Applying QFD Approach to Design an Online Course in a Virtual Learning Environment

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Abstract
Migration from the traditional to web-based learning paradigm is usually accompanied by remodeling of many learning core activities particularly those associated with user-centered services. In this capacity of the web-based learning paradigm, many educational centers have established networked environments within which many virtual-user communities are forming and growing. Understanding the virtual user’s needs in these communities has become the first priority of networked learning systems for designing, running and managing effective virtual learning services to meet the increasing expectations of the invisible users. To achieve this, the virtual learning system strives to improve their quality of service by applying a wide range of such quality management approaches as quality function deployment (QFD). QFD initially stresses on driving continuous improvement of the user-oriented services towards end-user satisfaction. The paper attempts to incorporate the QFD to be integrated strategically in designing and managing e-learning provision within networked learning environment.

Keywords: virtual learning environment, Quality function development, user-oriented services.

1. Introduction

Perhaps no other factor in the history of the information and communication technology (ICT) has changed the face of information use and delivery as significantly as the swift emergence of the Internet and related web-based applications in academic settings. The evolving genre of the web has engendered new paradigm of e-research community whose hallmark is scholarly use of the web within ICT-rich learning environments. The significant product of the ICT revolution is the networked education. The networked education has remarkably extended the breadth and scale of scholarly evidence to support innovative learning and research activities.

Migration from the traditional to the web-based education paradigm is usually accompanied by remodeling of many core activities of the networked learning particularly those associated with the user-centered services. Networked learning functions and academic information requirements are inextricably linked. This statement can be translated into: i – quality of information services; ii – efficiency of delivery system; and iii – satisfaction of information consumers. These components motivated
educational centers in incorporating a wide range of quality management approaches (e.g. quality function deployment (QFD)) as an effective means of incorporating quality improvement in their user-centered information services. Networked learning services can be illustrated as open interrelated systems with input-output interoperability where the education administration should maintain user-oriented collection development and information commons as an input and end-user satisfaction as output (Hsieh; et al., 2000).

In recent years, the appeal of web-based instruction has grown dramatically. The idea of having 24-hour access to curriculum from any remote location has students searching for institutions that offer online courses in their discipline. Fields and Huffstutter (2000) state, “To students, the key benefit of such virtual offerings is flexibility and time. Students can log in at their leisure, email their papers and post notes to classmates whenever they want”. Now that the demand is rising and online courses are becoming more commonplace, institutions are responding by offering more classes online. In fact, Chapp (2002) indicated that the number of online courses and colleges will increase drastically in near future. However, developing and delivering an effective online course requires specialized training, proper planning, and significant amounts of time. In an analysis presented by Palloff & Pratt (1999), it showed roughly seven hours per week for a face-to-face class and approximately 18 hours per week for an online class. The use of Quality Function Deployment (QFD) in the initial design process can prove beneficial and save valuable time in the course design process. The transformation of a face-to-face course to a web-based course is not a simple process. Saving PowerPoint slides or class notes as HTML and posting them on the web does not qualify as an instructionally sound web course. Meaning, faculty should adopt an instructional design paradigm that moves away from instructor-controlled (systematic) learning and toward learner-centered (dynamic) instruction. Because of the availability and focus of new technologies faculty should be facilitating online experiences that help learners become skilled at finding and accessing information, evaluating it critically, and using it to solve problems (Gillespie, 1998).

Quality Function Deployment (QFD), Akao “the voice of the customer” is a problem prevention tool. This model is a systematic method for structured product planning and development that enables developers to clearly identify customers’ (students’) wants and needs, and then evaluate each proposed component or service capability systematically in terms of its impact on meeting the expressed desires of the customer (Stein, 2002). QFD was conceived by Yoji Akao during the late 60’s in Japan. However, it was not until 1972 that QFD was publicly recognized when applied at the Mitsubishi shipyards in Japan. QFD was first introduced by two interrelated objectives (Akao, 1972, 1997), these were:

- To convert the core desire, demand and need of the end-users for interesting products into substitute quality characteristics (SQC) at different stages of design and testing.
- To assure that SQC is properly deployed throughout the processes of manufacturing, production, and delivery of new products or services.

If the producer succeeded in bringing the two objectives together, its product would meet the satisfaction of the end-users (Han et al., 2001; ReVelle et al., 1997). Moreover, we can view QFD as a fundamental trade-off between the end-users and the producers. The QFD has been experienced a vast range of development and modifications to yield a
A rigorous analytic tool to understand end-user behavior for developing comprehensive product and service specifications through creating end-user strategies and developing a mechanism for enabling such strategies (Killen et al., 2005). With its roots originally planted in the industrial sectors, QFD has now found acceptance in departmental research in education. These applications range from textbook selection to redesign of departmental business operations. Regardless of the application, the QFD process consists of four primary areas of focus (see Figure 1). The details of each component go beyond the scope of this paper and should be investigated as a separate issue for faculty unfamiliar with QFD. However, the general QFD application focus areas and their operational definitions for this paper are as follows:

1. Product planning – content and audience analysis
2. Part deployment – development of course objectives
3. Process planning – course activities and instructional methods
4. Production planning – delivery techniques

*Figure 1. Quality Function Deployment Stages*

## 2. Product planning stage

The initial phase of the QFD is the product planning stage. During this stage the purpose is to acquire students’ input to define the characteristics of a quality online course from their perspective. Obtaining student information can be accomplished through personal interviews, focus groups, telephone calls, surveys (online and paper), or whatever methods are available. The primary goal is to elicit feedback from those who have taken an online course and input from those who are interested in taking an online course. In addition, faculty must analyze course goals and content to determine course objectives. Product planning is the most critical and difficult step of the process. Maintaining objectivity and capturing the essence of the students’ needs and expectations is vital to ensuring a successful e-learning experience while analyzing course content is the first step in ensuring that the course is instructionally sound.
In trying to achieve the ideal e-learning experience faculty should begin by asking the following types of questions:

1. Who are the students? Is this course a requirement for them or an elective? Are they academically mature?
2. What are their needs?
3. Where does this course fit into the curriculum?
4. What content should be taught in this course?

After the data is collected and categorized through the use of affinity diagrams the process moves toward the creation of the initial House of Quality (HOQ) (see Figure 2). This portion of the process will allow the course designer to transform the information into quantitative data that is useful in the analysis and prioritization of course elements. The course elements that gain top priority are then shifted to the next House of Quality to begin the part deployment stage.

![House of Quality](image)

**Figure 2. House of Quality**

3. Part deployment stage

During the part deployment phase faculty are required to establish course objectives to ensure the course meets curricular requirements and is instructionally sound. In doing so, faculty should continue to analyze course content and student needs. At this point in the process, faculty must be careful not to compromise the instructional integrity of the course. The writing of objectives and test items is not to be taken lightly.
Objectives are the infrastructure upon which instructional experiences are built. However, proper writing of objectives goes far beyond the scope of this paper and therefore could not be addressed thoroughly in this format. Faculty members are encouraged to pursue additional guidance on the writing of objectives in order to ensure it is done properly. The following types of questions might be used to initiate the process.

1. What are the course objectives?
2. What instructional activities will facilitate the meeting of course objectives?
3. What types of test items, or other means of evaluation, will be used to determine whether, or not, students master the content and meet course objectives?

4. Process planning stage

Process planning is used to focus on the technical operations of the online course. Faculty has the opportunity to prescribe the flow and delivery styles of information and activities. For example, an instructor presenting lecture material on hiring front-line supervisors may choose to deliver a PowerPoint lecture followed by streaming video and an online discussion of the topic. Another instructor delivering the same lecture may choose to remove the PowerPoint slides and inject an online quiz relating to an appropriate chapter in the textbook. The ways in which faculty delivery their course materials and select course activities is unique to their teaching style. However, through the use of QFD we can structure the learning processes to best suite our students.

As the course development process begins, faculty must consider the style of web-based instruction and the learning styles of the students. Due to the diversity of student learning styles and academic maturity it is beneficial for instructors to utilize several different instructional approaches and activities. The acknowledgement of this incongruence should serve as a design consideration to avoid producing dysfunctional web-based courses. Although it is humanly impossible to meets the needs of all students in face-to-face environments, technology has made it possible to offer several varieties of learning activities to engage students in a web-based environment.

Developing a variety of activities to address students’ needs can prove to be a formidable task. There are multiple modes of delivery (text-based, streaming video/audio, graphic interfaces, etc.) available through the Internet, however all students are not equipped with the same hardware and software. Therefore, activities must be generated to work with a set of minimal standards (hardware and software) that are available to all students. This can be achieved by using programs that offer shareware to students. Examples of such software are Macromedia Flash, Adobe Acrobat, Real Media Player, and PowerPoint viewer. Providing students multiple options for learning course materials has proven to be effective. Additionally, the availability of options has the potential to facilitate an opportunity to help students learn or acquire information in alternate methods. In general, the choice of media for any learning activity will of course be heavily influenced by the range of issues related to how and when the activities will be undertaken by the students (Ryan et al., 2000).
In order to ensure that the quality of a course is enhanced by the activities, faculty must address the following:
1. Which course objective is addressed by each activity?
2. What, exactly will students gain from engaging in the prescribed activities?
3. Is the value of the activities obvious to students?

As course content and activities will vary, instructors are encouraged to continue the questioning process as needed for their online course(s). Overall, online activities must support course objectives in a manner that is meaningful to students and instructionally sound. An additional feature that was critical to Southeast choosing to create and use OIS was the clean architecture of the internal and external communication functions. In a web-based learning environment communication between the instructor, the software, and students is vital. Being able to maintain a high-level of secure communication throughout the e-learning experience is essential for academic success. By moving all communications modes (email, file sharing, electronic posts, etc.) inside the software, faculty and students are provided a heightened sense of privacy and security.

5. Production planning stage

The last stage of the QFD process is the production planning. The goal of the production planning stage is to outline and structure the material, activities, and technologies necessary to deliver the course online. The variety of online course delivery systems currently available allows institutions to choose from several options. As the market continues to grow with the advancements in technology, the selection of a software package can be a daunting task. In a web-based learning environment communication between the instructor, the software, and students is vital. Being able to maintain a high-level of secure communication throughout the e-learning experience is essential for academic success. By moving all communications modes (email, file sharing, electronic posts, etc.) inside the software, faculty and students are provided a heightened sense of privacy and security.

Technology selection and support has a significant impact on teaching online, both for faculty and students. Therefore, consideration must be given to the relationship between instructional needs and the available technological capabilities before venturing into the e-learning arena. At a minimum, faculty should remember that online courses require reliable, scalable, and flexible information technology capabilities for communicating, collaborating, and information sharing (Rai, 2000).

6. The other final stage (evaluation)

Although the production planning stage is referred to as the last stage this is not actually the case where course design and development is concerned. Upon completion of the production planning stage faculty should have a working prototype of the course. As with all prototypes, a thorough review of the online course should be performed before it
is deployed. A good method of evaluation would be to use a small group of students to pilot the course as an alternate delivery to a current face-to-face course. The feedback from these students will be necessary to see if the course design is effective. Once a beta-test of the course has been conducted the course will be either revised or packaged for use.

7. Conclusions

Well-developed online courses that facilitate above-average learning experiences are not commonplace. They are overshadowed by the multitude of self-directed online correspondence courses. As faculty set out to design an online course they should give thought to the entire process, from development to deployment. Otherwise, they can create frustration for themselves and their students. Quality Function Deployment (QFD) can be useful in the course development process. It is a simple, yet powerful, means of discovering key characteristics of a successful online course. Being proactive and using QFD principles properly will help faculty to identify instructional design and technical concerns early in the design process. Utilizing QFD early in the planning stages of an online course will minimize frustration and maximize the learning process. Both of which can lead to a strong e-learning experience for students and faculty.

The use of Quality Function Deployment and contemporary instructional design models can assist in the successful design of a web-based course. Understanding the student’s expectations and desires is critical.

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