding to a particular process or activity in the system are given in brackets or are referred to in the text.

3.3.2.2. Code development process

This process starts with the professor’s choice of defining a new code, adapting an existing code, or adopting such a code.

In defining a new code, the standard requires professors to determine :

- the objectives of the code (Clause 6.1),
- the issue to be addressed by the code (Clause 6.2), and
- the stakeholders and their needs (Clause 6.3)

ISO 10001 also asks the professors to consider different methods to deal with this issue (Clause 6.2).

To show the steps for developing a new code, the steps taken to develop the “Evaluation code” is explained. In one of the classes that this study was conducted, one of the students requested marking criteria for assignments and projects.

Based on the student’s request, the objectives for the new code was determined. This code objective is to assure students that the marking criteria for course materials are given to the students before the due date of the materials.

The next step in developing the new code is to determine the stakeholders in the classroom. In this case, the code stakeholders are the students and the teaching assistants. In the next step, the need of stakeholders should be determined. In this case, the professor determines what students need to know about the course material marking criteria or what the TAs need to mark the criteria.

The next step is to determine the issue to be addressed. In this example, the professor determines that students who know the marking criteria can focus on those aspects. Therefore, informing the students about the criteria would help them to do better in their course material.

The professor needs to determine how the issue arises and how to deal with that. In this case, the issue arose when the professor did not give the marking criteria in course outline and the student asked for them and to deal with this issue, the professor decided to add the “Evaluation code” to inform the students regarding the criteria.

From the information decided, the code purpose was defined. The scope of the code would be determined as well. In this case, the scope of the code was during the course. The promise and the limitation of the code were defined. In this case, announcing the marking criteria within specific time was defined as the promise. The other aspects of the code, the key terms and the method to deal with unmet promise, are determined.

In the last step, the professor needs to determine whether the code is acceptable and feasible or not. In this example, the code is acceptable and the marking criteria could be announced to the students within the time it was promised.

In adapting a code, the professor would not define a new code, but would rather use an existing one and make changes to its scope, limitations, key terms, and the action for dealing with the unmet promise. The acceptability and feasibility of the code should be evaluated before the code's development process ends. As an example of acceptability of the promise, a response within one month to an email probably would not be acceptable to a student and a guarantee to respond to an email within one hour would not be feasible for the professor. The same concept is applied to the limitations of the code. For example, a limitation of only answering the emails on Thursday probably would not be acceptable, and answering the emails even in case of an earthquake would not be feasible. All elements of the code, for example the limitations to the promise and scope of application of the code, need to be defined based on the standard requirement in Clause 6.4.

Adopting an existing code means that the professor would take the code without any changes to its scope, limitations, or actions in case of unmet promises, and would use it as such in the course.

Figure 3-2 shows the activities of the code development process.

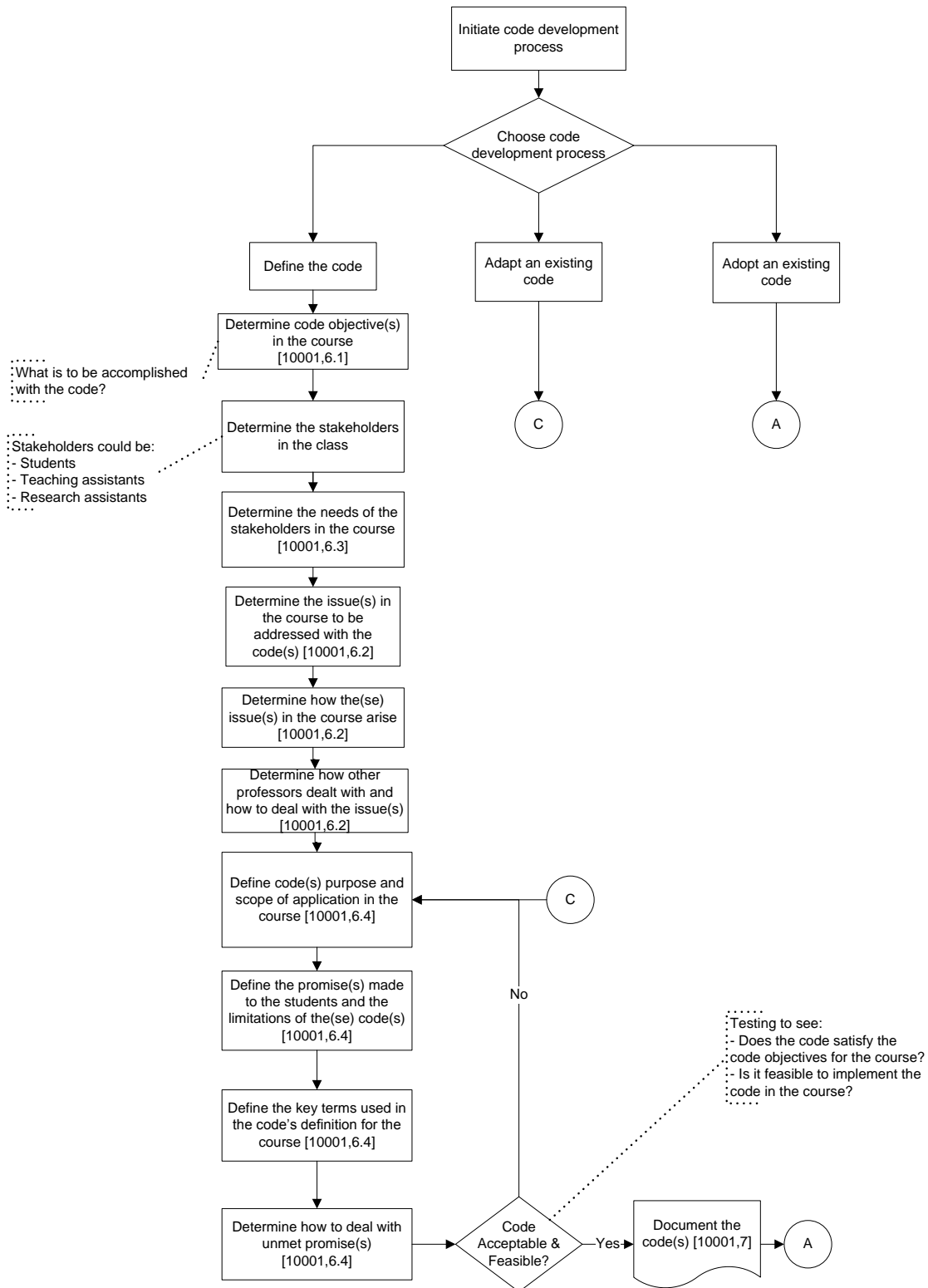


Figure 3-2: Code development process

3.3.2.3. Preparation for the code implementation process

After the codes have been defined, the professor needs to design a system to implement the codes and measure the performance against the codes. For this purpose, qualitative and quantitative performance indicators should be defined (Clause 6.5). For example, the performance indicators in the case of the response code could be the number of instances in which there has been a missed or unmet promise, or it could be, more specifically, the average of the response times during the course.

The availability of the teaching assistants (TAs) for the course and their involvement in the implementation of the codes need to be defined. If the professor decides to involve the TA in the code implementation, the need for a training session to introduce the codes and define the responsibilities and authorities in the application of the system should be studied. In this session, the level of the TAs' involvement should be decided upon (Clause 6.6).

The method of recording the code performance and unmet promises, the internal and external audience (i.e., students as internal audience and TAs as external audience), and the communication plan for both of the audiences should be decided. In addition, the resources available and the resources needed to effectively implement the codes need to be determined (Clause 6.6, 6.7, 6.8 respectively). A record of the resources used should be made (Clause 7). For example, if the professor is using a personal computer to respond to inquiries, a record of its usage should be kept. If a chocolate bar is given to a student as a redress, the chocolate bar and the cost of it should be recorded as a resource used. If a TA is involved in the implementation of the system, the required training defined previously needs to take place, and a record of the training should be kept (Clause 7). For example, the time, place, and the topics of the discussions can be recorded. The template forms for recording the information are discussed in section 3.3.3 of this thesis.

The last step of preparation of the code is to communicate the codes and promises to the students based on the determined communication plan. Informing the students could be achieved by explaining the codes and their promises verbally during the class, or

including them in the course outline or course website. The communication plan includes:

- How to introduce the codes to the students. It could be a verbal announcement in the first class, a note in the overhead lecture slides, course outline, or the course website.
- How the students can access the codes, the results of the code performance, and the results of the surveys.
- How often to announce the performance of the codes, for example, a weekly or monthly report posted on the course website
- How the students can leave feedback regarding the codes and their implementation.

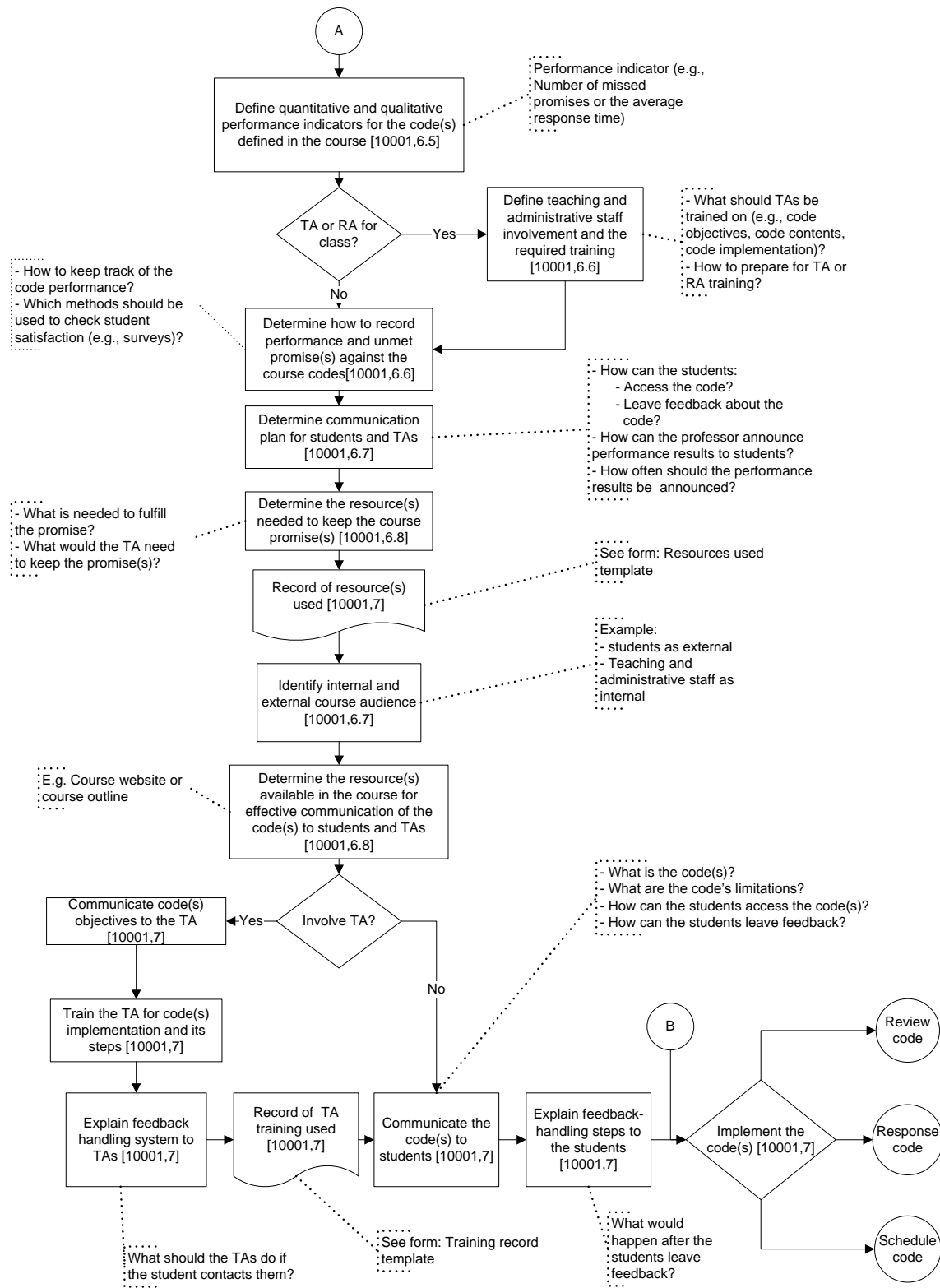


Figure 3-3: Code preparation process

3.3.2.4. Codes implementation process

The processes for each of the response, review and schedule codes was developed separately. The information required for implementing the codes, gathering data for performance review, reviewing the reasons for missed codes, and identifying corrective actions are explained for each of the three codes.

For the response code, the scope of the response code is not limited to enquiries that have been received by electronic mail, but also ones received by phone or in person. Since the enquiries received by phone or in person would be responded to right away, the professors in this study disregarded those enquiries and only recorded the ones received through e-mails, and dealt with them through this sub-process. This sub-process involves checking the professor's inbox, answering the email, documenting the enquiry, investigating the performance of the professors, identifying the reasons for the missed promise, and determining the corrective actions.

In this study, the Research Assistant (the thesis author in this case) would be documenting the code implementation performance. Therefore, the required information about the inquiries is sent to the RA. In the case of an unmet promise, the reason for the missed promise and the corrective actions decided would be documented in the corrective action form explained in section 3.3.3.6. In addition, an explanation of the reason for the missed promise and the remedy, as defined in the code, should be given to the student.

Figure 3-4 illustrate the activities of the response code implementation sub-process.

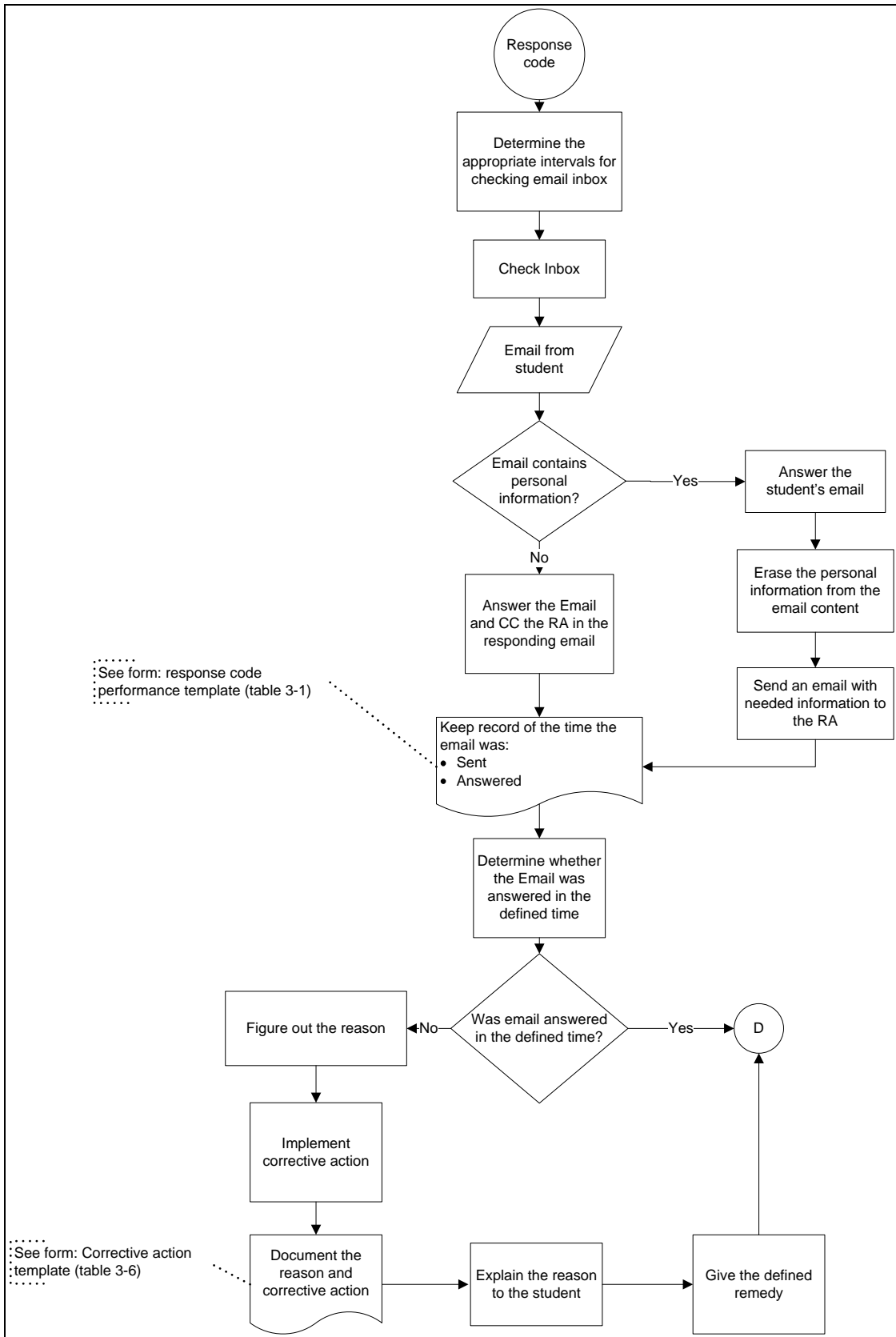


Figure 3-4: Response code implementation sub-process

For the review code, the flowchart processes for implementing this code start when the course material included in the review code scope is gathered in the class. The professor needs to check the availability of the resources (e.g., time and the TA availability) to mark the material and give the marked coursework back to the students. The information regarding the due date of the course work and the time that the material was reviewed and returned to the students would be sent to the RA for record keeping. A sample of the review code documentation form is explained in section 3.3.3.2. The RA would then determine whether the code promise was met. Once again, if the code was not met, the reason and corrective action required would be decided and a document of the corrective action would be made. The explanation of the reason and the remedy defined by the code would be given to the students.

For the schedule code, the professor would determine the course-teaching schedule and include the schedule in the course outline. After each class, the professor would check and compare the schedule and the covered material in the lecture, and determine whether the course is progressing based on the planned schedule or not. A record of the course progress would be sent to the RA and he would track the professor's progress and performance for this code. In case the professor misses the promise and is unable to cover or catch up to the schedule, the reason, corrective action, and remedy would be given to the students and documented in the form explained in section 3.3.3.6.

Figure 3-5 shows the activities of both the schedule code and the review code implementation sub-processes.

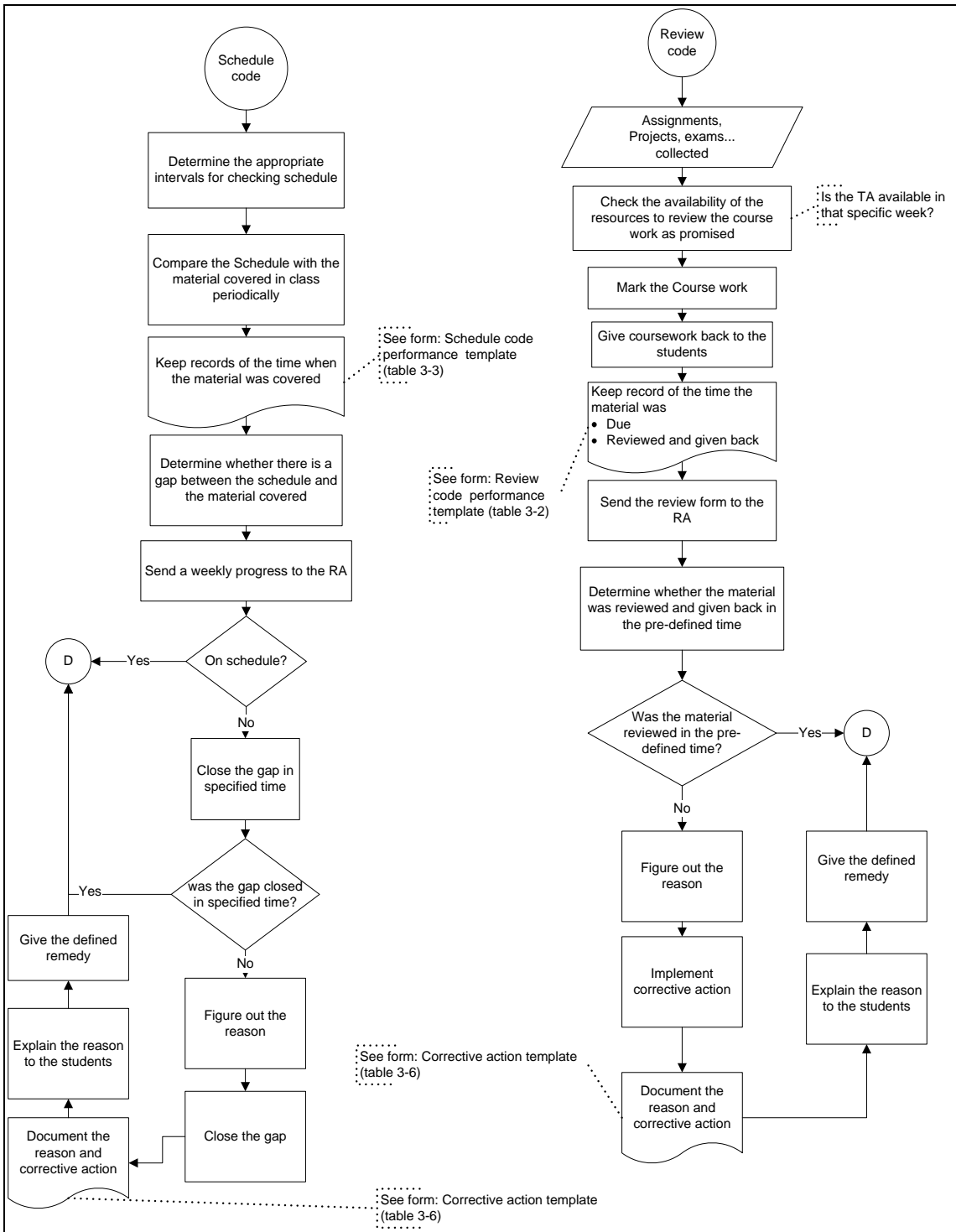


Figure 3-5: Schedule and review code implementation sub-processes

3.3.2.5. Codes maintenance and improvement process

This process deals with the management review of the CMS. It includes gathering information regarding the satisfaction of the students with the codes, and determining the improvement opportunities of all the codes implemented in the course. A record of the professor's performance with all the corrective actions taken would be sent to the professor (clause 8.1). In addition, two surveys would be conducted in the course to gather information about the implementation of the codes (i.e., the usefulness of the code and the usefulness of its determined time for the promises) and the related processes (i.e., the communication of the code). Based on all the data gathered during the course, the professor would decide whether the code is effective (Clause 8.2), whether the students are satisfied with the codes (Clause 8.3) and any improvement opportunities in the codes or the implementation steps (Clause 8.4 and 8.5). If the code could be improved, the professor would change the code to an improved version. An example of the improvement would be the decision of the professor C to include course project as part of the review code. Figure 3-6 illustrates the connection between the activities of this process.

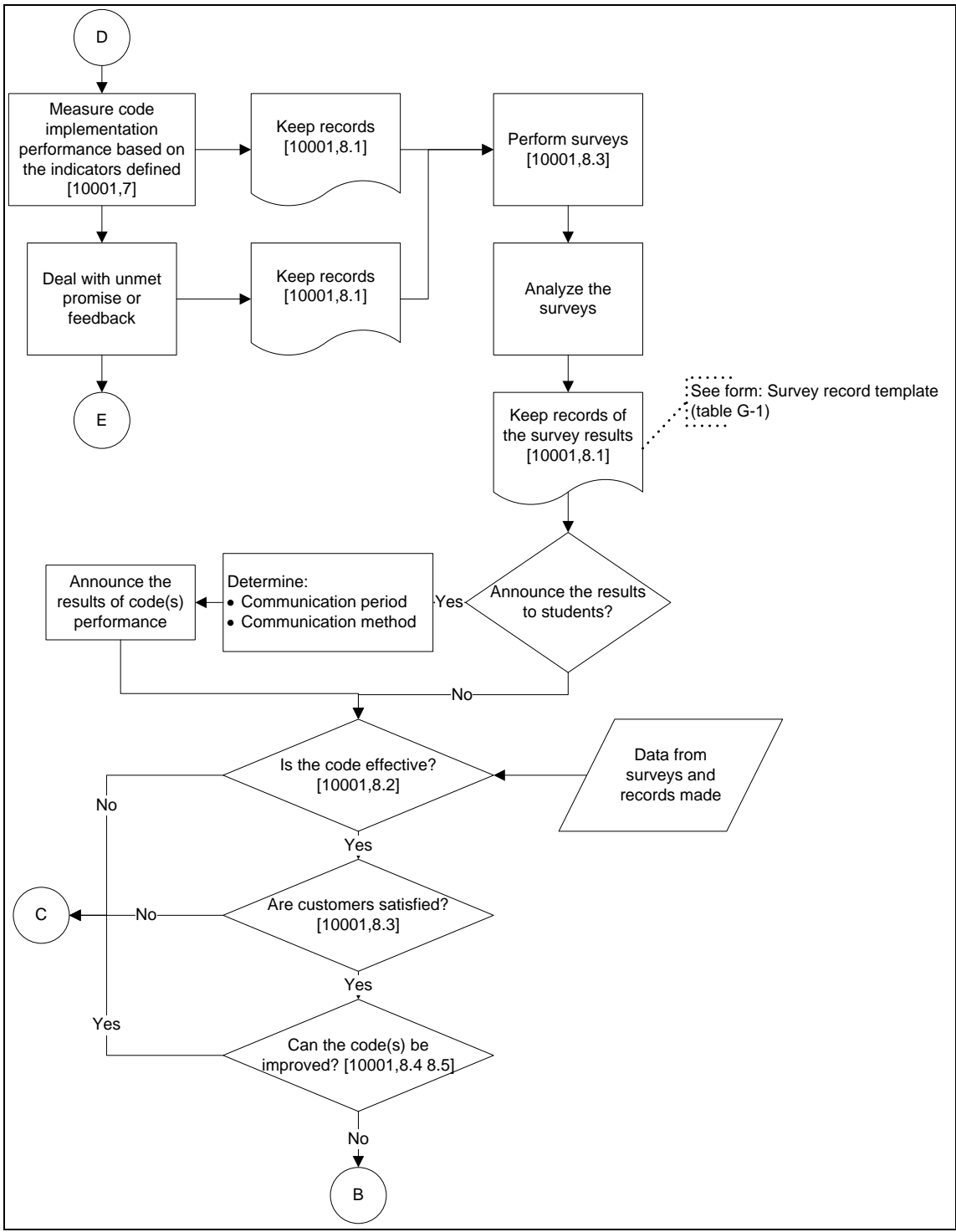


Figure 3-6: Maintenance and improvement process

3.3.2.6. Supporting process

The flowchart illustrating the research assistant's procedures was also developed. It includes informing the professor about the framework of the QSEC "Quality Standards in Engineering Courses" and AQSEC "Auditing against Quality Standards in Engineering Courses" studies, preparing the required documents, gathering information about the code implementation, recording the dates, and informing the professors of their progress in code implementation.

For the response code, the RA requires the class student list. Since student participation is voluntary and anonymous, the RA would assign a randomly generated number to each student. This number would be used to identify each student and record his or her inquiries. In case of an unmet promise, the RA would inform the professor of the instance and the proper actions would be taken to address that.

For the review code, the RA would gather information about the course work due date and review date, and document the results. After calculation of the difference in time, if the code were not met, the RA would inform the professor for the required actions to address it.

For the schedule code, the RA's processes involve gathering information about the course schedule and covered material in each class, and documenting those and determining if the code promise is being kept or not.

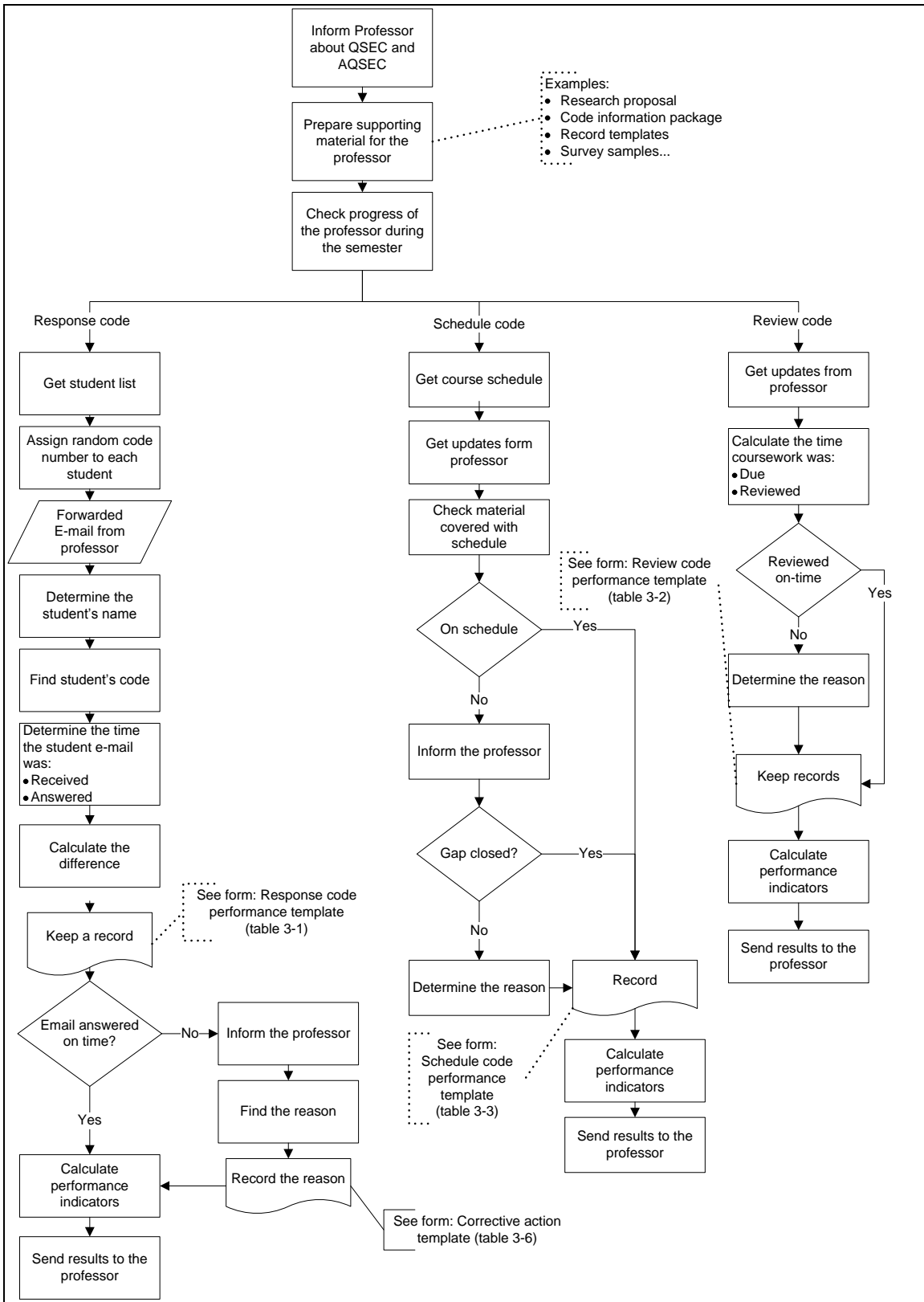


Figure 3-7: Supporting process

3.3.3. Tracking system performance

As part of the implementation of the codes, the performance of each professor against the codes should be monitored and any missed promise should be investigated based on the ISO 10001, Clause 7 and 8.1. During this study, the RA was responsible for gathering the data and monitoring the performance of the professors. An explanation of how each of the three codes was being tracked follows.

3.3.3.1. Documenting performance against the response code

The research assistant would gather information regarding the response code implementation. Therefore, the email that the student sent to the professor and the response email were being forwarded to the RA. After receiving the data, the RA calculates the response time and investigates whether the code was met. Based on the content of the emails, private or sensitive content in each email was deleted and only the time of each email and the category of each email were forwarded. As was mentioned before, a non-identifiable number was assigned to each student. These numbers were assigned to the students randomly in the beginning of the course. The RA would record all the information in a response code template. A sample of the template used to track the performance of the professor in response code is shown in Table 3-1. This template was slightly modified from a template used in an earlier part of the QSEC study (Karapetrovic and Doucette, 2009). The modification of the table includes adding a column for tracking the reason for the unmet promise.

Inquiry Number	Student Code Number	Time Received	Time Responded	Response Time	Inquiry Type	Met 24:00:00	Reason
1	W9-S13	1/8/2009 20:49	1/8/2009 22:02	1:12:27	Content	MET	
2	W9-S13	1/11/2009 13:46	1/11/2009 15:36	1:50:30	Logistics	MET	
3	W9-S3	1/5/2009 15:13	1/5/2009 15:35	0:21:50	Logistics	MET	
4	W9-S3	1/5/2009 16:00	1/5/2009 16:44	0:43:58	Logistics	MET	
5	W9-S12	1/12/2009 13:32	1/12/2009 16:39	3:07:15	Logistics	MET	
6	W9-S12	1/13/2009 9:44	1/13/2009 11:01	1:16:38	Logistics	MET	

Table 3-1: Response code performance record (Example)

The information gathered for each email as can be seen in the Table 3-1 is:

- The code related to each student. These codes were randomly assigned to each student for information confidentiality.
- The time that the question was asked.
- The time of response email.
- The response time: The time it took the professor to answer the email.
- The content of the email.
- Whether the code was met or not.
- The reason that the code was not met.

As can be seen in Table 3-1, each email was categorized into two different categories, which are logistics questions and content questions.

- The logistics questions are the questions that are related to the logistics of the course, for example the midterm exam date.
- The content questions were about the content of the course, for example, what the answer to an assignment problem would be.

The method used to determine whether to categorize the email as “content” or “logistics” is based on a simple question. This question is: “If you only look at the text in the email, would you be able to recognize what course it relates to?” For example, if the student is asking about what chapters would be questioned during the midterm exam, then this email would be categorized as a logistics question, because based on the information given in the email, this question could be asked in any course. On the other hand, when the student asks about a specific assignment question, then the reader could guess what the email relates to and therefore it would be categorized as a content question. For example, a question regarding the application of ISO 10001 would relate to the quality assurance course.

The emails were categorized into these two categories because the analysis of the breakdown could be conducted, and information about whether the logistics or content questions were being answered could more quickly be analyzed.

A report was sent to the professors informing them about the average, maximum, and minimum number of questions and the category of the questions. In addition, information regarding the reason for each missed promise was gathered to help identify improvement opportunities.

A sample of the report sent to professors regarding the response code performance is shown in Figure 3-8.

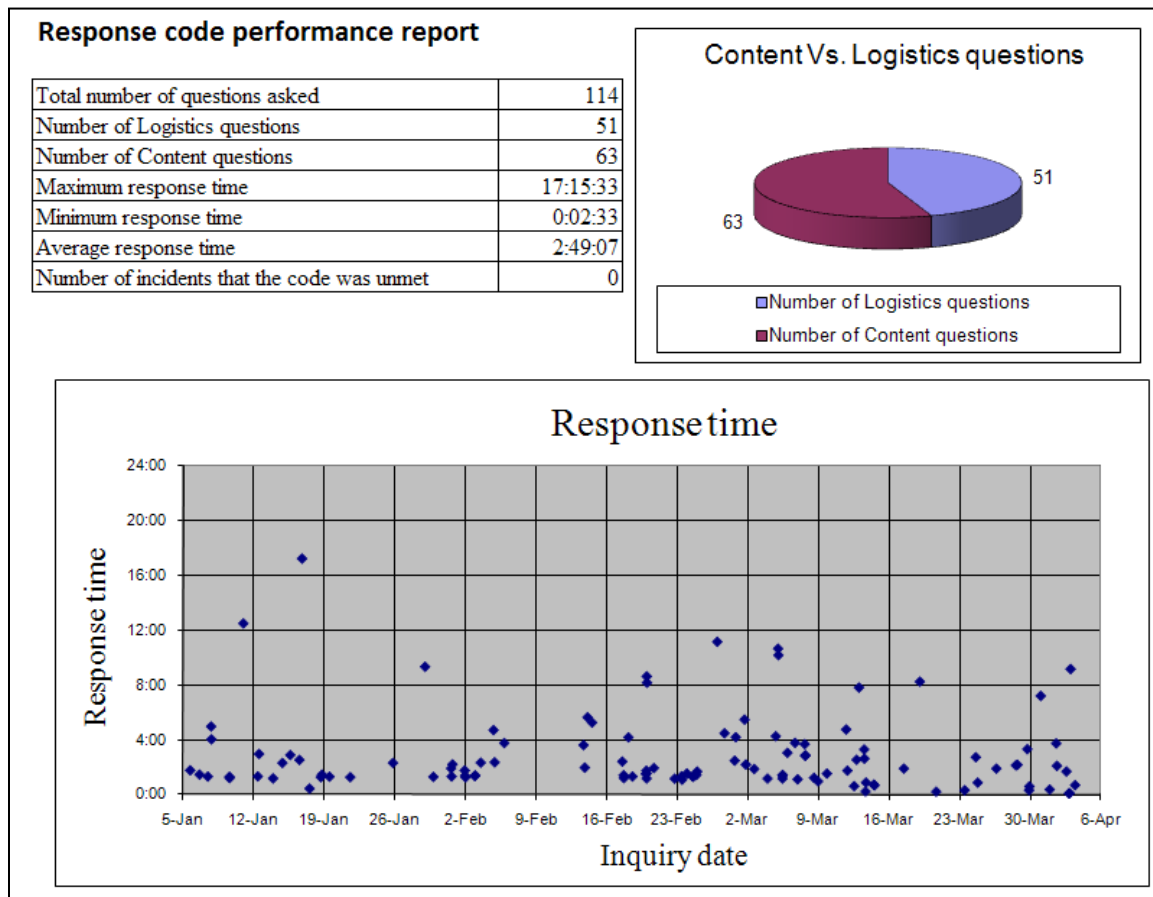


Figure 3-8: Response code performance report

3.3.3.2. Documenting the performance against the review code

The process of tracking the professors' performance is based on the scheduled assignment, project, exam or any other course component defined in the code. The

information about when the course work was due and when it was actually returned to the students would be recorded in the review code performance table. The RA would then evaluate whether the code promise was met. Information regarding the reason for each unmet promise was gathered for improvement. The information was documented in the review code performance template. A sample of the template used for the implementation of this code is shown in Table 3-2. This table was also used in an earlier part of the QSEC study (Karapetrovic and Doucette, 2009; Karapetrovic, 2009; Karapetrovic, 2008a). The template was slightly simplified from the original version. A column was also added to document the reasons for unmet promises.

Homework / Project Quiz / Exam	Due Date	Due Time	Date Homework / Quiz / Exam Available	Class Available	Code	Code Met?	Reason
P1 [Overview report]	29-Jan	20:00	1/31/2009 21:21	1st class	1st class (Feb-5)	Yes	
E1 [Midterm exam]	12-Feb	20:00	2/17/2009 23:26	1st class	1st class (Feb-19)	Yes	
P2 [Design report]	5-Mar	20:00	3/11/2009 20:01	1st class	1st class (Mar-12)	Yes	
A1 [Individual assignment]	19-Mar	20:00	4/2/2009 8:46	2nd class	1st class (Mar-26)	No	Professor's workload for the week

Table 3-2: Review code performance record (Example)

Table 3-2 includes the coursework to be marked, the due date and due time of the material, which is when the coursework is being submitted by students, and the date that the material was marked and was given back to the students. Since different course materials have to be returned in different classes as defined by the code, one column of the record (“code”) shows the class when the return of the material was promised to the students. For example, some of the professors decided that the assignments would be handed back to students within one class and that the projects and exams would be handed back within three classes. The “code” column shows the date and classes promised for the return, and the last column (“code met”) checks whether the promise was met or not.

3.3.3.3. Documenting performance against the schedule code

This code, as mentioned above, covers the course schedule as provided in the course outline. To monitor the performance against this code, the professors send the information about the covered material in each lecture to the RA. The RA compares the covered material with the course outline schedule. The performance of the professor in

meeting the code promise is then tracked, using the template as illustrated in Table 3-3. The same table was used in the earlier part of the QSEC study (Karapetrovic and Doucette, 2009)

NO.	LECTURE TITLE (PLAN)	DATE	TOPIC COVERED (Topic fraction)	GAP (topic fraction that wasn't covered)	GAP CLOSED IN NEXT CLASS
1	Introduction to Standardized Systems	08-Jan	4/5	1/5	Yes
2	Systems Approach in Engineering and Integration	15-Jan	3/5	2/5	Yes
3	Engineering of International System Standards	22-Jan	2/5	3/5	Yes
4	Use of International System Standards in Industry	29-Jan	0	1	Yes
5	Existing Standardized Systems	05-Feb	1	0	N/A
6	Standardized Systems Under Development	05-Feb	1	0	N/A
7	Midterm Exam \$ Guest speaker: ISO 26000	12-Feb	1	0	N/A
8	No Class - Reading Week	19-Feb	0	0	N/A
9	No Class – Project Work	26-Feb	0	0	N/A
10	Integration Models	05-Mar	3/5	2/5	Yes
11	Integration Methodologies	12-Mar	1	0	N/A
12	Assessment & Improvement of Integrated Systems	19-Mar	1	0	N/A
13	Current & Future Use of Integrated Systems	26-Mar	1	0	N/A

Table 3-3: Schedule code performance record (Example)

Table 3-3 includes the lecture title and date as given to the students in the course outline. The “topic covered” shows the fraction of the lecture title covered in each class and the “gap column” shows the fraction of the topic that was not covered in the scheduled class. Since the code states that the professor would close the gap within the next class, the arrows in the schedule performance table indicate when the untaught material was covered. Based on the code definition, if this material is covered in the next class, then the code requirement is satisfied. The last column states whether the code promise was met or not.

3.3.3.4. Documenting the resources used

Documentation of resources used is required by clause 7 of ISO 10001 standard. Because of this requirement, a resources used form was created to record the resources used during the implementation of the codes. The template of the form is shown in Table 3-4.

Resources used template	
Resource used	Purpose of resource
Smartphone (Blackberry)	Responding to students' emails
Candy bar	Redress for missed response code promise
Teaching assistant	Marking the course materials

Table 3-4: Resources used template

The table includes the resource used and the purpose of the resource. For example, the resource used could be a smart phone and the purpose would be to answer emails received from the students quickly or the candy bar that is given to the student as a result of missed response code promise.

3.3.3.5. Documenting training

Clause 7 of the standard also requires the organization to document the training of the personnel involved in the implementation of the codes. The template shown in Table 3-5 has been developed to record the training. In this study, the training of the teaching assistants of the courses should be documented.

Training record template				
Date and time	Trainer	Trainee	Subject of training	Place of training
January 10, 2009 at 14:00	Professor C	Teaching assistant	Review code information	Conference room 5-1

Table 3-5: Training record template

In this table, the professor would specify the date and time of the training, the person who is training the personnel, and the personnel. The professor would also indicate the subject of the training and the place it was performed. For example, as you can see in table 3-5, On January 10, 2009, at 14:00, the professor C informed and trained his TA on the review code subject in the conference room 5-1.

3.3.3.6. Documenting corrective actions

The documentation of the corrective actions decided by the professor in case of an unmet promise was not required by the standard but the template for the actions was developed to record the actions decided. This form can help the professor to improve the system during managerial review of the system. A sample of the corrective action form is shown in Table 3-6.

Corrective action Template				
Unmet promise	Time and date	Reason	Corrective action taken	Gap closed?
Review code	March 19, 2009	Professor's workload for the week	Evaluate the workload in advance and mark the material as soon as possible	Yes

Table 3-6: Corrective action recording template

The corrective action form includes information regarding the unmet promise (e.g., assignment 3 did not meet the review code promise), and the time and date that the promise was not met. The professor would investigate the reason for the unmet promise and record it in the table with the corrective action determined. The professor would investigate whether the corrective action would prevent the unmet promise in the future and determine if the gap is closed. For example, review code, on March 19, 2009 was not met due to professor's workload for the week and the corrective action suggested was to

evaluate the week's workload and mark the material as soon as possible. This action could result in gap closure.

3.4. Summary

Five professors took part in this study. Not all professors used all three codes. In this study, flowcharts covering the underlying processes of the CMS, based on the ISO 10001 standard, were developed. The processes were the development of the codes, preparation for code implementation, code implementation, maintenance and improvement of the system, and support. The activities of processes were explained. The supporting processes for documenting the implementation of the codes were explained and the forms developed to record those were illustrated.

Chapter 4: CMS implementation

4.1. Introduction

The CMS was implemented in undergraduate and graduate courses in an engineering department of a university in western Canada. The results of the code implementation systems are presented. Based on the data from its application and students' surveys, the performance of the system is analyzed. The study showed that the ISO 10001 standard can be applied in different graduate and undergraduate courses taught by different professors.

The CMS was implemented by five different professors in eight different courses. In total, 590 students participated in this study. Data was gathered to investigate the effectiveness of the system and was used to determine the improvement opportunities in the code implementation process. This investigation would result in having fewer instances of missed codes by investigating the reasons that they were not met. It could also help the professors to find more efficient methods to meet the codes or improving the code implementation processes.

4.2. Implementation of ISO 10001

After developing the CMS processes, a meeting was set with each of the professors. During this meeting, which happened before each semester, the study and its objectives were explained. Since the participation in the study was voluntary, upon acceptance of participation, information regarding the standard, its application, and the information regarding the implementation of the codes were given to each professor. In addition, the pre-defined codes and the objectives of those codes were explained to them.

The professors then would have three options in defining the codes for their courses. The codes were either defined by the professors or were adapted by professors with changes to their scope or limitations (adapting the codes), or they accepted the codes defined as they were (adopting the codes). The response code was adopted by three professors, but the other two professors adapted the code and made changes to the promise of its

limitations (e.g., responding to emails within 48 hours, and not implementing the code during weekends). The review code was adopted in three of the courses and adapted in the other five courses (e.g., the promise to post the correct answers on the course website within 24 hours, and different return time for each of the course materials). The schedule code was adopted by all the professors who implemented the code.

The flowchart, explained in sub-section 3.3.2, covers the three codes and all the processes for the implementation of those codes. The professors can choose to eliminate, add, or modify the activities to match their own system. For example, if the professor chooses not to implement the schedule code, the section that shows the steps required for that specific code would be eliminated. Some professors chose to implement the CMS differently and not follow the flowchart that was developed. Those flowcharts were then modified to match the system they used. The modification of the flowchart was done before or during the auditing of the system and was used as documentation of the system processes. For example, professor A decided that he would collect all the emails first, and then send them to the RA at the end of the course instead of forwarding each email to the RA as he responded to them.

After professors were informed about the system and decided on the codes to be implemented in their courses, the required information for documenting system performance was sent to the RA (e.g., the codes definition, the students' list, and the course outline).

The scope of the code implementation in each of the eight courses, with the information about the type of the courses, the time that the courses were taught, and the codes that the professors decided to implement in the courses, are shown in Table 4-1.

Course	Type of the course	Academic term	Professor	Codes implemented
A	Undergraduate	One	A	Response code Review code
B	Graduate	Two	A	Response code Review code
C	Undergraduate	Two	B	Response code Review code Schedule code
D	Graduate	Two	C	Response code Review code Schedule code
E	Undergraduate	Two	D	Response code Review code Schedule code
F	Graduate	Three	C	Response code Review code Schedule code Evaluation code
G	Undergraduate	Four	A	Response code Review code
H	Undergraduate	Four	E	Response code Review code

Table 4-1: Scope of the code implementation in each course

4.3. *Application results*

The methodology explained above was implemented in eight courses in the total of four academic terms (Table 4-1). Code usage in class A did not follow the flowchart, as the flowchart had not been developed before the time that this course was delivered.

The flowcharts were given to the professors and they modified the CMS flowcharts to match with the actual processes applied in each course. The professors chose to use two or three of the codes and implement them in their courses. Therefore, the modified

versions of the flowcharts, which did not include those promises that were not used by the professors, were developed.

In addition, professors changed the processes of implementing the codes and the steps that were previously defined. The professor checked the flowcharts given to them and marked the changes, or changed the steps of the flowchart, and the research assistant fixed the flowcharts to match with their systems. As an example of changes made in the flowcharts, some of the professors were not using teaching assistants (TAs) for the course and there was no reason for TA training. Another example would be the documenting of the results and updating the performance monitoring tables, which was done by the RA and not the professors, so those parts were modified.

4.3.1. Response code implementation results

The results of the response code implementation in the eight courses are discussed in Table 4-2 and the performance statistics are given. All of these data were gathered for all the courses and were used to indicate the performance of the response code implementation.

As can be seen in Table 4-2, there were only four instances that the code was not met. For one of the instances, the reason was that the professor had the response to the inquiry but was waiting for the issue to resolve itself and forgot to send the response. The reason for the other one was that the professor did not see the email and therefore did not answer the email within the time limit defined. It is likely that the implementation of the code could help to assure that each inquiry in those courses will be responded within 24 hours as the response code indicated, and if not answered during the time limit, the explanation would be given and the reason would be documented for further code improvements.

	Course A	Course B	Course C	Course D	Course E	Course F	Course G	Course H
Min. Response Time	0:01:55	0:03:09	0:02:33	0:00:36	0:07:50	0:02:44	0:02:04	0:02:55
Max. Response Time	22:44:00	23:17:36	17:15:33	27:53:23 x	37:16:33 v	204:40:16	21:03:4 4	24:58:29 **
Average Response Time	6:26:26	7:54:29	2:49:07	3:40:26	5:44:30	6:32:15	3:39:37	4:54:57
Number of Non-fulfillment instances	0	0	0	1	0	3	0	0
Number of inquires	107	96	114	167	59	114	126	80
Percentage of questions <ul style="list-style-type: none"> • Logistics • Content 	39% 61%	63% 38%	45% 55%	59% 41%	56% 44%	66% 34%	53% 47%	53% 48%
Total number of students	50	73	153	21	93	33	124	43
Student participation***	62%	62%	34%	90%	30%	60%	40%	60%
Average # of questions per student	2.14	1.32	0.74	7.95	0.63	3.45	1.01	1.86
<p>* The promise was fulfilled because the Email was not included in scope of the response code and did not require a 24-hour response.</p> <p>** The promise in this course was 48-hour response code.</p> <p>*** Percentage of students who sent emails during the semester</p>								

Table 4-2: Response code performance in each course

4.3.2. Schedule and review code implementation results

As can be seen in Table 4-3, the schedule code was implemented in four courses. During the implementation of the schedule code, the topics were covered as per the schedule within acceptable variation (e.g., “one lecture topic”). Only one instance was recorded, in which the professor was behind and could not cover the material in the next class, as was promised by the schedule code of that class. In this case, the remedy was given to the students and the material was covered in the next class.

The review code was implemented in all of the courses. As can be seen in Table 4-3, there were five instances where the code was not fulfilled. The definition of review code was different in courses. One of the professors considered reviewing the correct answers as the review code promised, while other professors considered returning the marked coursework to students as the promise made.

Table 4-4 shows the reasons for unmet code promises during the implementation of CMS. Mostly, the reason for unmet promise for review code was the high workload of the professors or the TAs in that specific week. As the result, the review of the course work was not done on the code duration defined. The review code was not met in one case in course D and three times in course C, and only in one case during the course H. The main reason for missing the promise in course D was that the professor did not anticipate the workload for that week and could not finish marking the course material on time. The reason for the unmet promise was documented and the corrective action was decided; the professor decided to pay more attention in defining the codes promise and limitation so that there would be more time for the marking of the course work. In course C, there were three instances that the code was not met. For one of the instances, the reason was that the professor was not present in class and the guest speaker taught the course for that specific lecture. Therefore, the professor did not get a chance to give the marked material back to the students. The corrective action was to define the code so that it only applies when the professor is present in class. The reasons for the other two instances were again the workload of the professor in marking the material. In the other four courses, the review code was implemented without any instance of unmet promise.

Course	Response code	Review code	Schedule code
A	0	0	N/A
B	0	0	N/A
C	0	3	0
D	1	1	0
E	0	0	0
F	3	0	1
G	0	0	N/A
H	0	1	N/A

Table 4-3: Number of instances when code promise was not met

Course	Code	Reason
D	Response code	Forgot to send the email
F	Response code	The emails were not seen by the professor
C	Review code	Not being present in the class and too much workload for the week
D	Review code	Too much workload for the week
H	Review code	TA had an exam and could not mark the material

Table 4-4: Reasons for unmet code promise

As can be seen in Figure 4-1, there number of students in the class did not have any effect on the average response time. Although in some courses the number of students is higher than the others, the average response time was not higher.

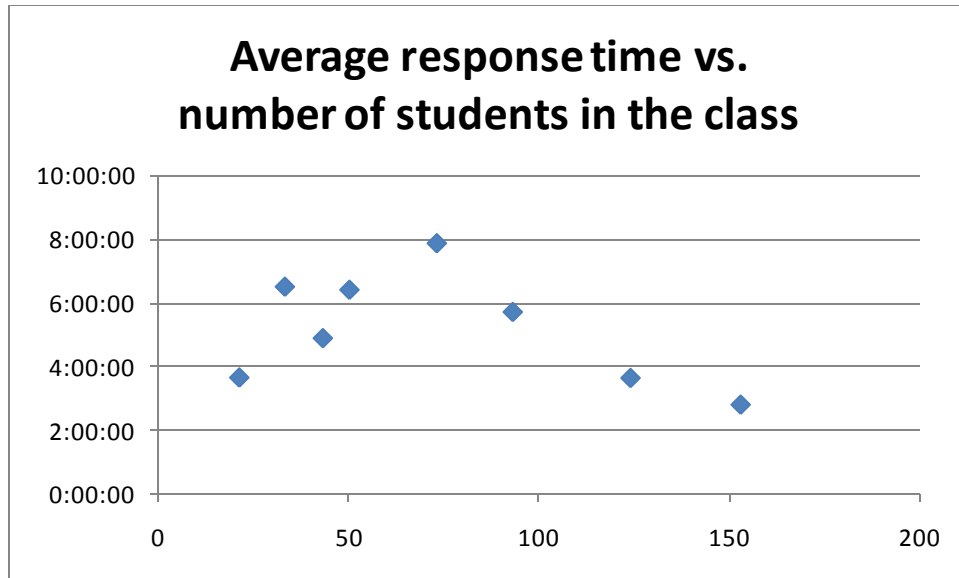


Figure 4-1: Average response time based on number of students

In this study, the response time based on the context of the questions asked from the professors was also investigated. To investigate which type of questions (Content or Logistics) was being answered more quickly, the average of the response times was calculated for each of the courses. Table 4-5 shows the results.

As can be seen in Table 4-5, the average time for responding to each category of the questions was different from each other. This means that some of the professors answered content questions more quickly than logistics questions, but the other professors did not. Based on the calculations, the decision whether either of the question categories are being answered more quickly cannot be made. In this study, the average time of all the professors in answering the questions was calculated. The average time to respond to each content question was 4:34:45 and for each logistics questions was 4:36:30.

	Average response time to content questions	Average response time to logistics question
Course A	5:48:16	7:25:29
Course B	9:18:32	7:04:03
Course C	2:41:42	2:58:17
Course D	4:34:03	3:03:36

Course E	8:13:54	3:46:47
Course F	3:28:38	9:55:42
Course G	3:52:40	3:28:08
Course H	5:42:33	4:11:54
Total	4:34:45	4:26:30

Table 4-5: Average response time based on context of inquiry

After the end of each semester, for selected courses, an audit of the CMS was conducted and the improvement opportunities were identified. In this audit, the system was audited against the ISO 10001 standard requirements and based on the flowcharts, which were modified by each professor. In addition, an on-site audit was conducted. A detailed discussion about the auditing of the systems against the standards and the results of the audits are explained in Chapter Six.

4.3.3. Measurement of satisfaction

As part of gathering information about the satisfaction of students with the codes and the system implemented, two surveys were conducted in each course, except in course A, where there was no midterm survey. These two surveys were called the “midterm survey” and the “final (end-of-semester) survey”. Information about students’ awareness of existence of the code and the students’ perception of the codes’ usefulness was gathered. In addition, students had the opportunity to leave improvement suggestions (e.g., suggestions about any other code that students think could be useful). Although students could contact the professors in person or through any other methods to leave feedback at anytime, the surveys conducted in the course would give the students a chance to give their feedback about the course and the promises made to them. The midterm and final surveys had been developed before this research was started and the questions in the midterm and final surveys were not changed during this study. The Research Assistant conducted the surveys and prepared the survey results and the students’ comments. The results of the surveys were sent to the professors. The detailed survey results of each course are presented in Appendix B. The professors can use the information gathered during the surveys to improve the course delivery or the CMS.

The results of the midterm surveys are presented in Table 4-6 and Figure 4-2. The midterm survey questions were about the students' awareness of the codes implemented in the course and their perception of the usefulness of the codes. The Table 4-6 illustrates the percentage of the students who responded to the questions.

Class	Response code		Review code		Schedule code	
	Usefulness	Awareness	Usefulness	Awareness	Usefulness	Awareness
A	-	-	-	-	-	-
B	94%	94%	93%	93%	-	-
C	93%	84%	89%	62%	83%	46%
D	100%	100%	75%	56%	93%	67%
E	86%	88%	73%	60%	70%	67%
F	97%	100%	69%	77%	75%	83%
G	96%	97%	89%	49%	-	-
H	92%	63%	91%	44%	-	-

Table 4-6: Midterm survey results

As mentioned above, the midterm exam was only conducted in seven courses.

Appendix B provides all the detailed information regarding the midterm and final survey.

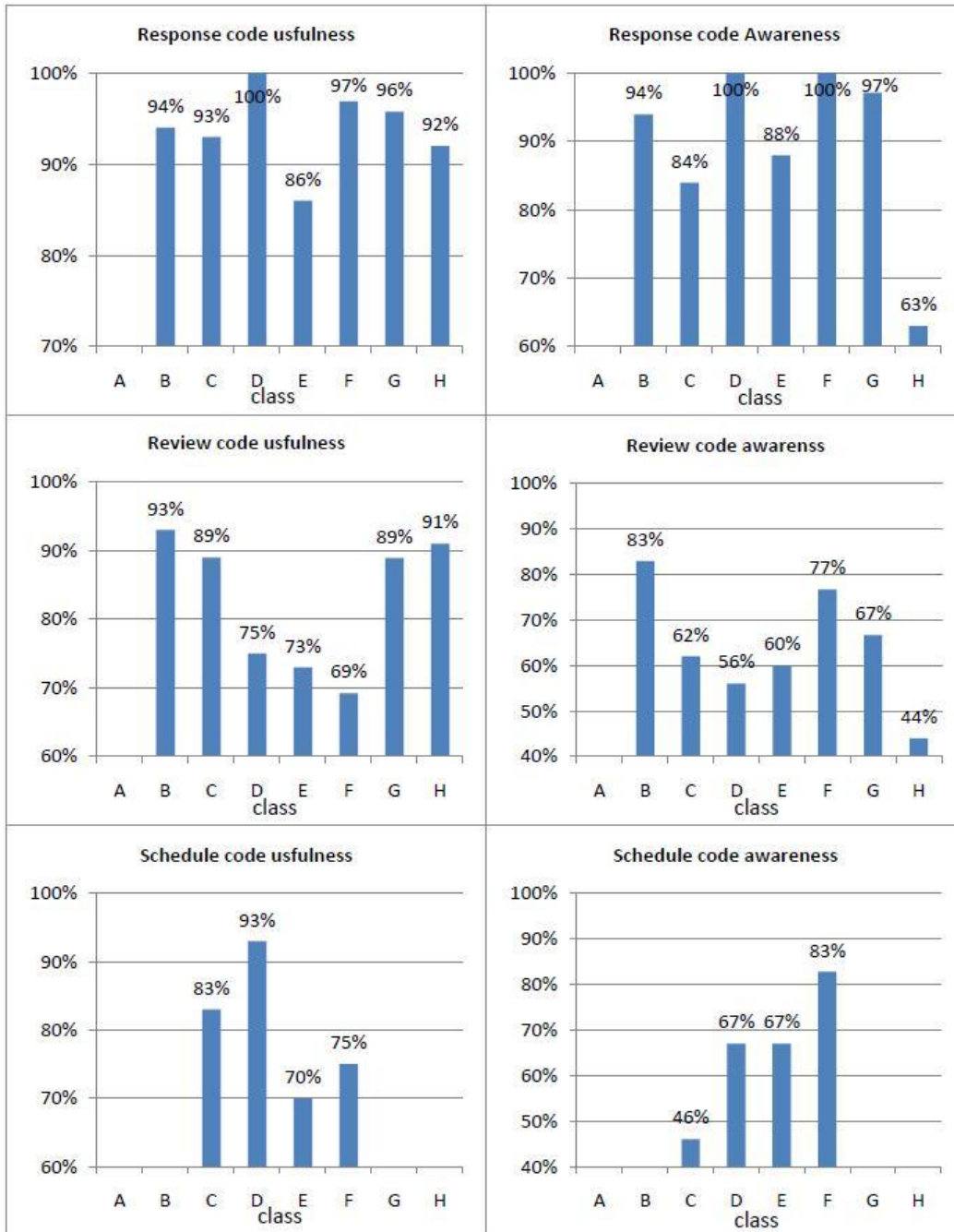


Figure 4-2: Midterm survey results

Other than the midterm survey, the final survey was also conducted in each of those courses at the end of the course. The questions in the final survey were more specific and targeted to address different aspects of the code implementation.

The questions were more specific and were focused on different parts of the codes' definition and their implementation. Having more focused questions would give a better understanding of which parts of the code definition or implementation are weaker and require improvements. Moreover, it would help the professor to investigate how useful the codes are and whether they are satisfying the students' needs. The students indicate the level of their agreement or disagreement with the statements in a 5-point Likert scale (Strongly disagree, Disagree, Neutral, Agree, and Strongly Agree) and the data from this survey was analyzed based on the median of the answers. Table 4-7 shows results of the final surveys in all of the eight courses.

		Class							
		A	B	C	D	E	F	G	H
A	Response Code:								
1	I was well-informed about the existence and the content of the code	4.6	4.6	4.3	4.7	4.5	4.7	4.6	4.1
2	I was well-informed about the professor's performance on the code	4.4	4.2	4.1	4.3	3.8	4.6	4.1	3.9
3	The 24-hour time limit for the response is appropriate	4.6	4.6	4.5	4.6	4.1	4.6	4.6	4.1
4	Explanation and snack is an appropriate redress action for this code	4.4	4.3	4.1	4.3	3.9	4.5	3.8	3.9
5	The professor provided effective responses to my questions	4.6	4.5	4.0	4.5	3.9	4.4	4.5	4.2
6	The professor provided comprehensive responses to my questions	4.6	4.3	3.9	4.6	3.9	4.4	4.4	4.1
7	This code effectively responded to my needs for a timely response	4.6	4.3	4.2	4.6	4.0	4.6	4.6	4.1
8	I recommend the use of this code in other courses.	4.6	4.3	4.4	4.6	4.1	4.5	4.6	4.2
B	Schedule Code:								
1	I was well-informed about the existence and the content of the code	-	-	4.0	4.4	4.1	4.3	-	-
2	I was well-informed about the professor's performance on the code	-	-	4.0	4.3	3.9	4.2	-	-
3	Time limits for the variation in the schedule are appropriate	-	-	4.1	4.4	3.8	4.0	-	-
4	This code effectively responded to my needs regarding material coverage	-	-	4.0	4.0	3.8	3.8	-	-
5	I recommend the use of this code in other courses.	-	-	4.0	4.4	3.8	4.2	-	-
C	Review Code:								
1	I was well-informed about the existence and the content of the code.	4.6	4.3	3.7	4.2	3.9	4.5	4.2	3.7
2	I was well-informed about the professor's/ TA's performance on the code.	4.4	4.2	3.6	4.3	3.8	4.4	4.1	3.8
3	Time limits stated in the code are appropriate.	4.6	4.3	3.8	4.4	3.8	4.1	4.4	3.9
4	This code effectively responded to my needs regarding material review.	4.6	4.2	3.7	4.1	3.7	4.2	4.4	4.0
5	I recommend the use of this code in other courses.	4.6	4.2	3.7	4.5	3.8	4.5	4.5	3.8
D	Evaluation Code:								
1	I was well-informed about the existence and the content of the code.	-	-	-	-	-	4.3	-	-
2	I was well-informed about the professor's performance on the code.	-	-	-	-	-	4.0	-	-
3	Time limits stated in the code are appropriate.	-	-	-	-	-	4.0	-	-
4	This code effectively responded to my needs regarding material marking.	-	-	-	-	-	3.9	-	-
5	I recommend the use of this code in other courses.	-	-	-	-	-	4.3	-	-

Table 4-7: Final survey results

A similar result to the midterm survey came from the final survey regarding the awareness and usefulness of the codes. Table 4-8 shows the bar chart of the usefulness and awareness of the codes in the final survey. The figures in Table 4-9 were drawn by counting the first question of the final survey (“I was well-informed about the existence and the content of the code”) as the awareness question. Moreover, the last question of

each section of the final survey (“*I recommend the use of this code in other courses*”) was counted as the usefulness question.

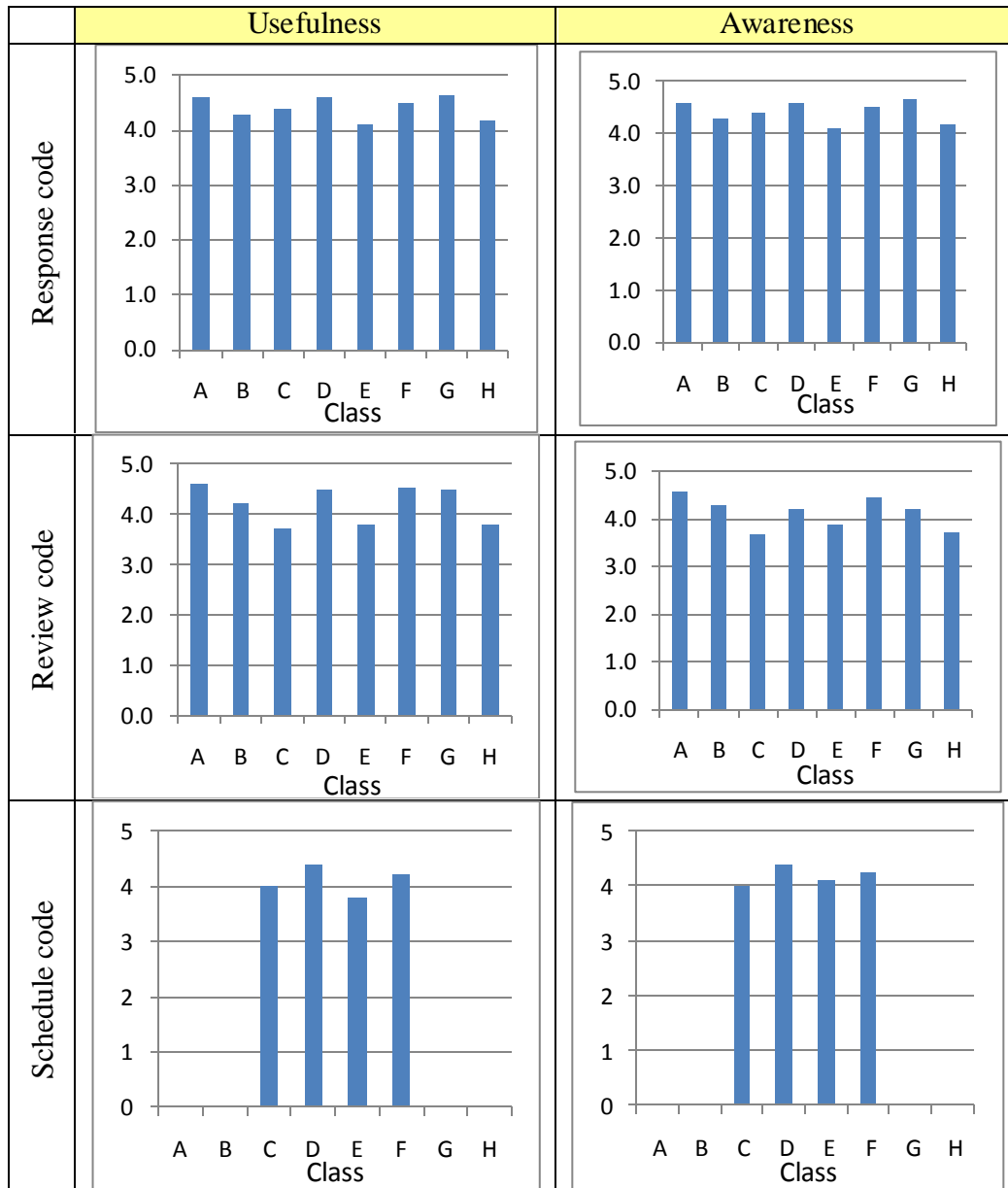


Table 4-8: Final survey results on code awareness and usefulness

As can be seen from the midterm survey and the final survey results, the students perceived the response code as the most useful. The percentage of the students who were aware of the existence of that code was also higher compared to the other two codes.

To test whether the awareness of the students and their perception of the codes usefulness were different among the codes, a statistical test was conducted on midterm survey results. In this statistical analysis (Montgomery and Runger, 1999):

$$H_0: P_1=P_2$$

$$H_1: P_1 \neq P_2$$

Where:

The null hypothesis (H_0) is accepted if (Montgomery and Runger, 1999):

For this test to be valid, the sample numbers should be large (Montgomery and Runger, 1999). Therefore, the analysis was conducted in courses C, E, and G and it was conducted for all the courses as whole. Therefore, For $\alpha=0.10$, the $Z_{\alpha/2}= 1.64$. The calculation for the codes in the courses and the whole study is shown in the table 4-9:

Usefulness	Course	P_1	P_2	N_1	N_2	Z_0	H_0
Response (1) vs. Review (2)	C	93%	89%	153	153	1.28	Accepted
	E	86%	73%	93	93	2.46	Rejected
	G	96%	89%	124	124	2.12	Rejected
Response (1) vs. Schedule (2)	C	93%	83%	153	153	2.86	Rejected
	E	86%	70%	93	93	2.98	Rejected
Review (1) vs. Schedule (2)	C	89%	83%	153	153	1.63	Accepted
	E	73%	70%	93	93	0.53	Accepted

Awareness	Course	P_1	P_2	N_1	N_2	Z_0	H_0
Response (1) vs. Review (2)	C	84%	62%	153	153	5.07	Rejected
	E	88%	60%	93	93	5.06	Rejected
	G	97%	67%	124	124	6.89	Rejected
Response (1) vs. Schedule (2)	C	84%	46%	153	153	8.64	Rejected
	E	88%	67%	93	93	3.89	Rejected
Review (1) vs. Schedule (2)	C	62%	46%	153	153	3.82	Rejected
	E	60%	67%	93	93	-1.24	Accepted

Total	Codes	P_1	P_2	N_1	N_2	Z_0	H_0
Usefulness	Response (1) vs. Review (2)	93%	85%	540	540	4.37	Rejected
	Response (1) vs. Schedule (2)	93%	79%	540	300	6.46	Rejected
	Review (1) vs. Schedule (2)	85%	79%	540	300	2.58	Rejected

Awareness	Response (1) vs. Review (2)	89%	65%	540	540	10.75	Rejected
	Response (1) vs. Schedule (2)	89%	58%	540	300	11.74	Rejected
	Review (1) vs. Schedule (2)	65%	58%	540	300	2.45	Rejected

Table 4-9: Statistical analysis on midterm exam results

From the data analyzed above, the response code usefulness and awareness are higher than the other two codes.

Two reasons for a higher percentage of awareness and usefulness of the response code were contemplated:

- Students sending emails were not expecting a fast response to their emails based on their experience with other professors. This could explain why the usefulness of the response code was higher. For example, an expectation of a fast response to enquiries (e.g., in 24 hours) is lower than the expectation of receiving a marked coursework back (e.g., within a week). In other words, the students who hand in their assignments, for example, probably expect their marked assignment back within a week, but they would probably not expect a response to their emails within 24 hours.
- Since the students perceive the response code as more useful, they would remember the existence of this code better than the other codes. This could explain the higher awareness of the response code.

Therefore, unless the need for the code could be easily noticed, the students would not find it as useful as other codes. For example, since the student is waiting for the response every time they send an email, the need for a response code is noticed easier. This could be the reason why the response code is being thought as more useful than the other codes. The overall awareness of the code could be improved if the professors could improve the code communication plan by informing the students about the codes' performance more frequently. Continuously reporting the professors' performance could be a reminder to students about the codes and could increase their awareness regarding the codes.

4.3.4. Survey comments

During the surveys, students were also asked to give inputs about the other codes or promises they would like to see in the course. They also commented on the topic of improvement opportunities concerning the implementation of the codes or any suggestion for the change in the codes. Table 4-10 shows some of the suggestions that students gave during the surveys.

Other Codes suggested	Other redness suggested	Suggestions
<i>“FAQ’s or students’ questions (Applicable) to be made known to all students (Either by email or post website)”</i>		
	<i>“Simple explanation is all that is needed”</i>	<i>“Although I think the standards are useful, I do not think they address the key customer requirement of being able to supply what we learn. Although the schedule code is being complied with. I would not agree that our in-class time is used effectively. I think we often stay off topic for significant amount of time then rush through topics to make up the schedule”</i>
<i>“For time sensitive questions 24 hour could be too long”</i>	<i>“Just give a good reason”</i>	<i>“Not needed as long as fairness prevails”</i>
<i>“Schedule code: provide your expectations on projects/ assignments before it is due- not after Provide these inputs to the whole group, not to individuals to ensure fairness”</i>		
		<i>“The response time for the questions asked was great. The FAQ was a great means of additional held that was also easy access”</i>
		<i>“I think this is great. I feel that most professors do not conform to standards and I think that reflects badly on the university because this leads to lazy and sloppy professors”</i>
		<i>“One-week notices on what to focus on when reading the chapters in the textbook. Some chapters are 30+ pages, so if you could give some direction so people actually</i>

		<i>read them before the class”</i>
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Table 4-10: Sample of student suggestions

Having a survey in the middle of the semester may help the professors to make changes to the course delivery system in the same semester, based on the comments left by the students, rather than the next time the course is being offered. As an example of a comment made during midterm survey, students were asking for the course assignments and projects marking criteria so that they can be more specific in those parts during course F. As a result of that, a new code was developed for this course (“Evaluation code”, which would be further explained in Chapter Five). Students also made comments about the teaching of the course and suggestions to improve the learning aspects of the course. Some examples of these comments were:

- Adding the notes to the slides, which the professor was writing during the class, on the slides so that the students do not have to write them down and it would save the class time to explain the concepts better.
- Request for solving more examples.
- Request for assigning an assignment and project drop box for the course.

Managerial review of the system also was useful in improving the codes. Adding a course component, i.e., the project, to the review code in course D is an example of continuously improving the codes by conducting “managerial review” of the codes.

4.4. Summary

Not all the students were completely satisfied with the codes and their implementation, but the majority of them found them somehow useful and suggested the codes to be implemented in other courses as well. Moreover, they suggested other improvements to the codes, their limitations, and their scope (e.g., lower response time for important questions). This study showed that ISO 10001 could be applied in graduate and undergraduate engineering courses.

Chapter 5: FHS application

5.1. Introduction

ISO 10002 has been used in different industries to design and develop a system to handle customers' complaints and to systematically address those. In this chapter, processes of a Feedback Handling System (FHS), based on the ISO 10002 requirements, have been further developed to address student feedback in engineering courses. The FHS was implemented in two courses. The development of the FHS processes is described first, followed by an explanation of the steps taken to implement them and the results of the implementation.

5.2. FHS development

By using the ISO 10002 guidelines, the FHS gathers the students' feedback about the teaching and learning processes. An FHS was designed and used prior to this study (Karapetrovic and Doucette, 2009). In this chapter, the system processes are further developed.

An FHS based on ISO 10002 was implemented by one professor and in two different courses (Courses D and F). This research investigates the applicability of this standard in responding to unsolicited feedbacks received from students in engineering courses. In these two courses, a CMS based on ISO 10001 was also implemented. Therefore, this chapter will also discuss the integration of the CMS with the FHS. FHS could also be used to respond to enquiries regarding the CMS. The steps suggested in ISO 10002 in dealing with complaints are used to handle unsolicited feedbacks received by the professors during the course.

The FHS was developed to address the feedback received via email or in person or surveys, which were conducted during the semester. All of the feedbacks, which dealt with the problems that affect the whole class, would go through the FHS and were responded to, based on the system developed.

5.2.1. Flowcharts

ISO 10002 is a guideline that describes the characteristics of a system, which addresses any complaint received from customers. This study uses that standard to develop a system to address any unsolicited feedback regarding the teaching and learning processes of the course that were raised. Since the ISO 10002 is a guideline standard, in this thesis, each clause of the standard is used to develop FHS system processes. Therefore, FHS processes were developed for the courses and any unsolicited feedback would go through the system. For example, unavailability of the course textbooks, which would affect the whole class rather than one person, is handled. The supporting data regarding each feedback, such as the issue raised, the time it was received, the investigation results, and the actions taken to address the feedback, are documented.

In this study, a flowchart of the FHS processes was developed based on the requirements of the ISO 10002 standard. This flowchart covers processes like developing the FHS, receiving the feedback, investigating the feedback, responding to it, and documenting it. Professors would make changes to the system based on the scope of the FHS. Figure 5-1 and 5-2 illustrates the FHS flowcharts developed. An explanation of the system steps and the required information for each step is explained on the FHS flowchart. In addition, the elements of the standard are given in brackets where they related to a step in the flowchart. The higher-level flowcharts were discussed previously (Karapetrovic, 2008a). This study is developing flowcharts in more detail and with a description of lower-level processes and activities.

The FHS system and its scope are explained to the students in the first class. After each feedback is received, the professor informs the research assistant about the feedback and the required information about the feedbacks as well. Based on the ISO 10002 guideline, an identifying code is assigned to each feedback and the supporting data are documented. After the response to the feedback has been decided, the professor informs the student about the decision made. The feedback forms generated would be made available to all the students, by either sending it via email or posting the form on the course website. The feedback form is created based on the template complaint follow-up form from Annex D

of ISO 10002 standard, and was developed prior to this study (Karapetrovic and Doucette, 2009). In the following sections, each process of the FHS is explained.

5.2.1.1. Scope

The first step to implement the system is to determine the scope of FHS, meaning the type of feedbacks that the professor chooses to address based on the FHS developed for the course. The professor has the option of addressing all the feedbacks received through the system or addressing only the feedbacks that have effect on all the students in the class. An example of this kind of feedbacks would be the “use of personal computer during the midterm exam”. The feedbacks regarding whether the students can use the computer during the exam would have effect on all the students in the class although it was asked by only one student. Whether the comment would affect all the students could be determined by examining if this issue could be raised by any student. Although everyone could ask questions about a part of the assignment, such a question is not considered an issue that could affect all the students.

5.2.1.2. Communication and maintenance plans

The second step in preparing the FHS is to determine the characteristics of the system such as a communication plan and the plan regarding the maintenance of the system. In this step, the professor needs to determine:

- How students can leave the feedback.
- Whether to announce the results.
- How to check the system performance.

This step helps the professors to decide how they can receive the feedback, analyze the feedback, respond to it, maintain the FHS, and improve it. This step satisfies the clause 7.1 of ISO 10002.

5.2.1.3. Teaching assistants' involvement

The next step in preparing the system is to decide whether the Teaching Assistants (TA) should be involved in the implementation of this system or not. Based on the standard (Clause 5.3.4), it is advisable to train people involved in the code implementation and determine their involvement. Therefore, the professor will decide to involve the TAs of the course in dealing with the feedbacks received or not. For example, the professor should decide whether the TAs can respond to any feedback they receive or just forward them to the professor. If the TAs are involved in the FHS, they should be trained about the system and its steps and also the reporting and documenting of the feedback. This step can be skipped if the professor does not have a TA or does not decide to involve the TA in the FHS. The courses that implemented this system did not have TAs and there was no need to implement this step.

5.2.1.4. Use

The next step would be the receipt of the feedback. In this step, the professor decides whether the feedback received falls within the FHS scope defined in the first step. The professor receives the feedback through different ways. The feedback could be sent to the professor via email, in person, through a note that was passed by the student, the surveys that have been conducted in the course or any other methods of sending feedback. The communication of the system and the information about how a student can leave feedback were decided in the second step, determining the FHS communication plan.

Upon reception of the feedback, supporting data regarding the feedback would be sent to the RA and documented. This information would be the date and time it was received, the method the feedback was sent, and information regarding the context of the feedback. This part satisfies ISO 10002, clause 7.2.

A feedback identification number is assigned by the RA to each feedback that was received. This identification number is shown with a number on the feedback form that

was created once it is being analyzed. Assigning a feedback identification number is normally done by the organization and is required by the standard in clause 7.3.

Acknowledgement of the feedback received was required by clause 7.4 of the standard. This acknowledgement is a reply sent to the student and shows the student that the feedback has been noted and will be dealt with.

The feedbacks that were received with emails were acknowledged by emails. The time that the feedback was received and the time it was acknowledged would be recorded in the feedback form. After the professor received an email regarding an issue, the professor will send an email back to the student acknowledging the receipt of the feedback. The professor will also send the student's email and the replied email to the RA, and the RA will collect the feedback supporting data.

The feedback that was received by the professor in person would be acknowledged in person right away. If the feedback is anonymous and was received by the professor anonymously, an acknowledgement of the issue would be announced in the class to all the students.

Once the professor receives the feedback and the initial supporting data are gathered, he would examine why addressing this issue is important (i.e., feedback severity). The professor may need to collect more information regarding the feedback. The professor would look at the possible actions to address the issue. The actions might be as easy as answering the student question (e.g., can a student use a personal computer during the midterm exam) or might require more investigation (e.g., when the bookstore brings the course textbooks and when the students can buy them). After the action has been decided, the response to the feedback is sent to the student.

According to clause 7.9 of ISO 10002, the student's acceptance or rejection of the feedback decision should be collected. Therefore, if the student, as the complainant, is not satisfied with the action suggested, the issue is not resolved, and alternative corrective

action should be evaluated. If the issue has been resolved, then the corrective action should be applied and documented. The updated feedback form, depending on the FHS communication plan, could be sent to the students.

Although the FHS flowchart addresses most of the steps of the system, each professor would determine the scope of its system and the steps required to effectively and efficiently respond to all the feedbacks, and communicating the results of those to the students.

Figure 5-1 shows the flowchart developed for FHS planning and use.

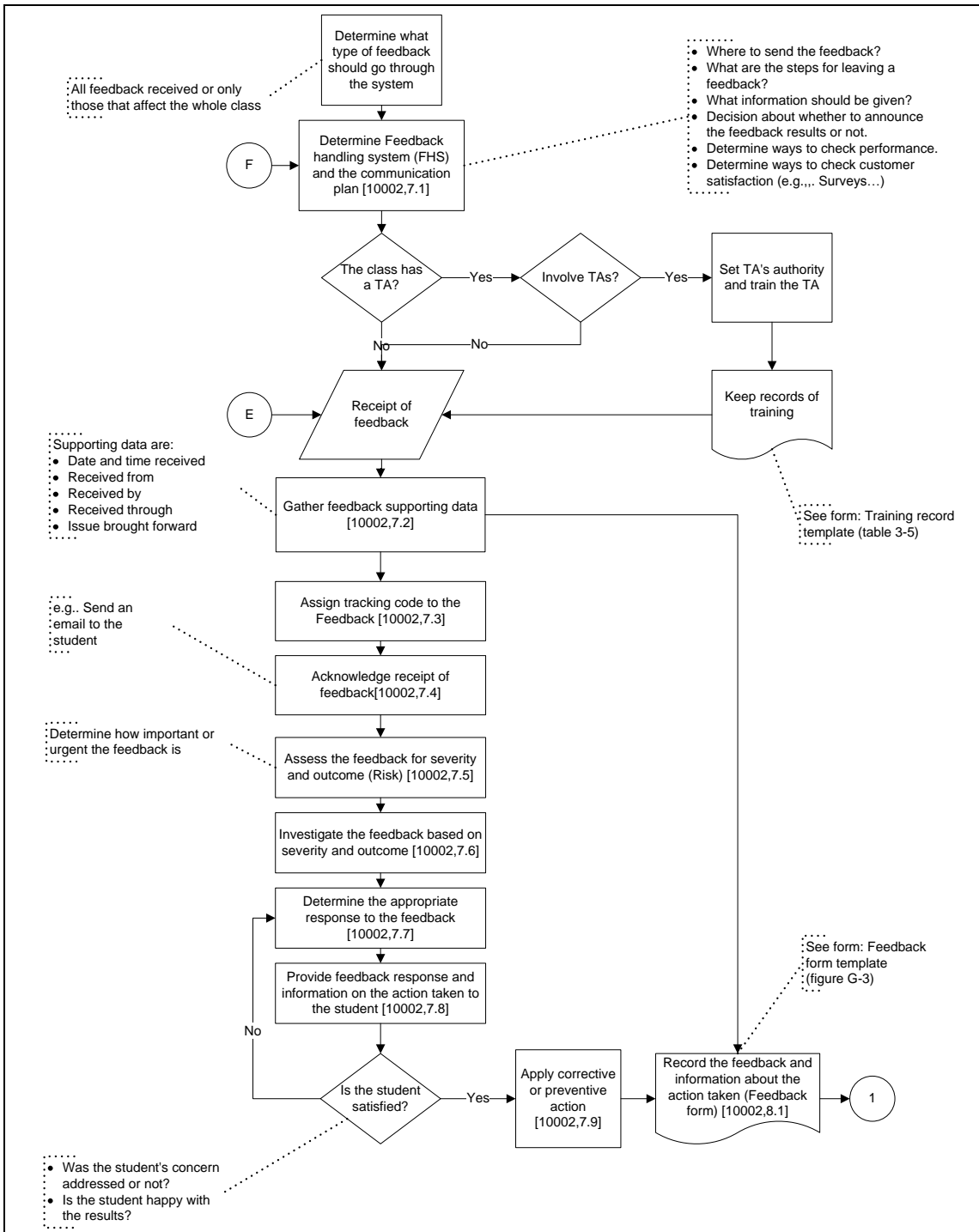


Figure 5-1: FHS planning and use

5.2.1.5. Maintenance and improvement

According to Clause 8 of the standard, the professor is required to collect information regarding the effectiveness and efficiency of FHS steps such as gathering the feedbacks, recording them, training the personnel, and students' satisfaction with the FHS processes. The data collected should be analyzed and the system performance against the criteria defined should be evaluated. During the management review of the system, which is required by Clause 8.6 of the standard, improvement opportunities in the FHS could be identified.

Figure 5-2 illustrates the flowchart processes for maintaining and improving the FHS.

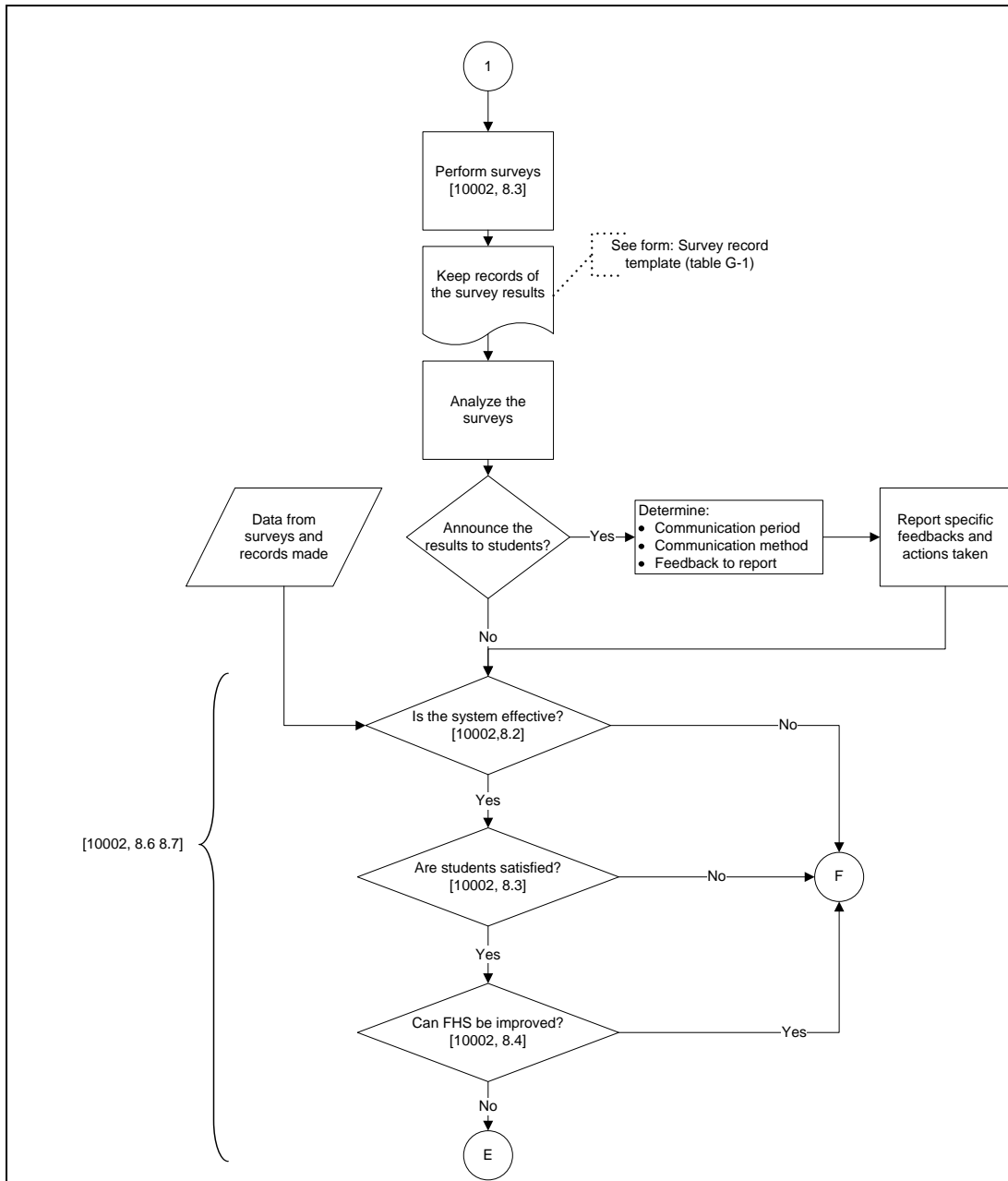


Figure 5-2: FHS maintenance and improvement

Surveys of the effectiveness of the FHS have been conducted in the course. The surveys were conducted to evaluate the students' satisfaction with the system.

5.2.2. Documentation

The feedbacks handled through the FHS are documented. Feedback forms are used to keep record of the feedback and the actions taken to address those. The information, gathered from the moment that the feedback has been received until the moment that the feedback response was decided and the issue was resolved, is documented in a feedback form template. The feedback form template was developed prior to this study, based on the Annex D of the standard (Karapetrovic and Doucette, 2009).

The feedback forms record the following information:

- *Date and time received:* This field keeps record of the time and date that the professor received the feedback, whether it is the time that the email was sent or the time that the student left the feedback in person.
- *Received from:* This field keeps track of the person who left the feedback; it could be one student or a few students who left the same feedback.
- *Received by:* This part of the feedback form records the person who received the feedback. It could be the professor or the teaching assistant if the TA is involved in the FHS.
- *Received through:* This part keeps track of the method used to leave a feedback; it could be an email sent or in person.
- *Issue brought forward:* This section explains the issue or the feedback received.
- *Issue acknowledged:* The time that the issue was acknowledged will be recorded in this field. It could be a replied email or a verbal acknowledgement in person.
- *Initial assessment:* It provides short information about how this issue can affect the students and why it has to be dealt with. This step serves as the step required by the standard (Clause 7.5 of ISO 10002) to assess the severity of the issue and its outcome.
- *Initial action:* It provides information about how the issue could be dealt with and what actions have been taken to address the issue.
- *Initial response:* the initial action that was taken to address the issue is sent to the student(s) and the reason that the issue exists is explained. For example, in the case of textbook unavailability, the professor contacting the bookstore is an initial response

to the feedback and the approximate date that the textbook can be purchased is sent to the students.

- *Investigation:* If the issue requires future action and cannot be resolved at the time, a further investigation of the possible solutions is conducted.
- *Further action:* the actions that were identified in the investigation or the further action to completely resolve the issue would be evaluated and the best action would be selected.
- *Further response:* The student would be informed about the result of the investigation and the further action taken.
- *Resolution status:* This field just tracks if the issue brought up by the student has been resolved or not. This can be defined by investigating whether the student accepted or rejected the proposed corrective action, and whether the corrective action resolved the issue.

5.3. FHS implementation

The feedback handling system was implemented in two courses (course D and course F) by one professor. During the implementation of the FHS, the professor did not follow the steps of the system developed sequentially. As an example, after receiving the feedback, the professor would look into the possible corrective actions and choose the appropriate response before sending the emails to the research assistant for documenting the data on feedback forms. Another example is that the professor did not look at the severity of the feedbacks because of the low number of feedbacks handled with FHS, and each feedback was dealt with as soon as it was received.

During the two courses, 18 different feedbacks that affected the whole class were dealt with and were documented. Some of the feedbacks received regarding the improvement of the course delivery were:

1. In one of the courses, accessing online material was essential. Although it was explained in the classroom how to access the online materials, a few of the students were having problems with accessing those materials. After one student

mentioned it, the feedback handling system was used to deal with this situation and the results were that instructions to how to use the online material was explained to the students again.

2. A few students noticed a typo error on the course outline and by handling it through FHS, the outline was fixed and the correct version of the outline was sent to all the students.
3. A request for posting online the lecture slides for the next class before the class so that the students have a chance to read the material before attending the class.

All the feedbacks that were received and documented are listed in the Table 5-1 and the summary of actions taken to address those is shown in Table 5-2 and Table 5-3. A sample of the feedback forms recorded during those two courses is shown in Figure 5-3. The 18 feedback forms created during this study are shown in Appendix D.

#	Course	Subject	How received	Acknowledged
1	D	Text availability	Email	With Email in 24 hours
2	D	Access to standards	Email	With Email in 24 hours
3	D	Receiving Emails	Email	With Email in 24 hours
4	D	Group formation	A note to the professor	Announcement in class on the same day
5	D	Minimum number of standards for course project	Email	With Email in 24 hours
6	D	Class handout in electronic version	In person	Announcement in the same class
7	D	The use of person computers during midterm exam	Email	With Email in 24 hours
8	D	Class mark average	Email	With Email in 24 hours
9	F	Course reading availability	Email	With Email in 24 hours
10	F	Accessing course information	Email to the teaching assistant	With Email from TA within 24 hours
11	F	Access to the standards	Email from three students	With Email in 24 hours to all 3 students
12	F	ISO 9001- related questions on Quiz Two	In person	In person response to the question
13	F	Course outline typos	In person and through email	In class announcement and with Email in 24 hours
14	F	Class greeting	Email	With Email in 24 hours
15	F	Assignment marking guideline	Email	With Email in 24 hours
16	F	Required reading access	Email	With Email in 24 hours
17	F	Posting course notes	Email	With Email in 24 hours
18	F	Response code	In person	In person and the professor asked the student to write a note

Table 5-1 : Feedback reception summary

#	Issue	Action	Issue resolved
1	Course textbooks were not available in the bookstore	Consultation with bookstore, Email to all students once the books became available	Yes
2	Students could not access the online standard documents	Analysis of potential reasons not being able to access the standard, Email to students about how they can access them.	Yes
3	The student was not receiving any the professors email	Investigation of the reason why the student did not receive the email and making sure that all the students email addresses were added to the list.	Yes
4	One of the students could not find other ungrouped students to for a group for the course project	At the end of the class, the professor made sure that everyone is part of a group by separating people who are already in a group	Yes
5	The minimum number of standards for two-student group project had to be changed	To be fair to those students with lower number of students in the group, the minimum number of standards for the project has been modified	Yes
6	The electronic version of the class handout was requested from one student	An electronic version was sent to all the students	Yes
7	Student were asking about whether they can use personal computer during the midterm exam for accessing the standards	To be fair to students who do not own a personal computer, the permission of using the computer was denied and instead the required material was handed out during the exam	Yes
8	The class mark average and the highest and lowest marks to be announced in the class	Each of those marks was calculated and was presented in class and was emailed to all the students.	Yes

Table 5-2: Feedback resolution action summary (course D)

#	Issue	Action	Issue resolved
1	Mandatory course reading #3 was not handed out in class prior to the class in which it was supposed to be discussed	The reading was printed and was made available outside the professors laboratory for students to pick up before the next class, the decision of handing out the whole course reading material at the beginning of the course was made	Yes
2	E-journal where the reading materials of the course were kept could not be accessed.	A PDF file of how to access the E-journal was made and put in the course website and the students was informed about how to access them	Yes
3	Not being able to access the standards on the SCC website	The website was down. An inquiry was sent to SCC and the website was fixed.	Yes
4	Requesting a sample quiz examples from the professor	Sample questions were posted on the course website	Yes
5	The final exam and the course reading had some typed incorrectly	The course outline was fixed and was updated on the online version and a correction was emailed to all the students	Yes
6	The professor was asked to clearly greet in the class upon entrance	The professor reminds himself to greet the class with aloud “hello”	Yes
7	Guidelines about how the course material are being marked	The guideline for marking assignments was posted on the course webpage.	Yes
8	Required reading #12 could not be accessed due to a registration issue	Only a brief look at the website was required and no registration was necessary for that reading. An announcement was posted on the course website regarding that	Yes
9	The lecture slides for one of the classes were not posted online	A PDF version of the course slides were made and was posted on the course website	Yes
10	The response code defined in the course does not have an expiration date		No

Table 5-3: Feedback resolution action summary (course F)

Using personal computers during midterm exam

DATE & TIME RECEIVED:	09 Feb 2009 at 15:02:12
RECEIVED FROM:	One student
RECEIVED BY:	C
RECEIVED THROUGH:	Email sent by the student
ISSUE BROUGHT FORWARD:	The ability to use personal computer during midterm exam
ISSUE ACKNOWLEDGED:	Email sent to the student (09 Feb 2009 at 15:08:38)
INITIAL ASSESSMENT:	Since some of the students might not have access to laptop to bring to the class for the exam, it would not be fair to them if others were allowed to have a personal computer.
INITIAL ACTION:	The standards that are needed in the midterm exam will be given to the students and therefore there will be no need to access the standards through personal computers during exam.
INITIAL RESPONSE:	As a clarification note for the upcoming midterm exam, and to ensure equal access to documents to all students, an Email was sent to all students (09 Feb 2009 at 15:24:46) saying: A) Laptops and copies of the standards should not be used during the exam. B) If needed, the text of required standards will be provided within the exam sheet
INVESTIGATION:	Not applicable
FURTHER ACTION:	Not applicable
FURTHER RESPONSE:	Not applicable
RESOLUTION STATUS:	Closed
CORRECTIVE ACTION:	Not applicable

* Modified from ISO 10002: 2004 (Annex H [sic] [D])

Figure 5-3: Sample feedback form

5.4. *Integration with the CMS*

This section investigates the integration of CMS and FHS to improve the effectiveness of both systems. For a more efficient application of these two standards in engineering courses, the study, explained in Honarkhah and Karapetrovic (2010b), looked at the integration of these two systems based on ISO 10001 and ISO 10002 requirements.

The ISO 10002 standard could be used to design the FHS and the system could be integrated with the CMS developed based on ISO 10001. As discussed in Chapter 3, ISO 10001 includes guidelines for implementing codes of conduct in organizations and steps to design and implement the CMS. These codes of conduct include a set of promises made to customers. Using an integrated system means any feedback regarding the CMS would be dealt with the FHS (ISO 10002 helping ISO 10001). Moreover, any feedback would be acknowledged promptly based on the response code promise (ISO 10001 helping ISO 10002) (Karapetrovic and Doucette, 2009; Karapetrovic, 2008b).

For a better illustration of the integration of these two systems, the links between the CMS and FHS are shown in Figure 5-4. As can be seen in Figure 5-4, all the feedbacks regarding the improvement of CMS could go through the FHS. An example of the FHS improving the CMS would be the note that was passed to the professor about the lack of information in the CMS regarding the response code. In this example, the note states that the response code had no end date, which implies that there is no end time for the promise that the professor made during the course to answer all the emails within a specific time. As a result, the professor would have to answer all the emails sent by the student even when the course is over. Other than the CMS feedbacks, any other feedback regarding the teaching process could go through the FHS. For example, questions about what can be used during the exam would go through the system. Moreover, feedbacks received during the course were acknowledged within the period defined for the response code because of the integrated system. For example, any email sent to the professor regarding any feedback has been acknowledged within 24 hours based on the response code defined.

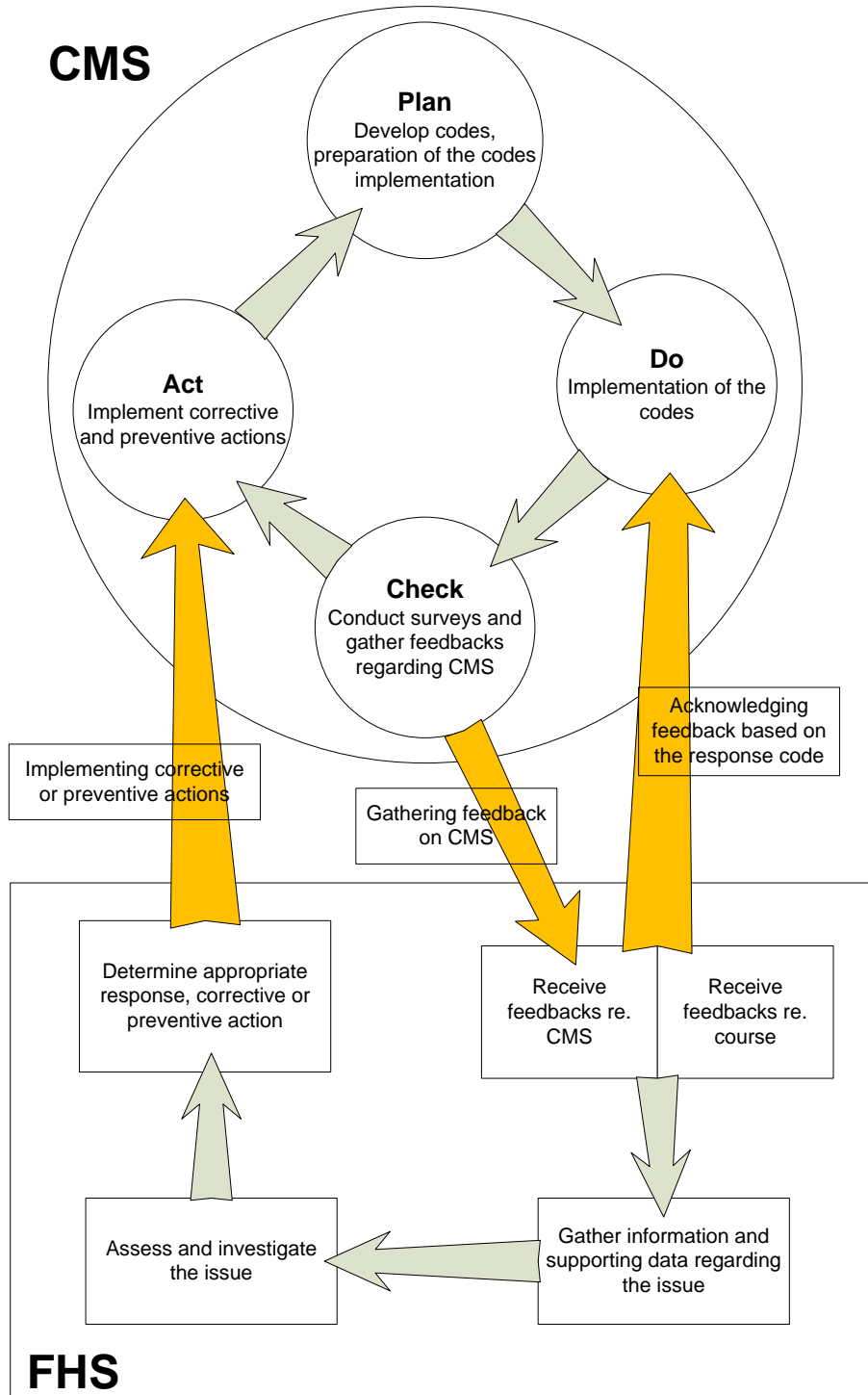


Figure 5-4: Integration of the CMS and FHS

The feedbacks used in this study that went through the FHS were the issues brought up by the student(s) and had an effect on all the students in general. Therefore, comments

made about the course in general (e.g., textbook unavailability and the use of personal computers during exams) or improvements to the codes or suggestions for a new code (adding the course work evaluation code) were handled by the FHS.

An example of feedback received from students which resulted in defining a new code for the CMS, is that the student made a comment about the availability of marking criteria for exams and assignments. After addressing it through FHS, the professor decided to develop and implement a new code. As a result, the code was added to the CMS. The new “Evaluation code” states:

“I will post:

- The details for the remaining testing course evaluation components (quiz #4 and the final exam),*
- The marking schemes for the remaining homework course evaluation components (final presentation, project report, assignment #4)*

On the course site by Tuesday, June 2, at 17:00 or I will provide a 100-gram chocolate bar to every student who shows up in class On June 2.

- This code does not apply in cases of unforeseen natural events.*
- Please let me know through e-mail or in person if you have any inquires about this code.”*

In developing an integrated system, ISO 10001 was the foundation of the system, which means that the CMS processes were developed first and the requirements of the standard were mapped onto the system. Then, the processes for FHS were added to the system to meet the ISO 10002 requirements. The FHS was used as the supporting system, in this case, to deal with the feedbacks.

5.5. FHS maintenance and improvement

As part of the monitoring FHS, surveys were conducted in both of the courses. The comments from the surveys and the statistics on the surveys were used to improve the

system. If the comment made in the survey had an effect on all the students in the class, then it would go through the FHS to be addressed based on that system.

There were two surveys per course during the semester, midterm and final (End-of-semester) surveys. The midterm and final surveys were designed prior to this study. The midterm survey was conducted to measure the effectiveness of communication of the system (student’s awareness of each codes implemented in the course and the FHS) and a better understanding of the students’ perception of the system usefulness (usefulness of each codes and FHS). This survey also included a section for students to leave feedback or improvement suggestions regarding the course or the system. A report of the survey results was prepared by the RA after each survey and was sent to the professor. The two midterm surveys asked for students’ feedback on both systems’ applications. The final exam asked questions regarding the level of students’ agreement with the sentences provided on the 5-point likert scale.

The students’ evaluation of the awareness and usefulness of the Feedback Handling System (FHS) during the midterm survey is shown in Table 5-4:

<i>Course</i>	<i>FHS awareness</i>	<i>FHS usefulness</i>
D	67%	92%
F	86%	86%

Table 5-4: FHS midterm survey results

The final survey for the feedback handling system was only conducted in the second course (course F) and the results of that are shown in Table 5-5:

With respect to the "Feedback Forms" and FHS	SD	D	N	A	SA	Total	Median
I was well-informed about the existence and the content of these forms	0	0	3	10	11	24	4.40
These forms effectively illustrate professor's actions on the student feedback	0	1	3	12	8	24	4.17
I recommend the use of these forms in other courses	0	0	4	8	12	24	4.50

Table 5-5: Final survey results on FHS for course F

The end-of-semester survey and the midterm survey were used to gather detailed information about the satisfaction of the students with different aspects of the codes and FHS designed for the course.

5.6. Summary

The Feedback Handling System (FHS) can help the professor systematically deal with the feedbacks sent by students about the quality of the teaching, the course, or the CMS used during the course. ISO 10002 gives guidance about how an internal complaint-handling system should be designed and what steps are required to systematically deal with the complaints. Using the FHS provides confidence that any feedback has been dealt with. It also provides suggestions on how corrective and preventive actions should be documented and applied to improve the overall QMS.

Application of ISO 10002 in this case study showed that by using the FHS, professors could improve the teaching and learning processes and address students' concerns or feedback. The feedbacks handled during each course can happen again in the courses offered later, for example, the unavailability of the course books. Therefore, by documenting the action taken, the professor could choose appropriate preventive actions.

During the semesters that the FHS was implemented, 18 feedback forms have been created. The FHS dealt with the issues raised by one or few students, but affected all the students in the classroom. For example, the issue of not being able to access the online course material is an example of that. The rest of the comments or feedbacks, outside the

scope of the FHS, have been dealt with but the system of documenting the issues and the actions taken to address those were not done. Those were the instances of problems occurring in a specific situation relevant to a specific student and did not involve all the students.

Chapter 6: Application of ISO 19011 in the CMS and the FHS

6.1 Introduction

ISO 19011 is a standard for auditing QMSs. This chapter investigates the applicability of ISO 19011 standard to audit the CMS and FHS against ISO 10001 and ISO 10002. A brief explanation of the auditing processes developed based on ISO 19011 is provided. The processes used to audit the systems against the standards are illustrated. Audit findings and the applicability of the ISO 19011 in auditing those systems are discussed.

6.2 ISO 19011 system development

For auditing against ISO 10001 and ISO 10002, the audit criteria should be defined based on the requirements these two standards. After the implementation of the CMS and the FHS, evaluation of the effectiveness of the application of these systems is needed. Therefore, auditing was necessary. To develop an auditing framework, ISO 19011 was a logical choice, because it provides guidelines for auditing systems against MSS requirements. Moreover, ISO 10002, unlike ISO 10001, requires the organization to perform audits to investigate the conformity of the system to the complaints-handling procedures and evaluate the achievement of the system objectives. Since ISO 19011 may not have been used to audit systems against ISO 10001 and ISO 10002, this study investigates an adaptation of the ISO 19011 methodology in auditing against those standards

This section explains the methodology and the auditing steps used to audit the CMS and FHS against the two standards implemented in the courses. The reporting of the audit findings is explained.

6.2.1. Study environment

Although the CMS was implemented in eight courses and the FHS was implemented in two courses, only five selected courses implemented CMS, and only one course (D) which implemented FHS, was audited. The CMS and FHS were audited based on ISO 19011 at the end of the academic term. The effectiveness of the system implementation

was evaluated and improvement opportunities were suggested. Table 6-1 shows the courses that were audited against the standard requirements.

	Professor	Standards Implemented	System scope to be audited
Course A	A	ISO 10001	Response code Review code
Course B	A	ISO 10001	Response code Review code
Course C	B	ISO 10001	Response code Review code Schedule code
Course D	C	ISO 10001 ISO 10002	Response code Review code Schedule code Feedback Handling System
Course E	D	ISO 10001	Response code Review code Schedule code

Table 6-1: Systems to be audited

The research assistant recorded the performance of each professor regarding the implementation of the codes (Figure 3-7) and non-compliances were reported to the professors. During each semester, system flowcharts were given to each professor. They were asked to modify the flowchart (Figure 3-1 to Figure 3-7) to match the actual system implemented in the course with the flowchart. This step was not implemented in course A, as the flowchart has not yet been developed. The modified version of each flowchart was later used in document review of the system during the audits in selected courses. A few examples of these modifications are:

1. Removing the schedule code processes in course B or removing the FHS processes in Courses B, C and E.

2. Removing the process of documenting the resources used in the courses.
3. Removing the training of the TAs in courses B, D, and E.
4. Modification of the response code processes in Course D. The professor modified the step explaining how to forward the emails to the RA in the response code processes.

6.2.2. Auditing flowchart and activities

The audit was conducted based on ISO 19011 and the suggested methodology was adopted. The audit steps are explained in Figure 6.1.

6.2.2.1. Initiating the audit

This step is implemented before the audit. The audit team (in this study, the research assistant and his supervisor) defines the audit objectives (e.g., to investigate the effectiveness of systems implemented), the audit scope (e.g., the CMS implemented in the course), and the audit criteria (e.g., ISO 10001 standard's requirements). The feasibility of the audit is evaluated based on the time available and the workload required for auditing against these standards. The professors, whose systems were being audited against the standards, are informed about the audit, and the time and place of audit is selected. The documents, such as modified flowcharts and records kept, are requested from the professors.

6.2.2.2. Conducting document review

Document review involves reviewing of the documented system processes (i.e., flowcharts), and the records kept, such as corrective action records. The flowcharts are modified either prior to or during the audit. Only one professor (C) modified the flowchart prior to the on-site audit. The other professors could not modify the flowcharts due to their course workloads. In these cases, during the on-site audit, either the professors edited the flowchart or the auditor asked questions about their CMS steps in

order to understand the system implemented. Other than the flowcharts, the code implementation performance records were reviewed and were used for auditing.

6.2.2.3. Preparing for on-site audit activities

The audit team, including the author and his supervisor, prepared the audit plan based on the requirement of ISO 19011. The responsibilities of each team member were assigned (i.e., the research assistant is responsible for conducting the audit, and the supervisor's responsibility is to collect information during the audit and suggest improvement opportunities on the audit process itself). In addition, on-site audit questions were prepared so that during the on-site audit, the auditor could interview the professors to understand the system and evaluate it.

6.2.2.4. Conducting the on-site audit

The on-site audit was conducted based on the time and place that was arranged with the professors. The audit was started with an opening meeting explaining the objectives, the scope, and the criteria of the audit. The auditor also explained the procedures and steps of the on-site audit. The RA conducted interviews with each of the professors and asked for examples to verify the information collected during the interview.

The observation of activities method was adapted from ISO 19011 methodology. For tracking the product, samples of each code incident were randomly selected and the professors' processes in dealing with those were followed based on the modified flowcharts. The professors' flowchart steps were verified by tracking each of the samples through the steps of the flowchart to match the system implemented with the developed flowchart steps.

6.2.2.5. Preparing the audit report

The audit findings were generated by comparing the information gathered during the on-site audit with the audit criteria. The audit report was created based on the audit findings. The audit findings will be discussed later in section 6.4 of this chapter.

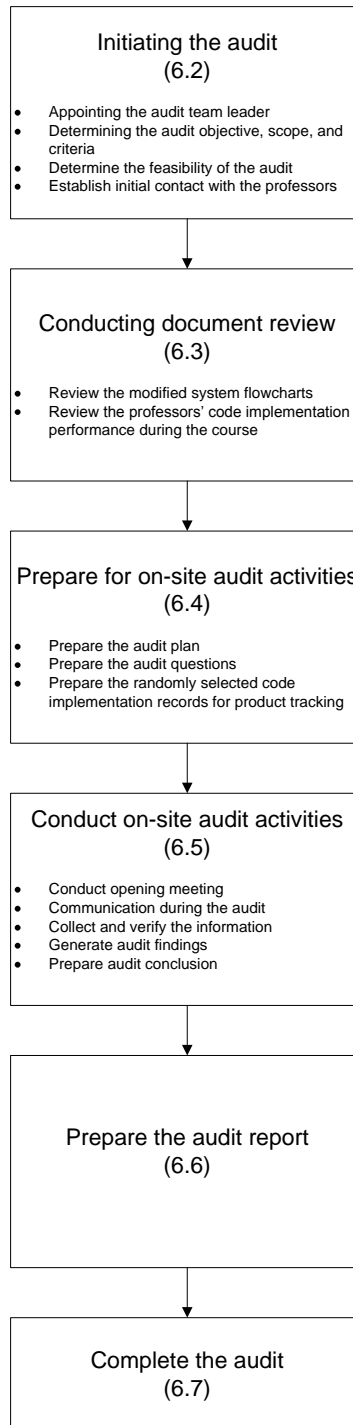


Figure 6.1: Audit Flowchart (adapted from ISO 19011:2002 – Figure 2)

6.3. ISO 19011 system implementation

In this section, the steps taken to audit the QMS against the standards are explained.

6.3.1. Initiating the audit

The auditor (RA) contacted each of the professors either in person or via email. The auditor explained the reasons for conducting an audit to the professors and requested a date and place for the audit that was convenient for the professors. After the audit initiation was conducted, the audit team prepared the audit plan for each of the system audits.

6.3.2. Preparing the audit plan

The audit team, including the research assistant and his supervisor, prepared an audit plan for each of the audits based on the requirement of ISO 19011.

The audit objectives for all audits of the QMSs (both the CMS and the FHS) include:

- To verify the compliance of the CMS in developing the codes (response code, schedule code, review code) against the ISO 10001 standard requirements.
- To verify the compliance of the CMS in implementing the processes based on ISO the 10001 standard requirements. This includes the development of the system, implementation of the codes, and monitoring the system.
- To verify the compliance of the FHS against ISO 10002 standard requirements.
- To verify the compliance of the integrated system against the ISO 10001 and ISO 10002 standard requirements.
- To evaluate the effectiveness of the QMS and suggest improvement opportunities.
- To investigate the applicability of ISO 19011 to audit against ISO 10001 and ISO 10002.

Where the FHS was not implemented, the objectives regarding the application of ISO 10002 were not included.

Audit criteria should be determined during the audit planning so that the auditor could investigate the audit results. This study used ISO 10001 and ISO 10002 requirements as the criteria for auditing the CMS and FHS.

The scope of each audit includes the code implementation in each course taught by the professors and the FHS where applicable. It was also limited to the specific courses offered in the Mechanical Engineering department of the University of Alberta.

The audit plan also includes the audit objectives, audit team members, their responsibilities, and the audit processes and procedures based on the ISO 19011 standard requirements. A few parts of the audit plan are shown in Table 6-2 below. A complete example of an audit plan for one of the courses is shown in the audit plan section of Appendix F.

Audit plan requirement based on ISO 19011	Audit plan section
[6.2.1] Audit team leader:	Research assistant
[6.2.3] Feasibility of audit:	<ul style="list-style-type: none"> ● Information available (Audit Plan, Audit criteria, ISO 10001 and ISO 10002, activities flowcharts) ● Cooperation (Professor C has agreed to be audited) ● Time and resources of audit is set (Friday March 27, 2009)
[6.4.1] Audit Plan basics:	<ul style="list-style-type: none"> ● Understanding the system and audit criteria ● Evaluation of the system against the criteria: <ul style="list-style-type: none"> ○ Collecting evidence ○ Verifying evidence ● Generate audit report and findings and conclusion
[6.5.1] Opening meeting:	<ul style="list-style-type: none"> ● The audit plan would be presented ● A short summery of the audit and its activities would be presented

Table 6-2: Section of audit plan

6.3.3. Document review

After the audit plan was prepared, the Audit team sent a copy of the audit plan to the professors. Document review was the next step in conducting the audit. The auditor requested the system flowcharts and documented records. Given that the auditor and the professors' research assistant was the same person (the RA) in this study, the auditor already had the documented records, such as the documented code performance and recorded feedback forms. The auditor looked at the modified system flowcharts that described the system used by the professors in the courses. By reviewing the flowcharts and the documented code performance and other records, the RA compared the documented system with the standard requirements and investigated the compliance of that system with the standard guidelines. A few non-compliances were found in the process of reviewing the documents. Two examples of non-compliances are:

- The corrective or preventive actions were not documented.
- The code definition was not updated. One of the professors missed a review code. As corrective action, he decided to change the limitation of the code but the code was never updated or the new code limitation was never sent to the students.

After conducting the document review, the on-site audit was scheduled with each of the professors in their offices. The on-site audit is used to compare the system implemented in each course with the system flowcharts modified by the professors. It started with an opening meeting (as required by ISO 19011, clause 6.5.1) and an explanation of the audit process.

6.3.4. On-site audit processes

Each audit included an interview with the professor. Table 6-3 shows some of the questions asked. The answers were verified by randomly sampling and selecting different code performance records. The Product-tracking method was also used to see if system processes matched the flowchart processes designed.

The interview questions used during the on-site audit include two parts: professor questions and Teaching Assistant (TA) questions. There were in total six different audit question sections:

- Preparation of the code,
- Response code,
- Review code,
- Schedule code,
- Feedback handling system,
- Teaching assistant questions

The complete list of questions can be found in Appendix C. The questions of each section were asked based on the scope of the professors' system. For example, only one of the professors implemented the FHS and the questions on those sections were not asked from others.

Audit Section	Audit Questions
General code preparation questions	<ol style="list-style-type: none"> 1) How did you inform the students about the codes and promises? 2) Where and how can students access the codes? 3) How do you check to see if the codes were implemented successfully? (What are the code performance indicators that the professor uses?) 4) How is the TA involved in codes' implementation?
Response code implementation questions	<ol style="list-style-type: none"> 1) How do you make sure that the questions are answered in [<i>pre-defined time interval</i>]? 2) How do you record the response time? 3) What is the process after an email was received? (What would happen after an email was received?) 4) How do you keep record of Corrective or preventive actions when you improve the code?
Review code implementation questions	<ol style="list-style-type: none"> 1) How do you make sure that the course materials were reviewed in [<i>pre-defined time interval</i>]? 2) Have there been any missed promises? What was the reason? How did you make sure that it does not happen again? (What were the measures you take to stop it from happening again?) 3) How do you keep record of Corrective or preventive actions when you improve the code?
Schedule code implementation questions	<ol style="list-style-type: none"> 1) Have there been any missed promises? What was the reason? How did you make sure that it does not happen again? (What were the measures you take to stop it from happening again?) 2) How do you make sure that the gaps between the schedule and covered material in class were closed?
Feedback system implementation questions	<ol style="list-style-type: none"> 1) What kind of feedback goes through the feedback handling system (FHS)? [All of them or just the ones that has impact on all the students?] 2) What happens after you receive a feedback or a question that is going through the FHS? [What are the procedures that it goes through?] 3) How do you record the feedbacks? (Ask to see an example) 4) How do you make sure that all the feedbacks are taken care of?
Teaching assistants audit questions	<ol style="list-style-type: none"> 1) How well do you know about the code and code implementation? 2) What is the extent of your authority in code implementation? 3) How have you been trained on the code and its processes?

Table 6-3: Sample audit questions

Because tracking every inquiry is time consuming, five instances when an inquiry was responded to for the response code, one coursework for the review code and one course lecture for the schedule code were randomly selected (Honarkhah and Karapetrovic, 2010c). An excerpt of the audit product sampling is shown in Table 6-4. As can be seen, a random number (between zero and one) was generated. The random number was then multiplied by the total number of inquiries, homeworks, or lectures, in order to select the inquiry, the homework, or the lecture sample number. The information regarding each of samples is shown in Table 6-4. For example, there were in total 114 inquiries for the response code in the course that is shown. The random number generated is 0.19. By multiplying 0.19 by 114, the 22nd inquiry is selected for product tracking. The same process was used for the other samples. Product sampling was not conducted during the course A audit because the methodology had not yet been developed. The audit product samples for each of the courses are shown in Appendix E.

The samples that were selected as part of the product tracking were analyzed during the audit. If any code promise was missed, the proper investigations regarding the actions taken to correct the system and improve it would have been conducted. For each of the response code samples, the time that the email was sent, the time that it was answered, and the time that it took to answer the email, were checked and compared to the code to see if the code requirements were met. The auditor also looked at whether the time that the reviewed material was returned or the time that a topic was covered met the review and schedule code promises or not.

Random samples

Response code samples

Random Number	multiplied Number (x114)	Inquiry Sample	Student Code Number	Time Received	Time Responded	Response Time	Inquiry Type	Code Met?
0.19	21.66	22	W9-M75	1/28/2009 22:10	1/29/2009 7:29	9:19:40	Content	Yes
0.87	99.18	99	W9-M130	3/24/2009 17:18	3/24/2009 18:07	0:49:54	Content	Yes
0.12	13.68	14	W9-M148	1/16/2009 11:14	1/16/2009 13:43	2:29:58	Logistics	Yes
0.26	29.64	30	W9-M116	2/2/2009 20:26	2/2/2009 21:45	1:19:08	Logistics	Yes
0.43	49.02	49	W9-M133	2/19/2009 21:42	2/20/2009 6:19	8:37:25	Logistics	Yes

Review code sample

Random Number	multiplied Number (x13)	homework Sample	Homework / Quiz / Exam	Due Date	Material Reviewed	Class Available	Code (Availability)	Code Met? (Availability)
0.64	8.32	8	A6	6-Mar	13-Mar	3rd	13-Mar	Yes

Schedule code sample

Random Number	multiplied Number (x26)	lecture Sample	LECTURE TITLE (PLAN)	DATE	COVERED	Not covered	GAP Closed
0.23	5.98	6	Income statements (3)	16-Jan	1	0	N/A

Table 6-4: Audit product sampling

The research assistant, who was receiving the data from professors to keep track of the performance of each professor in system implementation, was also audited for the recording of the data. The research assistant’s process flowchart could be found in Table 3-7. The audit was conducted by the RA’s supervisor and was considered as an internal audit. The audit was conducted by following the steps illustrated in the RA flowchart. Since the RA was responsible for gathering the CMS performance of the professors, a few professors’ CMS performance data were randomly selected and they were checked for accuracy of the information.

Although some of the professors were using Teaching Assistants (TA) for the courses, they decided not to involve TAs in the code implementation. Although in some cases, the TAs were not directly involved in code implementation, a meeting was set by the professors with the TAs to inform them about the existence of the review codes and its key terms, where the TAs were responsible for marking the materials.

The questions asked during the on-site audit were open-ended questions rather than “yes / no” questions (Arter et al., 2003, page 105; Kausek, 2008). The more specific and to-the-point questions were asked when the professors were explaining the processes that they used during the course. Product tracking and open-ended questions help the auditor to be able to follow the system flowchart and figure out if it matches the system implemented (ISO 19011, 2002; Arter et al., 2003, page 105; Kausek, 2008). Explaining the system by

answering the open-ended questions was helpful because some information that might not have come up in the yes/no questions would be given which the auditor might have missed or even the professor might have forgotten to mention. An example of that information could be the surveys that were done during the course and that the auditee had forgotten to mention. The answers to the audit questions were written down for investigating and preparing the audit report and as evidence collected during the on-site audit.

After each audit, the requirements of each standard implemented in the course were used as audit criteria and was compared with the system implemented. An audit report was subsequently prepared.

Auditing the integrated system in the courses that used both CMS and FHS was done at the same time. Questions were asked about the feedback handling system and the connection between those two standards. For example, the feedback received from a student should have been acknowledged based on the course response code promise (Karapetrovic, 2008b). Therefore, the replied email to the student's feedback email satisfies the requirement for the response code and requirements of acknowledgement of the feedback (ISO 10002, Clause 7.4; Karapetrovic, 2008b). The auditing of the system was considered the CMS and FHS at the same time, and was an integrated audit of an overall system.

The feedback forms made during the implementation of the FHS included the time that the feedback was received and the time that the acknowledgement email was sent back to the student, which made tracking of both of these aspects of the system easier. A sample of feedback forms was randomly selected as a product tracking sample. The recorded data about the feedback was compared to the required procedure based on the ISO 10002 standard requirements.

6.3.5. Audit report

After each audit, an audit report was prepared and the compliance or non-compliances with the standard requirements were mapped. Based on Clause 6.6.1 of ISO 19011, the audit report includes the audit objectives, criteria, plan, and audit findings and supporting information. The audit findings in this study were presented with the gap analysis table, which included the list of requirements of the standard and the compliance or non-compliance to the standard. The table also includes columns giving information about how the requirements have been met or what was missing. The last column of the table gives improvement suggestions on how to improve the system or close the gaps existed. A sample of the gap analysis table is shown in Table 6-5. Also at the end of the audit report, the product-tracking samples and information gathered during the on-site audit were attached for future use or tracking the results. Appendix F includes the audit report for course D.

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
6 Planning, design and development			
6.1 Determine code objectives	Complied	Since the codes were adapted, determining the code objectives were done prior to this course (no evidence from audit)	<ul style="list-style-type: none"> - Documentation of the objectives (Not specifically required by ISO 10001, but it would be useful to implement) - The standard states that the objectives should be measureable using performance indicators. (Defining them and recording them could be useful)
6.2 Gather and assess information	Complied	Since the codes were adapted, gathering of information was done prior to this course (no evidence from audit)	Documentation of the issues (Not specifically required by ISO 10001, but it would be useful to implement)
6.3 Obtain and assess input from relevant interested parties	Complied	<ul style="list-style-type: none"> - Since the codes were adapted, gathering input was done prior to this course (no evidence from audit) - The students were asked about bringing up issues with the code or suggesting other codes to be implemented or change-requests to the code (Midterm and Final survey) 	<ul style="list-style-type: none"> - How the relevant information was obtained and how effective and efficient the method was should be considered and assessed. - Note: students are the main customers but what other interested parties, which could help to define or improve the code, are there.
6.4 Prepare code	Partially complied	<p>Based on the code:</p> <ul style="list-style-type: none"> - The code scope and purpose was defined - The promise and the limitation of the codes were defined - The key terms used in the code was not defined (based on the flowcharts in document review) - How and to whom the enquiries and complain should be directed was explained in the code. - The remedy for each code was defined. 	The key terms used in the code should be defined properly

Table 6-5: Audit compliance report sample

6.4. Results

In this section, the results of the audits conducted for the CMS, FHS, and an integrated system implemented in the courses, are explained. The results of the application of ISO 19011 in auditing against the standards are presented.

6.4.1. CMS audit

One of the objectives of the audit was to evaluate the compliance of the CMS for the courses with the ISO 10001 standard requirements. The audit showed that the system developed is complying with the ISO 10001 but minor changes, such as improved documentation process, should be made in the system to address some of the requirements of the ISO 10001. The implementation of an ISO 10001 based system assured the students that the email inquiries are answered in a defined time (Response code). It also provided assurance to the students that the course material is reviewed within a specific timeline (Review code). The schedule code provided confidence to the students that the schedule of the course is followed based on the course outline (Schedule code).

6.4.1.1. Development of the codes

Audits conducted in the courses revealed that the codes were not defined completely. Some improvements in the code key terms are required. For example, professor D defined the review code as the time that the answer to the course material is explained to the students, while other professors defined it as the time the results of the material is handed back to students. The definition of the review code and its key terms should be explained in detail so that the students have a better idea about the professor's promise. In addition, any changes implemented to the codes should have been updated. For example, professor B defined the review code deadline as three lectures, but he forgot to mention that only the lectures that he is present at are counted, and if the professor is not present in the lecture (e.g., guest lecture), this would not count as a lecture. This information could have been added to the review code once this has been decided upon.

6.4.1.2. Preparation for code implementation

The audit also gives the auditor information that can be used in the future to improve the code implementation. For example, professor A did not stop informing the students about the codes in the first class. The professor introduced the codes in the second lecture as well. In this case, the students who missed the first lecture class are informed about the codes. Therefore, the communication of the codes is improved if the professors do not rely solely on introducing the codes on the first lecture. A periodic reminder of the codes in the classroom by announcing professors' performance in implementation of the codes could increase the students' awareness of the codes.

Another finding of the audits was that there was a lack of documentation and recording of the actions taken. The audits found that the records, such as the resources used or the training records, were not kept or even prepared. Documentation was one of the main problems resulting in non-compliances against the standard.

6.4.1.3. Implementation of the codes

During the implementation of the codes, the investigation of missed promises in order to improve the system was not conducted in all of the courses. For example, because of the TA's workload for the week, the professor could not return the marked assignment on time. The investigation of how this issue could be corrected was not done.

In addition, the documentation of the corrective actions suggested to improve the system was not documented. As it was mentioned previously in section 6.5.1.2, documentation processes of the CMS should be improved.

6.4.1.4. Maintenance of the system

Management review of the system was not done based on the clause 8.4 of ISO 10001 in most of the courses. This clause of standard recommends the organization to regularly review the system, such as its effectiveness and efficiency or in addressing significant instances of non-fulfillment of the code promises. The management review of the

standard should be done based on not only the missed promise but also the performance indicator defined for the codes (e.g., the average time to respond to an email inquiry). The professors should use all the data, gathered during the system implementation, to find improvement opportunities in meeting the codes (e.g., improving the system to minimize the response time). The professor could use the students' comments during the survey to improve the system. For example, students' concerns about the code implementation could be analyzed during the management review. As an example, based on the midterm survey comments, students were concerned about the fast pace of the professors in covering the material when the professor is behind the scheduled session. This concern should be reviewed in the management review of the schedule code, and preventive actions should be taken to address that.

Documenting the corrective or preventive actions could be used by other professors to improve the CMS. For example, a preventive action suggested by one of the professors to address this issue mentioned above regarding the fast pace of the professors was mentioned during the audit. He suggested that the schedule should include some extra examples that the professor could go through in case there is extra time. If the teaching of the course is behind, then the professor could use the extra examples time to cover the course and just hand out the solution to those examples later. The students can ask the TA or the professor for help if they needed more explanation regarding those extra examples.

Another example of a preventive action suggested by the professors regarding the review code was that when a professor promises to return the marked material back to the students within three lectures, he should aim to review the course work for the next lecture rather than the third lecture. This action would assure that in case of any complications during the reviewing and marking of the material, the professor would still have time to mark the material and return it before the time that the code specifies.

6.4.1.5. Improvement suggestions

The audit itself was useful in addressing the issues in the code implementation and finding improvement opportunities from the professors' point-of-view. For example, the professors suggested that a database (e.g., an online webpage) should be created and templates for recording the data, such as code implementation performance or resources used, should be made available through the database. This was suggested so that the professors could just enter the new information and the system would keep track of their performance. His concern was that professors usually do not have the time to send the information to the RA or fill the records themselves. For example, the system could ask for professor's progress during the course and fill the schedule code performance table automatically.

The audit also included improvement opportunities, such as the use of a webpage for gathering information about the codes and the system. If the professor has a course webpage, he can arrange a more detailed survey of the system. The students then would have opportunities to suggest improvements to the codes or the system.

6.4.2. FHS audit

An audit of the FHS system against the ISO 10002 was conducted at the end of course D based on the requirements of ISO 19011. This audit suggested some improvement opportunities and some partial compliance issues that have to be addressed.

A report of audit findings was prepared and was sent to the professor. A sample of the audit report that was prepared is shown in Table 6-6. The table includes the standard requirements and an explanation of the evidence found to support the compliance or non-compliance of the system, with the standard requirements and improvement opportunities. The audit discovered that some minor changes needed to be implemented in the system to make it completely comply with the standard requirements. For example, the standard requires the organization to define objectives and performance criteria

(clause 6.2 of ISO 10002). The objectives of the system were set, but there were no performance criteria or measureable objectives defined in the system.

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
6 Planning and design			
6.1 General	Complied	Based on the Feedback-handling system designs and flowcharts.	Other professors approaches should be consider regarding the Feedback handling system
6.2 Objectives	Partially complied	The objectives for the Feedback-handling system was established but there were no detailed performance criteria (no evidence from audit)	Detailed performance criteria should be set at regular intervals based on ISO 10002 requirements.
6.3 Activities	Complied	Any inquiry that is related to the course and can affect all the students goes through FHS and FHS was designed to improve students' satisfaction in the course.	
6.4 Resources	Complied	The professor sets the resources, which are needed for the FHS.	The use of website to leave feedback should be considered, if applicable.
7 Operation of complaints-handling process			
7.1 Communication	Complied	After receiving a feedback from students, the professor decides about how to address the concern. The students are informed about the FHS. They have access to the related information about how the feedback was handled after the forms were posted. (The Flowcharts and the sample feedbacks observed during the Audit)	More information about the feedback handling system could be readily available to the students. For example, a database to leave a feedback or track an on-going feedback
7.2 Receipt of complaint	Complied	The relevant information about the feedbacks are gathered and documented.	

Table 6-6: Sample audit report

Another finding of the audit was that the information, which was made during the feedback handling, was recorded but never reviewed. As an example, in one of the courses, because of the number of students in the class, the project groups did not have the same number of students. Therefore, this issue was brought up by one of the students and it resulted in changing a course project requirement. This feedback was documented

with the action taken to address this problem. The audit finding showed that the professor forgot that the action of changing the project requirements was taken. Therefore, the audit suggested having a database that updates the information and keeps track of changes to the course so that the professors could always check the latest changes to the course.

6.4.3. Integrated audit results

In situations where there was more than one standard required to be audited against, the audit of those two systems were integrated. The report on the results of the audit was also included in the findings of both systems together. The two systems (CMS and FHS) were integrated into one of the courses and the audit looked at the whole system and the link between those two. The integrated audit that was conducted in this course looked at the system and analyzed the compatibility of each part of the overall system with both standard requirements. As an example of the integrated audit step, the auditor looked at whether the feedback sent to the professor was acknowledged based on the response code defined in the system.

The audit also was integrated in the documentation level. This means that the audit had one audit plan and only one audit report and was conducted at the same time. In this case, there were no separate documents or audit times for each of the systems.

6.4.4. Applicability of ISO 19011

The applicability of ISO 19011 in auditing the CMS and FHS against ISO 10001 and ISO 10002 was also studied. Using this standard was helpful in organizing the audit steps and managing the audit against those standards. It showed that with an audit using ISO 19011, although originally setup to help organizations to audit against ISO 9001 and ISO 14001 (quality and environmental management systems), it can be used to audit against the augmentative standards (Karapetrovic, 2008a) as well. The steps required by auditing standard could be used to audit CMS and FHS against ISO 10001 and ISO 10002. As a

result, required improvements could be suggested once the system processes are identified and the standard requirements are mapped onto the processes.

Clause 6 of ISO 19011 could be used in different situations including auditing the customer satisfaction management systems (CMS and FHS) against the ISO standards. Clause 7 of ISO 19011, related to the auditor's competence, should be modified to be able to apply these standards in different system auditing. For example, in the case of auditing the systems against ISO 10001 and ISO 10002, the auditor should have knowledge and work experience in the application of those standards. This modification mainly should be done in section 7.3.3 and 7.3.4 of ISO 19011.

The ISO standards under study provide some requirements that need to be satisfied like documentation, communication of the codes and promises, and management review of the system. The challenge of auditing against the ISO 10001 and ISO 10002 was to decide to what extent the system complies with the standard requirements. Asking the question whether the system, which is designed to address the students' concerns and to deal with their feedbacks, could provide sufficient support to the professors or not, can help the auditor to investigate the system and its compatibility with the standard. Therefore, the auditor's understanding of the system and its implementation is an important factor in the effectiveness of the audit.

One of the problems encountered during the audit was that the professors' time to modify the system flowcharts was limited. Some of the professors had to modify the system at the time of the audit. This resulted in a longer time for the audit and the auditor could not actually review the documents before the on-site audit. Modification of the flowchart prior to the on-site audit would improve the audit. The reason is that the chances of the professor just accepting the process steps during the on-site audit would be higher at this point. A reminder of modifying the system could be used to make sure that the professor studies the flowcharts and modifies them before the audit. Knowing the system and knowing the weak points of it before the audit could help the auditor to pass through the strong aspects of the system and focus on the weaknesses. This would result in finding

improvement opportunities. For example, if the professor only looks at “the number of missed incidents” as the performance indicator, potential opportunities for system improvement may be missed. This is because “the response time”, which is a key performance indicator, is not acknowledged here. A detailed audit of the system could suggest an improvement in defining the code performance indicators. In the case of this example, instead of only using “the number of missed incidents”, it is proposed to include “the response time” in the list of indicators in order to ensure a more comprehensive measurement of system performance.

Using product tracking was helpful to get better information about the system and find improvement opportunities. One of the examples of the audit findings that the auditor would not have found had he not gone through the product tracking, is that of the professor who forgot what changes he had made in the code when he was improving the review code. During this audit, the randomly selected review code sample was the project of the course. The professor thought that the projects were not part of the review code. After further investigation, the auditor found out that the professor added the projects to the review code but he forgot about the change. This instance suggested having a reminder about the codes and their updates.

6.5. Summary

The audit against the CMS (based on ISO 10001) and FHS (based on ISO 10002) was conducted in five different courses. The effectiveness of those systems was evaluated based on the standards. Moreover, the applicability of ISO 19011 in auditing against the guidance standards (ISO 10001 and ISO 10002) was studied. The audit showed that the documentation of the system should be improved in all of the five courses and minor adjustment required. Some improvement opportunities were suggested to improve the application of these two standards in engineering courses. For example, one improvement opportunity suggested was the design of a database to document the corrective and preventive actions, which were decided during the course or during the review of the system. Another opportunity was to use a suggestion or feedback link on the course

website in order to better gather the students' feedback regarding the course or the code implementation. The steps required to audit each system were studied based on the auditing standard and explained in this chapter. It showed that the principles of ISO 19011 in auditing could be used to audit the systems against ISO 10001 and ISO 10002.

ISO 19011 standard deals with the logistics of audit, like the steps required to systematically audit a system (Clause 6), and the competency of the auditor to audit against the standard (Clause 7). The logistics and the process of auditing could be used to audit any system against ISO 10001 and ISO 10002. The auditor training and work experience could be easily modified to match the required skills of the auditor to conduct an effective and efficient audit against the standards.

Chapter 7: Conclusion

7.1. Research findings

As was discussed in the introduction chapter of the thesis, quality management principles have been used in different aspects of higher education. Researchers have also studied the application of ISO quality management standards in different curriculum and administrative aspects of higher education. Some researchers also looked at the application of customer satisfaction standards in teaching to enhance the satisfaction of the students with the course delivery (Karapetrovic and Doucette, 2009; Karapetrovic, 2009; Karapetrovic, 2008a). Therefore, this research looked deeper into the application of two customer satisfaction standards (ISO 10001 and ISO 10002) in teaching courses. Moreover, the application of ISO 19011 in auditing against those two standards was studied. The results of the findings are explained in this chapter.

ISO 10001 provides guidelines to design a system and provide support for the professors to meet the promises that they made. It also helps the professors to improve the system by investigating missed promises and determining corrective actions.

ISO 10002, on the other hand, helps the professors address students' comments, feedback, or complaints and systematically improve the processes of teaching their courses. This standard provides the steps needed to receive and investigate the feedback, determine the appropriate response, and implement the chosen action.

This research studied the applicability of using these two standards to define a system in educational organizations (i.e., the teaching aspect). The implementation of the developed system in eight different undergraduate and graduate level courses in the Department of Mechanical Engineering at the University of Alberta was studied.

In each course, different promises were made to the students and the performance of the designed system in meeting them was studied. The professors who volunteered in this study chose between three different codes, which were pre-designed, and implemented the system. These three codes, as was discussed in Chapter Three, were:

- Response code: To respond to each email enquiry within a specific time period.
- Review code: To review and mark the coursework material within a specific time period.
- Schedule code: To teach the course material within an acceptable period as defined in the course outline.

A fourth code was developed as a result of student feedback. This “Evaluation code” provided marking criteria to the students within a specific time.

Each of the four codes defined above included the required information about the scope of the codes, the limitation of the code and the remedy determined in case of an unmet promise.

The method used to conduct this study started with developing system flowcharts, which followed the specific standard requirements. These flowcharts, with the documentation form templates, were passed to the professors participating in this study. The flowcharts were modified based on the systems the professors chose to implement in their courses. The professors’ performance in code implementation was gathered and recorded. The study took place in four semesters (fall 2008 to fall 2009) and five different professors implemented the system in their courses.

The study showed that, of all the response code implementations in the eight different courses, there was only one instance that the response code promise was not met. In addition, the review code promise was not met in four different instances. The main reason for unmet promises in this review code implementation (three of the instances) was the excessive workload of the professors or the teaching assistants. Therefore, they could not mark and hand back the coursework material to the students on time. The reason for the other instance was the unavailability of the professor to attend the class and distribute the coursework. The schedule code implementation in three different courses was performed successfully and no instance of missed code promise was recorded during the study.

Based on the students' comments and the survey results, the implementation of the codes was useful and the students suggested the use of these codes in other courses. For example, during the midterm survey, on average, 94% of students perceived the response code as useful.

The methodology for the application of ISO 10002 in engineering courses started with the development of a system flowchart. The relationships between the standard requirements and the steps of the processes were shown on the flowchart. This system was implemented in two different courses and it resulted in 18 feedbacks handled. The application of this system showed that documenting the feedbacks could result in improving the system and could be used to improve the process of teaching in future courses. For example, the availability of the course books in the bookstore could be managed in advance for future terms.

The applicability of the integrated system based on ISO 10001 and ISO 10002 was studied and the links between the processes were identified. For example, the feedbacks were acknowledged within a specific time as defined by the response code, or the CMS was improved based on the feedbacks handled with FHS. In addition, for the courses implemented both the CMS and FHS, the surveys and auditing of these systems were conducted at the same time.

Another objective of this thesis was to study the applicability of auditing the systems mentioned above by using the ISO 19011 auditing standard methodology. The required steps for auditing the systems were developed based on the requirements of the ISO 19011. Clause 6 of ISO 19011 provides required steps for the process of auditing which could be used to audit any system against any MSS. Clause 7 of ISO 19011 provides the required auditor's experience and knowledge of the standard. The auditing system, which was developed based on the ISO 19011 methodology, was used to audit the CMS and FHS. The systems' compliance with the standards was investigated and the recommendations for improvement were suggested.

7.2. *Lessons learned*

From the application of CMS in different courses, some difficulties were noticed. One of the difficulties was the professors' time for documentation. Due to the professors' workload during the semester, most of the professors could not satisfy all the standard requirements. For example, system documentation (e.g., documentation of the recourses used) was one of the main components that lacked in most of the professors' system and was spotted during the audits.

Another issue was the communication between the RA and the professors as the information sometimes was not communicated to the RA. For example, corrective actions in case of an unmet promise or reasons for an unmet promise were not sent to the RA. The professors' workload was the reason for poor communication between the RA and the professors. In future, a better communication between the professors and the RA should be established. An automated system for reporting the progress (e.g., schedule code progress after each class) would make it easier to monitor the code implementation. This could also result in a more efficient method of documenting and transferring information to the RA.

An additional issue was that the professors defined the codes' concepts differently. As was explained before, some professors defined review code as reviewing the correct answers, while others defined it as returning the course work back to the students. As suggested in Chapter Six, a more comprehensive definition of key terms (e.g., "review" means returning the marked coursework back to the students) is required for the codes so that the students have a better idea of what is being promised in the codes.

The FHS could be used for gathering feedbacks from students and addressing the issues. One of the important aspects that should be emphasized for future should be the use of a database for corrective actions. For example, if corrective actions were taken because of comment or feedback, the changes should be documented and reviewed repeatedly to remind the professor of the changes made. For addressing this issue, a database, which could be updated, based on the changes made as a result of preventive or corrective

action, should be created. The same database suggested above could be used for this purpose as well.

The FHS is useful in addressing the students' feedbacks. It gives students the information regarding the investigation and its results. The documentation of the actions taken could help the professor to be prepared for the future so that those issues are not repeated.

The QMS used by professors to improve the customer satisfaction has been implemented and the quality audit against the standards has shown that the systems need to be improved in different aspects. Three examples of those aspects are the documentation, the identification of the performance indicators for the system itself, and the managerial review of the system based on the indicators.

ISO 19011 could be used to audit the CMS, FHS, or the integrated system. The requirements of the ISO 19011 could be adapted in auditing the system against guidance standards (ISO 10001 and ISO 10002 in this study). Defining the auditing criteria and measuring the audit findings and requirements regarding the auditor's competency were the only modifications required in the auditing standard. The augmentative standards (e.g., ISO 10001) requirements could form audit criteria but the extent of the processes required is not as specific as assimilative standards (e.g., ISO 9001). For example, the ISO 10001 standard suggests a communication plan. The auditor would have to figure out if there is a communication plan but there is no need for documentation of the plan based on the standard. The audit against the integrated system was done with the same steps as auditing against only CMS, except where there is a link between those two aspects, like receiving feedback through email or corrective action affecting the CMS.

The professors' workload was again an issue in auditing the system. The professors were given the developed flowchart to modify based on their systems but due to their high workload, some of the professors were unable to do so. In this case, the auditor had to ask detailed questions to understand the system used. The modification of the system

flowchart would give the auditor a better idea of the system, and make analyzing the system and suggestions for improvement opportunities more effective.

7.3. Contributions

This study showed that ISO 10001 and ISO 10002 could be helpful in designing a system for students' satisfaction. Using these two standards in higher education courses would likely increase the students' satisfaction by making promises to the students about the minimum level of quality in the courses and assure the students that the professor would deal with their feedbacks and comments systematically.

Professors from different universities can use the CMS developed. This system could help the professors to increase the quality level of services they provide to the students. The same system could be used in different aspects of educational organizations as well.

The FHS would improve the teaching quality of the professors by continuously improving their teaching system. Documenting the feedbacks and using them in future could improve the teaching and learning aspects of the course. In addition, sharing the feedbacks made with other professors could increase the improvement opportunities in the system.

One of the contributions was the implementation of CMS and FHS systems based on the overall system flowchart in various courses by different professors which resulted in gathering information about the effectiveness of the system. During the implementation, data was collected regarding the performance of the professors and the student satisfaction with the systems.

The study of the applicability of ISO 19011 in auditing against the standards showed that this standard could not only be used for auditing against the ISO 9001 and ISO 14001 standards, but could also be used to design a system to audit any system against any standard with minor changes mentioned in this thesis. Using this study to modify the ISO

19011 could result in an auditing standard that could be applicable to systematically audit any system independent of the standard it is audited against.

7.4. *Limitations*

The limitations of this study are as follows:

- 1) The scope of this study was limited to the engineering courses in the Mechanical Engineering Department of the University of Alberta.
- 2) The methodology was only used by five different professors and was implemented in only eight courses in the department.
- 3) The feedback handling system was implemented in only two courses and by one professor.
- 4) The feedbacks, which were dealt with in the courses were only those that affect all the students in the courses.
- 5) The use of ISO 19011 only to develop an auditing system and not the auditor competency was studied.
- 6) The efficiency of the auditing procedures using ISO 19011 was not studied.

7.5. *Future research*

To improve and expand the research in this field, a few suggestions for future research are presented:

- 1) The study could be conducted in other departments of engineering, or the application of the developed system could be studied in non-engineering courses or other universities by a greater number and variety of professors.
- 2) The application of these standards could be studied in countries with a poor quality of higher education.
- 3) The potential use of these standards in different educational structures (e.g., distance learning) could be examined.
- 4) Comparison of the professors' performance in responding to the emails, reviewing the coursework, or teaching based on the scheduled classes, should be conducted for the professors who are implementing the system and for the

- professors who are not. Consequently, the effectiveness of the system in improving the quality of the course delivery could be studied.
- 5) The application of an ISO 10002-based system in addressing all the students' concerns and feedback and not only specific feedbacks should be evaluated.
 - 6) The research for designing and creating an information system to collect and inform the professors about the corrective actions or preventive actions or any improvement of the system, based on the FHS and management review of the system, should be conducted.
 - 7) The applicability of the developed system in helping the professors to develop a new code or promise to the student should be investigated in detail.
 - 8) The auditors' qualification for auditing the system against the ISO 10001 and ISO 10002 should be studied and defined.
 - 9) The efficiency of the auditing steps and collecting information should be studied and improved.

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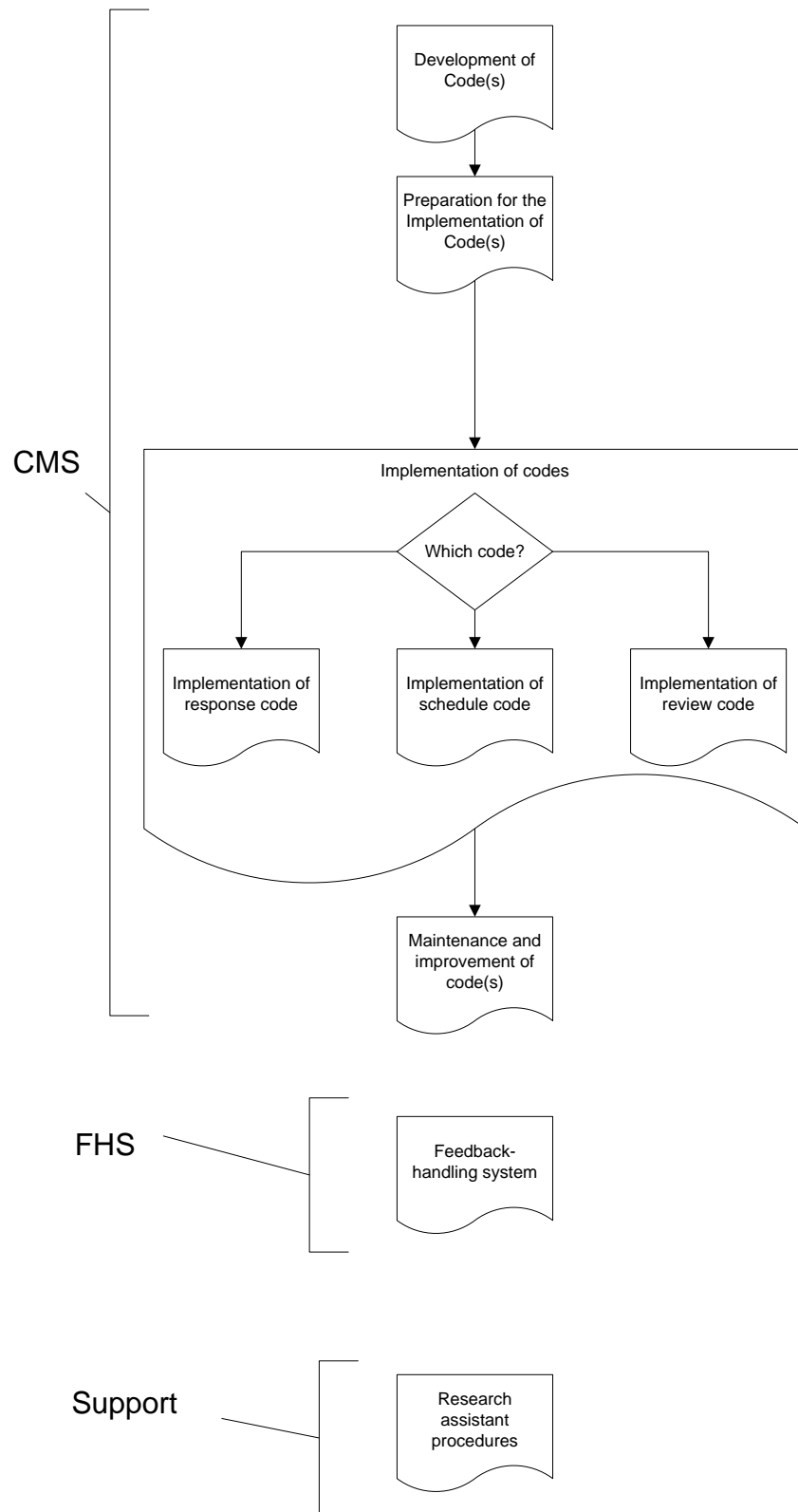
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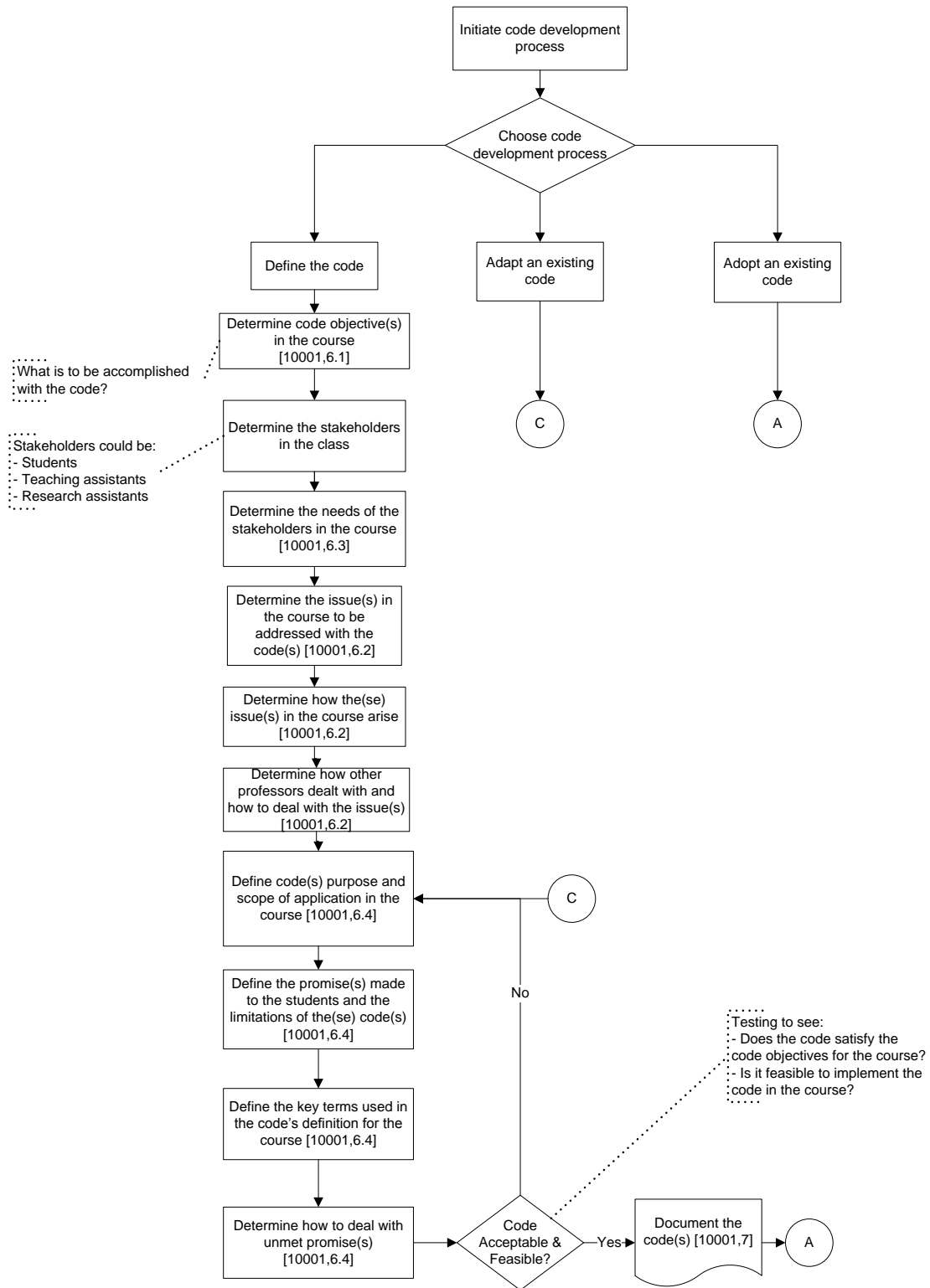
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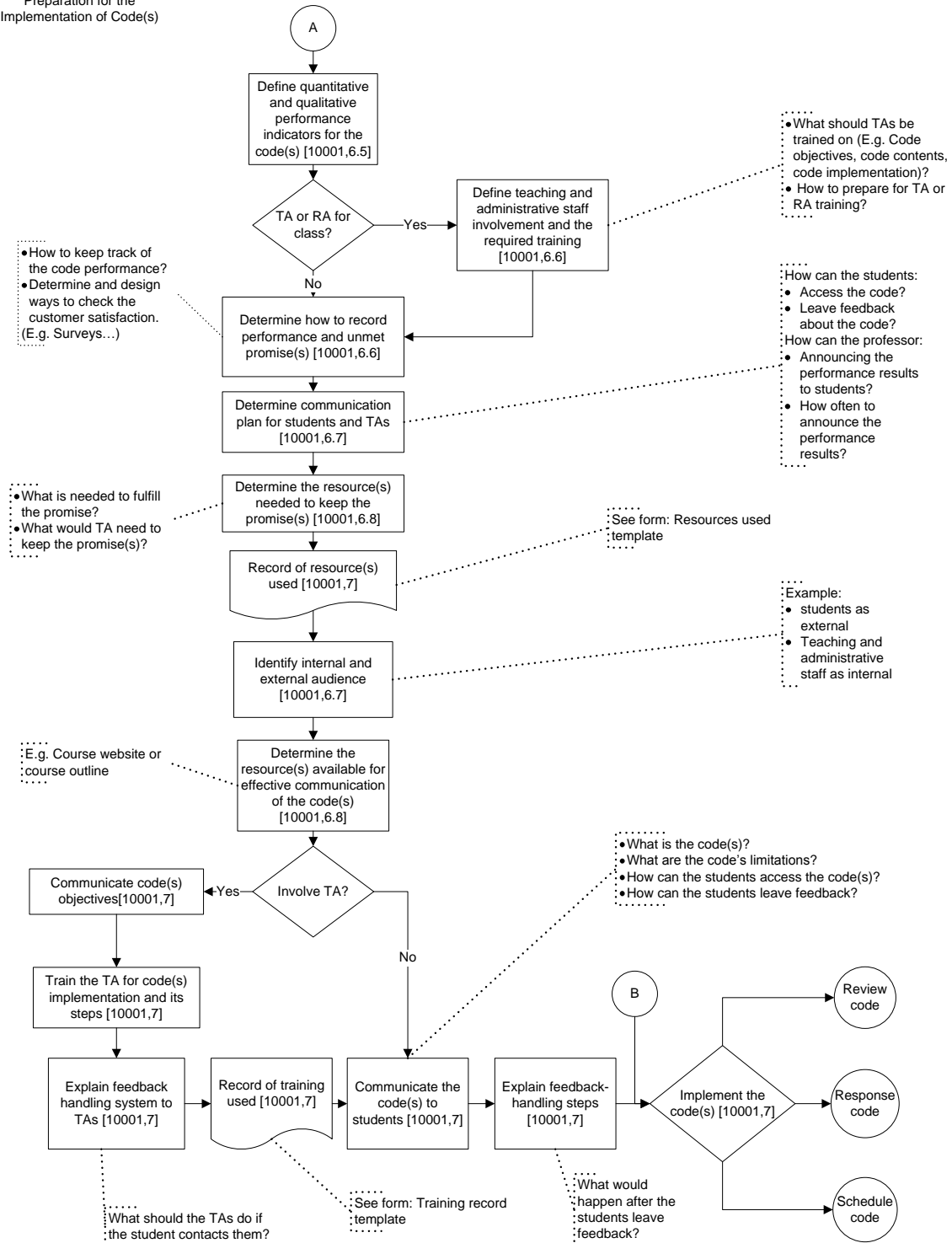
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Appendix A: System flowchart

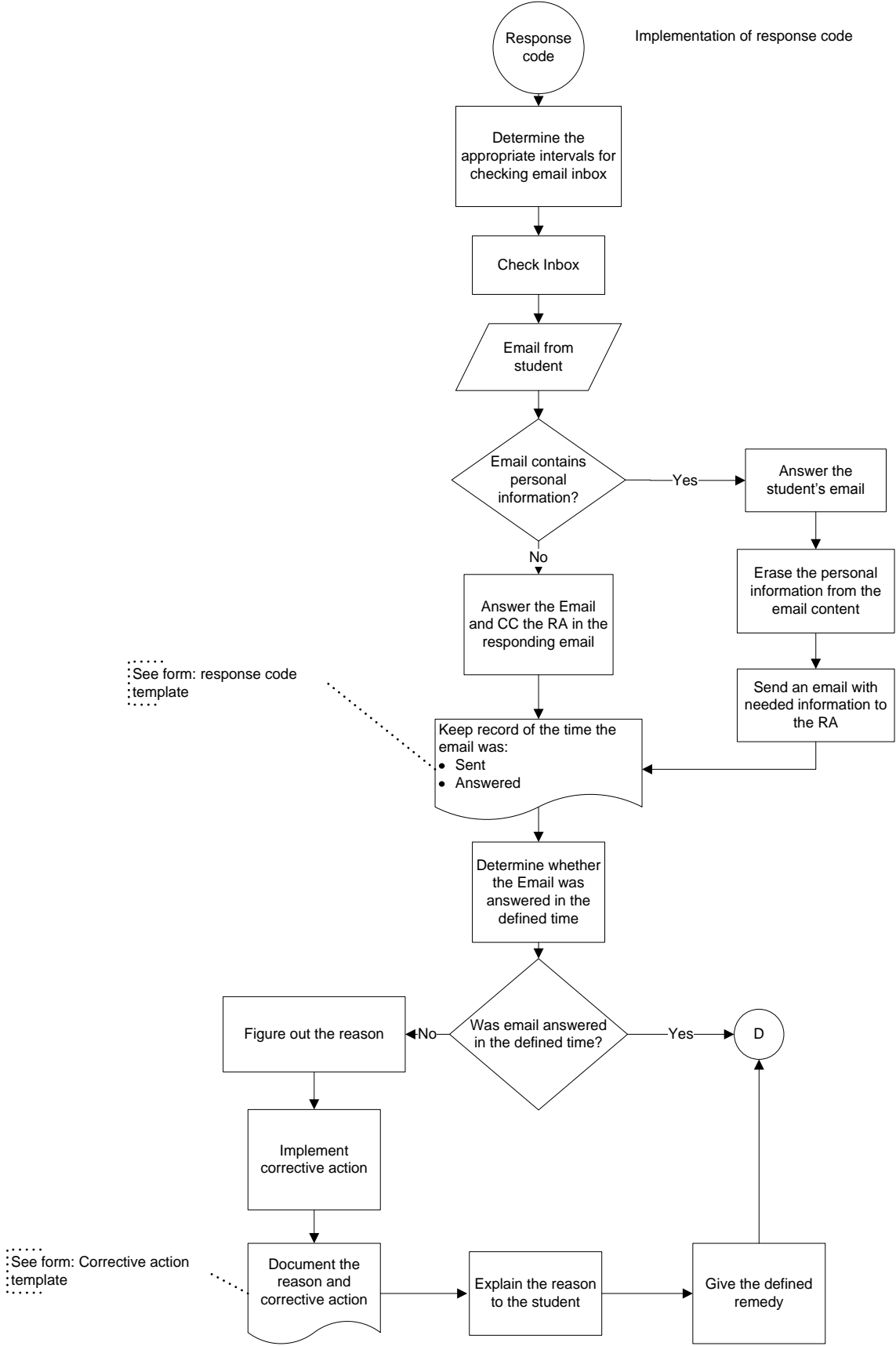




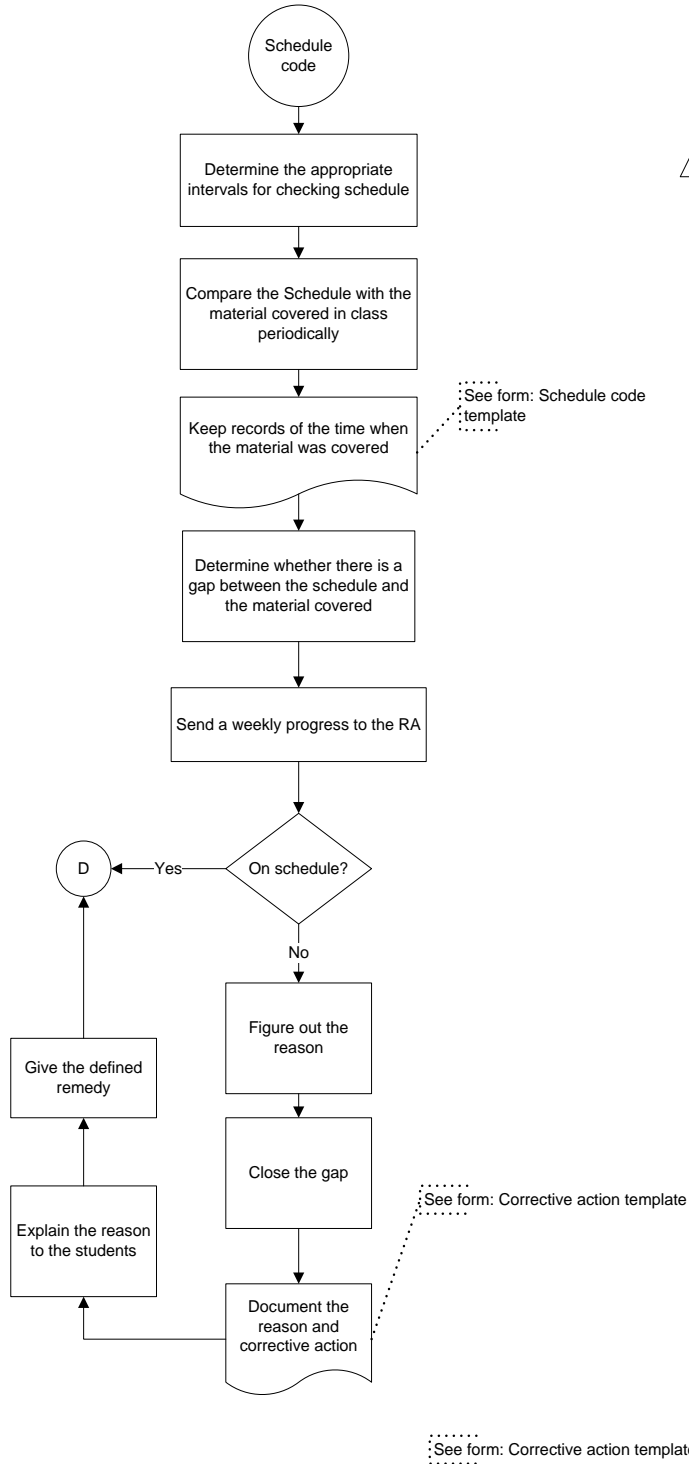
Preparation for the Implementation of Code(s)



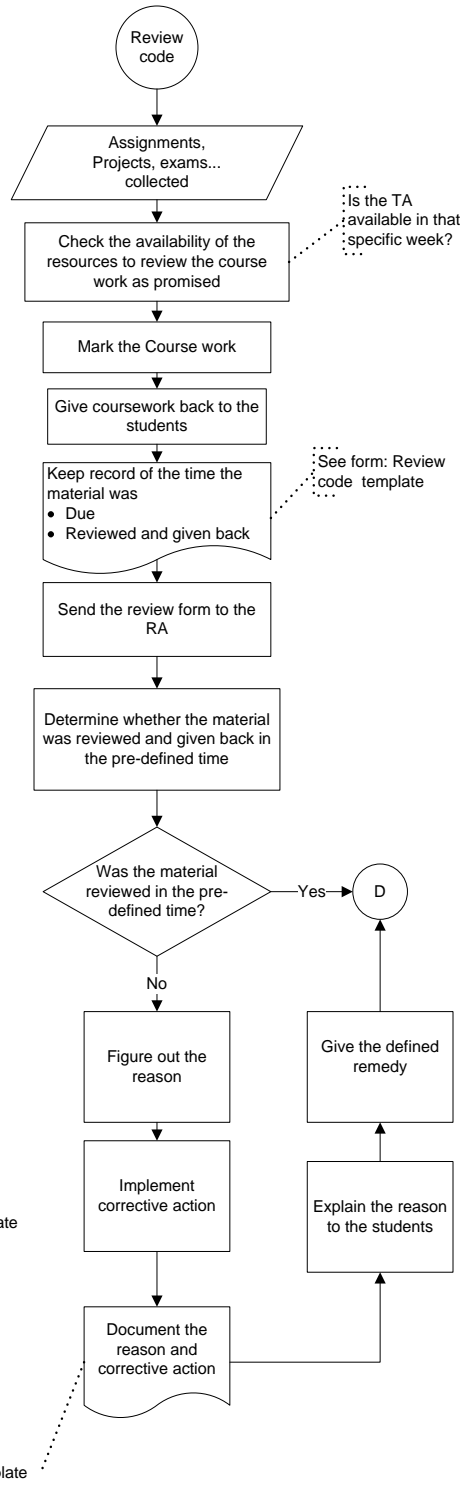
Implementation of response code



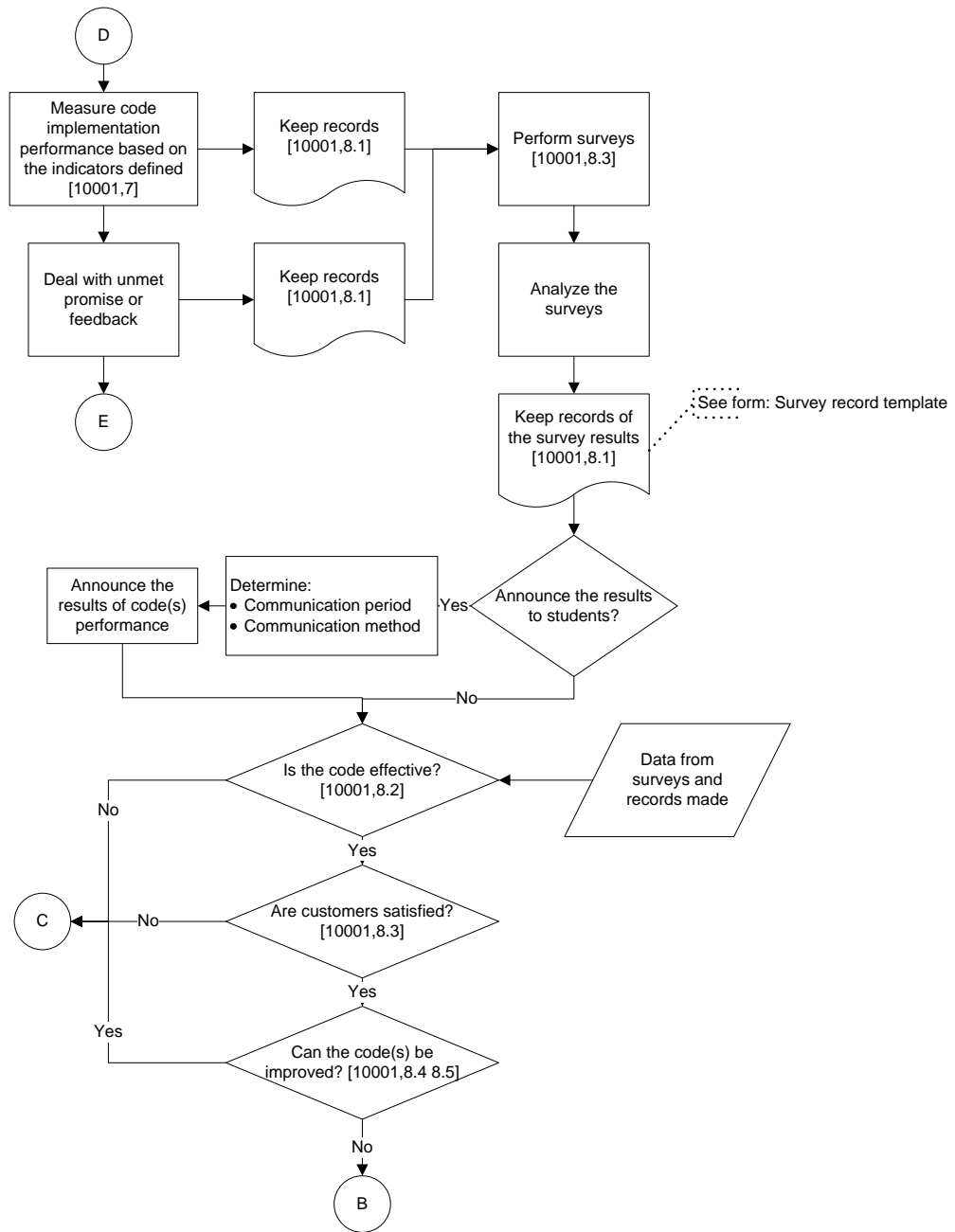
Implementation of schedule code



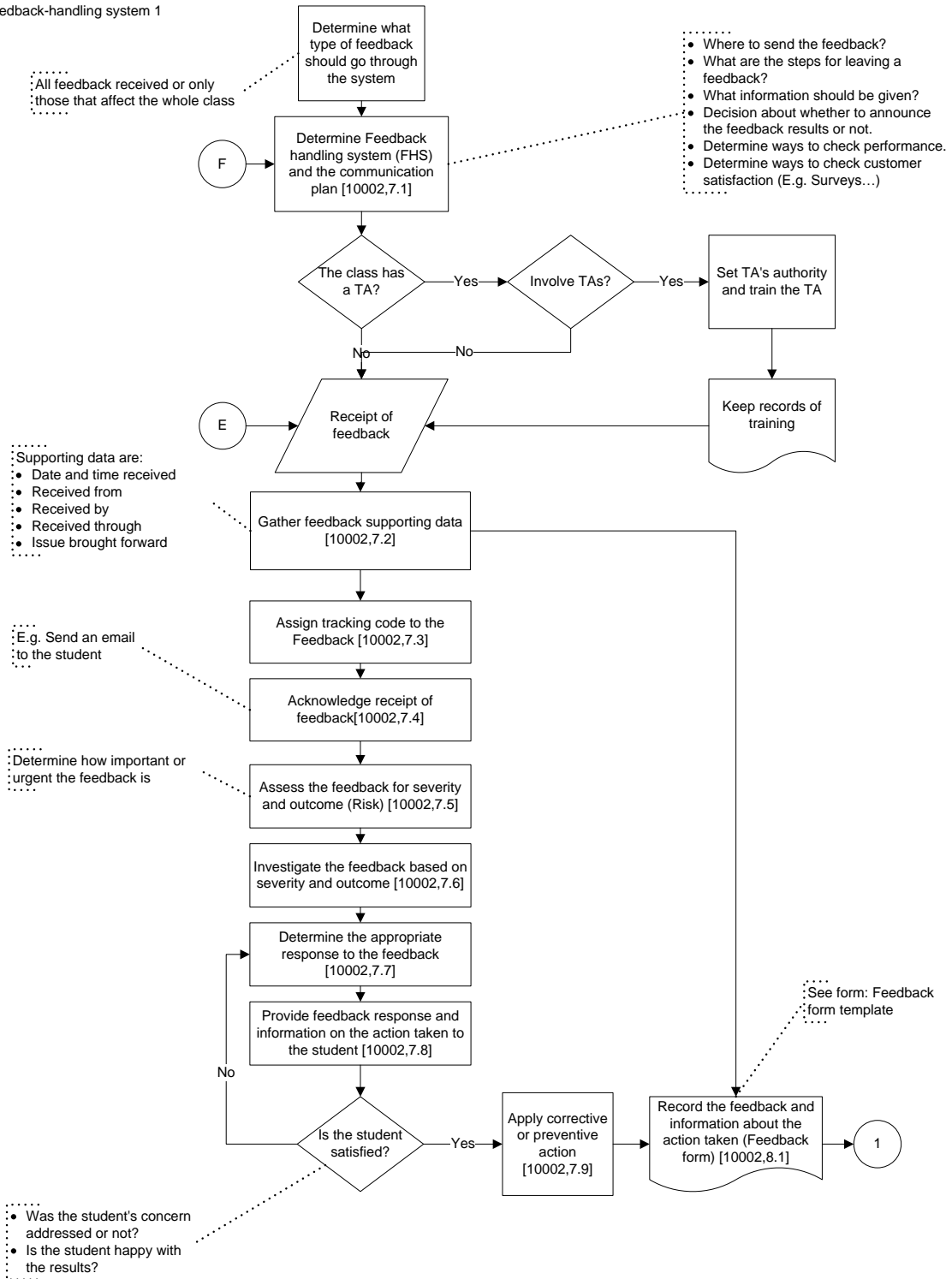
Implementation of review code

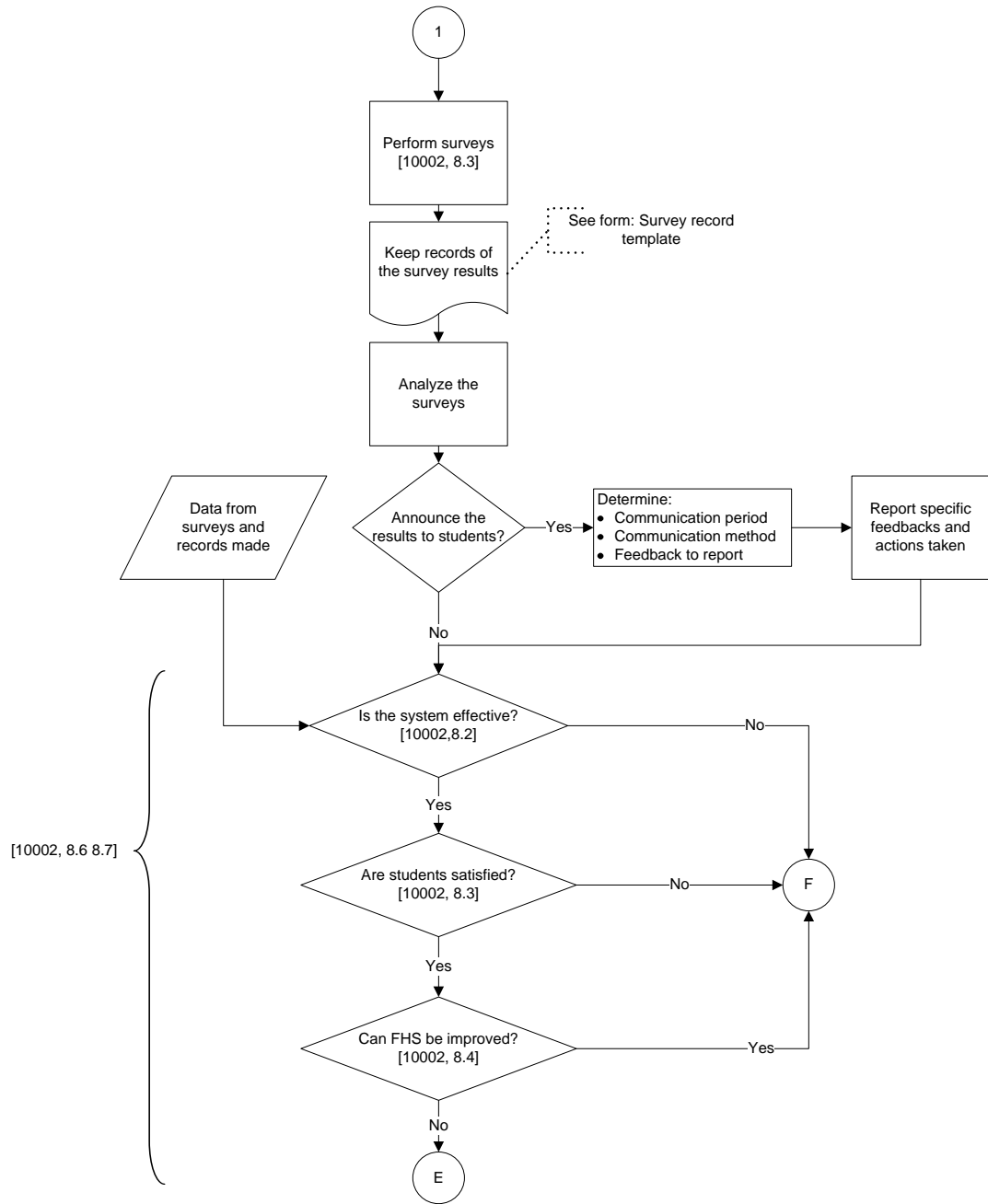


Maintenance and improvement of code(s)



Feedback-handling system 1





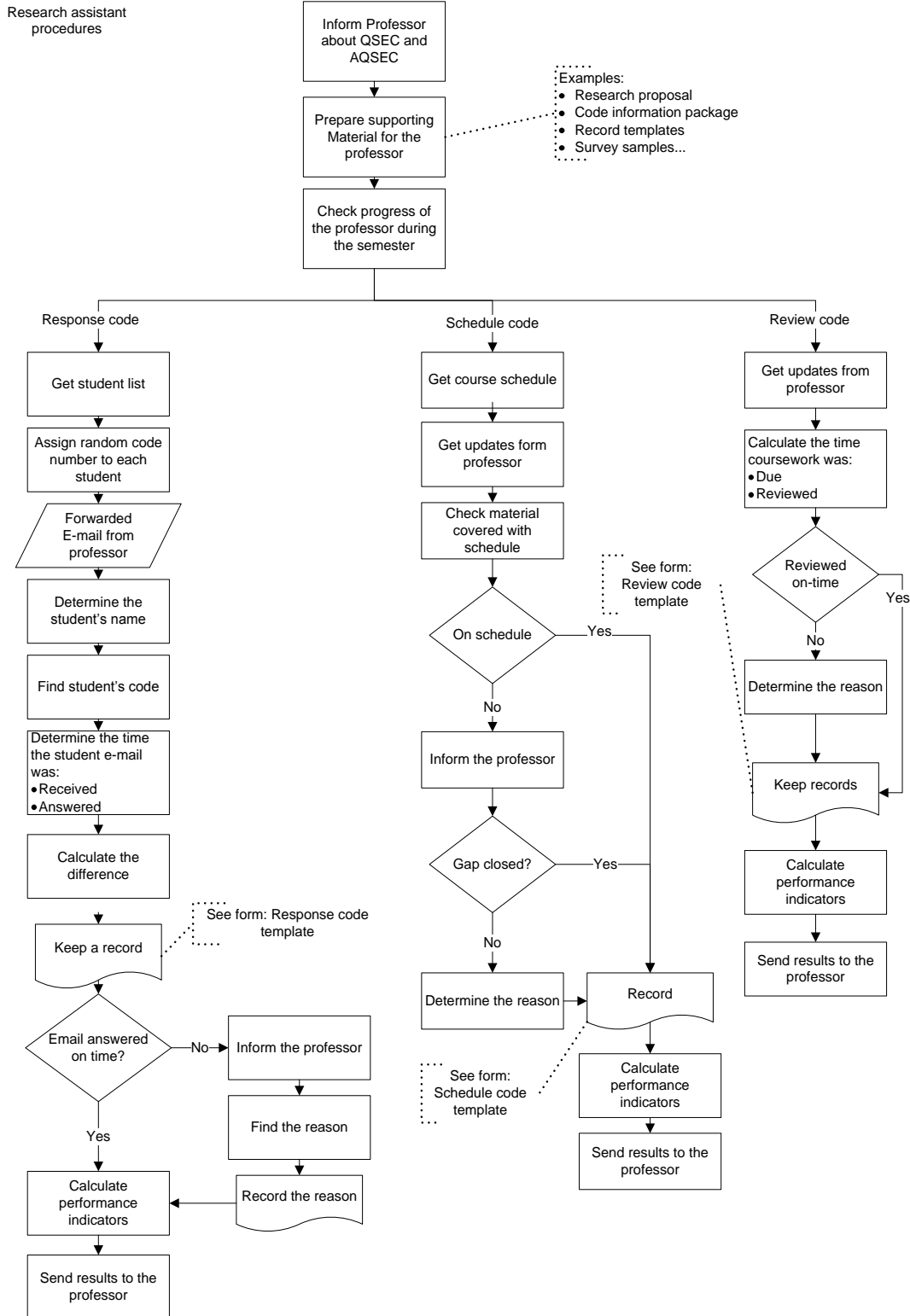


Figure A-1: System flowchart

Appendix B: Midterm and final survey results

Question#	SD	D	N	A	SA	Total answers	Median
Part (a): respond code							
1. I was well-informed about the existence and the content of the code	0	0	0	12	19	31	4.59
2. I was well-informed about the professor's performance on the code	0	0	4	13	14	31	4.38
3. The 24-hour time limit for the response is appropriate.	0	0	0	13	18	31	4.64
4. Public explanation is an appropriate redress action for this code	0	0	2	13	15	30	4.37
5. The professor provided effective responses to my questions.	0	0	0	12	18	30	4.58
6. The professor provided comprehensive responses to my questions	0	0	1	11	19	31	4.59
7. This code effectively responded to my needs for a timely response	0	0	1	10	20	31	4.61
8. I recommend the use of this code in other courses	0	0	3	8	20	31	4.61
Part (b): review code							
1. I was well-informed about the existence and the content of the code.	0	0	1	13	18	32	4.56
2. I was well-informed about the professor's performance on the code.	0	0	2	14	16	32	4.38
3. Time limits stated in the code are appropriate	0	0	0	13	19	32	4.58
4. This code effectively responded to my needs regarding material review	0	0	0	13	19	32	4.58
5. I recommend the use of this code in other courses.	0	0	2	8	22	32	4.64

Table B-1: Class A final survey result

Midterm Survey Results

Total number of students participated	36
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Number of students	Aware	Not aware	No answer	Useful	Not useful	No answer
Before and after	N/A	N/A	N/A	15	13	3
24 hour response	32	2	2	30	2	4
Review code	29	6	1	26	2	8

Percentage*	Aware	Useful
Before and after	N/A	54%
24 hour response	94%	94%
Review code	83%	93%

Comment:

Percentage is calculated based on number of students that answered the question as either Aware/Not aware or Useful/Not useful excluding students who didn't answer

Table B-2: Course B midterm survey result

Questions		SD	D	N	A	SA	Total	Median
A1	I was well informed about the existence and the content of the code	0	0	1	14	26	41	4.61
A2	I was well-informed about the professor's performance on the code.	0	4	4	17	16	41	4.24
A3	The 24-hour time limit for the response is appropriate.	0	0	1	16	24	41	4.57
A4	Explanation and snack is an appropriate redress action for this code	0	1	5	19	15	40	4.26
A5	The professor provided effective responses to my questions	0	0	8	13	20	41	4.46
A6	The professor provided comprehensive responses to my questions	0	0	9	15	17	41	4.27
A7	This code effectively responded to my needs for a timely response	0	1	5	19	16	41	4.26
A8	I recommend the use of this code in other courses	0	0	3	17	21	41	4.51
Review code								
B1	I was well-informed about the existence and the content of the code.	1	1	4	18	17	41	4.31
B2	I was well-informed about the professor's performance on the code	0	1	7	18	15	41	4.19
B3	Time limits stated in the code are appropriate	0	0	5	20	16	41	4.28
B4	This code effectively responded to my needs regarding material review	0	4	5	17	15	41	4.18
B5	recommend the use of this code in other courses	0	3	6	16	16	41	4.22

Table B-3: Course B final survey result

Midterm Survey Results

Total number of students Participated	104
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Numebr of students	Aware	Not aware	No answer	Useful	Not useful	No answer
Response code	87	16	1	80	6	17
Review code	63	39	2	63	8	33
Schedule code	47	55	2	49	10	45
Optional feedback assignment	76	26	2	75	6	23

Percentage*	Aware	Useful
Response code	84%	93%
Review code	62%	89%
Schedule code	46%	83%
Optional feedback assignment	75%	93%

Number of students	
Plan on submitting Feedback assignment	76

Comment:

Percentage is calculated based on number of students that answered the question as either Aware/Not aware or Useful/Not useful excluding students who didn't answer

Table B-4: Course C midterm survey result

Questions	SD	D	N	A	SA	Total	Median
Schedule code							
A1 I was well informed about the existence and the content of the code	0	2	10	58	49	119	4.30
A2 I was well-informed about the professor's performance on the code.	0	4	22	55	38	119	4.10
A3 The 24-hour time limit for the response is appropriate.	0	1	4	52	62	119	4.50
A4 Explanation and snack is an appropriate redress action for this code	6	5	16	55	37	119	4.10
A5 The professor provided effective responses to my questions	0	2	30	51	35	118	4.00
A6 The professor provided comprehensive responses to my questions	0	4	36	44	34	118	3.90
A7 This code effectively responded to my needs for a timely response	0	1	27	47	44	119	4.20
A8 I recommend the use of this code in other courses	1	3	14	48	53	119	4.40
Review code							
B1 I was well-informed about the existence and the content of the code.	2	6	23	55	33	119	4.00
B2 I was well-informed about the professor's performance on the code	2	6	28	51	32	119	4.00
B3 Time limit for the variation in the schedule is appropriate	1	3	26	51	38	119	4.10
B4 This code effectively responded to my needs regarding material coverage	0	2	34	46	34	116	4.00
B5 I recommend the use of this code in other courses.	1	3	34	45	36	119	4.00
Optional feedback assignment							
C1 I was well-informed about the existence and the content of the code.	4	19	25	48	22	118	3.70
C2 I was well-informed about the professor's performance on the code	4	15	34	45	21	119	3.60
C3 Time limits stated in the code are appropriate	2	7	38	47	24	118	3.80
C4 This code effectively responded to my needs regarding material review	1	8	43	43	24	119	3.70
C5 I recommend the use of this code in other courses	2	4	44	36	31	117	3.70

Table B-5: Course C final survey result

Midterm survey results

Number of students	Aware	Not aware	No answer	Useful	Not useful	No answer
Response code	18	0	1	19	0	0
Schedule code	12	6	1	13	1	5
Review code	10	8	1	9	3	7
Customer feedback forms	12	6	1	11	1	7

Percentage*	Aware	Useful
Response code	100%	100%
Schedule code	67%	93%
Review code	56%	75%
Customer feedback forms	67%	92%

Comment:

Percentage is calculated based on number of students that answered the question as either Aware/Not aware or Useful/Not useful excluding students who didn't answer

Table B-6: Course D midterm survey result

Questions	SD	D	N	A	SA	Total	Median	
A1	I was well informed about the existence and the content of the code	0	0	0	2	18	20	4.72
A2	I was well-informed about the professor's performance on the code.	0	0	2	10	8	20	4.30
A3	The 24-hour time limit for the response is appropriate.	0	0	0	6	14	20	4.64
A4	Explanation and snack is an appropriate redress action for this code	0	1	1	10	7	19	4.25
A5	The professor provided effective responses to my questions	0	0	1	9	10	20	4.50
A6	The professor provided comprehensive responses to my questions	0	0	2	6	12	20	4.58
A7	This code effectively responded to my needs for a timely response	0	0	1	7	12	20	4.58
A8	I recommend the use of this code in other courses	0	0	3	3	14	20	4.64
Schedule code								
B1	I was well-informed about the existence and the content of the code.	0	0	2	9	9	20	4.39
B2	I was well-informed about the professor's performance on the code	0	0	3	9	8	20	4.28
B3	One lecture hour limit for the variation in the schedule is appropriate	0	0	2	9	9	20	4.39
B4	This code effectively responded to my needs regarding material coverage	2	0	3	10	5	20	4.00
B5	I recommend the use of this code in other courses.	0	0	2	9	9	20	4.39
Review code								
C1	I was well-informed about the existence and the content of the code.	0	0	2	11	7	20	4.23
C2	I was well-informed about the professor's performance on the code	0	0	1	11	8	20	4.32
C3	Time limits stated in the code are appropriate	0	0	2	9	9	20	4.39
C4	This code effectively responded to my needs regarding material review	1	0	2	12	5	20	4.08
C5	recommend the use of this code in other courses	0	1	1	8	10	20	4.50

Table B-7: Course D final survey result

Midterm Survey Results

Number of students	Aware	Not Aware	No answer	Useful	Not useful	No answer
Response code	22	3	0	18	3	4
Schedule code	16	8	1	14	6	5
Review code	15	10	0	16	6	3

Percentage*	Aware	Useful
Response code	88%	86%
Schedule code	67%	70%
Review code	60%	73%

Comment:

Percentage is calculated based on number of students that answered the question as either Aware/Not aware or Useful/Not useful excluding students who didn't answer

Table B-8: Course E midterm survey result

questions	SD	D	N	A	SA	Total	Median
A1 I was informed about the existence and the content of the code	1	0	0	13	14	28	4.5
A2 I am aware of the professor's performance on the code.	1	2	6	14	4	27	3.8
A3 The 24-hour time limit for the response is appropriate.	0	0	6	14	8	28	4.1
A4 Explanation and snack is an appropriate redress action for this code	2	2	4	15	4	27	3.9
A5 The professor provided effective responses to my questions	0	0	8	14	5	27	3.9
A6 The professor provided comprehensive responses to my questions	0	0	8	13	5	26	3.9
A7 This code effectively responded to my needs for a timely response	0	0	7	13	6	26	4.0
A8 I recommend the use of this code in other courses	1	1	2	16	7	27	4.1
Schedule code							
B1 I was informed about the existence and the content of the code.	2	1	1	18	6	28	4.1
B2 I am aware of the professor's performance on the code	0	0	7	15	5	27	3.9
B3 Time limits for the variation in the schedule is appropriate	1	1	7	15	3	27	3.8
B4 This code effectively responded to my needs regarding material coverage	1	2	5	16	3	27	3.8
B5 I recommend the use of this code in other courses.	3	1	6	15	3	28	3.8
Review code							
C1 I was informed about the existence and the content of the code.	3	2	2	17	4	28	3.9
C2 I am aware of the professor's performance on the code	1	2	6	16	2	27	3.8
C3 Time limits stated in the code are appropriate	0	0	9	16	1	26	3.8
C4 This code effectively responded to my needs regarding material review	1	1	8	15	2	27	3.7
C5 I recommend the use of this code in other courses	1	1	8	14	3	27	3.8

Table B-9: Course E final survey result

MIDTERM SURVEY RESULTS

	Aware	Not aware	No answer	Useful	Not useful	No answer	Percentage
24-hour response	29	0	3	31	1	0	96.9
Schedule code	24	5	3	21	7	4	75
Review code	23	7	2	18	8	6	69.2
Customer feedback forms	25	4	3	24	4	4	85.7

	Aware	Useful
24-hour response	100%	97%
Schedule code	83%	75%
Review code	77%	69%
Customer feedback forms	86%	86%

Comment:

Percentage is calculated based on number of students that answered the question

As either Aware/Not aware or Useful/Not useful excluding students who did not answer

Table B-10: Course F midterm survey result

Questions	SD	D	N	A	SA	Total	Median
(a) With respect to the "24-Hour Response" Code:							
1. I was well-informed about the existence and the content of the code	0	0	0	4	20	24	4.70
2. I was well-informed about the professor's performance on the code	0	0	2	8	14	24	4.57
3. The 24-hour time limit for the response is appropriate	0	0	1	7	16	24	4.63
4. Explanation and snack is an appropriate redress action for this code	0	2	2	7	13	24	4.54
5. The professor provided effective responses to my questions	1	0	3	7	12	23	4.43
6. The professor provided comprehensive responses to my questions	1	0	3	9	11	24	4.39
7. This code effectively responded to my needs for a timely response	1	0	1	8	14	24	4.57
8. I recommend the use of this code in other courses.	0	1	1	10	12	24	4.50
(b) With respect to the "Schedule" Code:							
1. I was well-informed about the existence and the content of the code	0	0	3	12	9	24	4.25
2. I was well-informed about the professor's performance on the code	0	0	4	11	8	23	4.18
3. Time limits for the variation in the schedule are appropriate	0	0	5	11	6	22	4.05
4. This code effectively responded to my needs regarding material coverage	1	0	7	11	4	23	3.82
5. I recommend the use of this code in other courses.	1	0	4	9	9	23	4.22
(c) With respect to the "Review" Code:							
1. I was well-informed about the existence and the content of the code.	0	0	1	11	11	23	4.45
2. I was well-informed about the professor's/ TA's performance on the code.	0	0	3	10	10	23	4.35
3. Time limits stated in the code are appropriate.	1	1	3	11	7	23	4.09
4. This code effectively responded to my needs regarding material review.	1	1	3	9	9	23	4.22
5. I recommend the use of this code in other courses.	0	1	4	6	12	23	4.52
(d) With respect to the "Evaluation" Code:							
1. I was well-informed about the existence and the content of the code.	0	0	3	11	10	24	4.32
2. I was well-informed about the professor's performance on the code.	0	1	5	11	7	24	4.05
3. Time limits stated in the code are appropriate.	0	0	6	13	5	24	3.96
4. This code effectively responded to my needs regarding material marking.	1	1	5	12	5	24	3.92
5. I recommend the use of this code in other courses.	0	0	4	10	10	24	4.30
(e) With respect to the "Feedback Forms":							
1. I was well-informed about the existence and the content of these forms	0	0	3	10	11	24	4.40
2. these forms effectively illustrate professor's actions on the student feedback	0	1	3	12	8	24	4.17
3. I recommend the use of these forms in other courses	0	0	4	8	12	24	4.50

Table B-11: Course F final survey result

MIDTERM SURVEY RESULTS

	Aware	Not aware	No answer	Total
24 hour response code awareness	69	2	1	72
	Aware	Not aware	No answer	
Review code Awareness	48	24	0	72
	Useful	Not useful	No answer	
24 hour response code Usefulness	68	3	1	72
	Useful	Not useful	No answer	
review code usefulness	48	6	18	72

	Awareness	usefulness
24-hour response code	97%	96%
Review code	67%	89%

Comment:

Percentage is calculated based on number of students that answered the question as either Aware/Not aware or Useful/Not useful excluding students who didn't answer

Table B-12: Course G midterm survey result

Final survey results

Question#	SD	D	N	A	SA	Total answers	Median
Part (a): respond code							
1. I was well-informed about the existence and the content of the code	1	0	1	18	38	58	4.62
2. I was well-informed about the professor's performance on the code	1	1	9	28	18	57	4.13
3. The 24-hour time limit for the response is appropriate.	0	0	2	17	39	58	4.63
4. Public explanation is an appropriate redress action for this code	1	3	15	28	8	55	3.80
5. The professor provided effective responses to my questions.	0	0	12	15	28	55	4.51
6. The professor provided comprehensive responses to my questions	0	0	12	17	26	55	4.41
7. This code effectively responded to my needs for a timely response	0	0	5	18	32	55	4.57
8. I recommend the use of this code in other courses	0	0	2	16	40	58	4.64
Part (b): review code							
1. I was well-informed about the existence and the content of the code.	1	2	7	27	21	58	4.20
2. I was well-informed about the professor's performance on the code.	1	1	10	29	17	58	4.09
3. Time limits stated in the code are appropriate	0	1	7	24	26	58	4.38
4. This code effectively responded to my needs regarding material review	0	0	10	21	27	58	4.40
5. I recommend the use of this code in other courses.	0	0	10	19	29	58	4.50

Table B-13: Course G final survey result

MIDTERM SURVEY RESULTS

	Aware	Not aware	No answer	Total
48-hour Response Code Awareness	10	6	1	17
Review Code Awareness	7	9	1	17
	Useful	Not useful	No answer	
48-hour Response Code Usefulness	12	1	4	17
Review Code Usefulness	10	1	6	17

	Awareness	usefulness
48-hour Response Code	63%	92%
Review Code	44%	91%

Comment:

Percentage is calculated based on number of students that answered the question as either Aware/Not aware or Useful/Not useful excluding students who didn't answer

Table B-14: Course H midterm survey result

FINAL SURVEY RESULTS

Question#	SD	D	N	A	SA	Total answers	Median
Part (a): respond code							
1. I was well-informed about the existence and the content of the code	0	1	2	9	4	16	4.06
2. I was well-informed about the professor's performance on the code	0	1	3	10	2	16	3.90
3. The 24-hour time limit for the response is appropriate.	0	0	2	10	4	16	4.10
4. Public explanation is an appropriate redress action for this code	0	1	4	8	3	16	3.88
5. The professor provided effective responses to my questions.	0	0	0	11	5	16	4.23
6. The professor provided comprehensive responses to my questions	0	0	1	11	4	16	4.14
7. This code effectively responded to my needs for a timely response	0	0	3	9	4	16	4.06
8. I recommend the use of this code in other courses	0	0	2	9	5	16	4.17
Part (b): review code							
1. I was well-informed about the existence and the content of the code.	1	0	5	9	1	16	3.72
2. I was well-informed about the professor's performance on the code.	1	0	5	8	2	16	3.75
3. Time limits stated in the code are appropriate	0	0	4	11	1	16	3.86
4. This code effectively responded to my needs regarding material review	0	0	3	11	2	16	3.95
5. I recommend the use of this code in other courses.	0	0	5	10	1	16	3.80

Table B-15: Course H final survey result

Appendix C: Audit questions

Audit questions (Professor Questionnaire):

A. General code preparation questions

1. What are the codes and promises that you made to the students?
2. What are the limitations on your code implementation?
3. How would you deal with unmet promise?
4. Are they all defined in the code? (Ask to see the codes and verify them)
5. How did you inform the students about the codes and promises?
6. Where and how can students access the codes?
7. How do you check to see if the codes were implemented successfully?
(What are the code performance indicators that the professor uses?)
8. How is the TA involved in codes implementation?
9. How were TAs been informed and trained on the code implementation?
10. How were the TAs' trainings been recorded?
11. How did you inform the students about the code performance? (How and how often?)
12. What resources did you use to implement the codes? How did you record them?
13. How was the students' satisfaction with the codes implementation being measured? (...Survey)
14. Has the code or promise been improved during the semester? What was improved? What was the trigger for change? How did you record the improvements of codes?
15. How do you deal with the feedbacks on the course or codes?

B. Response code implementation questions

1. How do you make sure that the questions are answered in [*pre-defined time interval*]?
2. How do you record the response time?
3. What is the process after an email was received? (What would happen after an email was received?)

4. What are the equipments that you use for response code?
5. How do you record the resources used for implementation?
6. Have there been any missed promises? What was the reason? How did you make sure that it doesn't happen again? (What were the measures you take to stop it from happening again?)
7. How do you keep record of Corrective or preventive actions when you improve the code?

C. Review code implementation questions

1. How do you make sure that the course materials were reviewed in [*pre-defined time interval*]?
2. How do you record the performance on review code?
3. Have there been any missed promises? What was the reason? How did you make sure that it doesn't happen again? (What were the measures you take to stop it from happening again?)
4. How do you keep record of Corrective or preventive actions when you improve the code?

D. Schedule code implementation questions

1. How do you record the performance on Schedule code?
2. Have there been any missed promises? What was the reason? How did you make sure that it doesn't happen again? (What were the measures you take to stop it from happening again?)
3. How do you keep record of Corrective or preventive actions when you improve the code?
4. How do you make sure that the gaps between the schedule and covered material in class were closed?

E. Feedback system implementation questions

1. What kind of feedback goes through the feedback handling system (FHS)?
[All of them or just the ones that has impact on all the students?]

2. What happens after you receive a feedback or a question that is going through the FHS? [What are the procedures that it goes through?
3. What are the resources used in FHS? How do you record the resources used?
4. What is the TA involvement in the FHS?
5. How did you train the TA and how did you keep record of that?
6. How do you record the feedbacks? (Ask to see an example)
7. How do you make sure that all the feedbacks are taken care of?
8. How do you keep a record of the corrective or preventive actions taken?
9. How does the student satisfaction with the FHS is been evaluated?
10. What would happen if the student is not satisfied with the response of the feedback?
11. How do you inform the students about the changes made because of FHS?
12. Has the FHS processes been changed during semester? What was the change? What was the trigger for change?

F. Teaching assistants audit questions (TA Questionnaire):

1. How well do you know about the code and code implementation?
2. What is the extent of your authority in code implementation?
3. How have you been trained on the code and its processes?
4. How do you make sure to meet the code requirements?
5. How do you review the code and its performance?
6. How do you track and keep record of the improvement opportunities, corrective and preventive actions, code performance, and unmet promise?
7. How do you deal with unmet promise?

Appendix D: Feedback forms

Textbook availability

DATE & TIME RECEIVED:	5 January 2009 at 15:13:49
RECEIVED FROM:	One student
RECEIVED BY:	professor C
RECEIVED THROUGH:	Email sent from the student
ISSUE BROUGHT FORWARD:	Textbooks are not available in the bookstore
ISSUE ACKNOWLEDGED:	Email response (05 Jan 2009 at 15:35:39)
INITIAL ASSESSMENT:	Textbooks contain reading material for the course and students need to have the textbook by 15 January 2009 for the first reading.
INITIAL ACTION:	Appropriate consultations were made with the bookstore, resulting in an explanation that there are not enough copies of the textbooks in the bookstore but additional copies was ordered from the publisher, which should arrive by January 13 th .
INITIAL RESPONSE:	Announcement in class on 08 January 2009 about the existence of the issue before and also actions taken to prevent it from happening again but yet failure to prevent it from happening again in this semester and also the approximate time of receiving the first and second textbook for the semester.
INVESTIGATION:	Not applicable
FURTHER ACTION:	Announcement through email about the receipt of the textbooks and availability of those in the bookstore
FURTHER RESPONSE:	An email was sent to students about the availability of the first textbook on 14 January 2009 at 17:54:52 and also information about the time that the second textbook will be available
RESOLUTION STATUS:	Closed
CORRECTIVE ACTION:	Not applicable

* Modified from ISO 10002: 2004 (Annex D)

Access to Standards

DATE & TIME RECEIVED: 23 January 2009 at 16:36:34

RECEIVED FROM: One student

RECEIVED BY: professor C

RECEIVED THROUGH: Email sent from the student

ISSUE BROUGHT FORWARD: Not being able to access the online standard documents.

ISSUE ACKNOWLEDGED: Email response, 23 January 2009 at 23:51:40

INITIAL ASSESSMENT: Ability to access the standards is important for reading the material in and outside class. Specific standards are required readings in the course. A problem with a specific browser that was detected in the last offering of the course was mentioned in class on January 22.

INITIAL ACTION: Potential reasons for students not being able to access the standards and problems that were detected earlier about the use of the browser software were gathered.

INITIAL RESPONSE: An email (response email, 23 January 2009 at 23:51:40) was sent to the student with two suggestions on preventing the problem through:

- The use of a different browser, and
- The established sequence of links once logged on to the standards site.

INVESTIGATION: Not applicable

FURTHER ACTION: Not applicable

FURTHER RESPONSE: Not applicable

RESOLUTION STATUS: The student was able to access the standards after following the steps and an email was sent to the professor and informed him about the results (26 January 2009 at 13:20:30).

CORRECTIVE ACTION: The professor will mention the way to access the standards with Firefox and through site links to the students in future courses.

* Modified from ISO 10002: 2004 (Annex D)

Receiving e-mails

DATE & TIME RECEIVED:	23 January 2009 at 22:12:23
RECEIVED FROM:	One student
RECEIVED BY:	professor C
RECEIVED THROUGH:	Email sent from student
ISSUE BROUGHT FORWARD:	The student never received the e-mail explaining class schedule.
ISSUE ACKNOWLEDGED:	Email response, 23 January 2009 at 23:40:14.
INITIAL ASSESSMENT:	The student might not have received or will not receive other important emails that will be sent through the same system.
INITIAL ACTION:	Information about the schedule of class and what was covered in class was gathered.
INITIAL RESPONSE:	An email (response email, 23 January 2009 at 23:40:14) was sent to the student containing the text of the original email.
INVESTIGATION:	The reason why the student's email address may have not been on the Bear Tracks list was investigated. It was found that it is not possible to see the e-mail addresses to whom the e-mail was sent due to the configuration of the system. Therefore, verification was not possible.
FURTHER ACTION:	Investigation about how the professor can verify the list of addresses on the Bear Tracks will take place.
FURTHER RESPONSE:	Not applicable.
RESOLUTION STATUS:	The student was able to find the e-mail and sent an email to the professor to inform him (24 January 2009 at 21:57:43). However, this actually identified a preventive action.
REVENTIVE ACTION:	Make sure that the entire student's email addresses are added to the Bear Tracks list and also keep a record of the emails sent through the system.

* Modified from ISO 10002: 2004 (Annex D)

Group formation

DATE & TIME RECEIVED:	22 January 2009
RECEIVED FROM:	One student
RECEIVED BY:	professor C
RECEIVED THROUGH:	A note was given to the professor during class
ISSUE BROUGHT FORWARD:	One of the students couldn't find other ungrouped students to form a group for the course project
ISSUE ACKNOWLEDGED:	Announcement in class, 22 January 2009
INITIAL ASSESSMENT:	The students need to form their groups so that they can start working on the first part of the project
INITIAL ACTION:	Identifying the students that have not formed their groups yet
INITIAL RESPONSE:	An announcement in class regarding people who have not formed their group yet so that they can find each other easier
INVESTIGATION:	Not applicable
FURTHER ACTION:	At the end of the class, the professor made sure that everyone is part of a group
FURTHER RESPONSE:	Asking a question to make sure of that
RESOLUTION STATUS:	The student was able to join a group and every student was part of a group and the resolution was closed
CORRECTIVE ACTION:	Not applicable

* Modified from ISO 10002: 2004 (Annex D)

Minimum number of standards for the course project

DATE & TIME RECEIVED: 01 February 2009 at 11:00:03

RECEIVED FROM: One student

RECEIVED BY: professor C

RECEIVED THROUGH: Email sent by the student

ISSUE BROUGHT FORWARD: The minimum number of standards for two-student group projects

ISSUE ACKNOWLEDGED: Email sent to the student (01 February 2009 at 13:16:59)

INITIAL ASSESSMENT: The group project requires the students to integrate 4 different standards but some of the groups have only 2 students and it would not be fair to them to compare their work with three-student groups.

INITIAL ACTION: To be fair to those students (members of two-student groups) the group project requirement has been modified so that two-student groups need to integrate only 3 different standards for their projects.

INITIAL RESPONSE: Response email was sent to the students on 01 February 2009 at 13:16:59 and the permission to work with only 3 different standards was given to them as it was discussed in class.

INVESTIGATION: Not applicable

FURTHER ACTION: Not applicable.

FURTHER RESPONSE: Not applicable.

RESOLUTION STATUS: Closed

CORRECTIVE ACTION: Announcement through email to other two-student groups about the "minimum number of different standards" requirement for their projects. An email was sent to all three different two-student groups about the change in requirements on 01 February 2009 at 1:26 pm, 1:50 pm, and 1:54 pm, respectively.

* Modified from ISO 10002: 2004 (Annex D)

Class handouts in electronic format

DATE & TIME RECEIVED: 05 Feb 2009 at 16:57

RECEIVED FROM: One student

RECEIVED BY: professor C

RECEIVED THROUGH: In person

ISSUE BROUGHT FORWARD: The student asked to have the electronic version of the class handouts.

ISSUE ACKNOWLEDGED: Announcement in class, 05 February, 2009

INITIAL ASSESSMENT: Making course WebCT page was assessed at first but in the end of class, since the sample midterm solution had to be sent to the students, emailing the electronic version was the better choice.

INITIAL ACTION: The class handouts and the solution of midterm examples were converted to PDF version.

INITIAL RESPONSE: An email was sent to the students with the electronic version of the class handouts and the solutions to the sample midterm exams (06 February, 2009 at 22:30)

INVESTIGATION: Not applicable

FURTHER ACTION: Not applicable

FURTHER RESPONSE: Not applicable

RESOLUTION STATUS: Closed

CORRECTIVE ACTION: Not applicable

* Modified from ISO 10002: 2004 (Annex D)

Using personal computers during midterm exam

DATE & TIME RECEIVED: 09 Feb 2009 at 15:02:12

RECEIVED FROM: One student

RECEIVED BY: professor C

RECEIVED THROUGH: Email sent by the student

ISSUE BROUGHT FORWARD: The ability to use personal computer during midterm exam

ISSUE ACKNOWLEDGED: Email sent to the student (09 Feb 2009 at 15:08:38)

INITIAL ASSESSMENT: Since some of the students might not have access to Laptop to bring to the class for the exam, it would be not fair to them if others were allowed to have personal computer.

INITIAL ACTION: The standards that are needed in the midterm exam will be given to the students and therefore there will be no need in accessing the standards through personal computers during exam.

INITIAL RESPONSE: As a clarification note for the upcoming midterm exam, and to ensure equal access to documents to all students an Email was sent to all the students (09 Feb 2009 at 15:24:46) saying:
A) Laptops and copies of the standards should not be used during the exam.
B) If needed, the text of required standards will be provided within the exam sheet

INVESTIGATION: Not applicable

FURTHER ACTION: Not applicable

FURTHER RESPONSE: Not applicable

RESOLUTION STATUS: Closed

CORRECTIVE ACTION: Not applicable

* Modified from ISO 10002: 2004 (Annex D)

Class mark average

DATE & TIME RECEIVED:	26 March 2009 at 16:57
RECEIVED FROM:	One student
RECEIVED BY:	professor C
RECEIVED THROUGH:	Email sent by the student at March 27, 2009 08:43:12
ISSUE BROUGHT FORWARD:	Class average and highest and lowest mark to be announce
ISSUE ACKNOWLEDGED:	Email sent back to student, March 27, 2009 09:40:55
INITIAL ASSESSMENT:	Informing the students about the class average would give them information about how well they are doing in class.
INITIAL ACTION:	the class average and the lowest and highest marks in each components of the course were calculated with its standard deviation.
INITIAL RESPONSE:	An Email was sent to all of the students in class informing them about the class marks at March 27, 2009 09:57:26.
INVESTIGATION:	Not applicable
FURTHER ACTION:	Not applicable
FURTHER RESPONSE:	Not applicable
RESOLUTION STATUS:	Closed
CORRECTIVE ACTION:	Not applicable

* Modified from ISO 10002: 2004 (Annex D)

Course Reading Availability

DATE & TIME RECEIVED: 08 May 2009 11:37:07

RECEIVED FROM: One student

RECEIVED BY: professor C

RECEIVED THROUGH: Email from student

ISSUE BROUGHT FORWARD: Mandatory course reading #3 was not handed out in class prior to the class in which it was supposed to be discussed

ISSUE ACKNOWLEDGED: Email from professor D at 08 May 2009 13:46:41

INITIAL ASSESSMENT: The reading is a printed copy and should have been handed out to the students in a previous class (e.g., May 7), so that they could read it for the upcoming class (May 12).

INITIAL ACTION: Copies of the reading were made available in the morning of May 11 outside the AIMS lab for student pick up prior to the class on May 12.

INITIAL RESPONSE: A note was posted on the course website on May 9 with information on how to obtain the reading.

INVESTIGATION: N/A

FURTHER ACTION: Not applicable

FURTHER RESPONSE: N/A

RESOLUTION STATUS: Closed

CORRECTIVE ACTION: The reading material for the course is better to be handed out at the beginning of the course. Therefore, the other reading material for the course is going to be handed out in the next class (May 12), although it is not required until later on in the course. In future courses, any printed readings will be handed out early in the course.

* Modified from ISO 10002: 2004 (Annex D)

Accessing Course Information

DATE & TIME RECEIVED: May 8 2009 at 11:24 PM

RECEIVED FROM: One student

RECEIVED BY: Teaching Assistant (TA)

RECEIVED THROUGH: Email from student

ISSUE BROUGHT FORWARD: Could not access "E-Journal" articles

ISSUE ACKNOWLEDGED: Email from the TA on May 9, 2009 at 9:37 AM

INITIAL ASSESSMENT: Some course readings are accessible through "E-Journal" databases of the university library. The students need to access these journals for the purposes of the course. A detailed PDF file explaining how to access "E-Journal" articles was uploaded onto the "E-Class" website prior to the student inquiry. The file was placed under the "News" folder of the website. The TA pointed out that some students might have missed the posting, as they might not have expected that such course logistics information had been placed in "News", but rather under "Announcements".

INITIAL ACTION: The folder title was changed from "News" to "Course Notes", which should be less confusing for students and in order for the students to be able to find the information on "E-Class" easier.

INITIAL RESPONSE: The student was informed about how to access the PDF file which explains access to "E-Journals".

INVESTIGATION: N/A

FURTHER ACTION: N/A

FURTHER RESPONSE: N/A

RESOLUTION STATUS: Closed

CORRECTIVE ACTION: Not applicable

* Modified from ISO 10002: 2004 (Annex D)

Access to Standards

DATE & TIME RECEIVED: Student 1: May 9, 2009 at 22:37
Student 2: May 10, 2009 at 13:12
Student 3: May 10, 2009 at 22:59

RECEIVED FROM: Three students

RECEIVED BY: Professor C

RECEIVED THROUGH: Email from students

ISSUE BROUGHT FORWARD: Not being able to access the standards on the SCC website

ISSUE ACKNOWLEDGED: Email from professor D to:
Student 1: May 9, 2009 at 23:18
Student 2: May 10, 2009 at 19:16
Student 3: May 11, 2009 at 0:01

INITIAL ASSESSMENT: The website contains ISO standards that are required as the course readings and course assignments. However, the SCC website was down, not allowing access.

INITIAL ACTION: An inquiry was sent to SCC on May 11, 2009 at 12:06 am regarding the problem.

INITIAL RESPONSE: The website started working again sometime in the morning on May 11, 2009. This was confirmed by professor D at 10:54 am.

INVESTIGATION: Not applicable

FURTHER ACTION: An announcement was posted on the course website on May 11, 2009 at 10:54 to notify the students that the website was working again and that the standards were accessible.

FURTHER RESPONSE: Not applicable

RESOLUTION STATUS: Closed

CORRECTIVE ACTION: Not applicable, since the problem was out of the control of the teaching staff or the university.

* Modified from ISO 10002: 2004 (Annex D)

ISO 9001-Related Questions on Quiz Two

DATE & TIME RECEIVED: May 14, 2009 at 20:00:00

RECEIVED FROM: One student

RECEIVED BY: Professor C

RECEIVED THROUGH: In person

ISSUE BROUGHT FORWARD: Sample exam questions regarding ISO 9001

ISSUE ACKNOWLEDGED: In person responding to the question.

INITIAL ASSESSMENT: Quiz Two includes questions regarding ISO 9001: 2008. Sample questions for that quiz could help the students be better prepared for it.

INITIAL ACTION: Several sample questions were prepared.

INITIAL RESPONSE: Sample questions were posted on the website on May 17, 2009 around 12:00 pm (noon). Also, related announcement to the class on the course webpage was made on May 17, 2009 at 12:07 pm.

INVESTIGATION: Not applicable

FURTHER ACTION: N/A

FURTHER RESPONSE: N/A

RESOLUTION STATUS: Closed

PREVENTIVE ACTION: Additional details for Quiz Two were included in the "Quiz Two Details" file on "Course Notes" website folder.

* Modified from ISO 10002: 2004 (Annex D)

Course Outline Typos

DATE & TIME RECEIVED:	In class on the first day (May 5, 2009) Two emails from students - Student 1: 16 May 2009, 11:21:31 Student 2: 12 May 2009, 13:39:08
RECEIVED FROM:	Several students
RECEIVED BY:	professor C
RECEIVED THROUGH:	In person and emails from students
ISSUE BROUGHT FORWARD:	Typos in the course outline: Final exam date was not included Two course readings has incorrect issue numbers
ISSUE ACKNOWLEDGED:	Reply in the class (May 5, 2009) Emails from Dr. Karapetrovic - Student 1: 16 May 2009 20:04:39 Student 2: 12 May 2009 21:05:19
INITIAL ASSESSMENT:	The exact date of the final exam, although it is the last day of classes as per university regulations, was missing from the course outline. The course outline is the reference point for all reading materials required for the course. Correct information should be provided.
INITIAL ACTION:	For the final exam: the date was stated in the first class and was updated in the online version of the course outline. For the reading material: Typos were confirmed in e-mail responses.
INITIAL RESPONSE:	The online version of the course outline was changed and the typos were fixed. The updated course outline was posted online on May 18, 2009 at 1:12 pm.
INVESTIGATION:	N/A
FURTHER ACTION:	N/A
FURTHER RESPONSE:	N/A
RESOLUTION STATUS:	Closed
CORRECTIVE ACTION:	N/A

* Modified from ISO 10002: 2004 (Annex D)

Class Greeting

DATE & TIME RECEIVED: 20 May 2009 19:51:45

RECEIVED FROM: One student

RECEIVED BY: professor C

RECEIVED THROUGH: Email from the student

ISSUE BROUGHT FORWARD: Saying "hello" at the beginning of the class.

ISSUE ACKNOWLEDGED: Email from professor D on 20 May 2009 21:46:18

INITIAL ASSESSMENT: The professor should clearly greet the class upon entrance to the classroom.

INITIAL ACTION: The professor has mentioned this request in the class following the request and has greeted the class in accordance with the request.

INITIAL RESPONSE: Email from professor D on 20 May 2009 21:46:18

INVESTIGATION: N/A

FURTHER ACTION: The professor reminds himself to greet the class with a loud "hello" upon entry in each class. The professor has greeted the class in this manner for the remainder of the classes in the course.

FURTHER RESPONSE: N/A

RESOLUTION STATUS: Ongoing.

CORRECTIVE ACTION: N/A

* Modified from ISO 10002: 2004 (Annex D)

Assignment Marking Guideline

DATE & TIME RECEIVED:	23 May 2009 at 13:30:12
RECEIVED FROM:	One student
RECEIVED BY:	professor C
RECEIVED THROUGH:	Email from the student
ISSUE BROUGHT FORWARD:	Guideline for marking Assignment #3
ISSUE ACKNOWLEDGED:	Email from professor D on 23 May 2009 at 19:58:31
INITIAL ASSESSMENT:	It is beneficial for students to have a guideline for marking assignments and other course components ahead of time, since the marking guideline / scheme contains information on the important parts of assignments and on the manner in which assignments are being graded. It will also help students focus on the important parts of the assignment.
INITIAL ACTION:	Guideline for marking Assignment #3 was made.
INITIAL RESPONSE:	The guideline for marking Assignment #3 was posted on the course web-page on 27 May 2009 at 10:41.
INVESTIGATION:	N/A
FURTHER ACTION:	N/A
FURTHER RESPONSE:	N/A
RESOLUTION STATUS:	Closed
CORRECTIVE ACTION:	Potentially, a guideline on how assignments are being marked can be added to the course outline in the future.

* Modified from ISO 10002: 2004 (Annex D)

Required Reading Access

DATE & TIME RECEIVED: 24 May 2009 at 18:39:31

RECEIVED FROM: One student

RECEIVED BY: professor C

RECEIVED THROUGH: Email from student

ISSUE BROUGHT FORWARD: Required reading #12 could not be accessed due to a registration issue (the website requires registration for document access).

ISSUE ACKNOWLEDGED: Email from professor D at 24 May 2009 at 20:23:42

INITIAL ASSESSMENT: The information provided in readings #12 and #13 is not crucial for the course and will be discussed in lectures. Therefore, website registration is not required, and students should be informed that for readings #12 and #13, only a brief look at the websites is sufficient.

INITIAL ACTION: The professor informed the student that looking the websites is sufficient and asked the teaching assistant (TA) to post a related announcement on the course webpage.

INITIAL RESPONSE: See "initial action".

INVESTIGATION: N/A

FURTHER ACTION: An announcement was posted on the course website on May 24 at 21:53 by the TA.

FURTHER RESPONSE: N/A

RESOLUTION STATUS: Closed

CORRECTIVE ACTION: In future editions of the course, these two readings will not be placed on the list of required readings.

* Modified from ISO 10002: 2004 (Annex D)

Posting Course Notes

DATE & TIME RECEIVED: 01 Jun 2009 at 14:15:07

RECEIVED FROM: One student

RECEIVED BY: professor C

RECEIVED THROUGH: Email from student

ISSUE BROUGHT FORWARD: Lecture slides for a previous class (IV-1) were not posted on the E-Class course webpage.

ISSUE ACKNOWLEDGED: Email professor D on 01 Jun 2009 at 14:26:23

INITIAL ASSESSMENT: Class notes should have been posted on the course webpage, although a printed handout of the specific lecture slides (IV-1) was already provided in class.

INITIAL ACTION: A PDF version of the lecture slides was made for posting.

INITIAL RESPONSE: The lecture slides (IV-1) were posted on the course webpage and an email was sent to the student about the posting of the notes on 01 Jun 2009 at 14:40:13

INVESTIGATION: Posting lecture notes before the class gives the students some time to read them and be prepared for the class. In addition, students can make a larger printout than the handouts provided in class.

FURTHER ACTION: N/A

FURTHER RESPONSE: N/A

RESOLUTION STATUS: Closed

CORRECTIVE ACTION: Lectures slides for the remaining lectures (IV-2 to V-4) were posted on June 2 at 21:10.

* Modified from ISO 10002: 2004 (Annex D)

Response code

DATE & TIME RECEIVED:	4 Jun 2009
RECEIVED FROM:	One student
RECEIVED BY:	professor C
RECEIVED THROUGH:	Student and a note
ISSUE BROUGHT FORWARD:	The response code defined in the course does not have an expiration date.
ISSUE ACKNOWLEDGED:	professor D acknowledged the issue and ask the student to write a note about it and pass it to him.
INITIAL ASSESSMENT:	The response code defined in the course is for the duration of that course and any email that was sent during the course term should be answered within 24 hours. The code on the other hand does not define when the code implementation would end and that raise a problem because the students could send an email after the course was done and based on the code definition the professor has to answer that.
INITIAL ACTION:	Not done yet.
INITIAL RESPONSE:	Not done yet
INVESTIGATION:	Not done yet.
FURTHER ACTION:	N/A
FURTHER RESPONSE:	N/A
RESOLUTION STATUS:	Closed
CORRECTIVE ACTION:	Not done yet.

* Modified from ISO 10002: 2004 (Annex D)

Appendix E: Product sampling tables

Random samples
Response

Random Number	Multiplied number	Related Sample	Student	Time	Time	Response	Inquiry Type	24:00:00
			Code Number	Received	Responded	Time		
0.11	10.56	11	WD42	1/18/2005 12:22	1/18/2005 13:03	0:41:08	Logestics	Met
0.84	80.64	80	WD20	3/29/2005 8:58	3/29/2005 12:01	3:03:57	Logestics	MET
0.45	43.2	43	WD39	2/12/2005 12:01	2/12/2005 14:27	2:26:00	Content	MET
0.61	58.56	58	WD64	3/6/2005 22:15	3/7/2005 14:39	16:24:10	content	MET
0.05	4.8	5	WD62	1/6/2005 17:08	1/7/2005 14:56	21:48:15	Logestics	MET

Review

Random Number	Multiplied number	Related Sample	Homework / Quiz / Exam	Due Date	Date Homework / Quiz / Exam Available	Class Available	Code (Availability)	Code Met? (Availability)
0.47	5.17	5	Assignment 5	9-Feb	16-Feb	1st	1st	MET

Table E-1: Course B product sampling

Random samples
Response

Random Number	Multiplied Number	Related Sample	Student	Time	Time	Response	Inquiry Type	24:00:00
			Code Number	Received	Responded	Time		
0.19	21.66	22	W9-M75	1/28/2009 22:10	1/29/2009 7:29	9:19:40	Content	MET
0.87	99.18	99	W9-M130	3/24/2009 17:18	3/24/2009 18:07	0:49:54	Content	MET
0.12	13.68	14	W9-M148	1/16/2009 11:14	1/16/2009 13:43	2:29:58	Logistics	MET
0.26	29.64	30	W9-M116	2/2/2009 20:26	2/2/2009 21:45	1:19:08	Logistics	MET
0.43	49.02	49	W9-M133	2/19/2009 21:42	2/20/2009 6:19	8:37:25	Logistics	MET

Review

Random Number	Multiplied Number	Related Sample	Homework / Quiz / Exam	Due Date	Material Reviewed	Class Available	Code (Availability)	Code Met? (Availability)
0.64	8.32	8	A6	6-Mar	13-Mar	3rd	13-Mar	Yes

Schedule

Random Number	Multiplied Number	NO.	LECTURE TITLE (PLAN)	DATE	COVERED	Not covered	GAP
0.23	5.98	6	Income statements (3)	16-Jan	1	0	N/A

Table E-2: Course C product sampling

Random sampling

Response code

Random Number	Multiplied Number	Inquiry Number	Student Code Number	Time Received	Time Responded	Response Time	Inquiry Type
0.88	143.44	143	W9-S3	3/20/2009 18:01	3/21/2009 11:41	17:40:02	Logistics
0.1	16.3	16	W9-S3	1/23/2009 22:12	1/23/2009 23:40	1:27:51	Content
0.55	89.65	89	W9-S4	2/18/2009 16:07	2/18/2009 21:01	4:53:56	Logistics
0.85	138.55	138	W9-S3	3/18/2009 20:52	3/18/2009 21:00	0:08:34	Content
0.81	132.03	132	W9-S10	3/16/2009 13:27	3/16/2009 13:39	0:11:39	Logistics

Schedule code

Random Number	Multiplied Number	NO.	LECTURE TITLE (PLAN)	DATE	TOPIC COVERED (Topic fraction)	GAP (topic fraction that wasn't covered)	GAP CLOSED IN NEXT CLASS
0.37	4.81	4	Use of International System Standards in Industry	29-Jan	0	1	Yes

Review code

Random Number	Multiplied Number	Inquiry Number	Homework / Project Quiz / Exam	Due Date
0.88	5.28	5	P3 [Presentation]	26-Mar

Due Time	Date Homework / Quiz / Exam Available	Class Available	Code (Availability)	Code Met? (Availability)
20:00	3/26/2009 21:26	1st class	1st class (Apr-2)	Yes

Feedback Handling

Random number	Multiplied number	Inquiry number	feedback name
0.65	5.2	5	Minimum number of standards for the course project

Table E-3: Course D product sampling

Random samples

Response

Random Number	Multiplied number	Related Sample	Student Code Number	Time Received	Time Responded	Response Time	Inquiry Type	24:00:00
0.17	10.71	11	W9-Y9	1/7/2009 15:10	1/7/2009 16:09	0:59:09	Logistics	MET
0.25	15.75	16	W9-Y65	1/8/2009 10:48	1/8/2009 10:55	0:07:50	Logistics	MET
0.64	40.32	41	W9-Y16	2/3/2009 10:21	2/3/2009 14:10	3:49:33	Content	MET
0.68	42.84	44	W9-Y37	2/7/2009 19:53	2/9/2009 9:09	37:16:33	Content	MET
0.38	23.94	24	W9-Y58	1/13/2009 13:09	1/13/2009 14:08	0:59:51	Logistics	MET

weekend

Review

Random Number	Multiplied number	Related Sample	Homework / Quiz / Exam	Due Date	Code (Availability)	Code Met? (Availability)
0.15	4.2	4	A4	21-Jan	1st	Yes

Schedule

Random Number	Multiplied number	Related Sample	LECTURE TITLE (PLAN)	DATE	COVERED	Not covered	GAP Closed
0.77	23	23	The concept of the time value of money	4-Mar	all	0	N/A

Table E-4: Course E product sampling

Appendix F: Sample audit report

Quality Management System Audit Report

Against ISO 10001 and ISO 10002 standards

Auditee: C

Auditor: Mehdi Honarkhah

Place: Dr. C's office

Time: March 27, 2009 14:00-18:00

This report is part of AQSEC study and will only be distributed to C and a copy will be held in AIMS lab. Further use of this report for any research purposes will not include any names or any identifiable statement and will be confidential.

Introduction:

This Audit has used ISO 19011 as a guideline for the audit and the objective of this audit was to:

- Verify the compliance of QMS to ISO 10001 and ISO 10002.
- Evaluate the effectiveness of the system
- Evaluate the improvement opportunities of the QMS
- Investigate the application of ISO 19011 in QSEC study

The scope of this audit includes the Course D that was taught by C during the winter semester of 2009 in Mechanical engineering department and is only limited to the course teaching activities and the complain handling system defined in this course.

Audit criteria that were used during this audit include the criteria defined in the two standards ISO 10001: 2007 and ISO 10002:2004.

Audit conclusion:

Audit processes:

This audit was conducted in two steps. First the document review that included the review of the flowcharts that were edited by Dr. C to map the processes and activities of the Quality Management System used during the class and validating the processes against the standards and the second part of the audit was the interview in Dr. C's office to verify the flowcharts.

The objectives of the audit were met. The compliance of the QMS with the two standards and the effectiveness and improvement opportunities of the system were evaluated and a detailed report has been created.

Detailed results:

The compliance with ISO 10001:

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
6 Planning, design and development			
6.1 Determine code objectives	Complied	This has been done before defining the code (no evidence from audit)	Documentation of the objectives.(not required by standard) The standard asks for objectives to be measureable using performance indicators. (defining them and recording them could be useful)
6.2 Gather and assess information	Complied	This has been done before defining the code (no evidence from audit)	Documentation of the issues.(not required by standard)
6.3 Obtain and assess input from relevant interested parties	Complied	This has been done before defining the code (no evidence from audit) The students were asked about bringing up issues with the code or suggesting other codes to be implemented or change-requests to the code (Midterm and Final survey)	How the relevant information was obtained and how effective and efficient the method was should be considered and assessed. -note: students are the customers but what other interested parties are there that could help to define or improve the code?
6.4 Prepare code	Partially complied	Based on the code: - The code scope and purpose was defined - The promise and the limitation of the codes were defined - The key terms used in the code was not defined (based on the flowcharts in	The key terms used in the code should be defined properly

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
		document review) - How and to whom the enquiries and complain should be directed was explained in the code. - The remedy for each code was defined.	
6.5 Prepare performance indicators	Complied	Each of the codes have performance indicator (the reports that are given out to students includes the performance of the code) - Response code: is the time that the question is answered and statistics about that - Schedule and review code is the deviation from the promise in the code	
6.6 Prepare code procedures	Complied	- The code communication procedures have been planned and executed (the information about the code was written in the course outline and was distributed in the class) - There was no one else except the professor was involved in the code implementation so the training of relevant personnel does not apply here. - There instances that the code was not met, the remedy was given to the students. (the instance in response code: the reason was given and the remedy was not required	- Recording of the remedy and the time that it was given to the students would help in tracking the unmet promises and recording the reason why the code was not met and the preventive actions suggested would help in remembering the incidences. - Recording of the resources used and identifying the resources needed to implement the codes appropriately.

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
		<p>because the student did not want the chocolate bar) (the review code: the remedy which was the explanation was given to the students)</p> <ul style="list-style-type: none"> - The enquiries about the code has been recorded in surveys and the code performance have been recorded in the monthly reports (satisfy the disclosing of information regarding code fulfillment too.) 	
6.7 Prepare internal and external communication plan	Complied	The communication plan (e.g., how the supporting information should be made available to the personnel and other parties) exist. (the monthly reports of the performance and feedback forms)	<ul style="list-style-type: none"> - The standard does not require a documentation of the plan but having a documented plan would make the procedures easier to follow. (maybe a communication plan should be documented) - Use of Database to record all these information and maybe use of website to distribute the information so that everyone can access it at all times.
6.8 Determine resources needed	Complied	The resources needed to implement the codes were determined	<ul style="list-style-type: none"> - Record of the resources usage should be used to document the resources and their effectiveness.
7 Implementation	Partially complied	<ul style="list-style-type: none"> - The implementation of the code activities were managed and planned. 	<ul style="list-style-type: none"> - Record of the preventive actions where applicable for further use

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
		<ul style="list-style-type: none"> - The relative procedures and communication plan were applied - The remedy were provided to the students in case of unmet promise in code implementation - In case of unmet promise, the preventive action was determined and was implemented to prevent it from happening again (the change in prioritizing the schedule code after receiving the comment about what happens if the professor is behind the schedule and try to fix it by teaching faster and skipping. After the comment, there were more emphasize on the scheduled topic and time in hand) - There were no record of the resources usage - There were no training required regarding the code. - The surveys inquire about the effectiveness of the communication plan. - The remedies of the unmet promises were given to the students. 	<ul style="list-style-type: none"> - Record of the resources usage
8 Maintenance and improvement			
8.1 Collection of information	Complied	The information from students about the code and its application was collected	If using the website in class, could make a suggestion box that

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
		during the surveys and the code states that any inquiry about the code and its application could be send through emails to the professor.	students could effectively send their suggestions to the professor. (Applicability of this could be evaluated)
8.2 Evaluation of code performance	Complied	<ul style="list-style-type: none"> - The performance of the code was recorded and was distributed to the students monthly. - The complaints and suggestions about the codes were collected through the midterm and final surveys. 	<ul style="list-style-type: none"> - The reasons for incidents and problems with the code should be classified and analyzed to preventive them from happening again. (Documentation of these analyses could be useful in planning and implementation for the code in the future. - The standard suggest that for evaluating the code performance, information should be gathered prior the code being launched and after that. These information could be helpful in demonstrate the results achieved and progress through use of the code.
8.3 Satisfaction with the code	Complied	The satisfaction with the code was collected through the surveys and inquiries from students during the course.	
8.4 Review of the code and code framework	Complied	During the course, changes to the code have been made for improving the code. (The review code for example did not include the	- Recording and updating the changes to the code should be documented and the

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
		projects but after reviewing the code, it was added as part of the review code)	communicating the new and updated code to the students. The documentation is a good reference for the professor as well to know what is included in the code. (the instance where the professor did not remember a change in code happened during the audit interview)
8.5 Continual improvement	Complied	<ul style="list-style-type: none"> - The code and its framework were evaluated during the course and improvements to the codes were made during the course (the review code). - The underlying causes of problems with the code was spotted and changes have been made to prevent it from happening again (the response code: to answer emails right away and the schedule code: to keep in mind the topic and the time to cover it and in review code: to mark the material as soon as possible so that it is not left until it is too late) 	<ul style="list-style-type: none"> - Improvement of the communication plan based on the survey results and student awareness of the codes and its performance. - Documentation of the preventive actions and using them in defining the codes for future. - Review the codes of other professors for improvement opportunities.(recommended by the standard)

The compliance with ISO 10002:

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
6 Planning and design			
6.1 General	Complied	Based on the Feedback-handling system designs and flowcharts.	Other professors approaches should be consider regarding the Feedback handling system
6.2 Objectives	Partially complied	The objectives for the Feedback-handling system was established but there were no detailed performance criteria (no evidence from audit)	Detailed performance criteria should be set at regular intervals based on ISO 10002 requirements.
6.3 Activities	Complied	Any inquiry that is related to the course and can affect all the students goes through FHS and FHS was designed to improve students' satisfaction in the course.	
6.4 Resources	Complied	The professor sets the resources, which are needed for the FHS.	The use of website to leave feedback should be considered, if applicable.
7 Operation of complaints-handling process			
7.1 Communication	Complied	After receiving a feedback from students, the professor decides about how to address the concern. The students are informed about the FHS and have access to the related information about how the feedback was handled after the forms were posted. (The Flowcharts and the sample feedbacks observed during the Audit)	More information about the feedback handling system could be readily available to the students.
7.2 Receipt of complaint	Complied	The relevant information about the feedbacks are gathered and documented.	

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
7.3 Tracking of complaint	Complied	Most of the feedbacks do not require long process time and are address fast.	
7.4 Acknowledgement of complaint	Complied	An email was sent to the student as soon as the complaint was received.	
7.5 Initial assessment of complaint	Complied	Each feedback is assessed upon receipt.	
7.6 Investigation of complaints	Complied	Different options are considered and a response to the feedback was selected for each feedback	
7.7 Response to complaints	Complied	The feedback response was implemented and it was resolved.	
7.8 Communicating the decision	Complied	An email was sent to the students after the feedback has been assessed and the results were emailed to all the students since the feedbacks affect all the students.	
7.9 Closing the complaint	Complied	After the decision was made, the complaint was closed.	The standard requires the organization to close the complaint if the complainant is satisfied. Maybe the satisfaction of the students with the responded decision should be measured. Although the student would bring up the issue again if he/she is not satisfied.
8 Maintenance and improvement			
8.1 Collection of information	Complied	The information about the feedbacks that go through FHS is recorded and documented	

Standard requirement	Compliance with the standard	Evidence	Improvement opportunities
		and the information was sent to the students with non-personally identifiable data. (Sample of the feedback form is attached)	
8.2 Analysis and evaluation of complaints	Complied		
8.3 Satisfaction with the complaints-handling process	Complied	The satisfaction of the FHS was asked during surveys.	A better survey that could help to improve the FHS could be designed because the current survey does not ask for improvement opportunities about the FHS.
8.4 Monitoring of the complaints-handling process	Complied		
8.5 Auditing of the complaints-handling process	Complied		Regular evaluation of the FHS should be prepared and performed.
8.6 Management review of the complaints-handling process	Partially complied	The management review of the FHS should be recorded and the records should be kept for further use.	Potential changes to the FHS should be considered. Information from students regarding the improvement in FHS should be gathered so that the system could be improved to satisfy the students. The management review of the FHS should be recorded.
8.7 Continual improvement	Complied		

Appendix 1:

Audit Plan:

Audit Plan for Course D – Dr. C: ISO 10001 & ISO 10002

[6.1] General audit activities: this audit will use ISO 19011: 2002 as a guideline for auditing. Each clause of the audit activities guideline (clause 6) was reviewed and its relevance to the audit is explained.

[6.2] Initiating the audit

[6.2.1] Audit team leader: Mehdi Honarkhah

[6.2.2] Defining audit objectives, scope, and criteria

- Audit objectives:
 - To verify the compliance of the QMS (response code, schedule code, review code, feedback system) to ISO 10001 and ISO 10002
 - Evaluate the effectiveness of the system
 - Evaluate the improvement opportunities of the QMS
 - Investigating the application of ISO 19011 in QSEC study
- Audit scope:

The audit will be conducted in Mechanical engineering department, includes the Course D taught by C in winter semester of 2009, and is limited to the course teaching activities (three codes defined) and the complaint-handling system.
- Audit criteria:

ISO 10001: 2007 and ISO 10002:2004
- Audit duration: the on-site audit takes around 1-2 hours and will take place in Dr. C's office or AIMS lab.

[6.2.3] Feasibility of audit:

- Information available (Audit Plan, Audit criteria, ISO 10001 and ISO 10002, activities flowcharts)
- Cooperation (C is available)
- Time and resources of audit is set (Friday March 27, 2009)

[6.2.4] Selecting the audit team:

Audit member: Mehdi Honarkhah

Consideration:

- The audit could be conducted by MH
- The audit is combined audit (ISO 10001 and ISO 10002)
- The auditor had training to do the audit (Also, this audit is part of the learning process)
- The Auditor will only audit parts of the system that is not related to MH activities.

[6.2.5] Initial contact:

- Dr. C has been contacted.

- An email has been sent to set the date and place of the audit and the audit time was confirmed.

[6.3] Conducting document review:

Documented activity flowcharts: The activities flowcharts have been send to Dr. C for review and the edited version, which based on the actual process used by Dr. C, has been collected. This part would result in verification of compliance to audit criteria, and the on-site audit would validate the processes.

[6.4] Preparing for the on-site audit activities:

[6.4.1] Audit Plan basics:

The basic audit plan includes:

- Understanding the system and audit criteria
- Evaluation of the system against the criteria:
 - Collecting evidence
 - Verifying evidence
- Generate audit report and findings and conclusion

[6.4.2] Assigning work to the audit team: there is only one team member (MH).

[6.4.3] Preparing work documents: the on-site question list has been prepared

[6.5] Conducting on-site audit activities

[6.5.1] Opening meeting:

- The audit plan would be presented
- A short summery of the audit and its activities would be presented

[6.5.2] Communication during the audit:

N/A since there is only one team member

[6.5.3] Roles and responsibilities of guides and observers:

During this audit, SK will be observing the audit for education purposes and learning aspects of the audit. SK will provide suggestions on how to conduct the audit.

[6.5.4] Collecting and verifying information:

During the audit, MH will collect evidence and will record the verifiable evidence. The audit would start with opening meeting and after that a series of questions would be asked and the answer would be collected and MH will verify the evidence by sampling and tracking of processes and product or service.

[6.5.5] Generating audit findings:

After the audit, the audit findings would be evaluated and improvement opportunities will be identified.

[6.5.6] Preparing audit conclusion

Audit finding will be reviewed and recommendation and audit conclusion will be prepared. The Audit report would be prepared which includes the introduction to the audit and the findings and evidence supporting that and recommendation for improvements.

[6.5.7] Conducting the closing meeting:

The closing meeting will be conducted in the end of audit

[6.6] Audit report

[6.6.1] the audit report will be prepared after the meeting by MH and he will give a copy to Dr. C.

[6.6.2] the audit report will be issued within 3 weeks of the audit.

[6.7] Completing the audit:

The audit report and its documents will be retained for 5 years (as approved in ethics approval) and will be destroyed after that.

[6.8] Audit follow-up:

Depends of the conclusion of the audit, and the corrective actions and preventive and improvement actions suggested, there might be a follow-up on the audit if applicable.

Appendix 2:

Audit questions and answers:

Audit Time, March 27, 2009 started at 14:00 till 18:00

Auditee: C

Auditor: Mehdi Honarkhah

Audit questions (Professor Questionnaire):

A. General code preparation questions

- 1) What are the codes and promises that you made to the students?

Response code: 24 hour response to emails.

Review code: Review of the assignment in a week

In addition, schedule code: schedule would be within one topic lecture schedule

- 2) What are the limitations on your code implementation?

The limitations are defined in the code itself.

- 3) How would you deal with unmet promise?

They have been defined in the code itself.

- 4) Are they all defined in the code? (Ask to see the codes and verify them)

They are all in the codes (the course outline was printed as supporting document)

- 5) How did you inform the students about the codes and promises?

The codes were in course outline, which was given to all the students, there were no webpage for the course, but the codes were mentioned and explained in the first class with the students.

- 6) Where and how can students access the codes?

The students can access them just in the course outline.

- 7) How do you check to see if the codes were implemented successfully? (What are the code performance indicators that the professor uses?)

Response code is the time since the email was received until it was answered and the statistics related to the response time.

Review code: It is the time that the material was due till the time that the results were available, and the deviation from the promise in the code,

Schedule code: the deviation from schedule.

No statistics for review and schedule

8) How is the TA involved in codes implementation?

No TA involvement

9) How were TAs been informed and trained on the code implementation?

N/A

10)How were the TAs' trainings been recorded?

N/A

11)How did you inform the students about the code performance? (How and how often?)

The students were informed about the code performance: (Reports that RA made every month) sample of the report was printed as supporting document.

12)What resources did you use to implement the codes? How did you record them?

For the response code, use the computer, no blackberry, computer at home, and laptop.

For schedule code: the lecture schedule, send an email, with the topics included.

For review code: my time to mark the material and email to RA.

13)How was the students' satisfaction with the codes implementation being measured? (...Survey)

Student satisfaction was measured through midterm survey, and final survey, and feedback about the code through the feedback systems.

Most people were aware of the codes and they think they are useful

The feedback system: no change in any code.

14)Has the code or promise been improved during the semester? What was improved? What was the trigger for change? How did you record the improvements of codes?

No change in the code and no improvements.

15)How do you deal with the feedbacks on the course or codes?

Yes there is a feedback handling system

B. Response code implementation questions

1) How do you make sure that the questions are answered in [pre-defined time interval]?

Look at the email when he can and answers the emails, no specific intervals.

2) How do you record the response time?

Send to RA, and he keeps track of that.

3) What is the process after an email was received? (What would happen after an email was received?)

Look and answer the emails, then keep collecting them and put them in folder and forward them to RA later.

4) Have there been any missed promises? What was the reason? How did you make sure that it doesn't happen again? (What were the measures you take to stop it from happening again?)

Yes, the reason was that the email couldn't be answered right away, but did not respond with the acknowledgement. In addition, forgot about it and didn't answer it.

Not specific action to prevent it just keeping in mind to answer the emails right away.

Remedy was not given because the student didn't want it.

(That is ok) the explanation was given and the answer to the question but no chocolate bar

5) How do you keep record of Corrective or preventive actions when you improve the code?

No record of the actions taken,

C. Review code implementation questions

1) How do you make sure that the course materials were reviewed in [pre-defined time interval]?

Depends on the course components, (use the laptop), (use to write down on paper and then try to send them by email)

Explanation: before I would write on paper, and sometimes I wouldn't send the review at all or on time, sometimes I would be busy and couldn't send it before the final report, then the presentation comment would have been useless, so it would not make any difference on the final report, so for presentation, he write them on the computer and would just email it faster and they would get it faster, so the improvement was not the code itself but t use a resource, and write it directly in the word doc and was sent immediately (improvement would be in speed)

2) How do you record the performance on review code?
Send the updates on the review codes. In the sampling, an error typo in the time that the presentation was due to get mark back was made (Not April 8 but April 2). Based on the code, project is not part of it, the random generated sampling audit found the problem. (The professor didn't remember the time he changed the code that includes the project as well)

3) Have there been any missed promises? What was the reason? How did you make sure that it doesn't happen again? (What were the measures you take to stop it from happening again?)

It has, the reason was the unavailability of the time for marking the assignment.

The preventive action is to try to do them immediately when they receive it rather than waiting for later when the professor might get busy.

D. Schedule code implementation questions

1) How do you record the performance on Schedule code?
Send an email every week about the progress, and the RA will record it

2) Have there been any missed promises? What was the reason? How did you make sure that it doesn't happen again? (What were the measures you take to stop it from happening again?)

No missed promise

3) How do you make sure that the gaps between the schedule and covered material in class were closed?

When it was planned, the professor tried to schedule the content so that he can cover it. However, when he wasn't able to cover it on time he tried to cover them by emphasizing on only important things. (Response on the comments: that when he misses a schedule then the professor would rush through the material to catch up), after the comments, there were more specific on the topics and on time.

E. Feedback system implementation questions

1) What kind of feedback goes through the feedback handling system (FHS)? [All of them or just the ones that has impact on all the students?] What are the criteria?

Only the feedbacks that are relevant to the whole class go through the FHS and those that are related to course delivery (send all questions and answers to everybody)

Communication plan: not all the feedbacks but some of them,

2) What happens after you receive a feedback or a question that is going through the FHS? [What are the procedures that it goes through?

Respond with the solution, send the information of the feedback and the action to RA, and record them.

3) What are the resources used in FHS? How do you record the resources used?

No I don't record them. Depending on the action, different resources may be used

4) How do you record the feedbacks? (Ask to see an example) I will answer the feedback and RA keeps record. (Example of the feedback was checked)

5) How do you make sure all are resolved the feedback??

By the response and all the guidance of the iso 10002 make sure that you respond, and depend on the feedback, see what we can do and the action.

6) How do you keep a record of the corrective or preventive actions taken?

Feedback form

7) How does the student satisfaction with the FHS is been evaluated?

The satisfaction is measured through the surveys. No question in the final survey about the improvement in the FHS.

8) What would happen if the student is not satisfied with the response of the feedback?

The professor is not asking if they are satisfied or not, if they are not satisfied then they will ask again and then he would try to meet and satisfy them.

9) How do you inform the students about the changes made because of FHS?

No changes

10) Has the FHS processes been changed during semester?
What was the change? What was the trigger for change?
No change

Appendix 3:

Review code update record:

Email send from C to all the students regarding the change to the review code on Feb 1, 2009 at 17:14 pm:

“Just a note that, as a result of this performance measurement and analysis, which is a process integral to all standardized systems (as we saw in both the "process" model of ISO 9001 and the "PDCA" model of ISO 14001, where exactly?), improvement of the "Review Code" was undertaken. Namely, I realized that project components were not included in the original code, and since my intention is to offer this promise to all course evaluation components, I have added projects to the code to now read:

"If the results of project reports, project presentation, assignment and midterm exam are not reviewed during the first class following the due date, an explanation will be provided in this class and the corresponding review will be conducted in the class following the announcement."

All the best,
Dr. C”

Appendix 4:

Printed version of the codes printed during the audit

Appendix 5:

Feedback forms 2 and 3 collected during the audit

Appendix 6:

Midterm survey results and sample of the comments and end of term survey printed during the audit

Appendix 7:

Code performance report for March 3, 2009 printed during audit

Appendix G: Form templates

QSEC Research Study (Course F – Dr. C, [Date of survey])

MID-TERM SURVEY ON THE USE OF STANDARDS

In an effort to analyze and improve the use of customer satisfaction and quality management standards in the course, this short survey is designed to obtain feedback from you regarding their availability and usefulness. Participation is voluntary and anonymous. Please do not write your name, student number, or any personally-identifiable information on the sheet. You can place the completed survey in the designated box when done. The results will be summarized and presented in class.

- **Please indicate your awareness and opinion on the customer satisfaction codes and customer feedback methods established in the course. Please circle.**

<u>The 24-Hour Response Code:</u>	Aware	Not Aware	Useful	Not Useful
<u>The Schedule Code:</u>	Aware	Not Aware	Useful	Not Useful
<u>The Review Code:</u>	Aware	Not Aware	Useful	Not Useful
<u>Customer Feedback Forms:</u>	Aware	Not Aware	Useful	Not Useful

- **Please list any other codes or guarantees that you would like established in the course and/or provide improvement suggestions for the existing codes:**

(1) _____

(2) _____

(3) _____

- **In the case that the code promise is not fulfilled, what would you prefer as a redress:**

(A) Existing actions (i.e. apology, providing a chocolate bar, ...)

(B) Other actions (please suggest) _____

- **Any other suggestions regarding the use of the quality standards in the course:**

Figure G-1 : Midterm survey form (sample)

Class F - END-OF-TERM SURVEY ON THE USE OF STANDARDS

In an effort to analyze the past application and improve the future use of customer satisfaction and quality management standards in engineering courses, this short survey is designed to obtain feedback from you regarding their implementation in this course. Participation is voluntary and anonymous. Please do not write your name, student number, or any personally-identifiable information on the sheet. You can place the completed survey in the designated box by the exit door while done.

- **Please indicate your agreement or disagreement with the following statements.**

NOTE: SD = Strongly Disagree; D = Disagree; N = Neutral; A = Agree; SA = Strongly Agree

- (a) With respect to the "24-Hour Response" Code:

1. I was well-informed about the existence and the content of the code.	SD	D	N	A	SA
2. I was well-informed about the professor's performance on the code.	SD	D	N	A	SA
3. The 24-hour time limit for the response is appropriate.	SD	D	N	A	SA
4. Explanation and snack is an appropriate redress action for this code.	SD	D	N	A	SA
5. The professor provided effective responses to my questions.	SD	D	N	A	SA
6. The professor provided comprehensive responses to my questions.	SD	D	N	A	SA
7. This code effectively responded to my needs for a timely response.	SD	D	N	A	SA
8. I recommend the use of this code in other courses.	SD	D	N	A	SA
- (b) With respect to the "Schedule" Code:

1. I was well-informed about the existence and the content of the code.	SD	D	N	A	SA
2. I was well-informed about the professor's performance on the code.	SD	D	N	A	SA
3. Time limits for the variation in the schedule are appropriate.	SD	D	N	A	SA
4. This code effectively responded to my needs regarding material coverage.	SD	D	N	A	SA
5. I recommend the use of this code in other courses.	SD	D	N	A	SA
- (c) With respect to the "Review" Code:

1. I was well-informed about the existence and the content of the code.	SD	D	N	A	SA
2. I was well-informed about the professor's performance on the code.	SD	D	N	A	SA
3. Time limits stated in the code are appropriate.	SD	D	N	A	SA
4. This code effectively responded to my needs regarding material review.	SD	D	N	A	SA
5. I recommend the use of this code in other courses.	SD	D	N	A	SA
- (d) With respect to the "Evaluation" Code:

1. I was well-informed about the existence and the content of the code.	SD	D	N	A	SA
2. I was well-informed about the professor's performance on the code.	SD	D	N	A	SA
3. Time limits stated in the code are appropriate.	SD	D	N	A	SA
4. This code effectively responded to my needs regarding material marking.	SD	D	N	A	SA
5. I recommend the use of this code in other courses.					
- (e) With respect to the "Feedback forms: and the "Feedback Handling System":

1. I was well-informed about the existence and the content of these forms.	SD	D	N	A	SA
2. These forms effectively illustrate professor's actions on the content of these forms	SD	D	N	A	SA
3. I recommend the use of these forms in other courses.	SD	D	N	A	SA

- **Please add any comments regarding the codes or the use of standards in this course in general**
-
-

Figure G-2: Final survey form (sample)

Feedback form template	
COURSE TITLE & SECTION	Feedback Form #
FEEDBACK TOPIC	
DATE & TIME RECEIVED:	
RECEIVED FROM:	
RECEIVED BY:	
RECEIVED THROUGH:	
ISSUE BROUGHT FORWARD:	
ISSUE ACKNOWLEDGED:	
INITIAL ASSESSMENT:	
INITIAL ACTION:	
INITIAL RESPONSE:	
INVESTIGATION:	
FURTHER ACTION:	
FURTHER RESPONSE:	
RESOLUTION STATUS:	
CORRECTIVE ACTION:	

Figure G-3: Feedback form template

Midterm survey result template						
	Aware	Not aware	No answer	Useful	Not useful	No answer
Response code						
Schedule code						
Review code						
Customer feedback forms						
	Awareness %	Usefulness %				
Response code						
Schedule code						
Review code						
Customer feedback forms						

Table G-1: Midterm survey result template

The tables below were developed prior to this study.

Final survey result template								
Question number	Question asked	SD	D	N	A	SA	Total answers	Median

Table G-2: Final survey result template

Review Code Performance										
Homework / Quiz / Exam	Due Date	Due Time	Date Notes Posted	Time Notes Posted	Code (Posting)	Code Met? (Posting)	Date Homework / Quiz / Exam Available	Class Available	Code (Availability)	Code Met? (Availability)

Table G-3: Review code performance record template

Schedule code performance record				
NO.	LECTURE TITLE (PLAN)	DATE	COVERED	GAP

Table G-4: Schedule code performance record template

Response code Performance					
Inquiry Number	Student Code Number	Time Received	Time Responded	Response Time	Inquiry Type

Table G-5: Response code performance record template