# An Assessment of Factors of Service Quality of E-learning

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## Note:

## Preface

Research Center for Management Studies (RCMS), which was created five years ago at SDMIMD, has endeavoured to promote research in the field of management education in the Institute, in various ways. The Research Centre has encouraged faculty and students to actively take part in research activities jointly, collate and disseminate findings of the research activities through various types of projects to contribute to the body of knowledge to the academic fraternity in general, and management education in particular.

In this direction, keeping in line with the philosophy of promoting active research in the field of management to capture live situations and issues, the Research Center has taken a unique initiative to sponsor and encourage faculty members to carry out Applied Research Projects in various areas of management.

The duration of these projects is between four to eight months. At the end of the project, after peer review, a publication is taken out with an ISBN number by the institute. The projects help the faculty members, and the students, who work under the supervision of the faculty members for these projects, to identify issues of current importance in the field of management in various sectors. Data is collected mostly through primary research, through interviews and field study.

The institute takes into account the time and resources required by a faculty member to carry out such projects, and, fully sponsors them to cover the various costs of the project work (for data collection, travel, etc), thereby providing a unique opportunity to the two most important institutional stakeholders (faculty and students), to enrich their knowledge by extending their academic activities, outside the classroom learning situation, in the real world.

From the academic viewpoint, these projects provide a unique opportunity to the faculty and the engaging students to get a first-hand experience in knowing problems of targeted organizations or sectors on a face to face basis, thereby, helping in knowledge creation and its transfer, adding to the overall process of learning in a practical manner, with application of knowledge, as the focus of learning pedagogy, which is vital in management education.

**Dr. Mousumi Sengupta**

Chairperson, SDM RCMS

## Acknowledgement

Very rarely does a research project succeed due to one individual's efforts. Invariably, there are numerous people who work behind the scene and contribute to the success of research project. This project too is not an exception.

I would like to thank Dr. Lakshminarayana, Faculty at SDMIMD who added immense value by providing deeper insights into data modelling and analysis and guiding me through the analysis and inferences. It won't be an exaggeration if I say that, the project would not have seen the light of the day without the guidance of Dr. Lakshminarayana.

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## Executive Summary

On-line e-learning is becoming all-pervading, right from higher education to corporate training, thanks to the explosive growth of internet and reducing cost of communication. While diffusion of e-learning is exponential, there is also the disturbing trend of just about only 5% of people complete the course. (Ho A D et al, 2014). Service quality is one of the reasons why participants do not compete the course.

The objective of this research was to formulate a framework for service quality of paid on-line e-learning certification courses. The research was based on the study conducted on 243 respondents in Bangalore and Mysore who are pursuing/ have completed on-line e-learning certification courses.

The study identified three dimensions viz., information quality, system quality and experience quality that contribute to service quality. Further, the study also identified the factors that constitute these dimensions - content and instructional design constitute information quality; pedagogy and technology constitute system quality; user interface and user experience constitute experience quality. The factors in turn were made up of totally sixteen constructs. The results of the study helped in creating a model for evaluating service quality.

The study also established that positive relationships exist between service quality and different dimensions of service quality and service quality and different factors that constitute the dimensions of service quality.

***Key words :*** *service quality, e-learning, information quality, system quality, experience quality.*

# 1. Introduction

## 1.1 E-learning in India

Education has evolved over the past few decades in India. Fuelled by explosive growth in population and burgeoning middle class who aspire to reach higher standards of living, education is seen as a passport to success. However, the investment by government in education has not kept pace with the population growth. As a result, though India has the largest pool of students graduating from its multitudes of institutes and universities, it also has the dubious distinction of finding only a quarter of them employable. There is a crying need for job specific education for the un-employed and continuing training for those who are employed.

The gross enrolment ratio in India is just 21%, which means that 79% of those who join school never pursue higher education. To gainfully employ them and to channelize their potential for productive work, it is required to skill them. Skill India Mission alone is expected to impart skills training to 500 million people by 2022. This is up from 3.1 million people who are being trained annually now. (The Economic Times, 2015). Continuing education and skilling in India is a task of epic proportion, what with the huge population and acute shortage of teachers. The only way to overcome this mammoth challenge is to move to technology enabled learning, i.e. E-learning.

With the current connectivity and communication infrastructure, it is unthinkable that E-learning can be rolled out to millions across India. But with the promised investment of over Rs.4.5 Lakh Crores, the Digital India initiative is expected to take quality learning and education to nook and crook of the country, where high speed internet and bandwidth were hitherto not available. Even now, there are several organisations in India that are developing e-learning content for global markets, but could not deploy them within the country due to inadequate infrastructure. This is likely to change with 'Digital India' initiative.

Even without considering the impact of Digital India, E-learning in India is expected to grow at a CAGR of 17.4% from 2013 to 2018 (Docebo, 2014), double that of the global growth. In 2010-11, the Indian e-learning market was valued at Rs.18.41 trillion. Increased internet penetration, rising demand and lower cost of coverage are expected to further develop the Indian e-learning market. Newer technologies like Internet of Things, Big Data and Cloud are likely to change not only how content for e-learning is produced, but also how it is consumed by the learners. Even now, for example the MOOC (massively open online course) provider Coursera has one million users from India, almost the same as from China and considers India is its biggest source of online learners after the US, its home base.

Advancements in technology have helped in delivering digital content through multiple modes such as smart phones and tablets. There are several initiatives like that by Ericsson that uses smart phones to deliver content for IGNOU (Indira Gandhi National Open University), by Educomp that has launched its school education platform, where children download content through 3G wireless networks and by HCL Technologies in partnership with Government of India that proposed to launch Sakshat, a tablet priced at around Rs.1500. The scheme aims to connect 25,000 colleges and 400 universities across the country in an e-learning program through an existing Sakshat portal. (EY 2015).

Digital India and the resultant increase in high speed broadband connectivity, especially in rural areas and penetration of smart phones and low cost tablets and laptops are expected to grow India's e-learning industry many fold. Availability of education anytime, to anyone and anywhere is increasingly appealing not only to students, but also to working professionals and to the corporate sector.

# 2. Literature Review

## 2.1 Service Quality

The concept of service can be defined as an intangible product that cannot be owned or stored, but it comes to an existence at the time and place it meets or exceeds the expectations of customers (Jain et al, 2010; Zeithaml, et al., 2006; Nitecki & Hernon, 2000; Cronin & Taylor, 1992; Bolton & Drew, 1991; Lewis & Mitchell, 1990; Parasuraman, 2004). The difference in service quality is the degree and direction of discrepancy or gap between customer expectations and perceptions of a service (Parasuraman et al., 1985). The measurement of service quality has been illustrated along a continuum ranging from ideal quality to totally unacceptable quality with some point along the continuum representing satisfactory quality. The position of customer perceptions of service quality on the continuum depends on the nature of discrepancy

between the expected service and the service perceived by the customer. On one hand, if expectations are greater than perceptions, the perceived service quality is less than being satisfactory and customer dissatisfaction is said to occur. On the other hand, if expectations are less than perceptions, perceived service quality is said to be satisfactory and will tend toward ideal quality.

According to Parasuraman et al. (1991), the use of technology to cater to demand and to enhance the service quality, can give companies a fair competitive advantage. Service Quality has also been seen as a driver of corporate financial and marketing performance. Service quality is an antecedent of customer satisfaction and the customer satisfaction exerts a stronger influence on the purchase intentions than service quality (Cronin & Taylor, 1992). According to Chang (2008), the concept of service quality should be approached from the customer's point of view, because their values, grounds of assessment and circumstances may differ. Parasuraman et al (1985) state that customers find it more difficult to evaluate the quality of services than to evaluate the quality of products, because evaluating the former means assessing not only results, but also the process of providing the service. Kumra (2008) illustrates that, the service quality does not only concern with the final product and service but also is involved in the production and delivery process, which makes employee involvement very crucial.

Gronroos (1982) described the total service quality as customer's perception of difference between the expected service and the perceived service. Asubonteng et al (1996) defined service quality as the difference between customers' expectations for service performance prior to the service encounter and their perceptions of the service received. Gefan (2002) defined that service quality as the subjective comparison that customers make between the quality of the service that they want to receive and what they actually get.

### *2.1.1 Service Quality Models*

Two of the best known scales for measuring service quality are the SERVQUAL scale (Parasuraman et al., 1985, 1988) and the SERVPREF scale (Cronin & Taylor, 1992, 1994), the later scale being a reaction to and a criticism of the former. The SERVQUAL scale attempts to measure service quality as the difference between the expectations and perceptions of customers. It uses 22 items grouped into five dimensions: tangibility, reliability, responsiveness, assurance and empathy. By contrast, the SERVPREF scale is based solely on the result of the service, and does not take expectations into account.

A research study on service quality presented by Gronroos (2007) focuses on a model that is a comparison between customer expectations of the service and the experience they had before. This model is known as "total perceived service quality". In this, he emphasizes on what customer is really looking for and what they evaluate. The service quality is based on two dimensions. The first dimension is the technical quality which refers to the outcome; what the customer gets from the service. The second dimension is the functional quality which refers to the manner in which the service is delivered. Thus, both dimensions affect the corporate image and the perception of quality in various ways.

The Gap Analysis Model developed by Parasuraman et al (1985, 1990) is a well-known and even today, the mostly widely used model of service quality. This model shows an integrated view of the consumer-company relationship. The main idea of this model is that, service quality is dependent on the size and direction of the five gaps that can exist in the service delivery process.

a. ***Gap 1:*** the gap between customer expectations and those perceived by management to be the customer's expectations.

b. ***Gap 2:*** the gap between management's perception of consumer expectations and the firm's service quality specifications.

c. ***Gap 3:*** the gap between service quality specifications and service delivery.

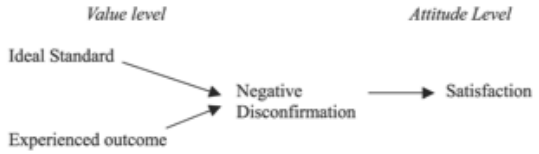
d. ***Gap 4:*** gap between the service delivery and service promised; external communication gap.

e. ***Gap 5:*** the perceived service quality gap, the difference between expected and perceived service.

The first four gaps are identified as functions of the way in which service is delivered by the service provider, while gap five focusses on the customer and is

considered to be the truth of service quality. Gap five is also the gap that the of SERVQUAL instrument influences.

Mattson (1992) developed a value model of service quality where he argues for value approach to service quality, modelling it as an outcome of satisfaction process. The value based model of service quality suggests the use of a perceived ideal standard against which the experience is compared. Figure shows that implicit negative disconfirmation on a pre-conscious value level which is then hypothesized to determine satisfaction on a "higher" attitude level. The negative disconfirmation is the major determinant of consumer satisfaction, more attention should be given to cognitive process by which consumers' service concepts are formed and changed.




**Source:** Mattsson (1992)

***Figure 1***

The traditional expectation disconfirmation paradigm which is the most common framework for satisfaction studies, proposes that customers maintain a standard of reference to which they compare perceived performance. It also assumes a linear relationship between product/service performance and customer satisfaction (Fick & Ritchie, 1991; Brock & Sulsky, 1994; Bhuian & Menguc, 2002). However, increasing fulfilment of customer expectations does not always mean a proportional increase or decrease in customer satisfaction since this change also depends on the 'type' of expectation (Matzler et al., 1996). Different customer expectations affect customer satisfaction differently.

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Kano et al. (1984) developed a two-way model that distinguishes between different quality attribute types. This model divides product or service quality attributes into the following five distinct categories, each of which influences customer satisfaction differently.

1. **Attractive quality:** customer will be satisfied if this attribute is present, but absence of this, will not lead to dissatisfaction. It can differentiate a product/service from competitors.
2. **One-dimensional quality:** this attribute is positively and linearly related to customer satisfaction – that is, the greater the degree of fulfilment of this attribute, the greater the degree of customer satisfaction, and vice versa.
3. **Must-be quality:** this is the basic criteria of a product/service, and customers will be extremely dissatisfied if it is absent. However the fulfilment of this attribute does not increase satisfaction since customers take it for granted.
4. **Indifferent quality:** an attribute whose presence or absence does not cause any customer satisfaction or dissatisfaction.
5. **Reverse quality:** an attribute whose presence causes customer dissatisfaction, and whose absence results in customer satisfaction.

Classifying customer requirements through the Kano's model is beneficial in setting priorities for product/service development and improvement. For example, a general guideline for product/service development based on the survey results may be to fulfil must-be requirements, be competitive with one-dimensional requirements, and include differentiating attractive requirement. In competitive product/service analysis, improving performance in terms of must-be requirements that have already reached a satisfactory level is less productive than improving performance in one-dimensional or attractive requirements. Kano's classification of customer expectations enables product/service developers to focus their efforts where the customer will notice their effect the most (Berger et al., 1993). The classified results can also provide valuable assistance in studying product/service

development trade-off. If two or more requirements cannot be met simultaneously due to technical or financial reasons, the requirement with the greatest influence on customer satisfaction is chosen.

### *2.1.2 Service Quality in Education*

The terms 'service quality' and 'quality in education' are difficult to define. Perceptions of service quality often differ based on the requirements of the service's individual customer. In the educational setting, one customer might consider a certain class, curriculum, or university a high-quality educational experience while another might find the same experience mediocre. Karapetrovic and Willborn (1997) defined quality of education as 'the ability of student's knowledge to satisfy stated requirements- those requirements being set by employers, accrediting bodies, professional societies, etc.

Nowadays, higher education is being driven towards commercial competition imposed by economic forces resulting from the development of global education markets and the reduction of Government funds that forces tertiary institutions to seek other financial sources. Tertiary institutions had to be concerned with not only what the society values in the skills and abilities of their graduates (Ginsberg, 1991; Lawson, 1992), but also how their students feel about their educational experience (Bemowski, 1991). These new perspectives call attention to the management processes within the institutions as an alternative to the traditional areas of academic standards, accreditation and performance indicators of teaching and research.

Tertiary educators are being called to account for the quality of education that they provide. While more accountability in tertiary education is probably desirable, the mechanisms for its achievement are being hotly debated. Hattie (1985) and Soutar and McNeil (1996) oppose the current system of centralized control, in which the Government sets up a number of performance indicators that are linked to funding decisions. There are a number of problems in developing performance indicators in tertiary education. One such problem is that performance indicators tend to become measures of activity rather than true measures of the quality of students' educational service (Soutar & McNeil, 1996). These performance indicators may have something to do with the provision of tertiary education, but they certainly fail to measure the quality of education provided in any comprehensive way.

According to Nadiri et al (2009), the evaluation of service quality in higher education consists of two dimensions- tangibles and intangibles. They say that, the students expect universities to have a modern looking equipment and appealing materials associated with the service such as brochures, pamphlets etc. Authorities should make sure that the employees are well trained and understand the level of service that the university expects to provide for its students. Also, Rasli et al (2011) suggest that the student's decision to enrol depends on the service encounters relating to factors like support and infrastructure, image and marketing, academic issues, administrative issues, location and access.

A survey conducted by Owlia and Aspinwall (1997) examined the views of different professionals and practitioners on the quality in higher education and concluded that customer-orientation in higher education is a generally accepted principle. They construed that from the different customers of higher education, students were given the highest rank. Student experience in a tertiary education institution should be a key issue on which performance indicators must be based on. Thus it becomes important to identify determinants or critical factors of service quality from the standpoint of students being the primary customers. In view of this, Firdaus (2004) proposed HEdPERF (Higher Education Performance), a new and more comprehensive performance-based measuring scale that attempts to capture the authentic determinants of service quality within higher education sector. The 41-item instrument, HEdPERF scale is compared with that of two alternatives namely SERVPERF instrument and the merged HEdPERF–SERVPERF as moderating scale. The goal is to assess the relative strengths and weaknesses of each instrument in order to determine which instrument had the superior measurement capability in terms of uni-dimensionality, reliability, validity and explained variance of service quality. Eventually, the results of this comparative study were used to refine the HEdPERF scale, transforming it into an ideal measuring instrument of service quality for higher education sector.

While many organizations struggle with competing customer demands, there are several other aspects that further complicate the higher education setting. Ewell (1993) pointed out that in the instructional area, faculty most often view students as raw materials. Mazur (1996) also believed that instructors don't view students as customers, rather as raw materials being developed into a product for the ultimate customers – industry and society.

Helms and Key (1994) noted that students could be classified as a raw material, customer, or even as employees. As a raw material, students move through a process and become the end product. As customers, students purchase the service of education. Helms and Key noted that students must be engaged in their studies, must be motivated to perform, and are evaluated –making them much like employees. In addition, quality of student performance is important to a university in much the same way that quality of employee performance is important in the business setting. Further analysing the differing roles of students, Helms and Key (1994) pointed out that different educational settings provide different roles for students. In large, introductory classes the students are very much like customers; however, in specialised graduate research settings students are more like employees.

### 2.2. E-Learning

E-Learning most often means an approach to facilitate and enhance learning by means of personal computers, CD-ROMs, audio-visual aids and the internet. This includes e-mails, discussion forums, and collaborative software (S.K.Nayak et al., 2010). The E-learning can also include learning through different technology tools like web or on-line e-learning.

#### *2.2.1 Types of Technology enabled learning*

Every instructor can use technology to enhance their teaching in uniquely effective ways. As technology and instructional methods evolve, students' expectation also evolve for a technology- driven learning experience. Technology enhanced learning is increasingly being used in the UK, Europe and other parts of the world (Kirkwoodet al, 2014). The different types of technology enabled learning tools and types are as below:

**Student created content**: Content is created by students for an assignment or project. It can be a persuasive presentation, a digital booklet, an animated report or a video they shot etc. It helps students to learn better when they create their own contents and share it with their peers.

**Collaborative Learning**: Digital collaborative learning is an interactive way to learn. This includes a team, who can communicate face to face anytime anywhere. It can also use interactive whiteboards to create content.

**Mobile learning:** Mobile technology is exactly what the name implies--technology that is portable. Otherwise known as "m-education" or "m-learning," mobile technology is having an effect on instruction. More recently, colleges have realized the great benefit of mobile learning. In the article, 'Mobile Technology Use in Education' in Marketing with New Technology (2011), the authors suggest that most campuses are now using mobile technology to connect with prospective and existing students, sharing information, and supporting overall administration. Interactions can happen at any time and in any place with other students, with the teacher, with the course materials, and with outside resources and experts.

**Audio and Video:** Audio can be classroom microphones or can be streaming audio over the internet through webcasts and podcasts. Video technology has included VHS tapes and DVDs, as well as digital video via server or streamed video from YouTube, Teacher Tube, Skype, Adobe Connect, and webcams. Telecommuting can connect with speakers and other experts. Interactive digital video games are being used at K-12 and higher education institutions.

**Computers and tablets:** It helps learners to help access websites as well as programs such as Microsoft word, PowerPoint, PDF Files and images.

**Whiteboards:** Current interactive whiteboards and smart boards help learners and instructors to write on the touch screens. The screen mark-up can be on either a blank whiteboard or any computer screen content. Depending on permission settings, this visual learning can be interactive and participatory, including writing and manipulating images on the interactive whiteboard.

**E-Learning tools:** These are software or online services that enable users to create courses, simulations or other

educational experience. These tools support presentation like courses and also enable screen recording, multimedia, interactivity, quizzes etc.

**Virtual classroom**: Virtual classroom provides the opportunity for students to receive direct instruction from a qualified teacher in an interactive environment. Learners can have direct and immediate access to their instructor for instant feedback and direction. The virtual classroom provides a structured schedule of classes, which can be helpful for students who may find the freedom of asynchronous learning to be overwhelming. In addition, the virtual classroom provides a social learning environment that replicates the traditional "brick and mortar" classroom. Most virtual classroom applications provide a recording feature.

### *2.2.2 Online E-learning*

On-line E-learning (which we shall refer as 'E-learning') is the main educational application of ICT and is usually defined by the types of learnings and technologies that are used (Khan, 2001; Govindaswamy, 2002). E-Learning utilizes web based communication, collaboration, knowledge transfer and training to support user's active learning without the time and space barriers (Kelly & Bauer, 2004; Lee et al., 2009).

**Benefits of e-learning :** E-learning provides flexibility of material and time, accessibility to the material, visibility of the multimedia and availability of data (Dan Bouhnik and Tali Marcus, 2005). According to S.K.Nayak et al (2010), its benefits are user centric learning, accessibility, collaborative learning, tools for innovation, flexibility study, just in time learning, adaptability, cost effectiveness and easy management and administration.

Applications of E-learning can be in all areas of learning starting from pre-schools, K-12, higher education to corporate and professional education.

**Preschool:** The age when a given child might start using a particular technology such as a cell phone or computer might depend on matching a technological resource to the recipient's developmental capabilities, such as the age-anticipated stages labelled by Swiss psychologist, Jean Piaget. Parameters such as age-appropriateness, coherence with sought-after values and concurrent entertainment and educational aspects have been suggested for choosing media.

**K-12:** E-learning is utilized by public k-12 schools in the US as well as private schools. It can be either synchronous e-learning or asynchronous e-learning and can be accessed through internet connection. Technology kits are provided to students which include computers, printers and reimbursement for home internet use. This technology can be used by the students only for school purpose and they must meet weekly work submission requirement. With respect to the teachers who are teaching for k-12 online public schools, they should be certified teachers in the state they are teaching. Online schools allow for students to maintain their own pace and progress, course selection, and provide the flexibility for students to create their own schedule. Virtual education in k-12 schooling are also called virtual schools. Virtual schools are "cyber-charter schools" with innovative administrative models and course delivery technology.

**Higher Education:** In many countries E-Learning has become predominant form of post-secondary education especially in the US. Based on reports, students are as satisfied with on-line classes as with traditional classes. Although a large population of for-profit higher education institutions now offer online classes, only about half of private, non-profit schools do so. Private institution focuses more on online presentations because costs are less. MOOC is a type of online education which has a limitation that it is excluded form fully replacing college education and such programs have been expanding significantly. University level programs such as edX offer wide range of disciplines at no charge. Private organizations like Udacity, Khan Academy, DOOC (Distributed open collaborative course), Coursera etc. also offer on-line classes. These websites provide content in the area of computer science, medicine, management, social sciences and so on. Some websites offers free micro-lectures through YouTube. Some are live lectures and some are pre-recorded into series of short videos discussing different topics and assignment in a weekly basis.

**Corporate and Professional Education:** Many companies are now adopting and using e-learning to educate and inform both their employees and customers. Companies with large and spread out distribution chains use it to educate their sales staff about the latest product developments without the need of organizing physical onsite courses. Compliance

has also been a big field of growth with banks and other organisations using on-line learning to keep their staff's CPD levels up. Other areas of growth include staff development, where employees can learn valuable workplace skills.

**Challenges of e-learning:**

- **Sourcing high quality content:** Quality is viewed differently by different people. For starters, contents must be factually accurate and courseware must meet the standard learning objectives. Also it is important to look at the level of interactivity and different learning styles. With many ways of determining "quality", one must manage the learner's expectations. Highly interactive content based on multimedia may be very appealing at a sales presentation, but it can be difficult to deliver over slower networks, whilst an IT department may restrict the use of plug-ins to prevent some types of content from being delivered.
- **Availability of development skills:** There are many roles involved in the analysis, design, development and implementation of e-learning, and the cost involved in bringing these skills into the provider's organization will depend upon current market conditions and the type of e-learning they are looking to implement. E-Learning based on static web pages loaded to a learner management system maintained by the IT department will be cheaper to resource than Flash based e-learning which includes audio and video maintained by a specialist LMS provider. Sourcing the right skills for the project can be an awkward task, so it is essential to find the right partner to work with in this respect.
- **Resistance to change:** One challenge to eLearning implementation is its unfamiliarity to many employees and managers who need to work with it. People commonly resist disruptions to the status quo, even if the changes are superior to what they had previously. They might not trust that a technology-based learning program will be as effective as interacting with an instructor. It's a fact that e-learning implementation can create enormous change within a company, so implementers can expect to face some resistance.
- **Learners' technological skills:** Any e-learning implementation will be limited by the computer literacy of the employees using it. The learners' ability to access and interact with the course material dictates the utility learner will get out of the program. This e-learning challenge can be mitigated by scaling the complexity of the system to the needs of the course and of the employees. When the content being taught is fairly basic, a simple interface can be used to impart it; the complexity can be scaled up as the course material and technological expertise of the learner demands. When students run into problems when using the e-learning courses, there has to be access to technical support services. Live chats, auto-help buttons, emails, discussion boards, are just some examples you can offer. Having e-learning tutors/facilitators available will also make them feel they are supported in the programme.
- **Evaluating effectiveness:** One of the oft-cited eLearning challenges, especially in an organisational/ corporate context, is the task of determining whether the course is having the intended effect. In the absence of pop quizzes and report cards, how can an employer tell whether the e-learning implementation is achieving its goals? It can be assessed by looking at the results. How many employees are using the eLearning program, how long they spend on it, and how many complete the course are all important figures, but most important is whether their performance reflects their newly-acquired knowledge. If they display the skills and information gleaned from the e-learning program in their work, then the e-learning implementation has been effective.

**Classification of E-Learning**

In general, e-learning can be classified as asynchronous e-learning, synchronous e-learning and blended e-learning. Firstly, asynchronous e-learning is a form of self-study, and it allows learners to follow their own time and schedule; however, it lacks real-time interaction between instructors and learners (Wu & Hiltz, 2004; Zhang, 2004; Liaw et al., 2008; Lee, 2010). Thus, it has to provide learners with standardized materials to achieve platform-independent course

exchange and reuse (Liaw et al., 2008). Asynchronous e-learning is when training material is made available on the web and students access it as needed.

- Asynchronous training is student guided.
- Asynchronous eLearning is a course that resides on the internet, available to students when the student is free to be trained, 24 hours a day seven days a week.
- Power Point is a poor choice for asynchronous training since it does not provide the breadth and depth of information necessary for material to stand on its own.

By contrast, synchronous e-learning allows for real-time interaction and just-in-time response between instructors and learners; however, it requires instructors and learners to participate simultaneously at distributed locations (Zhang, 2004; Huang et al., 2008; Lee, 2010). Thus, it loses time flexibility (Zhang, 2004). Further, blended e-learning combines asynchronous e-learning (self-paced e-learning) with synchronous e-learning (live e-learning) to provide learners with access to both asynchronous and synchronous communication and information (Martyn, 2003; EL-Deghaidy & Nouby, 2008; Donnelly, 2010). Synchronous e-learning is when students and teachers meet at a specific time and the teacher leads the training session.

- Synchronous e-learning is similar to traditional classroom training.
- Typically the students and instructor are on a conference call, log onto the same web page, or log onto an online white board facility.
- Power Point is the authoring tool of choice for Synchronous eLearning sessions.
- Most synchronous delivery systems include a shared white board for viewing Power Point presentations or for allow the teacher to let everyone else view their desktop. The teacher controls the slide or white board while the student listens to the lecture and views the white board or slide from their computer.

Benefits of asynchronous and synchronous e-learning from traditional e-learning (where content is fixed and does not change over time) are :

- SME (subject matter expert) can use the tool – as simple to use as PowerPoint and Word – one to two day learning curve.
- Produces content that is easily deployed.
- Does not require a team of people to create a course.
- Course creator imports graphics, clip art, simulations, and animations.
- Company understands the value of e-learning (understands the cost, time, accessibility savings of moving classroom training to the web).
- Works well in a bottom up initiative structure.
- Visual design (look and feel) is supplied by company – course developer is not involved.
- Courses can be easily maintained, updated, and re-posted.

E-Learning can also be classified as text driven, interactive or simulation driven.

a) **Text Driven:** This type includes simple content which includes text, graphics, and audio and simple test questions. Best example for text driven e-learning is compliance courses which usually has one goal or purpose - to present the learning and quickly test on the content. PowerPoint are used for this type but it lacks interactive components, gamification etc.

b) **Interactive:** This type of e-learning is more or less similar to text driven e-learning with the exception that there has been activities to interact to enhance the learning. In this type, visuals of graphics, charts, diagrams etc. are used for better interaction. Unlike in test-driven e-learning, videos are incorporated in interactive e-learning, which helps in better learning.

c) **Simulation:** This type is highly interactive and relies heavily upon graphics, video, audio and gamifications. In this type, 3D components are included to aid in e-learning experience. The main example for simulation and interactive e-learning is software training. E-learning through simulation places high emphasis on portraying concepts through various media, usually starting with text and graphics, audio and video. The course also often has a "try-it" mode where users can practice

the new skills, potentially earning achievements or points along the way.

**Purpose of E-Learning:** The purpose of e-learning can be any one or more of the following:

a) **Disseminating new information:** Information which is updated from time to time which the learner will simply receive and read. This is generally passive learning.

b) **Transfer of knowledge:** This includes reading, listening and answering to the questions by the learner. So this level requires participation from the learner.

c) **Learning new skills:** This involves active participation. The learner will read, listen, try out new skills and will then be assessed for the progress made.

d) **Certification:** This the highest level and most important level of learning mainly because in this level, certificates are awarded on the basis of the examination results at the end of the course.

### 2.3 Service quality and E-Learning

To adapt to the challenges of the internet and on-line world, academic research has identified numerous criteria used by customers to evaluate service quality delivery through websites. Zeithaml et al. (2002) used a three-stage process employing exploratory focus groups and two phases of empirical data collection and analysis to develop the e-SERVQUAL for measuring e-retail service quality. E-SERVQUAL comprises seven dimensions: efficiency, reliability, fulfilment, privacy, responsiveness, compensation, and contact. Four dimensions –efficiency, reliability, fulfilment, and privacy - form the core e-SERVQUAL scale used to measure customer perceptions of service quality delivered by online retailers, and another three dimensions – responsiveness, compensation, and contact - become salient only when online customers have questions or encounter problems. McKinney et al. (2002) proposed a measurement of web-customer satisfaction that measured perceived performance in terms of quality, including both information quality and system quality. Previous studies on e-commerce service quality focussed on the satisfaction factors in e-retail segment and rarely discussed e-service satisfaction factors.

The end user perceived service quality plays an important role in the adoption of e-learning in a company. To understand how service quality affects system success in IT, Wong and Huang (2011) adopted the SERVQUAL scale to assess information system service quality. From the users perspective they are motivated to use e-learning when they receive high quality e-learning service to overcome problems. Similarly, end users become more interested in learning and thus increase their satisfaction when the e-learning system provides useful information for their job functions (Roca et al., 2006). The SERVQUAL model was theoretically and empirically studied, examined, and discussed in several academic studies (Albassam T & Alshawi S, 2010).

Using SERVQUAL, LibQUAL was developed (Health, Boykin, & Webster, 2002) to define and measure library service quality across the institution, specifically for online library systems. Library service quality comprise information access (concept/scope and timeliness), personal control (ease of navigation and convenience), effect of service (responsiveness and reliability) and library as a place (utilitarian space).

Users of e-learning services are also information system (IS) users. Consequently, all customer satisfaction, information user satisfaction and web-customer satisfaction must be considered when assessing e-user satisfaction. In the IS domain DeLone & McLean (1992) proposed an IS success model, which depicted system and information quality as affecting user satisfaction and IS use. Seddon (1997) also modelled system quality, information quality and perceived usefulness as the key determinants of user satisfaction. To amend Seddon's model, Rai et al. (2002) proposed perceived ease of use, perceived usefulness, and information quality as antecedents of satisfaction. To reflect the importance of information systems, numerous IS researchers (Kettinger & Lee, 1994, 1997; Pitt et al., 1995, 1997; Van Dyke et al, 1997) also included service quality as an important factor affecting user satisfaction. DeLone & McLean (2003) proposed minor refinements to the IS success model as well as an updated model. In the updated IS success model, DeLone & McLean (2003) added 'service quality' as a key dimension of IS success in e-commerce environments.

A study was designed to identify the quality dimensions as perceived by adult learners who had taken one or more e-learning courses offered by higher education institutions in South Korea and to identify and confirm the structural features of these quality dimensions. The results of the exploratory factor analysis arising from a survey of 299 learners revealed that from their perspective, there were seven dimensions in evaluating the e-learning quality: Interaction, Staff Support, Institutional Quality Assurance Mechanism, Institutional Credibility, Learner Support, Information and Publicity and Learning Tasks. Defining the quality of e-learning is a complex task which needs to take into account the sometimes conflicting views of the various stakeholders, not least of which are learners (Jung, 2010)

E-Learning has become a particularly attractive educational method, as the use of web-based tools reduces the costs of sharing vast amounts of data. It also reduces communication barriers and geographical distance gaps between individuals, increases academic mobility in higher education, provides people with disabilities to have better access to higher education. E learning is totally dependent on ICT. For an effective e learning course, the ICT skills of the teacher and the learner becomes more important. E-learning should respond to all the stakeholders' needs including Quality Assurance agencies. It is vital to establish a solid quality assurance system for greater accessibility and quality of e-learning. There is a need for a common definition and understanding of the concept of e-learning, a need for a "common language" that would help higher education institutions and quality assurance agencies strive for the same goal. (ENQA, 2009)

According to Sun P C et al (2008) drivers for successful e-learning are learners, instructors, courses, technology, design, and environment. A survey was conducted to investigate the critical factors affecting learners' satisfaction in e-learning. The results revealed that learner computer anxiety, instructor attitude toward e-learning, course flexibility, course quality, perceived usefulness, perceived ease of use, and diversity in assessments are the critical factors affecting learners' perceived satisfaction. System quality is the main factor that increases or decreases the efficiency of e- learning system and therefore e-learning systems developers should take consideration of these dimensions of system quality viz., usability, accessibility, reliability and stability (Oun Alla, 2013).

The importance of interaction and learning lies on various levels such as interaction with content, interaction with the teacher, interaction with classmates and interaction with the system (Dan Bouhnik and Tali Marcus, 2006). Interaction with Content takes place when the learner, with the help of the teacher or the teaching institution, establishes new knowledge by encountering new information and combining it with the body of knowledge already retained by him. Interaction with the teacher is when educational researchers have found that teachers' verbal (i.e., giving praise, soliciting viewpoints, humor, and self-disclosure) and nonverbal (i.e., physical proximity, touch, eye contact, facial expressions, and gestures) immediacy behaviour can lessen the psychological distance between them and their students, thereby leading to increased learning. Therefore, distance-learning instructors should strive to ensure that a maximum amount of dialog takes place in the courses that they offer. Interaction with classmates is the ability to ask questions, to share ideas with others, or to disagree with others, which is a basic need in the learning process. In Asynchronous distance learning courses, interactions among students through discussion groups seem to be one of the most influential features- to overcome their isolation and strengthen their relationship with the group.

It was noted that students perceive e-learning group discussions as more equitable and more democratic than traditional classroom discussions. The interaction that is established by computer-mediated communication encourages experimentation, sharing of ideas, increased and more distributed participation, and collaborative thinking. Interaction with the System is related to the technological and technical problems that the students encounter while using the system are not solved immediately, this will reflect negatively on the student's level of satisfaction from the e-learning system. Mobile computing allows students to engage in learning-related activities in diverse physical locations, to work on projects supported by multimedia resources, to communicate with distant collaborators, and to access information networks anywhere and anytime.

The quality factors of e-learning is explained in the e-learning success model (Holsapple and Lee-Post, 2006). It is a description of a process devoted to measure and assess success. Success in e-learning is defined as a multifaceted construct to be assessed in three successive stages. They are system design, system delivery, and system outcome. System design is the first stage in which the goal is to attain system design success by maximizing the three quality dimensions: system quality, information quality and service quality. System delivery is the second stage in which its goal is to attain system delivery success by maximizing the use and user satisfaction dimensions. System outcome is the final stage in which its goal is to system outcome success by maximizing net benefits dimension.

Abdellatief et al (2011), in their study identify e-learning quality requirements a developer has to consider which will help in meeting customer needs. They categorise the quality requirements of e-learning into three levels, the first level being core services – termed as quality characteristics, the second level are elements that enable core services – termed as sub-characteristics while the third level are factors that support second level, termed as attributes. The study suggests four quality characteristics, viz., service content, system functionality, information technology and system reliability. Their study suggests that the developer is critical in e-learning since his ability to empathise with the needs of the user can ensure success of e-learning program.

While studying eLQA (e-learning quality assurance) framework that was launched in Taiwan to bridge digital divide between rural and urban areas, Chen (2009), examined e-learning quality through two programs – "e-Learning Service Certification program (eLSC) and the e-Learning Courseware Certification program (eLCC)". While eLSC evaluates three quality factors, viz., personnel, course and system, eLCC has four key aspects, viz., content, navigation, instructional design and instructional media.

While criteria and standards are at the core of service quality in e-learning, the objective of service quality is to eventually meet customer needs and achieve customer satisfaction. QFD (Quality Function Deployment) has customers at the core and translates their needs to specifications and processes. Ibrahim (2013) suggested a relationship between QFD and Learning System Technology Architecture (LSTA).

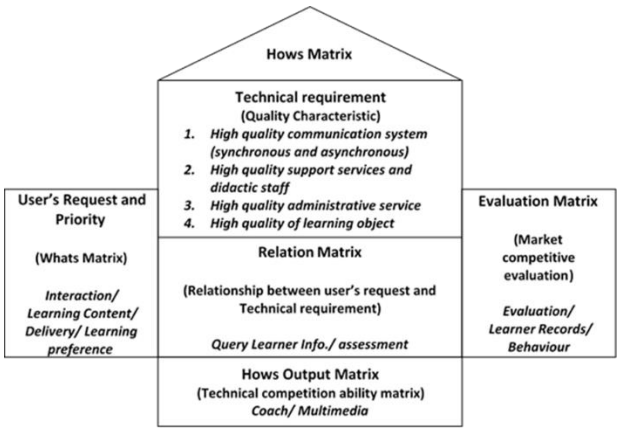


***Figure 2:***

*Merge between Learning System Technology Architecture (LSTA) and QFD*

*Source: Ibrahim (2013)*

As shown in figure 2, LSTA is super-imposed onto the QFD House of Quality model suggested by Chang et al (2009).

Agariya A K and Singh D (2012) proposed that the e-learning quality of synchronous e-learning can be measured from the perspective of learners and faculty. This study identified the factors based on which e-learning quality can be measured from the perspective of learners and faculty. The study identified course content and course structure as issues of importance for both learners and faculty. In addition, while the learners give importance to collaboration, industry acceptance and value addition, the other major concern area for faculty are transparency in assessment, technical knowhow and engagement.

The key factor that can be an indicator for the success of e-learning courses is course completion by the user. Chiu, et al (2005) applies "Expectancy disconfirmation theory" to predict the participant's intention to continue pursuing the e-learning course. The disconfirmation is defined as "the discrepancy between an individual's perceptions of a product or service's performance and his or her expectation levels". The research suggests that continuance of e-learning course is dependent on satisfaction, which in turn is determined not only by "perceived usability, perceived quality, and perceived value", but also by their disconfirmation constructs, viz. "usability

disconfirmation, quality disconfirmation and value disconfirmation" as shown in Figure 3.

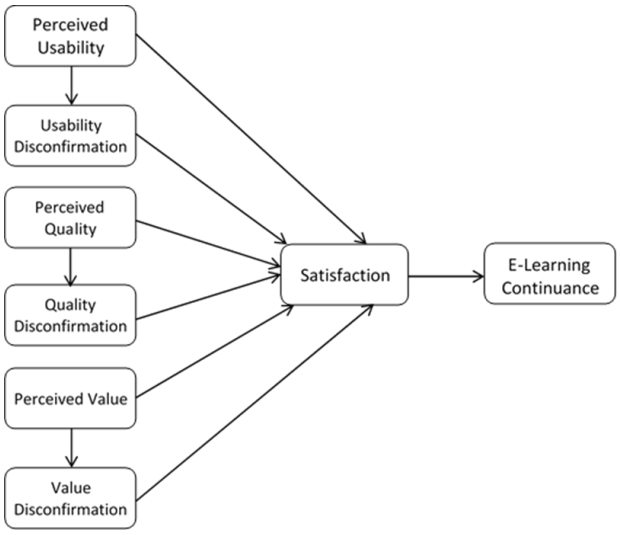


***Figure 3:***

*Usability, quality, value model*

*Source: Chiu et al, 2005*

Eom, S. B (2011) suggests that "system quality, information quality, self-efficacy, system-use, self-regulated learning behavior and user satisfaction" are the predictors that determine the learning outcome of e-learning course. Also the author says self-efficacy (a person's belief to complete a task and achieve performance goals) and self-motivation also play a role in satisfaction which in turn aso affects e-learning outcome.

### 2.4 Summary

The SERVQUAL scale (Parasuraman et al., 1985, 1988) is considered as the starting point for this research. However the scale, which was developed in the pre-technology era could not be considered since most of the scale dimensions were found to be irrelevant for e-learning. The study by Gronroos (2007), wherein he identifies two dimensions - technical quality and functional quality – as constituting service quality was found more relevant to this study. The categories and service quality attributes framework model of Kano et al (1984) model was found to be useful in this research.

E-SERVQUAL (Zeithaml et al. 2002) was one of the earliest tools proposed to evaluate an on-line service. Though the tool was meant for on-line retailing, the dimensions of efficiency, reliability, fulfilment and privacy was found to be relevant for e-learning also. Several studies (McKinney et al. 2002, Wong & Huang 2011, DeLone & McLean 1992, Seddon 1997, Oun Alla, 2013, Holsapple and Lee-Post, 2006) on service quality and customer satisfaction of web services have proposed the dimensions of information quality, system quality, perceived usefulness etc.

The studies specific to e-learning such as by Eom, S. B (2011), Sun P C Et al (2008) and Abdellatief et al (2011) identified factors like system quality, information quality, self-efficacy, system-use, self-regulated learning behaviour, course flexibility, course quality, perceived usefulness, perceived ease of use, and diversity in assessments, service content, system functionality, information technology, system reliability etc. as the critical factors in evaluating e-learning service quality. These studies helped in formulating the constructs of our research.

## 3. Research Design

### 3.1 Statement of Problem

Service quality of e-learning have been subjected to several studies. However, most of these studies focus on corporate e-learning and e-learning in higher education. There are no specific studies, especially in the Indian context on service quality of paid individual e-learning. i.e, on the factors of service quality of short term paid on-line courses taken up by individuals – either students or working professionals. The aim of this research project is to bridge this gap.

The study at the basic level will evaluate and validate the different variables that a learner will consider while assessing e-learning. Further, basis these variables/ constructs, the study aims to build a service quality framework. The constructs will form the base of the framework. The constructs will lead to the factors, which in turn will constitute different dimensions of service quality.

The service quality framework thus formed will enable e-learning service providers to assess the perceived service quality of their customers. The study will also help the service providers in understanding the relative importance of different factors and dimensions of service quality.

### 3.2 Exploratory Study

To develop the appropriate conceptual framework for assessing e-learning service quality, exploratory study was conducted with e-learning industry subject matter experts (SMEs). These experts hailed from companies

that offer on-line learning like Manipal Global, Avagmah, Simplilearn etc. who are leaders in e-learning in India. Extensive one-to-one interviews were conducted with these SMEs of service providers.

The interviews helped in coming up with a set of constructs that could form the basis of e-learning service quality. The interviews with SMEs also helped to gain valuable insights on industry perception of the key constructs/ factors/ dimensions of service quality and also industry perception of the customer's service quality expectations.

### 3.3 Development of framework

Based on the insights gained from the interviews with SMEs and based on the past research and study of literature, the proposed constructs and consequent dimensions of service quality were put in a framework as below:

**Table 1:**
**E-Learning Service Quality Framework**

| Variable as per questionnaire order | Items Description | Factors | Dimensions | |
|---|---|---|---|---|
| 1 | Relevant & complete | Content | Information Quality | Service Quality |
| 2 | Visually appealing | | | |
| 3 | up-to-date | | | |
| 4 | Credible | | | |
| 5 | easy to understand | | | |
| 28 | Provision to learn at one's pace | Instructional Design | | |
| 29 | Clarity on objectives of learning | | | |
| 30 | Appropriateness of the coverage vis a vis objectives | | | |
| 31 | Appropriateness of the outcome vis a vis objectives | | | |
| 32 | Logical structure | | | |
| 33 | Assessments vs. outcome | | | |
| 6 | Adequate simulations, videos to explain | Pedagogy | System Quality | |
| 7 | Pace of course delivery | | | |
| 8 | Suitability and adequacy of assessments tools | | | |
| 9 | Able to know the progress of the learning | | | |
| 10 | Access and availability | Technology | | |
| 11 | Speed of access | | | |
| 12 | Privacy | | | |
| 13 | Support from service provider | | | |
| 14 | Reliability | | | |
| 17 | Ease of navigation | User Interface | Experience Quality | |
| 18 | Attractive and unity in interface – Minimalist | | | |
| 19 | Consistency | | | |
| 20 | Ease of use – user friendly | | | |
| 22 | Ease of understanding | | | |
| 23 | Responsive - Interaction with the service provider | User Experience | | |
| 24 | Comfort and assurance | | | |
| 25 | Feedback on learning | | | |
| 26 | Learning Analytics | | | |
| 27 | Progress tracking | | | |

### 3.4 Research Objectives

The research aims at developing a model for assessing e-learning service quality. Specifically the objectives of this research are:

- To identify the constructs, factors and consequent dimensions that contribute to service quality of 'paid' individual e-learning courses
- To assess the relationship between the factors and the dimensions of service quality
- To create a model for service quality of paid e-learning

### 3.5 Hypotheses

H1: The information quality is positively associated with service quality of e-learning

H1a: The content factor of information quality is positively associated with service quality of e-learning

H1b: The instructional design factor of information quality is positively associated with service quality of e-learning

H2: The system quality is positively associated with service quality of e-learning

H2a: The pedagogy factor of system quality is positively associated with service quality of e-learning

H2b: The technology factor of system quality is positively associated with service quality of e-learning

H3: The experience quality is positively associated with service quality of e-learning

H3a: The user interface factor of experience quality is positively associated with service quality of e-learning.

H3b: The user experience factor of experience quality is positively associated with service quality of e-learning

### 3.6 Descriptive Research

While exploratory study was used to formulate the constructs and framework, descriptive research was used to evaluate the suitability of the items, constructs and factors and the relationships between them. Based on the items shown in the framework (as shown in Table 1), a detailed questionnaire was prepared (refer annexure). A five point Likert scale – with response categories from "strongly agree" to "strongly disagree" was used to measure the responses to the items in the questionnaire. In addition, the questionnaire also captured demographic information of the respondents.

### 3.7 Sampling & Data Collection

The respondents of the study were those who are pursuing/ have completed any paid short term on-line courses. These included students and working professionals. Convenience sampling was used and the respondents were from Business Schools and Companies in Mysore and Bangalore. The total sample size was 243.

## 4. Data Analysis

### 4.1 Factor Analysis

Factor analysis is used to identify the variables that constitute a factor. Also factor analysis helps in reducing the number of variables to a more manageable set.

In this research, factor analysis was used to understand the different variables that were considered for the factors of content, instructional design, pedagogy, technology, user interface and user experience and group them under the respective factors. Further factor analysis was also used to confirm the relationships between (a) content and instructional design to information quality, (b) pedagogy and technology to system quality and (c) user interface and user experience to experience quality.

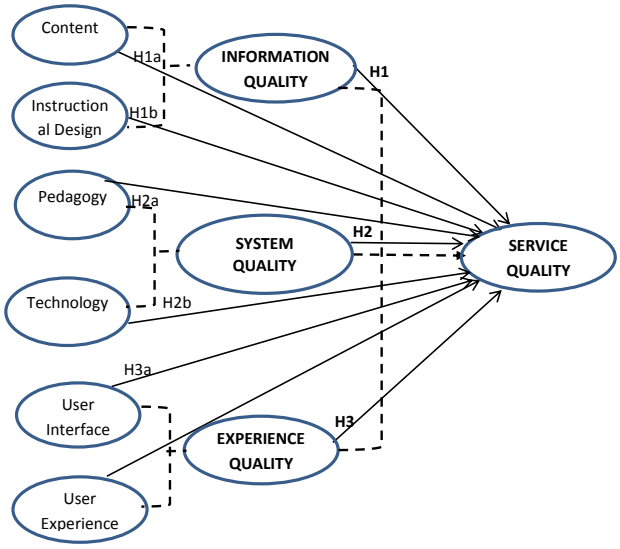


***Figure 4 :***
*Service Quality Framework*

KMO (Kaiser Meyer Olkin) value, factor loadings and communalities were used as major measures in factor analysis. KMO & Bartlett's Test is suggested to test the sampling adequacy by checking the case to variable ratio of the analysis. The KMO index must be >=0.5 for further analysis.

Communality is the variance of a variable explained by a factor structure and should be minimum of 0.6. Factor loadings indicate the importance of the item to a factor and should be ideally between (either positive or negative) 0.30 and 0.40. The factor loadings must be consider to enable grouping the variables into factors. All the variables that constitute the factors of dimensions of service quality were considered for first level factor analysis. Based on the outcome of this factor analysis, these constructs were used to confirm the dimensions of service quality.

The variables under the six factors of content, instructional design, pedagogy, technology, user interface and user experience were considered, evaluated and constructs arrived at as per the table below.

**Table 2:**
**Factor Analysis**

| Variables | Variable Description | Constructs | | KMO Value | Communalities | Variance Explained (%) |
|---|---|---|---|---|---|---|
| V4 | Credible | Intelligible | Content | 0.648 | .785 | 79.838 |
| V5 | Easy to understand | | | | .803 | |
| V1 | Relevant | Harmony | | | .735 | |
| V2 | Visually appealing | | | | .763 | |
| V3 | Up-to-date | Up-to-date | | | .907 | |
| V28 | Provision to learn at one's pace | Ease of learning | Instructional Design | 0.634 | .638 | 72.602 |
| V29 | Clarity on objectives of learning | | | | .725 | |
| V33 | Assessments Vs. Outcome | | | | .583 | |
| V31 | Appropriateness of the outcome vis a vis objectives | Structure and Outcome | | | .789 | |
| V32 | Logical structure | | | | .784 | |
| V30 | Appropriateness of the coverage vis a vis objectives | Appropriateness | | | .838 | |
| V6 | Adequate simulations, videos to explain | Adaptive | Pedagogy | .510 | .485 | 70.907 |
| V7 | Pace of course delivery | | | | .827 | |
| V8 | Suitability and adequacy of assessments tools | Assessments & Evaluation | | | .655 | |
| V9 | Able to know the progress of the learning | | | | .869 | |
| V10 | Access and availability | Dependability | Technology | .633 | .605 | 64.594 |
| V11 | Speed of access | | | | .573 | |
| V14 | Reliability | | | | .563 | |
| V12 | Privacy | Security | | | .746 | |
| V13 | Support from service provider | | | | .742 | |
| V19 | Consistency | User-friendly | User Interface | .613 | .860 | 80.654 |
| V20 | Ease of Use | | | | .785 | |
| V22 | Ease of Understanding | Clarity | | | .790 | |
| V17 | Ease of Navigation | Clutter-free | | | .717 | |
| V18 | Attractive and unity in interface | | | | .880 | |
| V25 | Feedback on learning | Learning Analytics | User Experience | .613 | .836 | 82.482 |
| V26 | Learning analytics | | | | .705 | |
| V23 | Responsive | Assurance | | | .856 | |
| V24 | Comfort and assurance | | | | .808 | |
| V27 | Progress Tracking | Performance Measurement | | | .919 | |

The component-wise factor analysis are in annexure.

### 4.2 Service Quality Framework

Based on the factor analysis of the variables, the e-structured/ combined variables and consequent constructs with the factors and dimensions of service quality are as below:

**Table 3:**
**Service Quality Framework**

| Variable Description | Constructs | Factors | Dimensions | |
|---|---|---|---|---|
| Credible | Intelligible | Content | Information Quality | Service Quality |
| Easy to understand | | | | |
| Relevant | Harmony | | | |
| Visually appealing | | | | |
| Up-to-date | Up-to-date | | | |
| Provision to learn at one's pace | Ease of learning | Instructional Design | | |
| Clarity on objectives of learning | | | | |
| Assessments Vs. Outcome | | | | |
| Appropriateness of the outcome vis a vis objectives | Structure and Outcome | | | |
| Logical structure | | | | |
| Appropriateness of the coverage vis a vis objectives | Appropriateness | | | |
| Adequate simulations, videos to explain | Adaptive | Pedagogy | System Quality | |
| Pace of course delivery | | | | |
| Suitability and adequacy of assessments tools | Assessments & Evaluation | | | |
| Able to know the progress of the learning | | | | |
| Access and availability | Dependability | Technology | | |
| Speed of access | | | | |
| Reliability | | | | |
| Privacy | Security | | | |
| Support from service provider | | | | |
| Consistency | User-friendly | User Interface | Experience Quality | |
| Ease of Use | | | | |
| Ease of Understanding | Clarity | | | |
| Ease of Navigation | Clutter-free | | | |
| Attractive and unity in interface | | | | |
| Feedback on learning | Learning Analytics | User Experience | | |
| Learning analytics | | | | |
| Responsive | Assurance | | | |
| Comfort and assurance | | | | |
| Progress Tracking | Performance Measurement | | | |

As shown in the table 3, the factors of content and instructional design together form information quality. Similarly pedagogy and technology forms system quality and user interface and user experience forms experience quality. Information quality, system quality and experience quality are three dimensions which together constitute service quality.

### 4.3 Testing of Hypotheses

The major hypotheses of this research evaluates the relationship between service quality and the constituent dimensions of service quality, viz., information quality, system quality and experience quality. The following major hypotheses are tested for correlations.

H1: The information quality is positively associated with service quality of e-learning

H2: The system quality is positively associated with service quality of e-learning

H3: The experience quality is positively associated with service quality of e-learning

The result of Correlation testing are as shown in table 4.

**Table 4:**
**Correlation Testing of Hypotheses**

| Correlations | | | | | |
|---|---|---|---|---|---|
| | | Information quality | System quality | Experience quality | Service quality |
| Information quality | Pearson Correlation | 1 | .789** | .701** | .404** |
| | Sig. (1-tailed) | | .000 | .000 | .000 |
| | N | 242 | 242 | 240 | 242 |
| System quality | Pearson Correlation | .789** | 1 | .680** | .528** |
| | Sig. (1-tailed) | .000 | | .000 | .000 |
| | N | 242 | 243 | 241 | 243 |
| Experience quality | Pearson Correlation | .701** | .680** | 1 | .318** |
| | Sig. (1-tailed) | .000 | .000 | | .000 |
| | N | 240 | 241 | 241 | 241 |
| Service quality | Pearson Correlation | .404** | .528** | .318** | 1 |
| | Sig. (1-tailed) | .000 | .000 | .000 | |
| | N | 242 | 243 | 241 | 243 |
| **. Correlation is significant at the 0.01 level (1-tailed). | | | | | |

The correlations testing clearly shows that the Pearson correlation coefficients between the three dimensions - information quality, system quality and experience quality with service quality are 0.4, 0.5 and 0.3 respectively. Though the correlations are moderate, the level of significance is high and hence hypotheses H1, H2 and H3 are accepted.

The sub-hypotheses evaluates the relationship between service quality and the factors that make up the dimensions of service quality, viz., content, instructional design, pedagogy, technology, user interface and user experience. These hypotheses are as below:

H1a: The content factor of information quality is positively associated with service quality of e-learning

H1b: The instructional design factor of information quality is positively associated with service quality of e-learning

H2a: The pedagogy factor of system quality is positively associated with service quality of e-learning

H2b: The technology factor of system quality is positively associated with service quality of e-learning

H3a: The user interface factor of experience quality is positively associated with service quality of e-learning

H3b: The user experience factor of experience quality is positively associated with service quality of e-learning

The results of the correlation testing of sub-hypotheses are as shown in table 5.

**Table 5:**

| Correlation Testing of Sub-hypotheses Correlations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Content** | **Pedagogy** | **Technology** | **User Interface** | **User Experience** | **Instructional Design** | **Service Quality** |
| Content | Pearson Correlation | 1 | .590** | .628** | .608** | .409** | .568** | .464** |
| | Sig. (1-tailed) | | .000 | .000 | .000 | .000 | .000 | .000 |
| | N | 242 | 242 | 242 | 240 | 242 | 242 | 242 |
| Pedagogy | Pearson Correlation | .590** | 1 | .494** | .594** | .414** | .607** | .441** |
| | Sig. (1-tailed) | .000 | | .000 | .000 | .000 | .000 | .000 |
| | N | 242 | 243 | 243 | 241 | 243 | 243 | 243 |
| Technology | Pearson Correlation | .628** | .494** | 1 | .628** | .423** | .590** | .472** |
| | Sig. (1-tailed) | .000 | .000 | | .000 | .000 | .000 | .000 |
| | N | 242 | 243 | 243 | 241 | 243 | 243 | 243 |
| User Interface | Pearson Correlation | .608** | .594** | .628** | 1 | .527** | .607** | .381** |
| | Sig. (1-tailed) | .000 | .000 | .000 | | .000 | .000 | .000 |
| | N | 240 | 241 | 241 | 241 | 241 | 241 | 241 |
| User Experience | Pearson Correlation | .409** | .414** | .423** | .527** | 1 | .553** | .183** |
| | Sig. (1-tailed) | .000 | .000 | .000 | .000 | | .000 | .002 |
| | N | 242 | 243 | 243 | 241 | 243 | 243 | 243 |
| Instructional Design | Pearson Correlation | .568** | .607** | .590** | .607** | .553** | 1 | .251** |
| | Sig. (1-tailed) | .000 | .000 | .000 | .000 | .000 | | .000 |
| | N | 242 | 243 | 243 | 241 | 243 | 243 | 243 |
| Service Quality | Pearson Correlation | .464** | .441** | .472** | .381** | .183** | .251** | 1 |
| | Sig. (1-tailed) | .000 | .000 | .000 | .000 | .002 | .000 | |
| | N | 242 | 243 | 243 | 241 | 243 | 243 | 243 |
| **. Correlation is significant at the 0.01 level (1-tailed). | | | | | | | | |

As shown in Table 5, Pearson's coefficient of correlation between the relationship between service quality and the factors that make up the dimensions of service quality, viz., content, instructional design, pedagogy, technology, user interface and user experience are low to moderate and the significance are high and hence all the hypotheses are accepted.

While all the sub hypotheses are accepted, it should also be noted that the Pearson Correlation coefficient for two factors viz., user interface and user experience are low at 0.183 and 0.251 respectively and hence may be of relatively low importance to the customer from the perspective of assessment of service quality.

## 5. Discussion and Conclusion

This research was taken up to examine and identify the constructs/ factors that contribute to the service quality of 'paid' on-line e-learning courses. The study confirmed six factors, viz., content, instructional design, pedagogy, technology, user interface and user experience as factors that contributed to the dimensions of information quality, system quality and experience quality which in turn contributes to the service quality of e-learning. The study also could narrow down the variables from thirty to sixteen which are the final constructs that constitute the six factors.

As shown in table 2, content factor is constituted by three constructs, viz., intelligible, harmony and up-to-date, instructional design factor by three constructs, viz., ease of learning, structure of outcome and appropriateness, pedagogy factor by two constructs, viz., adaptive and assessments and evaluation, technology factor by two constructs, viz., dependability and security, user interface factor by three constructs, viz., user-friendly, clarity and clutter-free and user experience factor by three constructs, viz., learning analytics, assurance and performance measurement. The entire framework is shown in Figure 5.

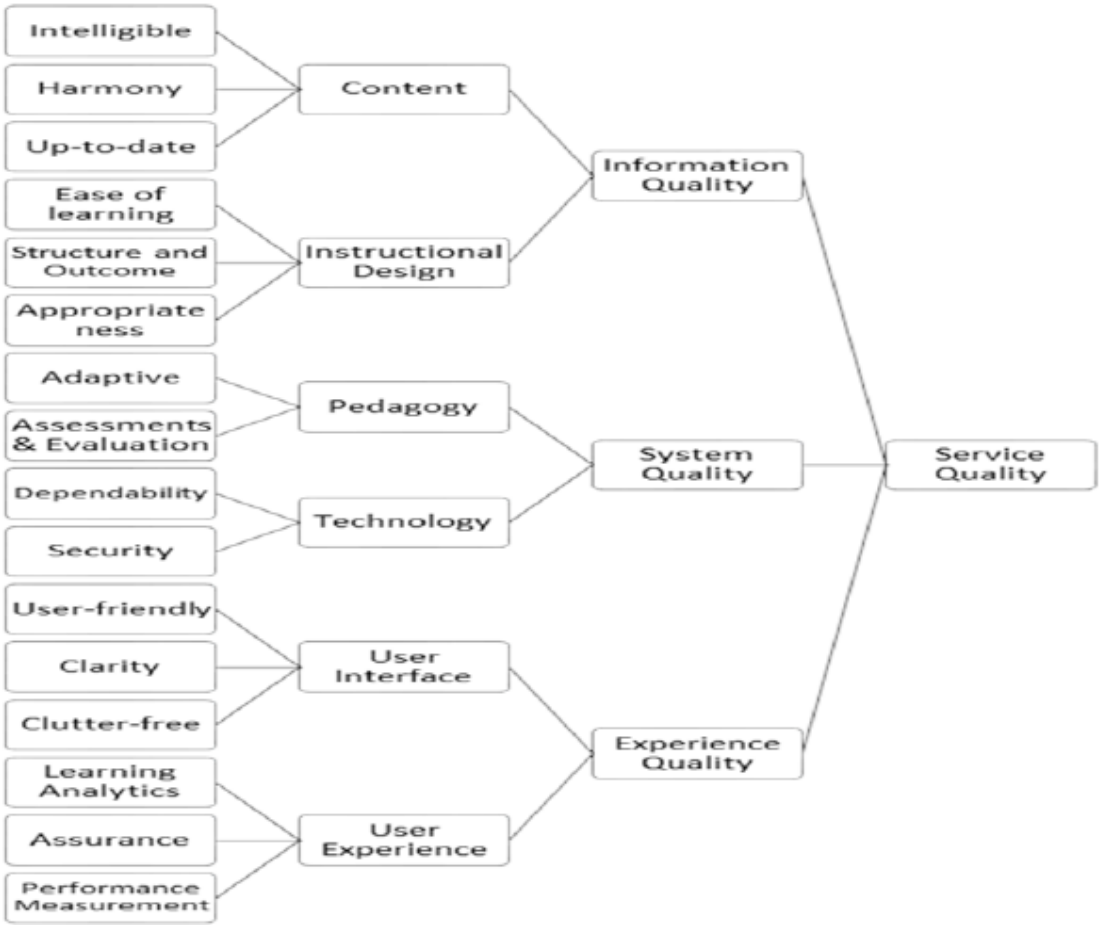


***Figure 5:***

*Service Quality Framework of Paid E-learning Course*

The study also examined the relationships between service quality and different dimensions of service quality, viz., information quality, system quality and experience quality and it was found that correlation was existing. It was found that the correlation between information quality and system quality with service quality was high at Pearson correlation coefficient of 0.404 and 0.528 respectively. However, it was noted that the correlation of service quality with experience quality was low at 0.318.

Correspondingly, while testing the relationships between service quality and different factors, viz. content, instructional design, pedagogy, technology, user interface and user experience, the correlation between service quality and user interface and user experience (which corresponds to experience quality) were low at Pearson correlation coefficient of 0.183 and 0.251. This goes on to show that the participants give more importance to content, instructional design, pedagogy and technology than to user interface and user experience. Based on the Pearson correlation coefficient, it can be concluded that the ranking (importance) of different factors in relation to service

quality is in the order – technology, content, pedagogy, user interface, instructional design and user experience.

The study provides valuable learning and helps in understanding the importance given by the learners of e-learning to different factors. The research outcome clearly shows the areas the e-learning providers should focus on to ensure effectiveness and ensuring service quality.

**Future Research**: Further research can be taken up to understand the importance of user interface and user experience and understand whether these factors are key determinants of e-learning service quality or play the role of hygiene factors. Also this research did not study the relationship between service quality and customer satisfaction. The study of relationship between different dimensions of e-learning and customer satisfaction and also the different factors and customer satisfaction will provide valuable insights into the assessment of perceptions of e-learning customers. This will help the e-learning service providers and the e-learning industry to understand and address the areas that are perceived as important by customers in ensuring not only service quality, but also customer satisfaction.

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**Annexure -1**

**QUESTIONNAIRE TO ASSESS ON-LINE E-LEARNING**

NAME- _____ AGE- _____

GENDER- ☐ MALE ☐ FEMALE LOCATION-_____

QUALIFICATION- ☐ GRADUATE ☐ POST GRADUATE ☐ OTHERS

OCCUPATION- ☐ PVT. SERVICE ☐ GOVT. SERVICE

☐ STUDENT ☐ OTHERS

Have you taken up any paid on-line course(s)? ☐ Yes ☐ No

If yes, Please answer the questions below with respect to the last/current on-line course you took up.

a) Course taken up - _____

b) Institute/Website- _____

Please provide your feedback on the course you last took up or currently undergoing:

| S No. | Description | Strongly Agree | Agree | Neither agree nor disagree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|---|
| 1 | The content is relevant to my need and completely meets my requirement | | | | | |
| 2 | The content is visually appealing. | | | | | |
| 3 | The content of the course is up-to-date and current. | | | | | |
| 4 | The content is in line with what is offered by reputed institutions and organisations. | | | | | |
| 5 | The content of the course is easy to understand. | | | | | |
| 6 | The course uses adequate simulations, videos and exercises to explain the concepts. | | | | | |
| 7 | The pace of the course is right and helped me get a perfect understanding of the concepts. | | | | | |
| 8 | The evaluation tools are appropriate and help in proper assessment of my performance. | | | | | |
| 9 | I am able to know the progress of my learning through assessment at different stages/ milestones of the course | | | | | |
| 10 | I am able to access the course always. | | | | | |
| 11 | The course website is quite fast and can be accessed easily. | | | | | |
| 12 | My personal information and payment details sent is safe and secured in the website. | | | | | |
| 13 | In case of any problem, I get excellent support and problem resolution from the service provider. | | | | | |
| 14 | The course website is quite reliable and I rarely encounter any problem. | | | | | |
| 15 | I am happy with the overall quality of the course. | | | | | |
| 16 | The course meets my expectations. | | | | | |
| 17 | I find it very easy to navigate through the course. | | | | | |
| 18 | There is a proper usage of pleasant colors, font styles in the user interface. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 19 | The icons, buttons, tabs are standard across the entire course. | | | | | |
| 20 | Learning to use the different menu options and other features of the course was very easy. | | | | | |
| 21 | I am happy that I have taken up this course | | | | | |
| 22 | The course is divided into multiple sections/ stages which make it easy to understand. | | | | | |
| 23 | My queries to the service provider are promptly responded. | | | | | |
| 24 | I feel comfortable while interacting with the service providers. | | | | | |
| 25 | I get proper feedback on my learning. | | | | | |
| 26 | The dashboard provided by the course for evaluating my learning is adequate. | | | | | |
| 27 | I can easily track my performance and progress of my learning. | | | | | |
| 28 | I have a choice to learn at my own pace. | | | | | |
| 29 | The course clearly spells out the objectives right at the beginning. | | | | | |
| 30 | The course coverage is in line with the course objectives. | | | | | |
| 31 | The learning outcome of the course is in line with the course objectives | | | | | |
| 32 | The course structure is logical and has been designed for easy learning. | | | | | |
| 33 | The evaluation tools of the course are well designed to assess the outcome vis a vis course objectives | | | | | |
| 34 | I shall recommend this course to my friend. | | | | | |

**Annexure- 2**

## Factor Analysis

### 1. Content

Content is one of the factors that influences the information dimension which in turn influences service quality of e-learning. Content was represented by five items/ variables in the questionnaire (Refer V1 to V5 – Table 1). These variables were subjected to KMO and Bartlett's test, test of communalities and rotated component matrix test to confirm their appropriateness.

| KMO and Bartlett's Test - Content | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .648 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 190.170 |
| | Df | 10 |
| | Sig. | .000 |

The KMO value is 0.648 which is greater than the minimum prescribed 0.500 and hence further analysis is possible.

**Communalities – Content**

| | Initial | Extraction |
|---|---|---|
| V1 | 1.000 | .735 |
| V2 | 1.000 | .763 |
| V3 | 1.000 | .907 |
| V4 | 1.000 | .785 |
| V5 | 1.000 | .803 |

Extraction Method: Principal Component Analysis

Since the communalities of all variables were >0.6, all the variables were retained.

**Total Variance Explained - Content**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 2.171 | 43.419 | 43.419 | 2.171 | 43.419 | 43.419 | 1.426 | 28.528 | 28.528 |
| 2 | .962 | 19.241 | 62.660 | .962 | 19.241 | 62.660 | 1.423 | 28.466 | 56.994 |
| 3 | .859 | 17.178 | 79.838 | .859 | 17.178 | 79.838 | 1.142 | 22.845 | 79.838 |
| 4 | .558 | 11.162 | 91.000 | | | | | | |
| 5 | .450 | 9.000 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis. The total variable explained is 79%

| Rotated Component Matrix - Content | | | |
|---|---|---|---|
| | Component | | |
| | 1 | 2 | 3 |
| V1 | .280 | .810 | -.005 |
| V2 | .014 | .828 | .278 |
| V3 | .085 | .180 | .931 |
| V4 | .770 | .060 | .434 |
| V5 | .865 | .213 | -.096 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Based on the rotated component matrix, we consider the variables with a factor loading of >0.55 and accordingly the variables are structured/ combined and constructs (factors) are arrived at as shown in Table (A):

**Table A**

| Variable | Variable Description | Construct (Factor) |
|---|---|---|
| V4 | Credible | Intelligible |
| V5 | Easy to understand | |
| V1 | Relevant | Harmony |
| V2 | Visually appealing | |
| V3 | Up-to-date | Up-to-date |

### 2. Instructional Design

Instructional design is the second factor that influences the information dimension which in turn influences service quality of e-learning. Instructional design was

represented by six items/ variables in the questionnaire (Refer V28 – V33 Table 1). These variables were subjected to KMO and Bartlett's test, test of communalities and rotated component matrix test to confirm their appropriateness.

| KMO and Bartlett's Test – Instructional Design | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .634 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 240.940 |
| | Df | 15 |
| | Sig. | .000 |

The KMO value is 0.634 which is greater than the minimum prescribed 0.500 and hence further analysis is possible.

**Communalities – Instructional Design**

| | Initial | Extraction |
|---|---|---|
| V28 | 1.000 | .638 |
| V29 | 1.000 | .725 |
| V30 | 1.000 | .838 |
| V31 | 1.000 | .789 |
| V32 | 1.000 | .784 |
| V33 | 1.000 | .583 |

Extraction Method: Principal Component Analysis.

The communalities of variables V28 to V 32 are more than >0.6 and hence are retained; The communality of variable V33 also is closer to 6 at 0.583 and hence is also retained.

**Total Variance Explained – Instructional Design**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 2.246 | 37.441 | 37.441 | 2.246 | 37.441 | 37.441 | 1.623 | 27.047 | 27.047 |
| 2 | 1.275 | 21.257 | 58.698 | 1.275 | 21.257 | 58.698 | 1.427 | 23.778 | 50.825 |
| 3 | .834 | 13.904 | 72.602 | .834 | 13.904 | 72.602 | 1.307 | 21.776 | 72.602 |
| 4 | .690 | 11.504 | 84.106 | | | | | | |
| 5 | .554 | 9.241 | 93.347 | | | | | | |
| 6 | .399 | 6.653 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis.

The total variance explained is 72.%.

**Rotated Component Matrix–Instructional Design**

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| V28 | .786 | .126 | -.056 |
| V29 | .626 | -.243 | .523 |
| V30 | .144 | .227 | .875 |
| V31 | -.107 | .753 | .459 |
| V32 | .270 | .843 | -.030 |
| V33 | .713 | .152 | .229 |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 9 iterations.

Based on the rotated component matrix, we consider the variables with a factor loading of >5 and accordingly the variables are structured/ combined and constructs (factors) are arrived at as Table B:

**Table B**

| Variable | Variable Description | Construct |
|---|---|---|
| V28 | Provision to learn at one's pace | Ease of learning |
| V29 | Clarity on objectives of learning | |
| V33 | Assessments Vs. Outcome | |
| V31 | Appropriateness of the outcome vis a vis objectives | Structure and Outcome |
| V32 | Logical structure | |
| V30 | Appropriateness of the coverage vis a vis objectives | Appropriateness |

### 3. Pedagogy

Pedagogy is the first factor that influences the system quality dimension which in turn influences service quality of e-learning. Pedagogy was represented by four items/ variables in the questionnaire (Refer V6 – V9 Table 1). These variables were subjected to KMO and Bartlett's test, test of communalities and rotated component matrix test to confirm their appropriateness.

| KMO and Bartlett's Test - Pedagogy | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .510 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 124.466 |
| | df | 6 |
| | Sig. | .000 |

The KMO value is 0.510 which is greater than the minimum prescribed 0.500 and hence further analysis is possible.

| Communalities - Pedagogy | | |
|---|---|---|
| | **Initial** | **Extraction** |
| V6 | 1.000 | .485 |
| V7 | 1.000 | .827 |
| V8 | 1.000 | .655 |
| V9 | 1.000 | .869 |
| Extraction Method: Principal Component Analysis. | | |

The communalities of variables V7 to V 9 are more than >0.6 and hence retained; Though the communality of variable V6 is < 0.6 at 0.485, this variable is also retained since this is critical variable in 'pedagogy'.

**Total Variance Explained – Pedagogy**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Total** | **% of Variance** | **Cumulative %** | **Total** | **% of Variance** | **Cumulative %** | **Total** | **% of Variance** | **Cumulative %** |
| 1 | 1.776 | 44.396 | 44.396 | 1.776 | 44.396 | 44.396 | 1.476 | 36.892 | 36.892 |
| 2 | 1.060 | 26.512 | 70.907 | 1.060 | 26.512 | 70.907 | 1.361 | 34.015 | 70.907 |
| 3 | .732 | 18.299 | 89.206 | | | | | | |
| 4 | .432 | 10.794 | 100.000 | | | | | | |
| Extraction Method: Principal Component Analysis The total variance explained is 71.%. | | | | | | | | | |

| Rotated Component Matrix - Pedagogy | | |
|---|---|---|
| | **Component** | |
| | **1** | **2** |
| V6 | .614 | .329 |
| V7 | .897 | -.149 |
| V8 | .540 | .603 |
| V9 | -.044 | .931 |
| Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.[a] | | |
| a. Rotation converged in 3 iterations. | | |

Based on the rotated component matrix, we consider the variables with a factor loading of >5 and accordingly the variables are structured/ combined and constructs (factors) are arrived at as shown in Table C:

| Table C | | |
|---|---|---|
| **Variable** | **Variable Description** | **Construct** |
| V6 | Adequate simulations, videos to explain | Adaptive |
| V7 | Pace of course delivery | |
| V8 | Suitability and adequacy of assessments tools | Assessments & Progress Tracking |
| V9 | Able to know the progress of the learning | |

### 4. Technology

Technology is the second factors that influences the system quality dimension which in turn influences service quality of e-learning. Technology was represented by five items/ variables in the questionnaire (Refer V10 to V14 – Table 1). These variables were subjected to KMO and Bartlett's test, test

of communalities and rotated component matrix test to confirm their appropriateness.

| KMO and Bartlett's Test - Technology | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .633 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 190.513 |
| | df | 10 |
| | Sig. | .000 |

The KMO value is 0.633 which is greater than the minimum prescribed 0.500 and hence further analysis is possible.

| Communalities - Technology | | |
|---|---|---|
| | Initial | Extraction |
| V10 | 1.000 | .605 |
| V11 | 1.000 | .573 |
| V12 | 1.000 | .746 |
| V13 | 1.000 | .742 |
| V14 | 1.000 | .563 |
| Extraction Method: Principal Component Analysis. | | |

The communalities of all the variables are >0.6 or closer to 0.6 (in case of V11 and V14) and hence are retained.

| Total Variance Explained - Technology | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 2.127 | 42.546 | 42.546 | 2.127 | 42.546 | 42.546 | 1.732 | 34.638 | 34.638 |
| 2 | 1.102 | 22.048 | 64.594 | 1.102 | 22.048 | 64.594 | 1.498 | 29.956 | 64.594 |
| 3 | .722 | 14.432 | 79.026 | | | | | | |
| 4 | .615 | 12.300 | 91.326 | | | | | | |
| 5 | .434 | 8.674 | 100.000 | | | | | | |
| Extraction Method: Principal Component Analysis. The total variance explained is 65.%. | | | | | | | | | |

| Rotated Component Matrix - Technology | | |
|---|---|---|
| | Component | |
| | 1 | 2 |
| V10 | .773 | .088 |
| V11 | .738 | .169 |
| V12 | .156 | .849 |
| V13 | .113 | .854 |
| V14 | .743 | .103 |

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 3 iterations.

Based on the rotated component matrix, we consider the variables with a factor loading of >5 and accordingly the variables are structured/ combined and constructs (factors) are arrived at as shown in Table D:

**Table D**

| Variable | Variable Description | Construct (Factor) |
|---|---|---|
| V10 | Access and availability | Dependability |
| V11 | Speed of access | |
| V14 | Reliability | |
| V12 | Privacy | Security |
| V13 | Support from service provider | |

### 5. User Interface

User interface is one of the factors that influences the experience quality dimension which in turn influences service quality of e-learning. User Interface was represented by five items/ variables in the questionnaire (Refer V17 to V20 and V22 – Table 1). These variables were subjected to KMO and Bartlett's test, test of communalities and rotated component matrix test to confirm their appropriateness.

| KMO and Bartlett's Test – User Interface | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .613 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 204.430 |
| | df | 10 |
| | Sig. | .000 |

The KMO value is 0.613 which is greater than the minimum prescribed 0.500 and hence further analysis is possible.

**Communalities – User Interface**

| | Initial | Extraction |
|---|---|---|
| V17 | 1.000 | .717 |
| V18 | 1.000 | .880 |
| V19 | 1.000 | .860 |
| V20 | 1.000 | .785 |
| V22 | 1.000 | .790 |

Extraction Method: Principal Component Analysis.

The communalities of all the variables are >0.6 and hence are retained.

**Total Variance Explained – User Interface**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 2.167 | 43.347 | 43.347 | 2.167 | 43.347 | 43.347 | 1.423 | 28.454 | 28.454 |
| 2 | 1.015 | 20.308 | 63.654 | 1.015 | 20.308 | 63.654 | 1.365 | 27.295 | 55.749 |
| 3 | .850 | 17.000 | 80.654 | .850 | 17.000 | 80.654 | 1.245 | 24.905 | 80.654 |
| 4 | .572 | 11.447 | 92.101 | | | | | | |
| 5 | .395 | 7.899 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis.
The total variance explained is 80%.

| Rotated Component Matrix – User Interface | | | |
|---|---|---|---|
| | Component | | |
| | 1 | 2 | 3 |
| V17 | .049 | .597 | .599 |
| V18 | .185 | .028 | .919 |
| V19 | .903 | -.088 | .191 |
| V20 | .750 | .468 | .054 |
| V22 | .086 | .884 | .047 |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 5 iterations.

Based on the rotated component matrix, we consider the variables with a factor loading of >5 and accordingly the variables are structured/ combined and constructs (factors) are arrived at as shown in Table E:

**Table E**

| Variable | Variable Description | Constructs |
|---|---|---|
| V19 | Consistency | User-friendly |
| V20 | Ease of Use | |
| V22 | Ease of Understanding | Clarity |
| V17 | Ease of Navigation | Clutter-free |
| V18 | Attractive and unity in interface | |

### 6. User experience

User Experience is the second factor that influences the experience quality dimension which in turn influences service quality of e-learning. User Experience was represented by five items/ variables in the questionnaire (Refer V23 to V27 – Table 1). These variables were subjected to KMO and Bartlett's test, test of communalities and rotated component matrix test to confirm their appropriateness.

| KMO and Bartlett's Test – User Experience | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .613 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 253.908 |
| | df | 10 |
| | Sig. | .000 |

The KMO value is 0.613 which is greater than the minimum prescribed 0.500 and hence further analysis is possible.

| Communalities – User Experience | | |
|---|---|---|
| | **Initial** | **Extraction** |
| V23 | 1.000 | .856 |
| V24 | 1.000 | .808 |
| V25 | 1.000 | .836 |
| V26 | 1.000 | .705 |
| V27 | 1.000 | .919 |

Extraction Method: Principal Component Analysis.

The communalities of all the variables are >0.6 and hence are retained.

| Total Variance Explained – User Experience | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Component** | **Initial Eigenvalues** | | | **Extraction Sums of Squared Loadings** | | | **Rotation Sums of Squared Loadings** | | |
| | **Total** | **% of Variance** | **Cumulative %** | **Total** | **% of Variance** | **Cumulative %** | **Total** | **% of Variance** | **Cumulative %** |
| 1 | 2.282 | 45.631 | 45.631 | 2.282 | 45.631 | 45.631 | 1.638 | 32.762 | 32.762 |
| 2 | 1.038 | 20.761 | 66.392 | 1.038 | 20.761 | 66.392 | 1.429 | 28.574 | 61.336 |
| 3 | .805 | 16.090 | 82.482 | .805 | 16.090 | 82.482 | 1.057 | 21.146 | 82.482 |
| 4 | .538 | 10.758 | 93.240 | | | | | | |
| 5 | .338 | 6.760 | 100.000 | | | | | | |

Extraction Method: Principal Component Analysis.
The total variance explained is 82%

| Rotated Component Matrix – User Experience | | | |
|---|---|---|---|
| | **Component** | | |
| | **1** | **2** | **3** |
| V23 | -.063 | .891 | .242 |
| V24 | .454 | .772 | -.075 |
| V25 | .904 | .129 | .050 |
| V26 | .756 | .071 | .359 |
| V27 | .201 | .131 | .928 |

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]
a. Rotation converged in 5 iterations.

Based on the rotated component matrix, we consider the variables with a factor loading of >5 and accordingly the variables are structured/ combined and constructs (factors) are arrived at as shown in Table F:

**Table F**

| Variable | Variable Description | Constructs |
|---|---|---|
| V25 | Feedback on learning | Learning Analytics |
| V26 | Learning analytics | |
| V23 | Responsive | Trustworthy |
| V24 | Comfort and assurance | |
| V27 | Progress Tracking | Performance Measurement |