Impact of ICT based tools on Teaching - Learning System - a case study

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Abstract

Information and Communication (ICT) based teaching and learning technologies including simulations, animations, Physics cinema classic videos and virtual lab etc. along with the traditional learning methodologies have been relatively new concepts in current scenario. In this concept, the tasks of the educators and the students both are manifold as the educators have to make sure that the concept is clarified in many ways and the students have to practice not only inside the class but outside the class as well. Self-motivation and responsibility of both the students and the teachers are equally important. In this paper we have studied the impact of technology initiated learning in the courses of Physics-1 and Physics-2 along with traditional learning methodologies on the development of interest, performance and result of same group of students in sem-1 and sem-2 respectively of B. Tech first year. We found that technology initiated learning tools are substantially effective in improving the clarity of concept and subsequently the result of the students.

Keywords: ICT, technology enabled learning, traditional learning, simulation and animation etc.

Introduction

Educational technology is becoming an additional tool of interaction between educators and learners along with traditional teaching-learning system in improving the quality of education. Additional tools can make fair teaching superior and fine teaching excellent but it can't make awful teaching outstanding. Technology assisted teachers cannot be the drivers of improved education until they themselves are primarily very well learned (Roblyer & Hughes, 2018). Modernization and globalization are mostly accepted to impose challenges to individuals and societies (Schleicher, 2012). Teachers are expected to enable citizens, workers to acquire those functional and critical thinking skills. This indicates that teachers have to be competent to use information and communications technology (ICT). They need to be prepared to provide their students with technology supported learning opportunities to enrich student learning. Pedagogies within

technologically rich environments are linked to teacher's pedagogical knowledge, technological knowledge and content knowledge (Chai et. al., 2011). The task of teacher as instructive, collective, decision-making and technological measures, building a broad assessment for public communication base, is to comprehend the add-on learning, teaching process (Maor, 2003). We have to consider the strength and weakness together of technology enabled teaching & learning techniques. In conventional classroom education, teacher and students gather at a meticulous time & teacher delivers the lecture using traditional methods while technology enabled learning allows teacher and student to integrate themselves with additional tools. Technology enabled learning education entail endurance, enthusiasm, confidence, keenness & understanding of computer in general and various softwares like java, flv and qtm etc as well. Furthermore, the success of technology enabled education is based on individual's learning approach and activities type (Katrina, 2003).

For this study, Physics-1 and Physics-2 courses were offered to one particular group of students in sem-1 and sem-2 respectively during two consecutive semesters by the same teacher to the same students. We investigated the effects of ICT based learning on variety of students. It presents mathematical information on students who had studied in conventional classroom and other from technology enabled classroom. The accomplishment of the group of students using technology enabled education depends on different aspects as shown in Table 1. A comparison between these two education methodologies is made and discussed in analysis and results section. Though ICT based education seems to have a number of advantages when used along with conventional classroom for enhancing the teaching and learning process.

Comparisons between ICT based education and conventional Learning

Table - 1 sums up various opinions to make a comparison between conventional learning and ICT-based education.

Table -1: Comparison between conventional education and add on Learning based on the pattern of Jha et al, 2012

Categories	Traditional Education	Technology Initiated Learning
Education Process	It is not group or individual study as learning is conducted with the entire class	The learning process takes place with whole class as well as in group or by individuals
Classroom Discussions	Students are generally mum and teacher talks most of the time	The students & teacher both talk equally

Subject Matter	The course structure is fixed and The teacher delivers the lesson plan	Numerous sources of information are needed
Inspiration	The learners are passive and their motivation is less.	The students participate and their motivation is high
Educators' Role	The role of an educator is authoritative.	The students are directed for expected results in the simulation
Location of Learning	Education is within the classroom and the college	Education is within the classroom as well as outside the classroom on java simulations.
Time of Learning	Education happens within the given time-frame	Education happens within the class as well as out of the class on java, qtm.

Expectation and fulfilment of students from technology initiated education are high when compared with conventional learning, which seems to be true based on the performance of the students in final exam result. Technology initiated learning includes lots of merits over traditional education such as : instants for grabbing the information and answering, better communication between the learners, knowledge being obtained and transferred amongst the learners themselves (Can, et. al., 2007).

Review of Literature

Information and communication technologies (ICTs) are a diverse set of hi-tech apparatus and assets used to correspond and to generate, dispense, stockpile and supervise information as these actions largely used at the spirit of education.

The research model & its components as shown in Figure -1(Aslan & Zhu 2018) has been used to study add on ICT based Learning system. The representation illustrates the contents that give ICT base-education background and the items can be stirred among this mechanism.
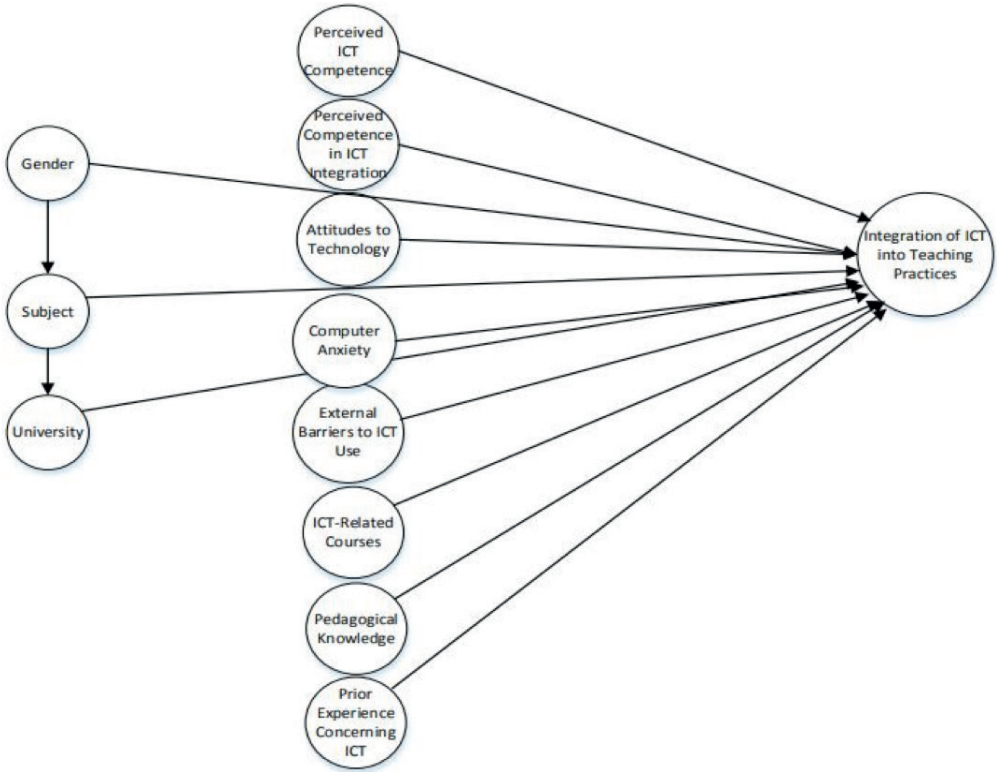
Figure - 1: Research Model of add on based ICT Learning system

In this study, both quantitative and qualitative research was used to investigate the participants' integration of ICT into their teaching practices as the research questions aimed at investigating the different dimensions of ICT integration into education. In this respect, the quantitative and qualitative research was conducted respectively to comprehensively understand the issue in multiple dimensions.

Number of students preferred to take classes in the Active learning classroom (ALC) rather than conventional classroom are more (Gordy et al, 2019). The analysis of student's grades suggested that GPA was one of the strongest predictors for both courses. Final grades in the Traditional Class rooms was better but had weaker predicting significance in the ALC setting. Overall, the majority of students enjoyed taking classes in the ALC due to its physical charm and dynamic collaboration.

Amorphous nature of technology is shown in Figure - 2 (Mishra & Koehler, 2006) and concluded that there is no single best way to make educational design for technological integration but that design should consider subject and classroom contexts.
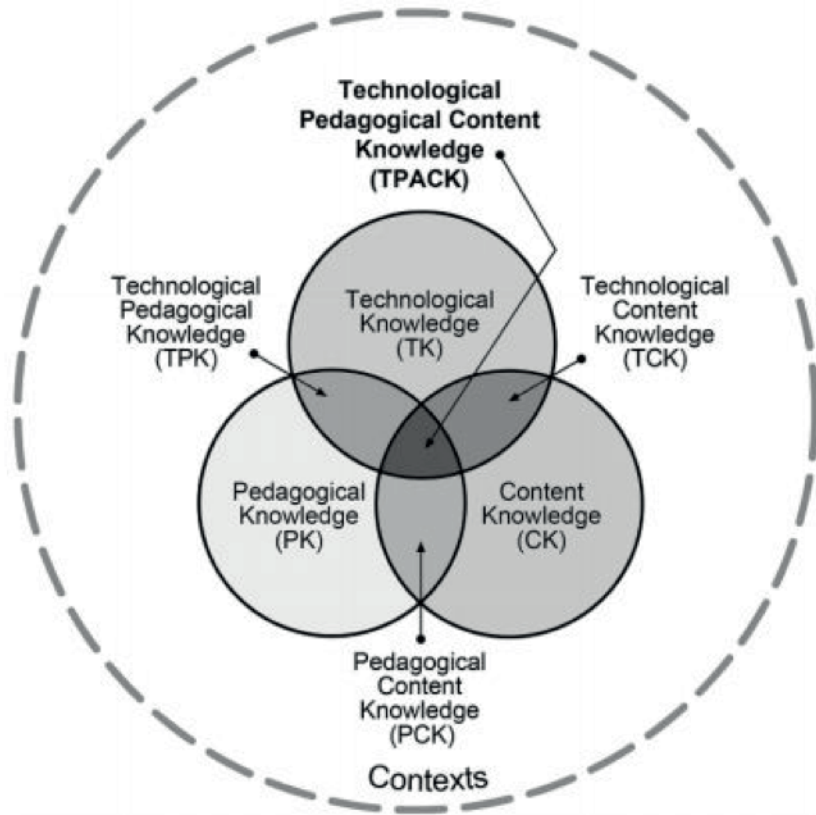
Figure - 2: Technological pedagogical content knowledge model

This means that unlike content and pedagogy that may be largely stable over extended periods of time, technology is continually changing and evolving, creating a shifting landscape that is challenging for teachers to master.

Traditional Learning system motivated by knowledge is a variety of all things of information flow involving learners and teachers including content of knowledge, its path & its compactness (Jha et al., 2012). Flow of knowledge is generally divided into an organization of three components educators, knowledge and students. The interacting structure of e-Learning system and the knowledge flow has been used (Jha et al., 2012).

Materials and Methods

This research is carried out at Faculty of Science & Technology, ICFAI University, Dehradun for teaching the Physics-1 (PH-111) & Physics-2 (PH-121) courses at the time when the main author was working as a faculty in charge of Physics there. These courses are for the sem.-1 and sem.-2 respectively of first year students of B.Tech. program. The task students taken for this research work belong to sem-1 & sem-2. For this study, Physics-1 and Physics-2 courses are offered in two different semesters by one professor using identical syllabi based on the books of Physics, vol. 1 & 2, 5th Edition authored by Resnick, Halliday and Krane of Wiley publication and same assessment instruments

have been employed except utilizing technology enabled learning in sem-2. Two examples taken from world press (2019) and physics classroom (2019), are been shown here; the reflected wave at the soft boundary does not get phase change while there has been a change of 180 degree phase of reflected and no change of phase in transmitted wave as shown in Figure - 3 at hard boundary when a wave passes through a medium of low density to a medium of high density;
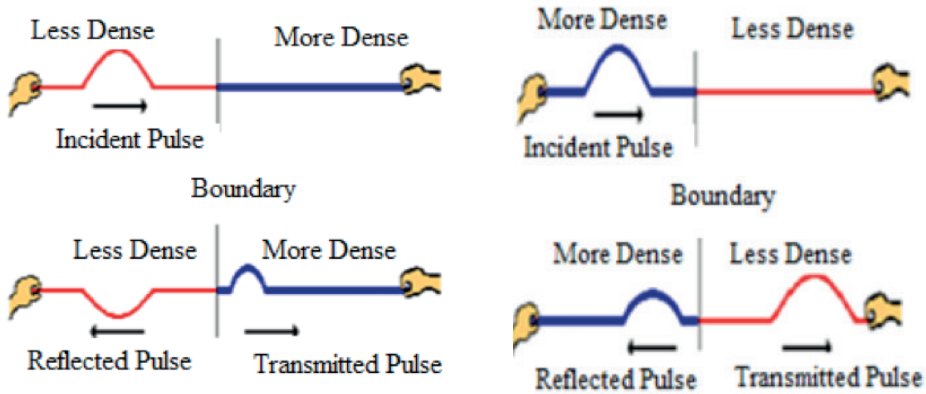

Figure - 3: Wave behaviour at soft and hard boundary

Second one is to make understand the concept of Gauss law as shown in Figure - 4 as it will be difficult to understand it but when seen in Fig. 4 of Pearsonhighered (2019) in which the angles between electric field lines with different surfaces, the law becomes quite clear and understandable.
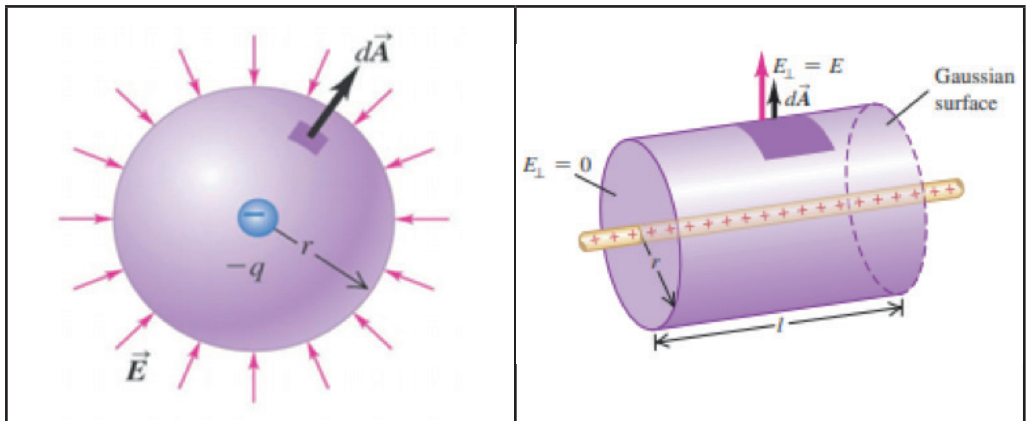

Figure - 4: Integrable surfaces in Gauss law

Similarly the following Figure - 5, taken from Colorado University (2019) shows the production of travelling waves in which students can vary the parameters such as amplitude, frequency and string thickness also. Rarefactions and compressions and the production of sound by a tuning fork is demonstrated in Figure - 6 taken from Amrita university (2019).
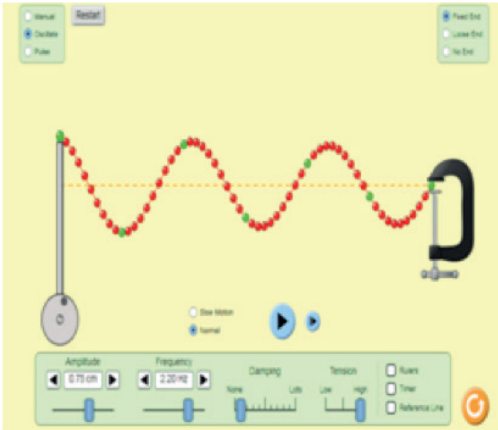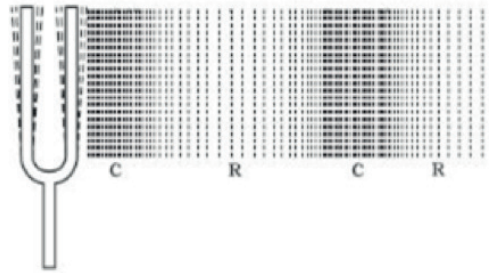
Figure - 5: Travelling Wave

Figure - 6: Production of sound by tuning fork

The two courses of Physics-1 (Resnick, Halliday and Krane,5th Ed. Vol.1) and Physics-2 (Resnick, Halliday and Krane, 5th Ed. Vol.2) in sem-1 and sem-2 respectively are differentiated only in the presentation format: one was a conventional classroom employing chalk duster method with exercises in sem-1 while the other was delivered with additional tools of videos on Physics cinema classics, simulations and animations in sem-2 as shown by few similar examples given above, however the assessment methodology remains the same. Here, videos on

Physics cinema classics are primarily obtained from American Physical society and ZTek Company, USA while simulations and animations used by us are mostly from Wiley and Thomson publication. Various aspects of handling the simulations and animations during the course were familiarized in the very first class of the semester. In both the semesters student sample is same that is 63. All the students were generally usual, residential B. Tech first year college students. The details of the sex and age of the students are shown in Table - 2.

Table - 2: Gender and age of participating B.Tech. first year students, ICFAI University, Dehradun

Categories	Number	Percent (%)
Gender		
Female	05	7.93
Male	58	92.07
Total	63	100
Age		
16 - 18	30	47.61
18 - 20	25	39.69
20 - 22	08	12.70
Total	63	100

Animations are shown in qtm and flv player while java is used to run the simulations. Animations are straight forward and do not provide variation in physical parameters while in simulations the physical parameters can be controlled. The students are allowed to play the various parameters of simulations & rerun the animations as per their choices.

Evaluation Methodology, Results and Analysis

The results of students are measured by grades obtained by them. The grading formulae adopted here is same in both the semesters. Students were accessed constantly during both semesters. The continuous evaluation was done by giving tests in which 2 tests were of 15 marks each while mid sem. test was of 20 marks and one quiz of 10 marks making a total of 60% weightage. Final evaluation was done by taking the comprehensive examination which was given 40 percent credence. The weighted final marks are calculated as below;

Weighted final marks = $0.50 \times$ Class Test + $0.10 \times$ Quiz Test + $0.40 \times$ Comprehensive Exam

The weighted final marks of all the students in both the semesters were calculated after the comprehensive examination. A range of mathematical values like mean, standard deviation, maximum and minimum marks for both the sections are calculated and shown in the table - 3.

Table - 3: Descriptive statistics of weighted final marks

Semester	Teaching Methodology adopted	Maximum marks	Minimum marks	Average	Standard deviation
SEM-1	Traditional Classroom	62	10	29.07	8.1
SEM-2	ICT based Learning	62	12	31.86	9.6

Comparison of marks and grades obtained by the students has been done in table - 4 and it is found from the mathematical analysis that average and minimum marks for the students of conventional classroom teaching learning system (sem-1) are little lower than the students of add on Learning environment of system (sem-2).

Table - 4: Explanatory information of weighted final grades

Grades	Sem-2	Sem-1
A (≥60)	2	0
B(50-59)	12	10
C (25-49)	30	28

D (15-24)	10	12
E- (10-15)	4	6
F(≤9)	5	7

Therefore, it is quite clear that modern addition tools involved with traditional tools in teaching learning environment are impressive in creating the interest of the students in the subject and improving their results and grades.

Conclusion

In this student oriented study, we analyzed and compared how additional technical tools like videos, simulations and animations in teaching learning environment along with traditional teaching learning impact on the understanding of the students. It has been established from our results and analysis that add on tools when involved with traditional class room teaching procedures can make a significant contribution in manifold development of the students. Knowledge flow with the support of computer technologies not only clears the concepts in a better way but also give a chance to the student to use his or her intellect in performing and understanding the concept. From this Analysis, it appears that students of sem-2 gain more amount of information and knowledge by using add on learning tools as compared to students of sem-1 who had been delivered with conventional class room methodologies. Most of the students of sem-2 were much comfortable and enjoyed moreover due to their understanding or their changed study habits. Therefore, new ICT based techniques and old teaching systems must be used together for improving the teaching -learning process.

India has a huge budding market of add-on educational tools such as videos, animations, simulations and virtual lab. Only few universities and industries have started it. ICT based add- on educational projects have bright business scenario but it has been growing as a subject rather than an industry. Therefore, industrialization of ICT based add-on learning projects are required to be promoted.

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