Quality Function Deployment applied to the design of Educational Intranet

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Abstract: This paper introduces an application of Quality Function Deployment (QFD) in design of Educational Intranet. In order to capture student's requirements, and translates those needs into characteristics about a product or service, develop, and implement the plan to progressively deliver an improved Network Computer course in an on-line format through the Intranet.

Introduction

The Internet opens a new generation of distance education, introducing sophisticated delivery tools and creating a paradigm shift with profound implications on the design of distance education courses.

QFD was developed to design quality into a product [3]. QFD utilises basic dimensionality within a project to provide a structure way of designing quality into a system. It addresses dimensions including customer desire, quality characteristics, functions, parts, and failure modes. QFD is a system engineering process, which can be applied to large systems. It can be extended to a project functions, project phases, project resource utilisation, and other areas such education.

The Virtual University has gained considerable experience in the use of computer-mediated communication and similar techniques in distance education. The strengths and weakness of electronic communication as an educational medium and the resulting consequences for universities are examined. It seems clear that while the short- term effects of the medium are relatively small, in the longer term they may entirely reshape the conception of a university. The role of the academic will change, and new forms of literacy will need to be developed. Issues of access and equability will need to be addressed and learning methods adapted so that the medium gives high added- value.

Quality Function Deployment (QFD)

QFD was born as a method or concept for new product development under the umbrella of Total Quality Control [4], to flourish business, designing products and services that excite the customer and creating new markets is a critical strategy.

Growth can be achieved in many different ways-selling through different channels, selling more to existing customers, acquisitions, geographic expansion-nothing energises a company more than creating new products or upgrading existing products to create customer delight.

Quality Function Deployment (QFD) is a methodology for building the voice of the customer into product and service designs. It is a team tool, which captures customer requirements and translates those needs into characteristics about a product or service.

The origins of QFD come from Japan. In 1966, the Japanese began to formalise the teachings of Yoji Akao on QFD. Quality Function Deployment uses some principles from Concurrent Engineering in that cross-functional teams are involved in all phases of product development. Each of the four phases in a QFD process uses a matrix to translate customer requirements from initial planning stages through production control.

A QFD process involves four phases, each phase, or matrix, represents a more specific aspect of the product's requirements, where binary relationships between elements are evaluated for each phase. Table 1 represent the Phases of Quality Function Deployment. QFD is a systematic means of ensuring that customer requirements are accurately translated into relevant technical descriptors throughout each stage of product development. Meeting or exceeding customer demands means more than just maintaining or improving product performance. It means building products that delight customers and fulfil their unarticulated desires.

PHASE	DESCRIPTION
Product Planning: "The House of Quality"	Led by the marketing department, many organisations only get through this phase of a QFD process. Phase 1 documents customer requirements, warranty data, competitive opportunities, product measurements, competing product measures, and the technical ability of the organisation to meet each customer requirement. Getting good data from the customer in phase 1 is critical to the success of the entire QFD process.
Product Design	Led by the engineering department. Product design requires creativity and innovative team ideas. Product concepts are created during this phase and part specifications are documented. Parts that are determined to be most important to meeting customer needs are then deployed into process planning, or phase 3.
Process Planning	Process planning comes next and is led by manufacturing engineering. During process planning, manufacturing processes are flowcharted and process parameters (or target values) are documented.
Process Control	In the production planning, performance indicators are created to monitor the production process, maintenance schedules, and skills training for operators. Also, in this phase decisions are made as to which process poses the most risk and controls are put in place to prevent failures. Phase 4 is usually led by the quality assurance department in concert with manufacturing.

Table 1: Phases of Quality Function Deployment

The House of Quality

The House of Quality (HOQ) is the first matrix that a product development team uses to initiate a Quality Function Deployment (QFD) process. This matrix is especially powerful because of the amount of information that can be documented and analysed. QFD methodology requires that the team ask specific questions about customer needs, competitors, and how their organisation will meet the challenges of providing products that delight the customer. Table 2 represent the Steps of the House of Quality and their description.

Numbers are then added up in their respective columns to determine the importance for each technical descriptor. Now you know which technical aspects of your product matters the most to your customer!

STEPS	DESCRIPTION
Step-1 Customer Requirements - "Voice of the Customer"	The first step in a QFD project is to determine what market segments will be analysed during the process and to identify who the customers are. The team then gathers information from customers on the requirements they have for the product or service. In order to organise and evaluate this data, the team uses simple quality tools like Affinity Diagrams or Tree Diagrams.
Step-2 Regulatory Requirements	Not all product or service requirements are known to the customer, so the team must document requirements that are dictated by management or regulatory standards that the product must adhere to.
Step-3 Customer Importance Ratings	On a scale from 1 - 5, customers then rate the importance of each requirement. This number will be used later in the relationship matrix.

Step-4 Customer Rating of the Competition	Understanding how customers rate the competition can be a tremendous competitive advantage. In this step of the QFD process, it is also a good idea to ask customers how your product or service rates in relation to the competition. There is remodelling that can take place in this part of the House of Quality. Additional rooms that identify sales opportunities, goals for continuous improvement, customer complaints, etc., can be added.
Step-5 Technical Descriptors - "Voice of the Engineer"	The technical descriptors are attributes about the product or service that can be measured and benchmarked against the competition. Technical descriptors may exist that your organisation is already using to determine product specification, however new measurements can be created to ensure that your product is meeting customer needs.
Step-6 Direction of Improvement	As the team defines the technical descriptors, a determination must be made as to the direction of movement for each descriptor.
Step-7 Relationship Matrix	The relationship matrix is where the team determines the relationship between customer needs and the company's ability to meet those needs. The team asks the question, "what is the strength of the relationship between the technical descriptors and the customers needs?" Relationships can either be weak, moderate, or strong and carry a numeric value of 1, 3 or 9.
Step-8 Technical Analysis of Competitor Products	To better understand the competition, engineering then conducts a comparison of competitor technical descriptors. This process involves reverse engineering competitor products to determine specific values for competitor technical descriptors.
Step-9 Target Values for Technical Descriptors	At this stage in the process, the QFD team begins to establish target values for each technical descriptor. Target values represent "how much" for the technical descriptors.
Step-10 Correlation Matrix	This room in the matrix is where the term House of Quality comes from because it makes the matrix look like a house with a roof. The correlation matrix is probably the least used room in the House of Quality; however, this room is a big help to the design engineers in the next phase of a comprehensive QFD project. Team members must examine how each of the technical descriptors impact each other. The team should document strong negative relationships between technical descriptors and work to eliminate physical contradictions.
Step-11 Absolute Importance	Finally, the team calculates the absolute importance for each technical descriptor. This numerical calculation is the product of the cell value and the customer importance rating.

Table 2: Steps of the House of Quality

The use of Workflow in the modelling of the actual situation

After the use of QFD methodology a traditional workflow procedure is use to represent the actual situation in the educational process of single student in the Industrial Engineering Department in a Network Computer course at Santiago University in Chile [1]. In the process

of perform the course there are four essential steps which are defined as preparation, presentation, development and finalise the course, in this steps the lecture and students]interact producing an interacting map as represented in Figure 1.

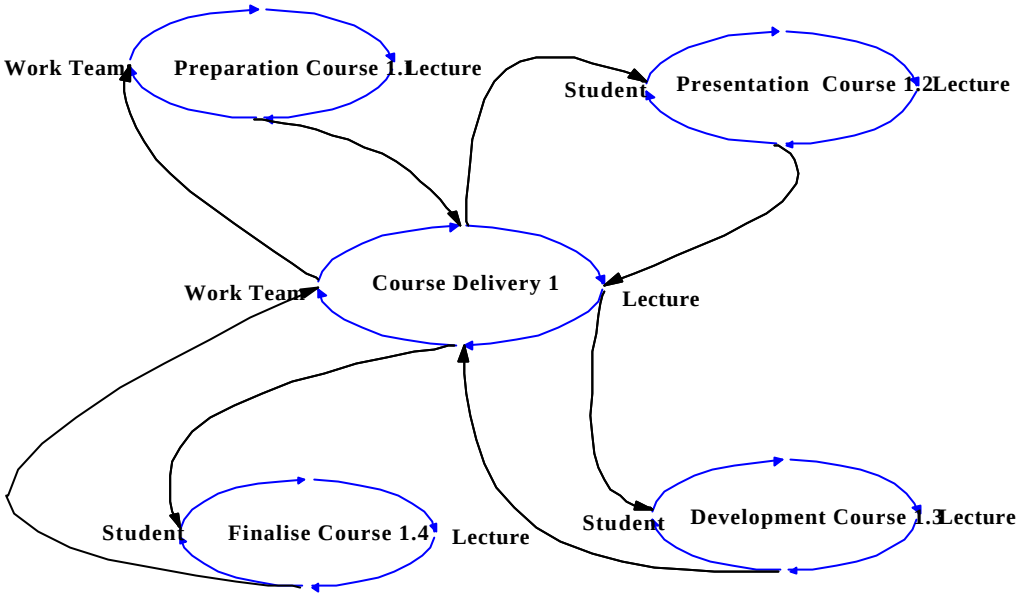

Figure 1: Preparation, Presentation, Development and Finalise a Course

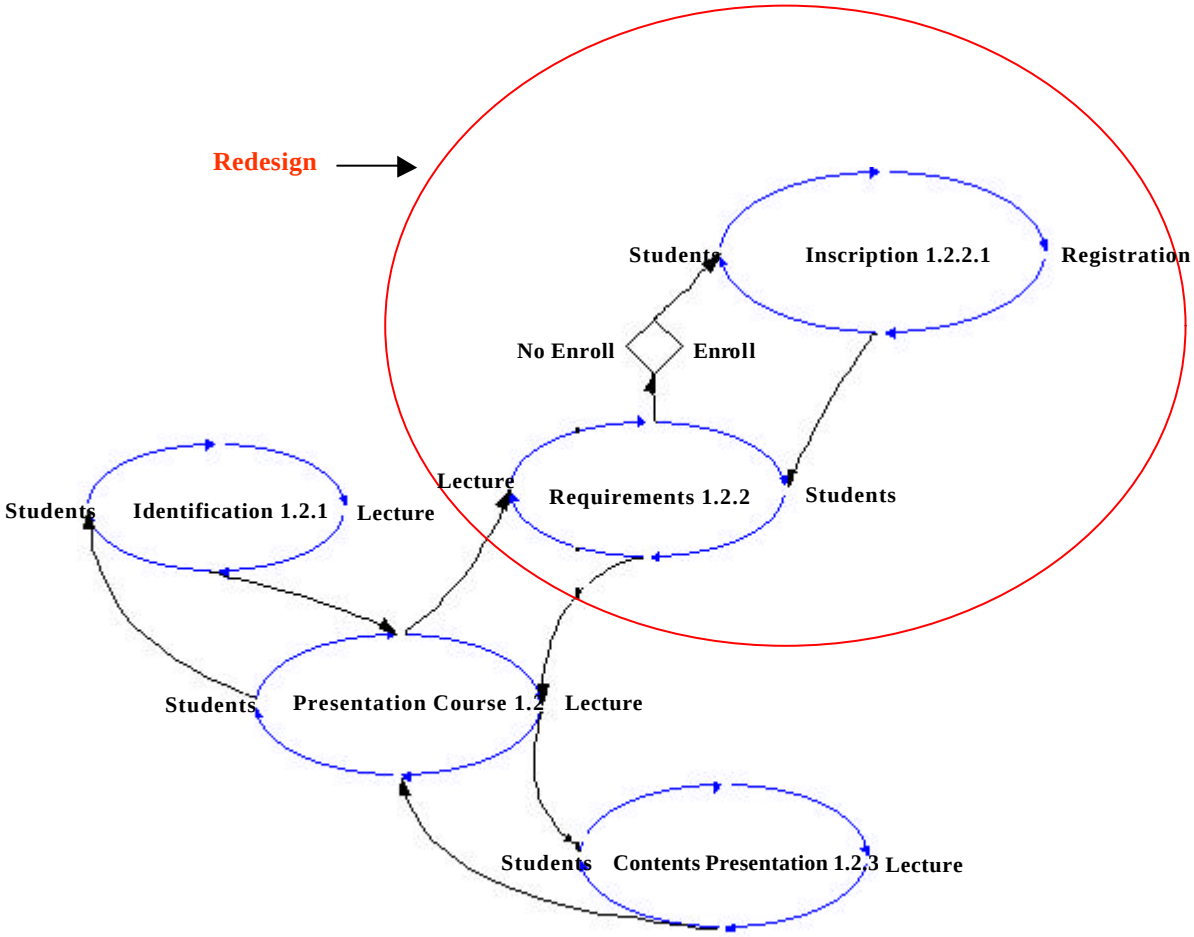

Figure 2: Redesign of the Presentation Course

Modelling of the proposed situation

The new situations propose the development of the study through the use of the Internet. Figure 3 represents the client/server architecture to be used in this application.

Where:

Client: The student receives and transmits information by the use of the browser from their computer.

Web Application: Hypermedia system, which provided an interface to the student to work and study by the use of the Internet.

Web Server: Is the computer in charge of replay the information requirements generated by the student.

Web Requirements Handlers: Interfaces used to generate responses to the request. Among them Java applets, ASP (Active server page) o CGI (common gateway interface) and electronic mails (e-mail).

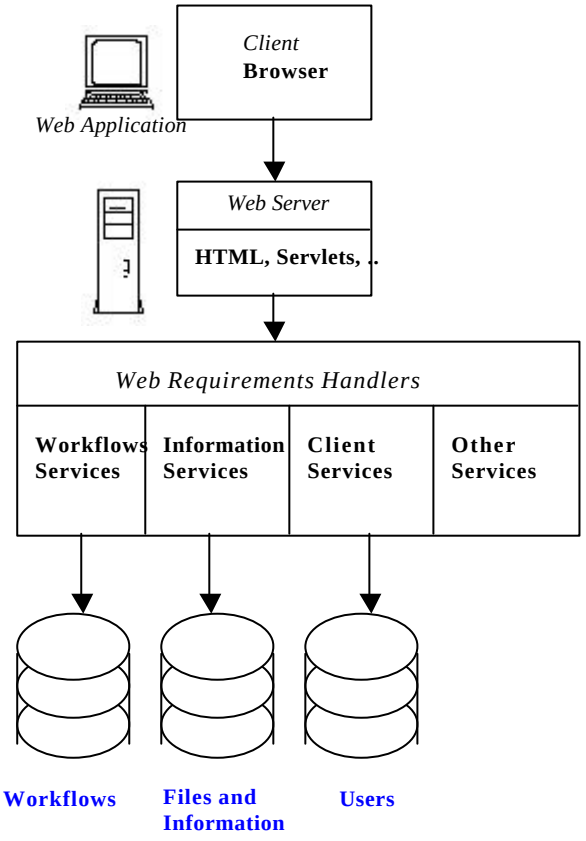

Figure 3 Client/server architecture

Output generation

Figure 4 represent one of the standard output of this system, to achieve to this slice traditional RMM methodology [2] has been used in order to guide the navigation, those details are not presented in this paper.

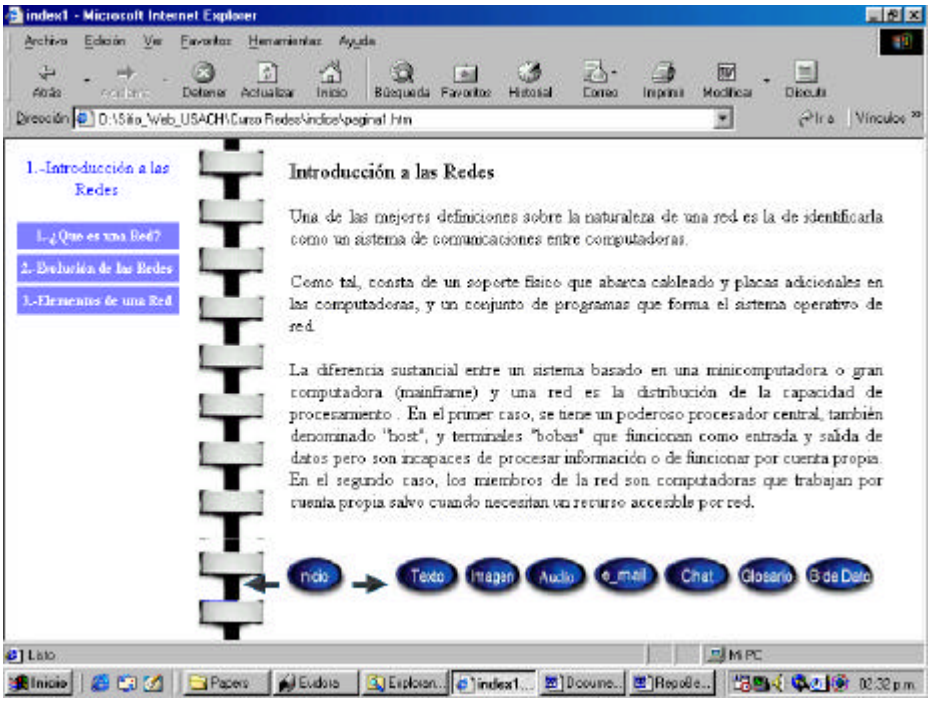

Figure 4: Slice

Figure 5 represents the Glossary service provided by the system according to the student requirements, this service can be issue every time the student has a doubt and can be removed every time the requirement is satisfying.

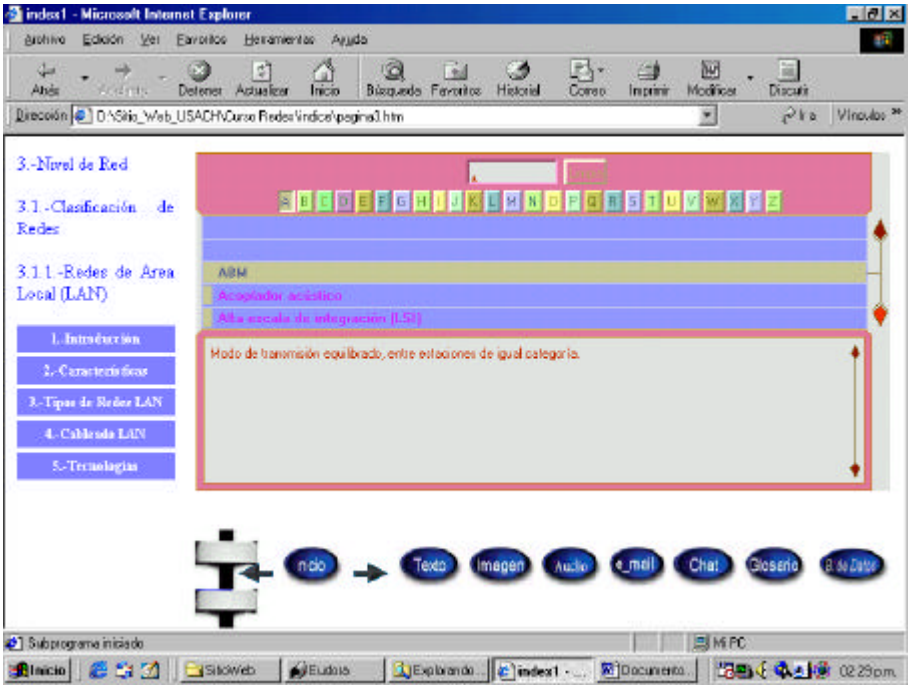

Figure 5: Glossary service

Figure 6 represent the audio service used to control the reproduction of audio file, previously recorded that can be executed according to the student's requirement.

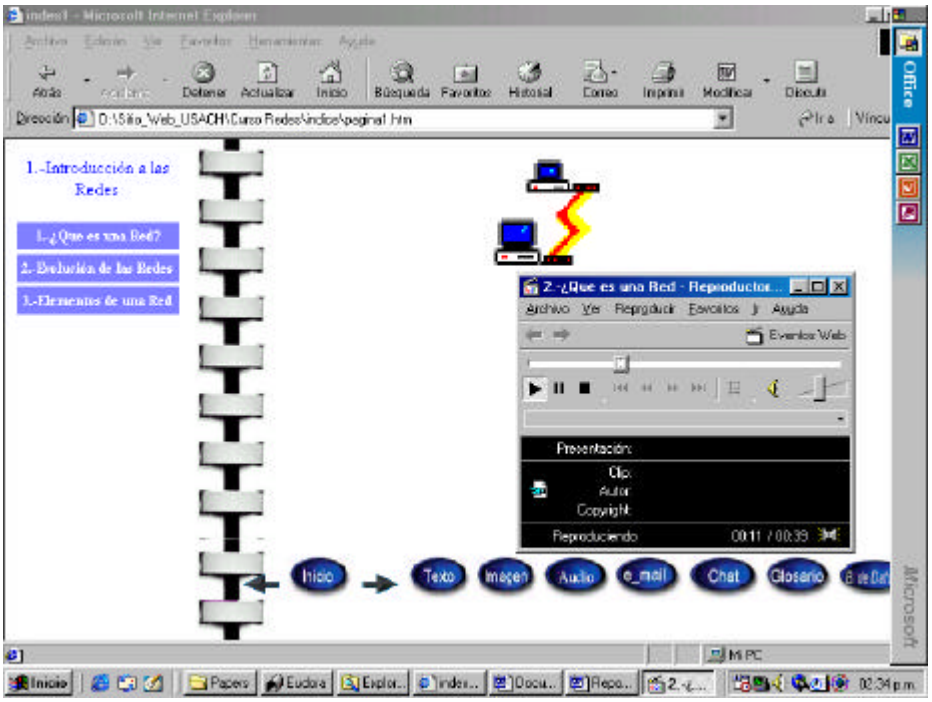

Figure 6: Audio service

Comparison between actual situation and proposed situation.

Figure 7 shown the number of interactions for every actor in the physical educational process and distance learning process, which correspond to the actual situation and proposed situation, respectively.

The number of interaction is dramatically reduced by the use of the Intranet through the web.

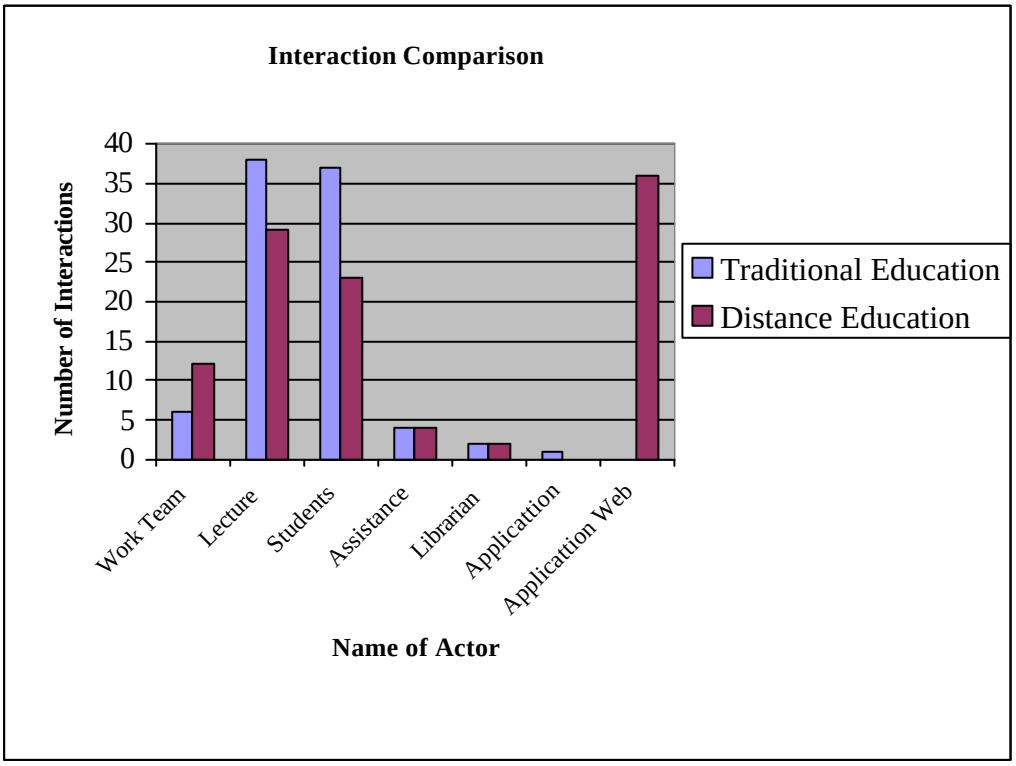

Figure 7: Interaction comparison

Conclusions

In this work an application of QFD in Intranet design has been achieved trough Workflow methodology.

In order to obtain direct information on trainee's perceptions of this on line course, groups we asked to complete a questionnaire after the course. This covered past experience of Internet, the perceived usability of on-line course, its main advantages or disadvantages, and what other support they felt might have been useful. Which aspects of the course task had been seen as most useful, and which as least, and whether there were any surprising or disappointing outcomes. Everyone liked the speed of exchange. The successful joint production of the on- line course was spontaneously mentioned by almost all as surprising and positive outcomes.

The characteristics of the trainees and the task they were set would help them establish a shared purpose, which would motivate on line interaction. The computer mediated communication usage that occurred would reflect the requirements of this shared purpose and the conferencing system's success would be a function of how far it helped the shared purpose to be achieved.

In this course, the number of interactions between teacher and pupil has been reduced in order to decrease of education cost .

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