DEVELOPMENT OF INSTRUCTIONAL MODULES FOR ICT ENABLED CURRICULUM TRANSACTION FOR VARIOUS SUBJECTS AT SECONDARY LEVEL FOR TEACHER EMPOWERMENT AND THEIR QUALITY ASSESSMENT.

By

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ABSTRACT

Integrated instructional module in various subject areas at secondary level for Kerala was developed in a workshop mode and a CD was prepared using Linux-base. Training was given to the teachers in the instructional modules prepared by NIIT i.e. ICR and the same have been evaluated through a feedback mechanism. This paper is focusing on the comparison of the instructional materials developed by NIIT i.e. ICR with mostly used software quality models. It was an attempt to find out whether the instructional materials as the application software are having the quality characteristics so that the integration of the same in the teaching learning process makes a meaningful effect and is appreciable.

Keywords: Module, Curriculum, Transaction, Computers, Secondary Level, Evaluation, Quality Assessment, ICT, Skills, Teacher, Empowerment.

INTRODUCTION

The computers for education in early 70's were capable of text and line drawings application. The only thing students could do was to learn how to programme a computer. Through such a process it was expected that they learn the process of logical thinking and learn the tricks of problem solving. Soon in early 1980-90's computers were application oriented and became learner friendly. Their affordability, ease of learning resulted in their increased use in work places and educational institutions.

The application of multimedia along with moving pictures and audio text gained more significant place in curricular transaction and teaching content. This became a starting point for Information Communication Technology (ICT) infused curriculum/ module designing and development came in to prominence. Nowadays a lot of open and free content and software are available; Linux is one such platform, which the teachers can use. Teachers' use this software for the transactional purpose either through a tailor made or through self developed modules.

Computer can be a tool for education. It has really played a vital role in present day educational system. Probably with the advent of computers entering in the educational system, the information was integrated with technology. In the new millennium Quality education is the trend. Today's teacher is no longer the traditional "guru". The teachers need lot of skills to deliver the content by a new way using Information and Communication Technologies/systems, creating an e-learning environment. A suitable e-learning ambience has to be created by the teacher at his/her end. NIIT along with NCERT has started a smart computer lab, Math Lab and also introduced Interactive Class Room (ICR), ICT solutions such as dCAL, iCAT for teachers of Demonstration Multipurpose School (DMS) of Regional Institute of Education (RIE), Mysore to transact the content using the software prepared by NIIT. Teachers can create blogs and can ask the fellow teachers/ other institutions to explain their view on the subject. Moodle platform also enables the teacher to use in interactive class room wherein the transactional strategies, assessment, learning

on-line are attained. This e-learning potential will make learning more profound and effective and the emotional intelligence can be inclusive in the e-learning.

Materials and Methods

The present work was an outcome of a programme undertaken by NCERT, in a workshop mode.

In Phase I, the authors had discussion with SCERT personal and did the need assessment. They also collected 2 CDs from IT@School GNU/Linux version 3.0.2-2008 on 25th September 2008 and visited local schools to understand physical facilities at some schools; Government Girls High School, Manacaud, Trivandrum, Chala Upper Primary School. In phase II, they had a two day workshop for module design and development from 6-7th November 2008. NIIT and IBM personal had come and helped in the design and module development. The guidelines for module development in different subject areas at secondary level for Kerala state had been designed, and after that in Phase III, they had called for a five-day workshop from 2nd February to 6th February 2009 Wherein 18 teachers participated and the feedback obtained from them is a basis for this paper. They have used a tool, which comprises 17 items covering the major features of the NIIT ICR. The test items were provided with five point ratings as excellent, very good, good, fair and poor.

All the teachers were further grouped subject wise namely Group I-Biology, Group II- Social Science, Group III-Chemistry, Group IV- Physics and Group V- Mathematics.

- In Biology, topics selected were Homeostasis, Green cover, Skeleton.
- In Social Science, Rivers and Socio-cultural impact of rivers on economic status were taken.
- In Chemistry, Acids, Bases, Periodic Table were taken.
- In Mathematics, Triangles and related problems were taken.

The software developed was recorded in a CD form. The Questionnaire for getting feedback was given after they were exposed to ICR demonstration and first hand experience. The responses were used for analysis of the Quality assessment of the Software.

The analysis of the data is as follows:

The Linux base was requested by Kerala since it is open software. The teachers were exposed to various kinds of software including which were developed by NIIT, the one specifically for ICR in various subjects (Table 1).

Software Quality Models

As per ISO 9126-1 Software quality model, software should have the following quality characteristics:

- Functionality.
- Reliability.
- Usability.
- Efficiency.

No	Item	Excellent (%)	Very Good (%)	Good (%)	Fair (%)	Poor (%)
1.	The style of presentation of the content in the Module	17	39	44	0	0
2.	The vocabulary used in the module	33.2	44.4	22.2	0	0
3.	The method of explanation used in the module	22.2	38.9	33.3	5.56	0
4.	The easiness of access of the content in the module to the students	22.2	33.3	27.78	11.11	0
5	The attainment of the objectives/ learning outcomes in the module	11.11	33.3	27.78	16.67	0
6.	The appropriateness of the colour of the pictures used in the module	27.78	50	11.11	11.11	0
7.	The clarity of voice used in the module	38.9	55.6	0	5.56	0
8.	The pace of the voice over used in the module	5.6	78	11	5.6	0
9.	The appropriateness of the exercise given in the Module	11.1	22.2	50	16.7	0
10.	The frequency of the exercise given in the module	0	33.3	50	16.7	0
11.	The test items in the timed test iven in the module	0	33.3	38.9	16.7	11.1
12.	The time given to complete the test in the module	5.556	27.8	55.56	5.556	0
13.	The logic , coherence and sequence in the content presented in the module	16.7	27.8	38.9	16.7	0
14.	Error freeness of the content	11.1	38.9	44.4	5.56	0
15.	Richness of the content	11.1	44.4	44.4	0	0
16.	The predicted level of the content of the students in the module	5.6	33	56	0	0
17.	The scope for going beyond what the teacher can provide by other means	0	38.9	50	11.1	0

Table 1. Analysis of Quality Assessment of Software

- Maintainability.
- Portability.

Quality assessment of software is based on the following principles (Table 2)

1. Reliability: The ability to operate freely.
2. Modifiability: The ability to adapt changes.
3. Understandability: The ability to understand the software.
4. Efficiency: The ability to use the software speedily.
5. Usability: The ability to use the software easily.

With respect to the above characteristics, the items used to collect the feedback were classified as follows:

- Functionality: Item Number 1,2,3,5,8,11,17
- Reliability: Item Number 6,7,9,10,11,14
- Usability: Item Number 4,12,13,16,17
- Efficiency: Item Number 4,5,14,15
- Maintainability: Item Number 9,10
- Portability: No items.

Some of the software quality models are Mc Call's Software quality model, Boehm's software quality model, Dromey's quality model and the FURPS model. The above analysis has been compared with the existing software quality models, wherein it is almost equal to Boehm's model and FURPS model. The software quality models built a Quality evaluation framework, which analyses the quality of software components through the measurement of tangible quality properties, which

Quality Characteristics	Boehm	McCall	FURPS	ISO 9126	Dromey
Testability	X	X		X	
Correlation		X			
Efficiency	X	X	X	X	X
Understandability	X			X	
Reliability	X	X	X	X	X
Flexibility		X	X		
Functionality			X	X	X
Human Engineering	X				
Integrity		X		X	
Interoperability		X		X	
Process Maturity					X
Maintainability	X	X	X	X	X
Changeability	X				
Portability	X	X		X	X
Reusability		X			X

Table 2. Quality assessment of Software based on Quality Characteristics

ultimately strengthen teaching and transaction mode, i.e., Teacher empowerment at large. The feedback analysis serves as the data for this paper. As per NCF (2005), IT and Computer science are part of the school curriculum.

A growing number of researchers and teacher educators develop application of the hypertext, multimedia and networking to build cognivistic and constructivistic learning environments aimed at improving learning (Harasin et.al 1995; Resnick, 1996; Schank, 1996). Educational system around the world is under increasing pressure to use the new Information and Communication Technologies (ICTs) to teach students the knowledge and skills they need in 21st century.

Starting from mid-nineties, the use of ICTs in schools rapidly expanded in developed nations through curriculum support, networking, the professional development of teachers and software improvements (Aston, 2002). The ICT gadgets/ software used should be of that Quality, that it can cater to both trainer and learner and are more, flexible in, pace of learning, personalized, reusable, accommodative and interactive in nature and can cater to all subject areas/ specific fields and are more economically viable (Fisser, 2001; Peluiccione, 2001).Till the last decade of 20th century, abstract knowledge was showpiece. In current reforms i.e., NCF (2005), application of knowledge has been given greater importance, which brings the imbalance with abstract knowledge (Gallasher, 2000). If the teachers teach with the ICT modules the following advantages are possible. Practical applications however, have a role in the process of learning and understanding science.

The continuous thinking about the connections between the abstract idea knowledge and real world has a greater importance in science teaching, which really empowers the teacher. Learning is significantly enhanced when the orientation of the ICT application helps in to deepen understanding of the phenomenon and its explanation using a model. This has a potential to foster deeper understanding and thinking in the class room to make the students more constructivist in approach (NCF-2005).

Application of any knowledge is a central part of learning when it helps students to identify practical applications of concepts and reflect on practical experiences. These experiences will make connection between concepts and the real world. Mercedes model of teaching, clearly demarcates between teaching and learning process (Figure 1).

Mercedes model was compared with ICT modules and the deployments of ICT for multiple objectives attainment were cited(Figure 2).

- *Standards:* Use of ICT to transform teaching and learning and raise the standards across the curriculum.
- *Innovation:* Use of ICT to transform schools to deliver in a more lucid and effective way of Interactive learning environment/e-learning atmosphere creation.
- *Inclusion:* Use of ICT to provide universal access to educational opportunities to all types of learners.
- *Skills:* Provide learners with key skills for future employment, better learning and transaction of subjects, which will make a potential ICT rich society at a later stage.

By using ICT module the changes that took place can be assessed as in (Table 3).

Analysis:

The histogram for functionality indicates the mean as 2.99

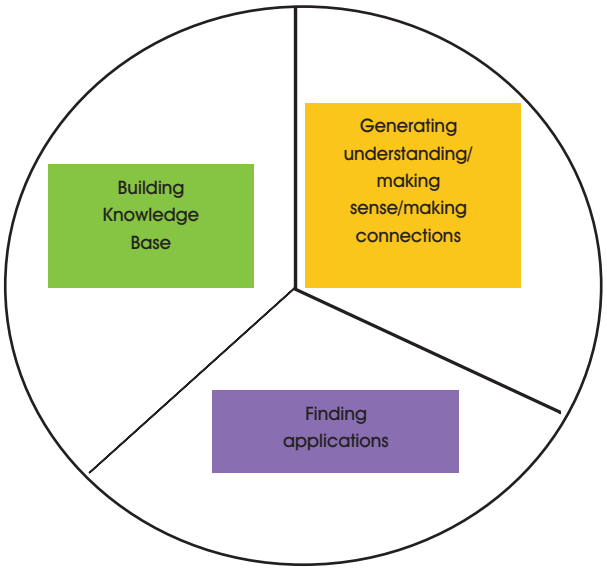

Figure 1. The Mercedes Model for Teaching and Learning

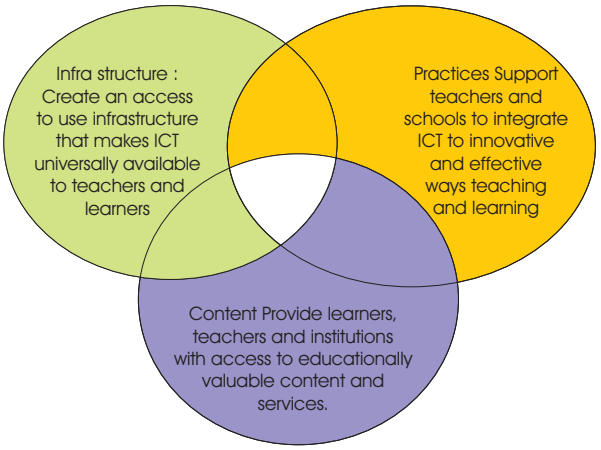

Figure 2. Information and communication strategy-Multiple outcomes which are desirable/expected

Without ICT modules	With ICT modules
Treating all students alike and responsibility to the group as a whole	Understanding and responsibility of the individual students. The communication strengthens experiential learning and caters to the individual needs and pace.
Rigidly follow Curriculum	Selecting and adapting curriculum for better understanding, freedom and flexibility learning.
Focusing on students acquisition of information	Focusing on student's acquisition of information along with understanding of subject/ scientific knowledge, ideas and inquiry process.
Asking for recitation of acquired knowledge.	Providing opportunities for scientific discussion and debate among students and promote innovative approaches of learning the content and application
Presenting scientific knowledge through lecture, text and for demonstration methods	Guiding students in an active manner leaving scope for scientific inquiry with skill acquisition.
Separating science knowledge and science process, covering many science topics.	Integrating all aspects of science content, studying a few fundamental science concepts.
This is a static mode of learning limited to the students	This is dynamic model of learning, can be changed from time and again.
Testing is mainly objective based	Testing can be based upon objectives along with variation and extended testing items.
Maintaining responsibility and authority	Sharing responsibility for learning along with peers support the class room transaction with liberty, shared responsibility and respect.
Working alone	Working with peers and teacher together.

Table 3. Changes in Teaching that takes place with ICT Integration

and standard deviation as 56% from the mean. The curve is moderately positively skewed. From the mean score one may conclude that, the functionality characteristics of NIIT ICR is good. (Figure 3).

The histogram for reliability indicates the mean as 3.53 and standard deviation as 51% from the mean. The curve

is moderately negatively skewed. From the mean score one may conclude that, the reliability characteristic of NIIT ICR is good, comparatively higher than functionality.

The histogram for usability indicates the mean as 3.37 and standard deviation as 66% from the mean. The curve is moderately positively skewed. From the mean score one may conclude that, the usability characteristic of NIIT ICR is good, comparatively higher than functionality (Figure 5).

The histogram for efficiency indicates the mean as 3.44 and standard deviation as 76% from the mean. The curve is almost normal (Figure 6). From the mean score one may conclude that, the efficiency characteristic of NIIT ICR is good, comparatively higher than functionality.

The histogram for maintainability indicates the mean as 3.06 and standard deviation as 76% from the mean. The curve is moderately negatively skewed. From the mean score one may conclude that, the maintainability characteristic of NIIT ICR is good, comparatively higher than functionality (Figure 7).

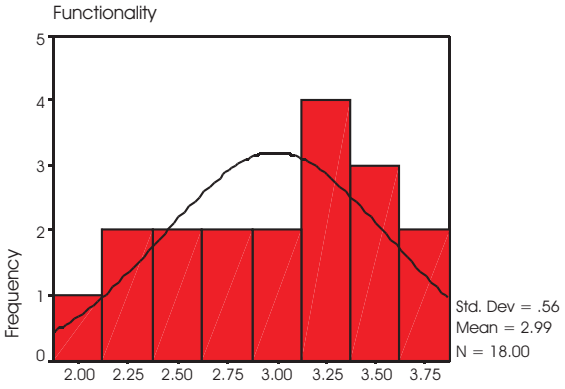

Figure 3. Histogram for Functionality

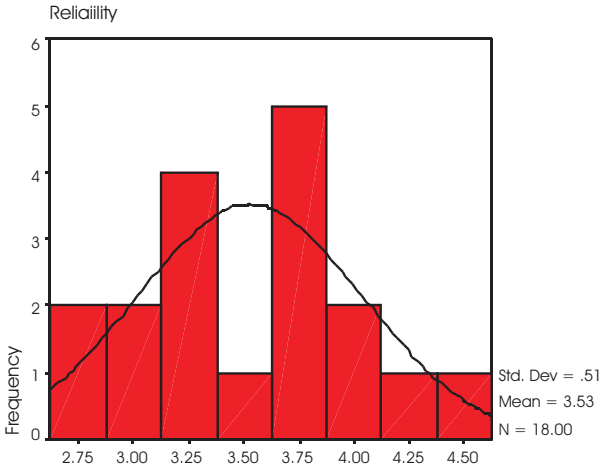

Figure 4. Histogram for Reliability

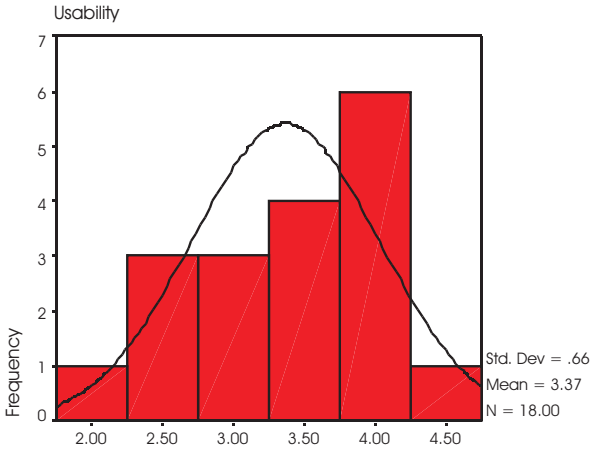

Figure 5. Histogram for Usability

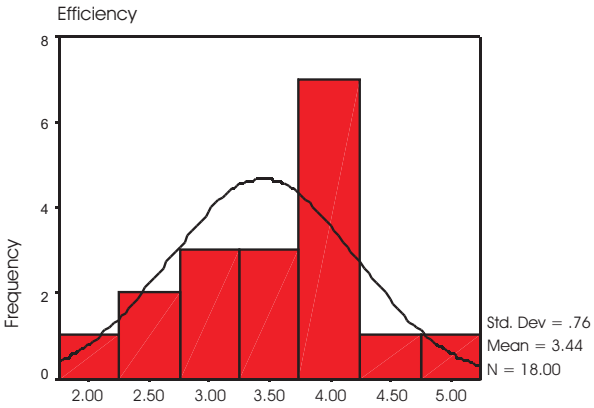

Figure 6. Histogram for Efficiency

From the graph for comparing all the quality characteristics, it is clear that reliability has got the maximum value, efficiency and usability also has got higher value than maintainability and functionality. But all the characteristics have got value greater than 2.9, which indicate that, the quality of NIIT ICR is good (Figure 8).

Process Quality: Quality metric provides a numerical value that can be scaled to measure a quality factor. So in the present investigation, the researchers have used the quality metric of functionality, usability, reliability, efficiency and maintainability. The parabolic graph curve indicates quality achievement in terms of mean values and percentage. The software used for teacher empowerment was more near to the McCall's model, Boehm's model and FURPS model together. The

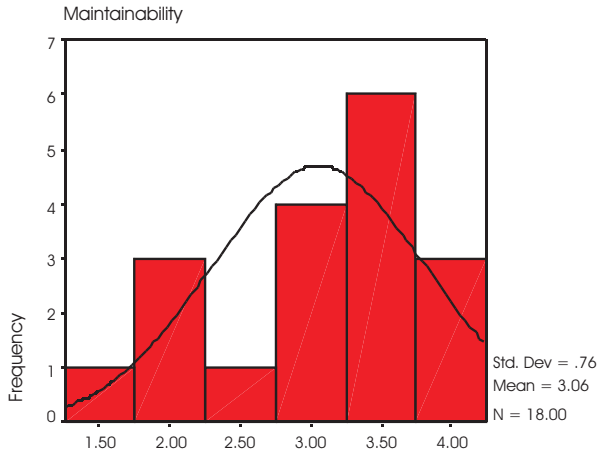

Figure 7. Histogram for Maintainability

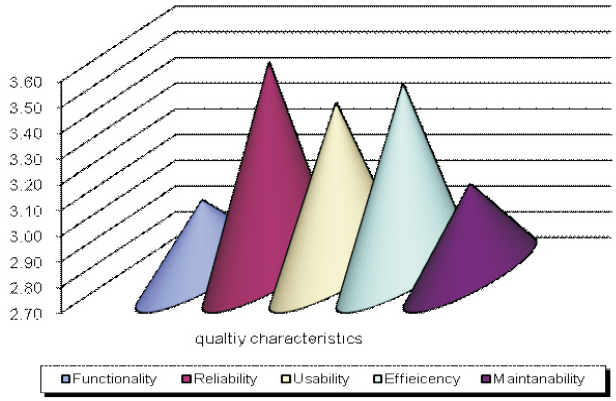

Figure 8. Quality Characteristics - Percentage Analysis

resemblance is more towards Boehm's model.

Conclusion

Thus the ICT interventions helped in both teaching and learning process and make the students to acquire skills for resolving problems, making decisions, recognizing risks and able to learn science concepts which are abstract and can link them to the present day world, be innovative which is the major objective of science teaching. Thus it makes the science teacher more empowered. In general the key attribute of a software quality is based on the level of satisfaction and the product value. The key attributes can be further classified in to a combination of desired properties, like functionality, reliability, portability, and maintainability.

Acknowledgments

The authors are acknowledging thanks to NIIT, Prof. G. T. Bhandage, Principal, RIEM and Prof. G. Ravindra, Joint Director, NCERT for their support and motivation.

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