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Editorial

Science and Technology is at an ever increasing pace and one has to keep him abreast with the newer developing frontiers. Research is normally carried out to firm foot or support some existing concept, but sometimes it may be on unconventional subject or theme also; in the latter case, researchers will find it difficult to find a space for its publication. PAHER University has taken a desired step in this direction by introducing a journal “Pacific University Journal of Science & Technology” so that established as well as younger and budding scientists and technologists can get an opportunity to express their views in form of research findings and reviews in the fields of their own expertise. However, these will be published only after peer review by the experts with no compromise with the quality of work. Authors from different branches of science and technology are welcome to submit original research papers or reviews from their own arena. Any suggestion for further improvement of the journal is always welcome.

With Regards,

Prof. Suresh C. Ameta

Editor

A Comparative Study of the Bacterial Contamination Among the Mobile Phones of the Doctors and Laboratory Technicians in Jamnagar, Gujarat

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Abstract

The aim of this study is isolation and identification of bacterial colonies found on mobile phones of various doctors and Laboratory Technicians from the city of Jamnagar Gujarat and compares the bacterial contamination thereby. A total of 100 mobile phones were randomly selected in the month of December 2017. 50 samples were taken from doctors and 50 from Lab technicians and were streaked on agar plates to examine and isolate the bacterial colonies according to standard microbiological techniques. Data were analyzed through T- test and Chi-test. 92.7% of bacterial contamination was found in the mobile phones of doctors, whereas, it was seen 2% more among those of lab technicians making it 94.7%. The bacterial isolates mainly seen were Staphylococcus Epidermidis (41.1%), Staphylococcus Aureus (36%), followed by Bacillus spp. (33.1%), Pseudomonas Aeruginosa (21.6%), Escherichia Coli (18.3%), Streptococcus spp. (15.9%), Proteus spp. (10.5%), and Klebsiella spp. (6.0%), whereas among the Laboratory Technicians bacteria mainly seen were Escherichia Coli (39.3%), Staphylococcus Aureus(35.8%), Pseudomonas Aeruginosa (21.6%), Staphylococcus Epidermidis(21.1%), Proteus spp.(18.9), Klebsiella spp. (16.0%) and Bacillus spp. (17.0%).

Keywords: Mobile Phones, Doctors, Laboratory Technicians, Nosocomial Infections

Introduction

The first mobile phone call was made in 1973 which was improvised in shape, size, and technology from the oldest 1983 Motorola model until now¹. The mobile phone has now become a common device used very often for

communication from rural to urban areas of the world, it has become one of the most necessary accessories for all persons and easy way to contact with the other². It has given rise to the technology wherein the world has become a very small place. In Libya, World's first mobile phones were used in the registration for the vote for official election³.

The mobile phone used between doctors, Lab technicians, patients, and visitors were the devices carrying the high risk of transmitting bacterial contamination and the infections transmitted through them inside the hospital and the community². The mobile phones prove to be the vectors for transmission of these communicable diseases as it provides optimum temperature for the natural flora and bacteria to grow on its surface. The moisture of our skin and optimum temperature of the human body especially our palms make the culturing of bacteria easier⁴. Cross-contamination occurs between doctors, visitors, Laboratory Technicians, and visitors⁵. The mobile phone is the reservoir for many harmful pathogens which are responsible for the nosocomial infections or Hospital Acquired Infections² and become exogenous sources of infection for the family members⁶. Besides, they are also an important source of transmission of bacteria between hands, mouth, and face, ears (skin) to the users and others who use the mobile phones of others⁵. The hands and other instruments of the doctors and Lab technicians are easily cleaned using different types of sanitizing methods but the mobile phones are rarely disinfected². To reduce this contamination through bacteria or other microbes, the mobile phone devices must be disinfected at regular interval of times with 70% isopropyl alcohol wipes or ethyl alcohol wipes⁷. There are several suggestions from the researchers round the world like while at work, mobile phones and hand hygiene must be strictly controlled (Elsevier Health Sciences, 2011).

To add further, the best behavior recommended is not to share mobile phones with anyone which helps to reduce the transmission of the bacteria from person to person.⁸ Moreover, the shape of the phone, size, and the space between keys makes it most difficult to clean it. There were many cases reported which proved fatal and caused deaths by the contamination through hands in hospitals.

Objectives

The study was aimed to isolate and identify the bacterial colonies on the surface of the mobile phones of various doctors and Laboratory technicians of a general hospital in the city of Jamnagar (Gujarat) and compare the results.

Materials and Methods

A. Samples Collection:

This study was carried out during the first half of the month of December, 2017 (winter season). A total of 100 samples; 50 from doctors and 50 from Laboratory technicians from different general hospitals of Jamnagar (Gujarat) were collected randomly and were tested for bacterial contamination using standard microbiological techniques. We had taken the required permission from the Hospital authorities from wherever the samples were collected. The samples were collected using a sterile cotton swab stick moistened with normal sterile saline. These swabs were swiped over the surface of the phone, near its keys, the speaker, back, and ear phone⁹. A systematic questionnaire was designed to know various aspects of the mobile owner which is as follows:

B. Cultured Samples:

All swabs collected were immediately cultured onto different media like Nutrient broth, MacConkey, and Blood agar (Oxoid, England) by soaking it on the surface of the media and were then incubated aerobically at 37°C for 24 hours⁹.

C. Identification of the Bacterial Isolates:

To identify the bacteria on the samples, the bacterial colonies were isolated and subjected to Gram staining followed by morphological characterization. After recording these observations, further, the isolates were tested by biochemical tests according to the standard microbiological techniques^{10,11}.

Results and Interpretations

Isolation and Identification of the Bacterial Colonies:

Among 50 doctors and 50 Laboratory technicians, bacterial colonies were isolated from various parts of the mobile phones as mentioned in Table 1. The mobile phones showed 94.7% microbial contamination among the laboratory technicians

which exceeded to that of doctors by 2%. The bacteria mainly identified from the surface of the mobile phones of doctors were *Staphylococcus Epidermidis* (41.1%), *Staphylococcus Aureus* (36%), followed by *Bacillus spp.* (33.1%), *Pseudomonas Aeruginosa* (20.6%), *Escherichia Coli* (18.3%), *Streptococcus spp.* (15.9%), *Proteus spp.* (10.5%), and *Klebsiella spp.* (6.0%), whereas, among the Laboratory Technicians bacteria mainly seen were *Escherichia Coli* (39.3%), *Staphylococcus Aureus* (35.8%), *Pseudomonas Aeruginosa* (22.6%), *Staphylococcus Epidermidis* (21.1%), *Proteus spp.* (18.9), *Klebsiella spp.* (16.0%) and *Bacillus spp.* (17.0%). The rate of *Staphylococcus epidermidis* was seen highest among the mobile phones of doctors where as among the Laboratory technicians it was *E. coli* was highest.

Types of bacteria	Doctors N=50	Percentage of isolates	Lab technician N=50	Percentage of isolates
S. Epidermidis	22	41.1	11	21.1
Staphylococcus Aureus	18	36.0	17	35.8
E. Coli	9	18.3	21	39.3
Klebsiella Spp.	3	6.0	9	16.0
P. Aeruginosa	10.8	21.6	9.9	20.6
Bacillus Spp.	16.4	33.1	8.4	17.0
Proteus Spp.	5.2	10.5	8.8	18.9
Streptococcus	7.8	15.9	5.2	10.8

Table 1: Bacterial Isolates from Mobile Phones of Doctors and Laboratory Technicians from Various Hospitals of Jamnagar in Gujarat State of India

Source: Primary Data, Author's Compilation

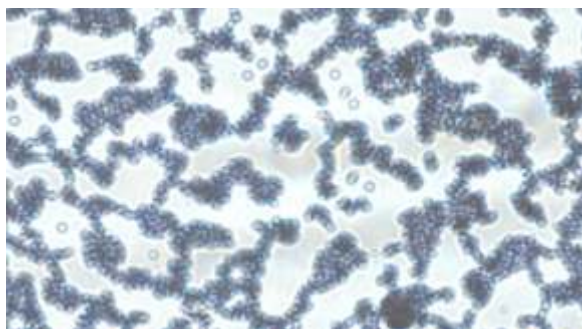


Figure 1: Gram Positive Bacteria under Microscope

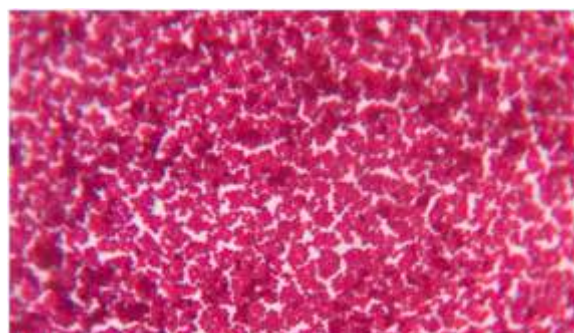


Figure 2: Gram Negative Bacteria under Microscope

Discussion

The device used for communication (here mobile phones) of various doctors and Laboratory technicians are the prime source of transmission of Hospital acquired infections and community¹².

The current study showed a very high prevalence of bacterial contamination on the mobile phones of both doctors as well as Laboratory technicians. This percentage is higher than the study conducted in Alexandria University students Hospital, Egypt (25%) Selim, H.S., Abaza, A.F. 2015 and lower than the results found in Saudi Arabia Hospitals (83.9%) Kumar, B.V. et al. 2014, Gondar town Hospitals, Ethiopia (98.3%) Gashaw, M. et al. (2014), the teaching Hospital Umberto I in Rome, Italy (86.0%) Orsi, G.B. et al. (2015).¹³

These differences might be due to the hand hygiene observed by the doctors and laboratory technicians at particular hospitals, the time of usage of the mobile phones, the places where the mobile phones are kept, the place where the mobile phones are used etc. Among different bacterial isolates, *S. aureus* which is normally responsible for Nosocomial infections and is found on skin was almost common among doctors as well as lab technicians which are in agreement with the previous studies¹⁴.

The reason behind *S. Aureus* to be common is that it grows on warm environment which is found on the surface of the mobile phones¹⁵ and the skin which is a natural habitat for this bacteria, due to the moisture of the skin it becomes easier to transmit this bacteria among the mobile users and thus gives good atmosphere for the bacterial colonization.⁴

When compared the types of bacterial isolates found from the surface of the mobile phones of doctors and lab technicians, they were found to be almost similar which reveals that the transmission of these pathogens must be through the skin contact in both the cases. In other similar studies carried out, Roy, S.S. et al. 2013, Enterobacteriaceae

group particularly *Klebsiella* spp., *Proteus* spp. and *E. coli* were the main Colonies which had high frequency of association with the mobile phones of meat handlers (84%) followed by animal handlers (80%), fish handlers (60%), laboratory attendants (48%), veterinary surgeons(20%) and students (12%) mobile phones which is in agreement by current study that observed the colonies of *E. Coli* strains on the mobile phones of lab technicians. This indicates fecal contamination suggesting poor hand hygiene and handling of mobile phones among lab technicians and doctors.¹⁵

The colonies of *Bacillus* Spp. were lower in rate in contrast to the present study¹⁵. These bacteria have tendency to produce spores and can resist the change in environment as well as chemical disinfectants.¹⁶

The present study indicated that the bacterial contamination on doctors and lab technicians are more or less similar types that may be transmission to the patients and visitors and among them also, it may also be the reason for the spread of nosocomial infection. Through this study, it is highly recommended for the stakeholders to state the guidelines for disinfecting the device, to limit the usage of mobile phones during working hours, to strictly maintain the hand hygiene and to avoid using the mobile phones at bacteria prone places.

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Simultaneous Estimation of Nimorazole and Ofloxacin in Tablet Dosage Form By RP-HPLC

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Abstract

A new simple, rapid and precise reverse phase high performance liquid chromatographic method had been developed for the simultaneous quantification of Nimorazole (NIM) and Ofloxacin (OFLX) in pharmaceutical tablet dosage form. The chromatographic separation was carried out using a puritus C18 (250 × 4.6 mm, 5 μ m) column. Eluting mobile phase consisting of Acetonitrile:20mM phosphate Buffer in ratio of 23:77 v/v at flow rate of 1 ml / min and detection wavelength of 300 nm was used for method development. The retention time for nimorazole and ofloxacin was found to be 5.613 and 8.336 min respectively. Linearity for nimorazole was observed in the concentration ranger of 25-175 μ g/ml and for ofloxacin 10-70 μ g/ml. The developed method was validated as per ICH guidelines.

Keywords: Nimorazole, Ofloxacin, RP-HPLC

Introduction

Ofloxacin is a fluoroquinolone derivative, Chemically (\pm)-9-fluoro-2, 3-dihydro-3-methyl-10- (4-methyl-1-piperazinyl)-7-oxo-7H-pyrido-[1,2,3-de]-1,4-benzoxazine -6-carboxylic acid having potent activity against a broad spectrum of bacterial flora mainly used for the treatment of urinary tract infection and sexually transmitted diseases¹. Nimorazole is a 5-nitroimidazole derivative, chemically 4-[2-(5-nitro-1H-imidazole-1-yl)ethyl] morphine, used as a hypoxic sensitizer concomitantly with radiotherapy for head and neck cancer².

Ofloxacin is official in IP³, BP⁴ and USP⁵. All three pharmacopoeias describe potentiometric non aqueous titration method for assay of ofloxacin. Nimorazole is not yet official in any of the Pharmacopoeia. Literature survey revealed that, few analytical methods including chromatographic⁶⁻¹⁴, and

spectrophotometric¹⁵⁻²¹ are reported for the estimation of OFLX and NIM either individually or combination with other drugs. One HPLC method is reported for simultaneous estimation of OFLX and NIM from pure and Pharmaceutical dosage form²². Present paper describes simple and accurate RP-HPLC method for simultaneous estimation of OFLX and NIM from Pharmaceutical tablet dosage form along with validation as per ICH guidelines.

Experimental

A. Material and Method

Pure drug sample of Nimorazole and Ofloxacin were provided as gift sample by Luipin Pharma, Mumbai and were further authenticated by FTIR studies. All chemicals and solvents used for present study were of HPLC grade, Pharmaceutical formulation used for present study were tablet with label claim as NIM 500 mg and OFLX 200 mg per tablet. Three different batches of formulation were procured from local market.

For present investigation a Shimadzu HPLC system (LC-20 AD and LC-20 AT) was used Separation was achieved on Puritus C18 column (250 x 4.6 mm, 5 μ m) was used. Mobile Phase used was Acetonitrile: 20mM phosphate Buffer in ratio of 23:77 v/v, at flow rate of 1 ml / min and detection wavelength as 300 nm. Mobile Phase was filtered through 0.45 micron membrane filter before use.

B. Standard Stock Solution

Standard stock solutions of 500 μ g/ml of NIM and 200 μ g/ml OFLX were prepared separately in methanol. From the stock solutions, the working standard solutions were prepared to contain 20 μ g/ml of OFLX and 50 μ g/ml NIM. The working standard solutions were filtered through nylon membrane filter.

Result and Discussion

A. Selection of Detection Wavelength

The standard solution of NIM and OFLX were scanned over the range of 200 to 400 nm in double

beam Shimadzu spectrophotometer against blank. The spectra obtained were overlain. Wavelength 300 nm was observed as isobestic point and same was selected as detection wavelength for present method development. Overlain UV spectra of NIM and OFLX is shown in fig 1.

B. Selection of Mobile Phase

Series of trials were taken for finalization of mobile phase. The final mobile phase selected was Acetonitrile : 20mM phosphate Buffer in ratio of 23:77 v/v so as to achieve proper peak shape with sufficient height, theoretical plates, resolution and peak purity index. With selected mobile phase NIM and OFLX were properly resolved with retention time of 5.613 and 8.336 min respectively using puritus C18 (250 x 4.6 mm, 5 μ m) column and 20 μ l injection volume. A representative chromatogram of resolved peaks of NIM & OFLX shown in fig 2.

Method Validation

I. System Suitability Testing

Working standards mixture of NIM (50 μ g/ml) and OFLX (20 μ g/ml) were injected six times and chromatogram was recorded. Retention time, theoretical plates, tailing factor and resolution were calculated for all six repetitions. It was observed that plate count of NIM and OFLX is greater than 2000, tailing factor is less than 2.0 and Resolution of peaks is greater than 2.0. The system suitability data are reported in table 1.

II. Linearity and Range

From standard stock mixture solution proper aliquots were withdrawn and transferred to 10 ml volumetric flask and diluted with mobile phase to get concentration of 25, 50,75,100, 125, 150 and 175 μ g/ml of NIM and 10,20,30,40,50 60 and 70 μ g/ml of OFLX. Each solution (20 μ g/ml) was injected and chromatogram recorded. Areas under the curve for both the resolved peaks were calculated and calibration curve plotted. It was observed that NIM shows linearity in concentration range of 25-175 μ g/ml and OFLX shows linearity in concentration

range of 10-70 $\mu\text{g}/\text{ml}$. Overlain chromatogram for linearity range determination is represented in Fig 3. Calibration curve for NIM is represented in fig 4 and calibration curve for OFLX is represented in fig 5. Corresponding data of Area under the curve for both the peaks are reported in table 2.

III. Repeatability

The precision of the developed method was checked by repeatedly injecting (n-6) standard solution of 100 $\mu\text{g}/\text{ml}$ of NIM and 40 $\mu\text{g}/\text{ml}$ of OFLX under same chromatographic conditions. The peak area was measured, percentage RSD calculated and was found to be 0.301 for NIM and 0.263 for OFLX reflecting repeatability of developed method. The data of repeatability studies are reported in table 3.

IV. Intraday Precision

Three replicates of three concentrations 80, 100 and 120 $\mu\text{g}/\text{ml}$ of standard solution of NIM and 32, 40 and 48 $\mu\text{g}/\text{ml}$ of standard solution of OFLX were analyzed at three consecutive days, percentage RSD calculated which was found to be 0.094-0.378 for NIM and 0.272-0.346 for OFLX reflecting method to be precise. The data of intraday precision studies are reported in table 4.

V. Interday Precision

Three replicates of three concentrations 80, 100 and 120 $\mu\text{g}/\text{ml}$ of standard solution of NIM and 32, 40 and 48 $\mu\text{g}/\text{ml}$ of standard solution of OFLX were analyzed at the same day, percentage RSD calculated which was found to be 0.879- 1.176 for NIM and 1.020-1.755 for OFLX reflecting method to be precise. The data of interday precision studies are reported in table 5.

IV. Accuracy

Accuracy of the developed method was determined by calculating the recovery of NIM and OFLX by standard addition method. Three concentrations from linearity range of NIM and OFLX were selected and spiked at three different levels (80%, 100% and 120%). The amount of NIM

and OFLX were estimated by applying regression equation of the calibration curve to the obtained values of area under the curve. The developed method was found to be accurate. Data of accuracy studies are reported in table 6.

VII. Limit of Detection and Limit of Quantification

LOD and LOQ were calculated from set of five calibration curve used to determine linearity. The calculated values of LOD and LOQ are reported in table 7.

VIII. Robustness

Robustness studies were carried out by changing flow rate (+ 0.2 ml/Min), wavelength (+ 2 nm) and mobile phase ratio. Percentage RSD calculated. The data of robustness studies are reported in table 8 (a), 8 (b) & 8 (c).

Assay in Pharmaceutical Formulation

Twenty tablets were accurately weighed, crushed and finely powdered. Powder equivalent to 200 mg of OFLX was accurately weighed and extracted with 50 ml methanol with sonication. Filtered through Whatman filter paper no. 42 and then transferred the filtrate to 100 ml volumetric flask, make up the volume up to the mark with mobile phase. This solution was further diluted with mobile phase to give final concentration of 100 $\mu\text{g}/\text{ml}$ of NIM and 40 $\mu\text{g}/\text{ml}$ of OFLX. This solution was injected and chromatogram recorded. From area under the curve of sample chromatogram concentration of NIM and OFLX was calculated using respective calibration curve regression equation. The process was repeated three times with three batches of tablet formulation. Results of analysis are reported in table 9.

Discussion

An accurate, precise, selective RP HPLC method has been developed for simultaneous estimation of Nimorazole and Ofloxacin from tablet dosage form. Method was developed using mobile phase containing Acetonitrile: 20mM phosphate Buffer

in ratio of 23:77 v/v. The flow rate was 1 ml / min and detection wavelength used was 300 nm. A C18 reversed phase column was used to achieve separation of two components. The retention time of Ofloxacin and Nimorazole were found to be 5.613 and 8.336 min respectively. Linearity of developed method was found to be in the concentration range of 25-175 µg/ml for Nimorazole and 10-70 µg/ml for Ofloxacin. Developed method was validated as per ICH guidelines. The percentage recovery of Nimorazole and Ofloxacin from marketed formulation was found to be in the range of 99.94 – 100.15 and 99.95 – 100.15% respectively. Overall, method provides high throughput solution for the determination of Nimorazole and Ofloxacin in tablet dosage form with excellent precision, specificity and accuracy.

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Sr. No.	RETENTION TIME		THEORETICAL PLATES		TAILING FACTOR		RESOLUTION
	OFLX	NIM	OFLX	NIM	OFLX	NIM	
1	5.99	8.67	19185	12868	1.2	1.1	8.305
2	5.95	8.75	19356	12982	1.2	1.1	8.334
3	5.89	8.60	19465	12850	1.2	1.1	8.350
4	5.89	8.65	19157	12359	1.2	1.1	8.351
5	5.96	8.74	19259	12975	1.2	1.1	8.348
6	5.82	8.76	19396	12456	1.2	1.1	8.355
% RSD	1.04	0.7444					
LIMIT	<2%		>2000		<2		>2

Table 1: Data of System Suitability

Source: Data Analysis

Sr. No.	OFLX		NIM	
	Concentration (ug/ml)	Area	Concentration (ug/ml)	Area
1	10	755809	25	922649
2	20	1529059	50	1978696
3	30	2559545	75	3362155
4	40	3434174	100	4172074
5	50	4373448	125	5298804
6	60	5415950	150	6477650
7	70	6249566	175	7613840

Table 2: Data of Linearity and Range

Source: Data Analysis

Nimorazole		Ofloxacin	
Concentration (ug/ml)	Area	Concentration (ug/ml)	Area
100	4172074	40	3434854
100	4172274	40	3457895
100	4187565	40	3455855
100	4718982	40	3456585
100	4157485	40	3455655
100	4154664	40	3458688
Mean	4170507	Mean	3453255
S.D.	12561.46	S.D.	9091.235
% RSD	0.301198	% RSD	0.263266

Table 3 : Data of Repeatability

Source: Data Analysis

Drug	Conc (Ug/ml)	Area			Mean Area	SD	% RSD
		Set1	Set 2	Set 3			
NIM	80	3547448	3567898	3542525	3552624	13455.03	0.378735
	100	4172545	4165552	4165845	4167981	3955.542	0.094903
	120	4558774	4568475	4588985	4572078	15424.41	0.337361
OFLX	32	2845656	2854852	2865452	2855320	9906.295	0.346942
	40	3435454	3442552	3421552	3433186	10682.13	0.311143
	48	4054545	4064585	4042552	4053894	11030.92	0.272107

Table 4: Intraday Precision Data for NIM and OFLX

Source: Data Analysis

Drug	Conc (Ug/ml)	Area			Mean Area	SD	% RSD
		Day1	Day 2	Day 3			
NIM	80	3527448	3597898	3602525	3575957	42073.68	1.176571
	100	4112545	4185552	4165845	4154647	37769.65	0.909094
	120	4518774	4558475	4598985	4558745	40106.18	0.879764
OFLX	32	2805656	2864852	2905452	2858653	50185.93	1.755580
	40	3405454	3472552	3421552	3433186	35029.24	1.020313
	48	4094545	4164585	4192552	4150561	50486.18	1.216370

Table 5 : Intraday Precision Data for NIM & OFLX

Source: Data Analysis

Drug	Level	Amount Of Sample (ppm)	Amount Of Standard Spiked (ppm)	Total Amount (ppm)	Amount Recovery (ppm)	% Recovery
NIM	80%	80	25	105	104.2	99.23
	100%	100	25	125	124.4	99.52
	120%	120	25	145	145.3	100.20
OFLX	80%	32	10	42	41.5	98.80
	100%	40	10	50	49.8	99.52
	120%	48	10	58	58.3	100.51

Table 6 : Data of Accuracy for NIM & OFLX

Source: Data Analysis

Parameter	NIM	OFLX
S.D. Of the Y-Intercepts Of The 5 Calibration Curves	10957.29	6213.174
Mean Slope of The 5 Calibration Curves	44359	93042
LOD = $3.3 \times (SD/Slope)$	0.815	0.279
LOQ = $10 \times (SD/Slope)$	2.470	0.848

Table 7 : Data of LOD & LOQ

Source: Data Analysis

Drug	Conc (Ug/ml)	Area			Mean Area	SD	% RSD
		0.8	1.0	1.2			
NIM	80	3505478	3561411	3602525	3556471	48711.71	1.369664
	100	4054862	4104552	4115845	4091753	32443.68	0.792904
	120	4644582	4588475	4608985	4614014	28389.56	0.61529
OFLX	32	295412	2975545	2995452	2975136	20523.05	0.689819
	40	3547752	3592552	3601552	3680619	28816.89	0.804802
	48	4145255	4164585	4202552	4170797	29149.29	0.69889

Table 8 (a) : Data for Flow Rate Change

Source: Data Analysis

Drug	Conc (Ug/ml)	Area			Mean Area	SD	% RSD
		298	300	302			
NIM	80	3557448	3497898	3492525	3515957	36032.55	1.024829
	100	4112545	4785552	4205845	4167981	49069.20	1.17729
	120	4508774	4585475	4608985	4558745	50106.04	1.099119
OFLX	32	2815656	2874852	2915452	2868653	50185.93	1.74946
	40	3415454	3482552	3521552	3473186	53665.52	1.545138
	48	4114545	4184585	4212552	4170561	50486.18	1.210537

Table 8(b) : Data for Wavelength Change

Source: Data Analysis

Drug	Conc (Ug/ml)	Area			Mean Area	SD	% RSD
		77:23	75:25	79:21			
NIM	80	3578955	3612475	3597854	3596428	16805.44	0.467281
	100	4104565	4164758	4187455	4152259	42835.16	1.031611
	120	4554789	4574856	4602547	4577397	23980.21	0.523883
OFLX	32	2847547	2874852	2904455	2875618	28461.73	0.989761
	40	3478952	3514785	3524788	3506175	24100.49	0.687373
	48	4125548	4147854	4185456	4152953	30277.70	0.729065

Table 8(c) : Data for Mobile Phase Ratio Change

Source: Data Analysis

Sample No.	Label Claim (mg)		Amount Found (mg)		% Label Claim (mg)	
	NIM	OFLX	NIM	OFLX	NIM	OFLX
1	500	200	499.3	200.3	99.86	100.15
2	500	200	499.7	200.6	99.94	100.30
3	500	200	500.3	199.9	100.06	99.95
Mean			499.76	199.9	99.95	100.13
S.D.			0.50	0.35	0.100	0.175

Table 9 : Analysis of Drugs in Tablet Dosage Form

Source: Data Analysis

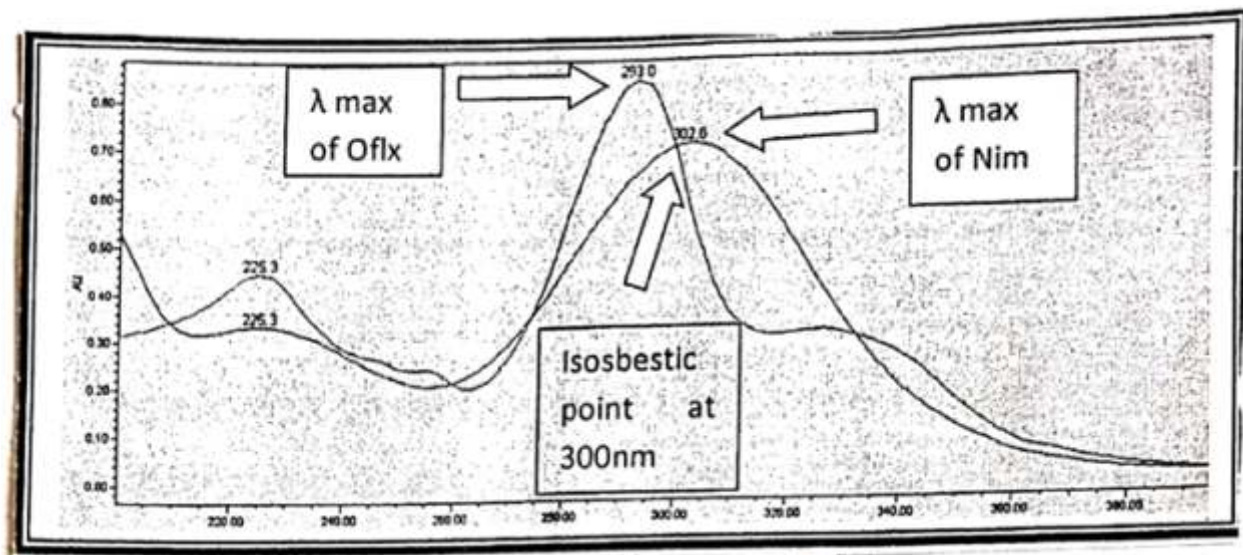


Figure 1: Overlain UV Spectra of NIM and OFLX in Methanol

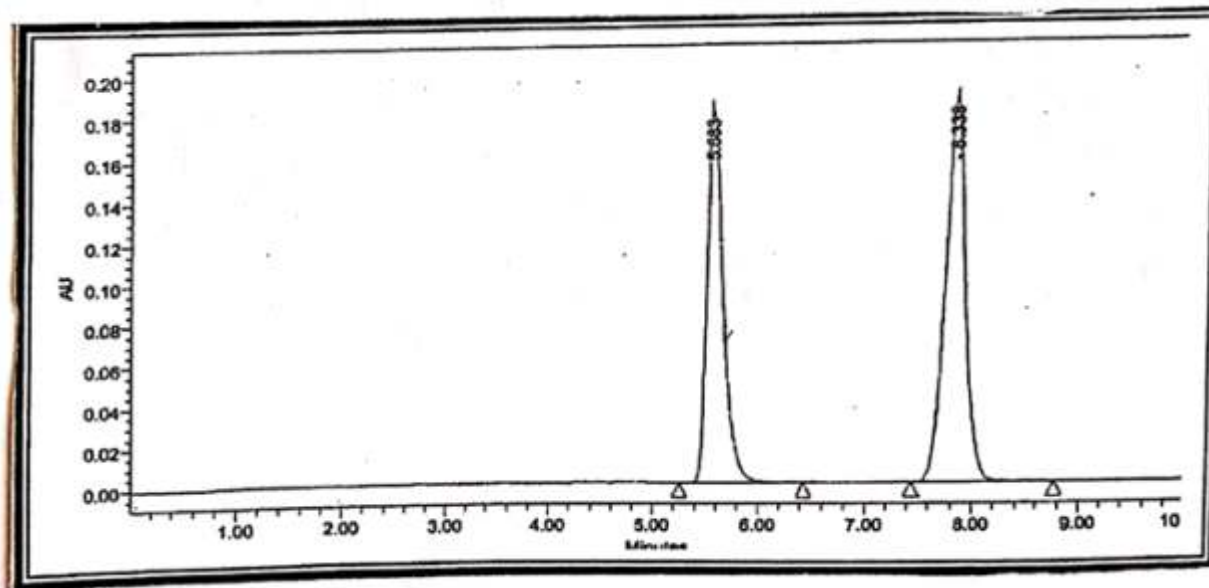


Figure 2: A Representative Chromatogram of NIM and OFLX

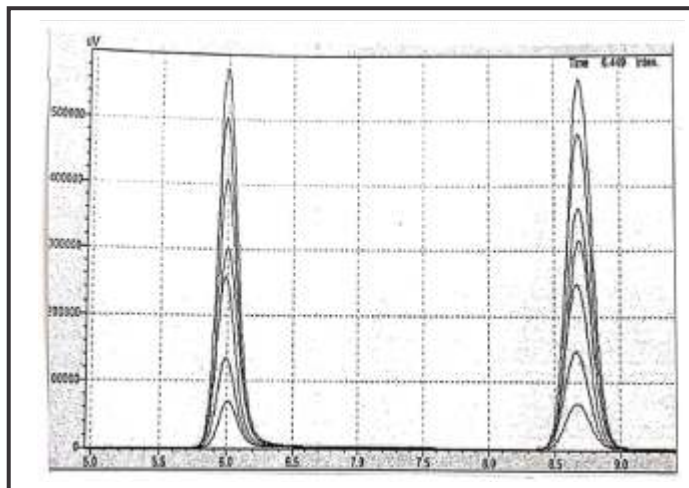


Figure 3: Overlain Chromatogram of NIM and OFLX for Linearity Range Determination

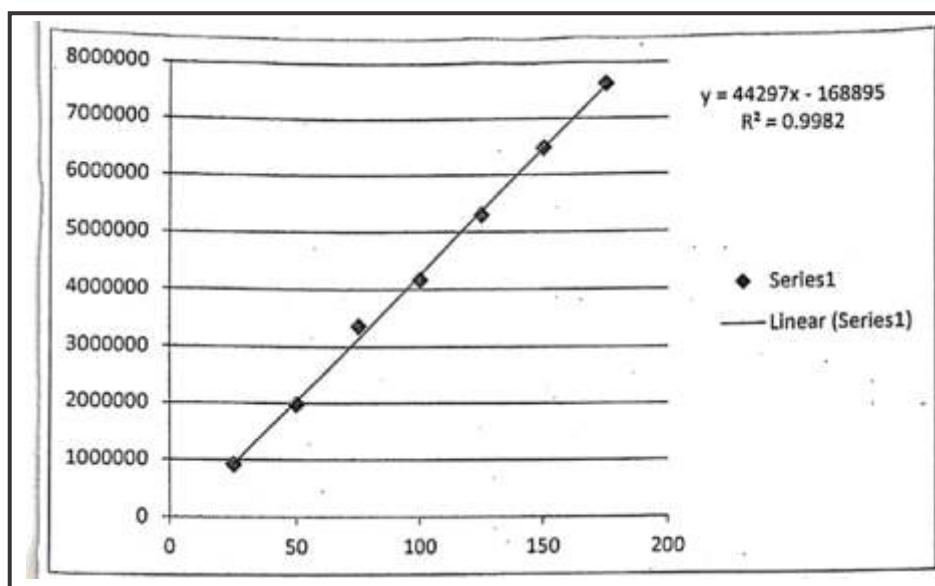


Figure 4: Calibration Curve of NIM

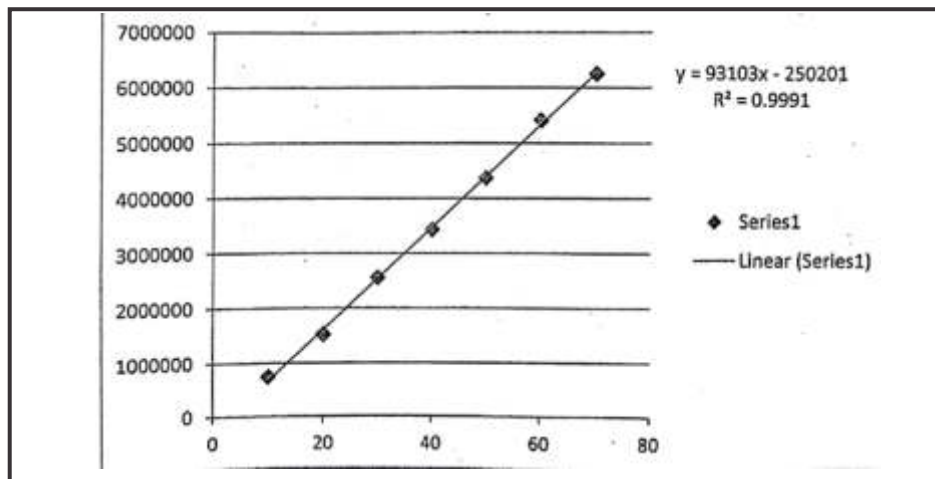


Figure 5: Calibration Curve of OFLX

Review Article on Database Flexibility & Simulation Practices to Lessen ERP Implementation Issues

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Abstract

Higher educational institutions and universities need strategically sound system which can control over quality, performance parameters and could deliver competitive educational environments. Consequently, the higher education sector has applied several electronic practices like e-governance, office automation and management, intelligent agents and much more electronic software to cope up with the changing needs of the education system. So, as an overall solution ERP as a ultimate solution tool of administrative, non administrative, academic and non academic activities of the educational institutions is gaining wider acceptance. To cope up with the changes or to develop the exact compatibility between the institutional processes and the software application domain either all the institutional process must be improved and altered or the application domain may go for the updates. All the changes of both the sides lead customization. Several ERP vendors ensure the risk associated with the ERP implementation practices by following the guidelines and practices of database flexibility and simulation. This article will present brief overview of literature reviewed to understand the context of application of Database flexibility and Simulation as implementation practice of Enterprise Resource Planning System in Higher Education Institutions to reduce the extension, customization and user resistance like crucial implementation issues.

Keywords: ERP, Database Flexibility, Simulation, Customization, Information Technology, Electronic Practices, ERP Vendors

Introduction

ERP is a system or software solution which consists of several integrated functional module that share data of organization in a systematic order to provide connectivity. ERP consists of three different entities: Enterprise, Resource, and Planning which is responsible for managing all the

operational and functional activities of an organization or institution by the application of computer based information architecture with in organization system. ERP is recognized as a computer based application solution of the all the functional units of a system which ask for lot of manual job. Some of the key features which make the ERP one point solution of complex operational and functional activities of the organizations are as follows:

1. **A Common Data Set:** "A single data set used in all of the company's internal business processes¹." ERP offers a single data set for the entire business units of the organizations which increase the operational efficacy of the system.
2. **Standardized Data Definitions:** ERP business processes defined in the ERP application modules sharing the same data definitions. The common data definition helps to integrate the several platforms over the common unit and also helps to reduce memory management problems of the system.
3. **System Adaptability:** "ERP system is adaptable to enterprise changing needs²." It supports the forward and backward compatibility with constraints which allows upgrading the system with the changing needs of the organization.
4. **Outside the Organization's Range:** "ERP systems support the online communication with the environment outside the boundary of the company and should not only be limited to the boundaries of the company. ERP web application integrates the new web applications with the existing system module and enables the system to perform over the new environments of the web³."

Enterprise Resource Planning in Education Section

Using the information technology in education especially in India is not so complex and advanced few years ago as now days. However, the

development and evolution in the in the every domain all around the world presented a global and common platform to society in the form of internet and asked for the integration of technology as a core process of any business which result into a complicated form of managing the information within the organization. In the present scenario, the biggest challenging issue knocking the risk for educational institutions is the explosive growth of educational data and to how use this data to improve overall institutional efficiency and efficacy. "Despite of the challenges in the implementation of ERP system the success stories about the experience of numerous benefits encouraged the higher educational institutions or universities to adopt the ERP systems with the same goal that promoted the corporate adoption⁴" such as operational efficiency and decreasing cost.

ERP systems are considered to be the largest software applications adopted by most of the educational organizations along with some investments in their implementation. Indian education system is still in evolving stage and struggling to establish a global image of its institutions and university to attract the researchers and students. The massive growth is realized by the education system in terms of increasing number of universities and institutions as well as other dimensions of the educational system as well. Universities and Higher Education Institutions have a good number of students and due to liberal policies promoted by GOI for increasing the literacy rate this number is multiplying year by year. Apart of intake, universities and institutions are also doing changes in the associated policies, procedure related to admission, registration, examinations, result declaration, teaching, interaction with the students, integration of virtual classes, libraries etc resulting into a complex system which is becoming tough to manage for the administrative cells. Information technology tools and applications are promising a magic potion in order to effectively manage such a scenario. Enterprise resource planning is recognized as one

of such information technology tool which is getting wider acceptance from the institutions and universities.

As integration and application of information technology offers several advantages the same

was observed for the integration of ERP systems also, because of investments performed in ERP implementation by the institutions is increased to derive the complete associated benefits of it like:

Benefit(s)
1. "Main advantage of ERP is integration of information and modules in the institutions." ⁵
1. "Reduced development risk, increased global competitiveness, improved operational and functional efficiency." ⁶
<ol style="list-style-type: none"> 1. "More sophisticated and improved information accessing for better planning and management of functional department of the institutes or university. 2. Improved quality services to all the constituents of the university like student, staff and faculties. 3. Time regulation and reduced complexities of time delays by monitoring the schedule delays. 4. Reduced overhead cost and improved efficiency results into decrease in expenses."⁷
1. "Improved communication and coordination, task efficiency, data quality, better decision making, increased customer satisfaction, shared data and activities throughout the entire enterprise, easy generation of information, improved information accuracy, generation and accessing of information online." ⁸
1. "Course listings, libraries, human resources, e-mail, campus information, public relations, registration, admissions, and other campus functions were successfully implemented. The University of Nebraska-Lincoln successfully implemented an ERP system for recruiting and admissions for it's more than 22,000 students." ⁹
1. "Benefits include facilitating learning, empowering employees, building a culture with common visions, and improve employee morale and retention." ¹⁰
1. "Improved IT architecture reduced maintenance burden through outsourcing and increased profitability." ¹¹
1. "Use of ERP can help in improving the competition in the education sector. High cost and time is required to develop scalable and flexible ERP systems in higher education institutions." ¹²
<ol style="list-style-type: none"> 1. "Benefits reported are classified as qualitative and quantitative. 2. The measurable or quantitative benefits include big savings in person-hours, savings from phased-out legacy systems, increased productivity, efficiency and revenue, automation of various functions and hence streamlining the education processes. 3. Qualitative benefits include improved process, data and operational security. Also transparency and accountability is enforced."¹³

1. "The effectiveness and efficiency of operations of educational institution would improve significantly through the implementation of ERP. The processes like HR, Payroll, and CRM are improved. Yet no clear cut trend is observed with respect to nature of the experience of ERP implementation in Academic management¹⁴."

Table 1: Benefits Derived by Universities and Institutions by the Application of ERP

Source: Author's Compilation, Review of Literature

Database Flexibility in ERP Implementation

Sheilds¹⁵ in his study suggested that ought to have few of these qualities in an ERP framework; it ought to be incorporated and work continuously, all applications definitions and every one of the modules ought to have a similar look and feel. There ought to be no compelling reason to incorporate work with respect to the IS division as the clients get to any data in the framework.

S. No.	ERP selection criteria
1.	Increased Transparency and Better Information Flow
2.	Well Tried Software System
3.	Good Support
4.	Y2K problem
Adaptability and Flexibility of Software	
5.	Shorter Cycle Time
6.	Press Improvement
7.	Currency Conversion
Increased Organizational Flexibility	
8.	Increased Customer Satisfaction
Internationality of Software	
9.	Other Strategic Consideration
10.	Modular architecture of Software
11.	Higher Reliability
12.	Market Position of Vendor

Implementation of Desired Business processes	
13.	Short Implementation Time
14.	Operating System Independency
15.	Availability of tools for software adoption
16.	Ergonomic Software
17.	Availability of Special solution or Branch of Badness
18.	Improvement of Organizational Structure
19.	Guidelines from a controlling company
20.	Improved Innovation Capabilities
21.	Increased know how
22.	Customer and Supplier Needs
23.	Better application of management style
24.	Improved E-Commerce Support
25.	Improved Internet Services

Table 2: List of ERP Selection Criteria

Source: Bernroider and Koch¹⁶

After reviewing the failure of implementation of ERP and Selection criteria some of the major reasons extracted which were the major reasons of the ERP application failure. The reasons are as follows:

1. Process used by the institutions or the organizations were not included in the package of ERP software.
2. Processes that are included in the ERP package and used by the firm or institution but extra data entrance are required.

3. Processes that are included in the ERP package and used by the firm or institution but firm or institutions insist on using its exact process.
4. Complexities of the modules which were not required by the institutions or the firms.
5. Difference between the observed and expected feature and benefits of ERP.
6. Migration of information environment from the legacy environment to the modern application based environment.

To solve out the stated problems it was under consideration that some of the solutions which can better handle the potential complexities as well must be in application like:

1. **Extensions of the software program-** Adding new program units.
2. **Database Flexibility-** Flexible design of ERP which can better handle the new data entrants and can better adjust with the existing database as well.
3. **Application Domain-** Proper understanding and acceptance of the know-how on the application domain and implement the entire ERP package business processes.
4. **Simulation-** Delivering the prototype to identify the exact need of the user of the software and also studying the behavioural aspects of the user over the software environment.
5. **User friendly-** Developing the user friendly software and user ends by adopting more advanced graphical user interface practices and modules.
6. **Migration Architecture** - It is hard to manage and it creates problems in upgrade-migration phases so a successful and tested migration or upgrade architecture must be adopted with the legacy system.

As the size of the firm and higher educational institution is not fixed so that their requirements for the software solution would be different and according to the size and capacity, so that it is required to develop flexible ERP means the package should be flexible enough to adopt the requirements which are specific to the country, capacity and sector. In this section the emphasis is on, if the ERP vendors' have flexible database design and an interface support that design then it would be easy for the ERP developing team to offer and to develop more customized interface which can satisfy the requirements of the institutions without changing or editing the source code of the ERP application which appears during implementation and post implementation.

In order to develop flexible design of database for the ERP software, researchers worked with several levels of ERP development and implementation. According to Navathe, Elmasri (2000) database design include following sequence for the generic database application software:

1. **Requirements Collection and Analysis-** It covers understanding the applicant's data and functional requirements.
2. **Conceptual Design-** This step covers examination of the data accumulated from the previous step and examining the functional requirements with the production of specifications for the defined transaction.
3. **Logical Design-** Transforming the conceptual data schema into logical data schema.
4. **Physical Design-** Consists of selecting specific storage and access structures for the DBMS to be used.

According to Ferreira and Busichia (1999) while working for flexible database design two sub steps must be studied and examined, which are: Collection and Analysis of Modularization Requirements and Modularization Design. These

sub-steps have changed the generic design process in order to ensure modularization requirements have been met. At Functional Requirements sub-step, the proposed design evaluates modularization requirements. Then, these requirements are considered in modularization design phase. Modularization design phase takes "Global Conceptual Design" as input. Then modularization requirements and "Global Conceptual Design" are evaluated together to setup conceptual design with modularization.

Simulation in ERP Implementation

Simulation is best tool for representing the attributes of a system like the capabilities, behaviours, capacities, interaction etc. Simulation does not ask for the real application it asks for the model representation of the problem situation by an abstract view or model. Simulation methodology has following fundamental concepts (Table3).

Concept	Description
Model	Model is representation of the actual system which helps to identify the boundaries of the system in model form.
Events	An occurrence which result into transformation of the state of the system. It is of endogenous and exogenous type.
System State variables	It defines the function of the system at particular point of time and its behaviour.
Entities and Attribute	A set of properties which can individually present in the system representation is called entity and the attributes are its characteristics.
Resource	A kind of entity which deliver services to dynamic entities.
List Processing	Entities are organized in a list according to the allocated resources that provide services to them.
Activity Duration	Time difference between starting a job and finishing the job.
Delays	A delay is an indefinite duration that is caused by some combination of system conditions.
Analysis	It allows examining of behaviour and capabilities of the actual system.

Table 3: Fundamental Concept of Simulation

Source: Literature

Simulation modelling can also assists in improving the practice by exploring different outcomes, and evaluating and comparing them, thereby leading to improved practice.

Merits and Demerits of Simulation
"Simulation is cost effective, less risky, less turnaround time to reach the reality model and more practical in comparison to real system." ¹⁷
"Effective and efficient way of teaching complex and dynamic systems, time efficient in learning process and improved results (effectiveness)." ¹⁸
"Simulation process relative inaccuracy in comparison to real systems is its limitation which is result of inefficacy to recreate all aspects of the real system. In addition it can also affected by lack of data availability." ¹⁷
"Simulations create "willing suspension of disbelief" where people forget that they're playing game and instead do their best to actually win." ¹⁹
"Useful in developing and analyzing different implementation strategies, predict efforts and resources needed for ERP implementation." ²⁰
"With the help of simulation employees experience that their knowledge about the ERP is significantly improved. Author also affiliated simulation as a very effective tool in training employees on ERP concepts." ²¹

Table 4: Merits and Demerits of Simulation

Source: Literature

Conclusions

ERP frameworks are not just frameworks that gather information and deliver exchanges to help operations; ERP frameworks can give central business knowledge that backings vital basic leadership. Implementation of ERP frameworks is not a straightforward procedure which can be applied over all type of organizations without any crucial alteration. ERP framework is a well arranged suit, however this suit may not fit each association. In this way, ERP programming must be sufficiently adaptable to meet the association's prerequisites. Simulation and Database flexibility are the two considerable approaches to deal with the very significant implementation issues such as user reluctance and extensibility.

Adaptability of database flexibility for the extra data item requirements issue depends on both program and the database. ERP programming, as a matter of first importance, ought to have a flexible database

design of framework, at that point, an interface that actualizes that outline. In this manner, database configuration is vital for adaptability of ERP programming. Computer Simulation demonstrates as a learning instrument is one of the principle subjects in data science education. Simulation shows recreation, utilization of computer system - the device of present regular day to day existence. Reproduction models can and, as we would like to think, ought to be utilized as a supplement to the procedure of training and educate the learners. In this way, the simulation models can be utilized all through the data science educational modules, from the earliest starting point of the investigation to its very end until accomplishment. Besides, the use of models can be taken as an essential factor for separating the quality educational module from the educational module that doesn't consolidate simulation models.

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Chatbots : Reshaping E-Retail Industry and Reinventing Customers' Shopping Experience

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Abstract

The world is now experiencing the emergence of the new e-commerce technologies that are going to revolutionize the way customers and businesses are treated. The e-business has completely changed the way of selling products. E-commerce is one of the e-business models, which mostly do business over the internet. The major drawback of this field is the quality of customer service they provide. In the e-commerce sites, there are deals with many kinds of products throughout the world. An artificial chatting system integrated with e-commerce site contains different services to make user feasible in e-shopping time. When the user wants to buy anything from these sites, he needs guideline about the product and other things in this system just like do shopping in a physical store. In every e-business model, customers miss a sales representative of traditional shopping and have to wait for a long time to get a response from the customer service representative. As some customers increase, the need for customer service also increases. As a solution to this problem, e-commerce Chatbots are the brightest spot that has drawn a lot of attention. They are a powerful tool for personalizing and even reinventing customer service, which is definitely a pillar of any e-commerce business. This conversational commerce approach is growing very fast. Chatbot market is anticipated to witness a substantial Growth in the near future. The present Research Article is all about taking e-commerce industry to the next level. The study focuses on understanding the current state of Chatbots and their outlook, its possibilities and limitations of uses and the objective are to understand and forecast industry trends and business sentiments.

Keywords: E-commerce, Chatbots, Artificial Chatting System, Conversational Commerce

Introduction

The Chatbot is a term popularized by Mark Zuckerberg when he launched the Facebook messenger platform. It is software that is designed mainly to mimic conversations with humans. It uses NLP (Natural Language Processing) to attempt to understand what asked to it and then it replies accordingly. It is an intelligent robot that follows a set of rules and in some cases, utilizes artificial intelligence. It is very similar to walking into a physical store and talking to an employee there.

The Chatbot is a conversational interface, infused with the artificial intelligence, cognitive abilities and the power of natural language processing. It is a contemporary and fast-growing technology through which people can access the information. Because of cloud technology and Artificial Intelligence, the top examples of the Chatbots are no longer a simple greeting tool which only sends "hello" or "how are you," but in fact is stimulating an excellent customer service for businesses across all industries. In this business world where customer service is a crucial area, modern Chatbots can surely give the fastest solution to the different queries of different customers. It has been seen that 65% of consumers are willing to interact with a company via Chatbot, indicating a substantial opportunity for various brands¹.

According to a report, Chatbot market is growing at a CAGR of 37.11% and is expected to reach USD 6 billion by the end of 2023. As the digital interactions are scaling high, it is essential for digital marketers to stay on a level with the latest trends in the market. The developers of modern Chatbots are making it more human-like, making the interaction more comfortable².

These Chatbots turned out to perfectly fit in e-commerce as customer support option. Though there are many good alternatives to phone calls, contact forms, and online chat, email, remains the fastest and, in many cases, the most convenient means for various visitors to get answers. Live web chat is another akin to Chatbot support option, but it is linked to the browser and requires a user to remain online during the conversation. Different

from other live web chats, Chatbots are typically based on messaging apps, and their unique advantage is that they are personal and mobile.

E-commerce is booming, continually transforming the industry. Mobile shopping is steadily but surely gaining pace regarding global online sales. In alignment, the leaders of digital retail are continuously evolving their service offerings with the freshest groundbreaking technology, i.e., Chatbots³.

E-commerce has been robustly implementing Chatbots for its business purpose. Reportedly, by mid-2018, AI-powered Chatbots⁴ are expected to rise exponentially in the retail sector and e-commerce. Today modern consumers also spend almost 90 % of their time on messaging apps via mobile rather than social media. As Chatbots do not require the installation of a native app, it makes more comfortable for the e-commerce owners and retailers to tap and nurture the potential as well as existing clients. E-Commerce websites through Chatbots can easily increase brand loyalty by engaging with customers on a personal note. It also helps the retailers to send promotional deals and regular updates. The ultimate motive of the e-commerce sites implementing Chatbots is to take care of customer support. Chatbots can also cross-sell and upsell by recommending different products based on a customer's previous purchases. This is known as "conversational commerce."

Automated personal assistant or Chatbots will bridge the gap between personalizations that customers face in online shopping. Consumers nowadays are knee-deep into chat culture and are already turning to the Chat platforms for their day-to-day needs. Chatbots are going dramatically to advance the shopping experience of most of the consumers. Reports show that today consumers expect personalization from the various sellers. They want such websites that treat them like an old friend. E-commerce Chatbots will provide a conversational assistant, who can acknowledge the shopper's intent and personalize the recommendations that are presented to the shopper⁵.

In the e-commerce world, Chatbots can be very

helpful on multiple levels and provide a complete shopping service⁶. They can be used for accurate and quick product search. They can simultaneously handle more product orders from various customers, therefore speed up the ordering and shipping process. Also, customers can even pay your purchased products directly via Chatbots so that the customers can have a complete and integrated shopping experience.

According to a Report of Ubisend

- 1 in 5 consumers would consider purchasing goods and services from a Chatbot.
- 40% of consumers want deals and offers from Chatbots.
- Consumers are willing to spend more than \$410 through a Chatbot.

The Chatbots act as the in-store sales assistant⁷ and offers several advantages encapsulating always availability, instant and prompt responses, and highly knowledgeable. They do more than just offer a new channel for people to find deals and make e-commerce purchases. They also help consumers to identify what products they want and need. Rising inclination of e-commerce enterprises towards increasing customer experience and reducing operational costs will garner the growth of global Chatbots market over the next five years.

Chatbot Platforms

- Facebook Messenger
- Amazon Alexa
- Kik
- Telegram
- WeChat
- SMS
- Apple iMessage
- Slack

Chatbots can have many different skills and perform many different tasks for organizations. Imagination and inventiveness will give rise to more and more functionality.

Benefits of Chatbots

- **Smart Communication** : Chatbots can assist in the retention of customers. Clever use of push messages, text message and emails can be structured into Chatbots. Either by offering a reminder or by pushing a special offer that encourages the customers to return.
- **Improve the User Experience (UX)** : Customers want to interact with a service provider in a seamless, natural way otherwise they look elsewhere. Small business often suffers from workforce shortages, which can leave customers frustrated. Chatbots offer urgency, immediacy, and speed. Personalize the shopping experience at a potentially higher capacity than standard response, due to the speed and accuracy of customer data gathering/analysis.
- **Chatbots Never Sleep** : Chatbots enable 24/7 customer service and guidance, without the extra resource costs. They are also capable of fielding thousands of requests at the same time, so can potentially be handling thousands of sales. They Streamline response times.
- **Prevent Cart Abandonment** : It is so frustrating to see the potential customers leaving before they complete a sale. There are so many reasons why cart abandonment happens, but one of the biggest is life. The phone rings, or the baby cries, they suddenly realize school is ending. Life just gets in the way sometimes. Having a chatbot handling the sales means there is a virtual brain on-board to monitor or find out what is happening. If a cart is left, then the bot can prompt the user with a few helpful reminders or offers of assistance.
- **Hyper-Personalization** : Chatbots technology exists to not only maximize efficiency but to build customer loyalty and affinity through what the customer deems to be real understanding on the brand's behalf. When customers feel appreciated and understood, they will be more inclined to remain devoted.
- They eradicate human error.
- **Surging Sales and Reduced Costs** : Uses of

Chatbots have been proven to increase revenue as well as profit due to efficient customer assistance that requires less human support. It gives an expansion room to business without the immediate need for more staff.

- Greater convenience, deeper personalization, improved customer satisfaction. it's a way to success in any e-commerce brand's digital strategy.
- Chatbots don't require a download. They run inside messaging applications like Skype or Facebook Messenger or on websites
- **Enhanced Brand Image** : In today's world, trust is often portrayed not only through excellent service; but also alongside the perception of being up-to-date and innovative.
- Chatbots can provide information such as store opening hours but can also carry out more complex tasks like helping users' complete online forms and payments.
- Once the customer has purchased, Chatbots can, after a certain period, check if they liked the product, offer services and additional products, and help them write, and post product reviews.
- Developing a Chatbot is very hassle-free and less expensive in comparison to developing an app for a business.
- **Product Recommendations** : famous fashion brand H&M launched a Chatbot on its messenger app Kik, which allowed customers to share, see and purchase products in their catalog that is very effective.
- Chatbots help with product comparisons and can gently make additional product recommendations once the customer has selected an item in the cart. Chatbots can capture shipping address, billing, preferences, and manage the entire payment process.

Technological Aspects of Chatbots

Chatbots, or conversational interfaces as they are known, present a better and efficient way for individuals to interact with computer systems.

Traditionally, to get a question answered by a software program involved using a search engine, or filling out a form. A Chatbot allows a user to directly ask questions in the same manner that they would address a human. The most well-known Chatbots currently are voice Chatbots: Alexa and Siri. However, Chatbots are presently being adopted at a high rate on computer chat platforms.

The technology at the core of the rise of the Chatbot is natural language processing ("NLP"). Recent advances in machine learning have significantly improved the accuracy and effectiveness of NLP, making Chatbots a viable option for many organizations. Mostly commercial Chatbots are dependent on platforms created by the technology giants for their NLP. These include Microsoft Cognitive Services, Amazon Lex, Facebook DeepText, Google Cloud Natural Language API, and IBM Watson⁸.

To bring a chatbot online for e-commerce, one needs to ensure that they have shopping cart integration. This gives the Chatbots access to the information it will need to retrieve to handle the customer with no glitches such as stock levels, shipping terms, product details etc. All the things a customer will want to know. Many companies are encouraged to use and create Chatbots. Microsoft generated Bot Framework to support programmers to develop bots for their apps. Facebook strengthen developers with instruments to make more structured messages, such as call-to-actions, images, descriptions, and URLs. It also helps to speed up the relationship between Chatbots and e-commerce and expands Facebook's audience⁹. Google created a messaging app "Allo", which also includes the Google assistant.

People generally prefer to receive information about the brands while they are shopping, and Chatbot seems as service description or product and FAQ. A Chatbot is a highly interactive and engaging way to cut down the whole shopping time¹⁰. It allows enhancing ROI, keeps costs low. Brands may build the robots with actual answer decision trees that level off with developing ways to services and products. It is essential to understand that Chatbots allow capturing data in advance to create a more personalized experience for clients.

Shopping Cart Integration for Chatbots

Brands build their stores on shopping carts, and that is where all the information from the online shops is stored. Once a Chatbot system is integrated with one of the shopping carts, it can work with all of the stores based on that platform. The more shopping carts the Chatbot application supports, the more potential clients it has. Also, such systems need shopping cart integration to retrieve product quantities, details, shipping terms and other information.

Integration with shopping carts is necessary for chatbot systems to get its proper market share in the e-commerce industry, which is very powerful these days. However, along with the profits, the integrations process brings many challenges to overcome. Shopping cart integration is among the most significant pain points for enterprises, due to the high technological complexity. Setting up a real-time data exchange and synchronization between two different systems involves hard tech work, and so does their maintenance. That is why many companies choose to entrust shopping cart integration to professionals. Thus, they save money, time, and efforts and get more qualitative and secure connection with shopping carts.

Applications of Chatbots

A Chatbot can be used anywhere a human is interacting with a computer system. These are the areas where the fastest adoption is occurring:

- **Customer Service** : A Chatbot can be used as an “assistant” to a live agent, increasing the agent's efficiency. When trained, they can also provide service when the call center is closed, or eventually even act as an independent agent, if desired¹¹.
- **Sales / Marketing / Branding** : Chatbots can be used for sales qualification, e-commerce, promotional campaigns, or as a branding vehicle¹².
- **Human Resources** : An HR Chatbot can help with frequently asked questions (“how many vacation days do I have left?”) and can act as an on boarding assistant.

Some of the Major Chatbots from India

1. **Gupshup** : One of the most advanced bots and messaging platforms, it enables developers to quickly and easily build, test, deploy and manage Chatbots across all messaging channels.
2. **Aisha by Micromax** : A 'desi' version of Siri, Aisha can perform tasks like initiate Google search, make calls, and give movie reviews, read news among other tasks. It is one of the most popular bots in India.
3. **Alexa** : E Commerce companies like Amazon have also launched their E Commerce Chatbot “Alexa” to assist their customers in the best way they can.
4. **MagicX** : MagicX helps in day-to-day tasks like bill payments, food order, travel bookings, among other daily chores. It learns from human interaction, giving a sense of more humanlike responses, but highly scalable at the same time.
5. **Engati** : It allows build, manages, integrates, trains, analyzes and publishes personalized bot in a matter of minutes.
6. **Niki.ai** : Niki.ai started by responding to requests for services such as cab, food delivery, and phone credit top-ups. This fully automated Chatbot now works up on the concept of artificial intelligence with no human intervention.
7. **Syphora** : Sephora is a Virtual Artist on Facebook, which allows people to try on different lip colors using selfie photos. Sephora's Chatbots are helping consumers find deals and make purchases, but also make fashion choices and find products that meet their unique style and tastes. That's something a simple e-commerce website doesn't offer.
8. **Shopbot** : eBay first started using Chatbot technology by piloting a simple Facebook Messenger tool that reminds bidders 15 minutes before an auction listing is about to

end. Now they've expanded to offering ShopBot, a virtual personal shopping assistant that helps people find items they want (at the price they want) on eBay. It's another great example of how AI can improve the shopping experience beyond what a regular e-commerce site has to offer. In the end, it improves engagement, retention, and can drive sales.

9. **SnapTravel** : SnapTravel is a Facebook Messenger bot that helps people find deals on hotels. Using AI to search Expedia, Priceline, and more than 100 other sites, SnapTravel goes above and beyond by helping automate the process of finding the right hotels for your travel needs.
10. **1-800-Flowers** : 1-800-Flowers were one of the first bots on Facebook Messenger. It serves as a great example of how older brands can benefit from adopting new technologies early on. Their bot allows users to send flowers and gifts. It prompts to select items based on the kind of event (birthday, romance, anniversary, etc) and offers suggestions for different gifts.
11. **Aerie** : Clothing and lingerie retailer Aerie by America Eagle Outfitters is another early developer of Chatbots for the Kik messaging app. Their bot allows users to browse products based on personal preferences. After a few rounds of the game, the bot is able to make personalized recommendations based on your style preferences.
12. **Spring Bot** : Spring Bot is one of the first to launch on Facebook Messenger. It's a live messaging and personal shopping service that fashion brands can use to connect with customers. Brands like Balenciaga, Givenchy, and Lanvin use the tool to sell to customers. Consumers can make purchases right from the bot and it will give you receipts, shipping information, and answer any other purchase-related questions.
13. **H&M** : Clothing brand H&M developed an interactive bot for the Kik messaging app that recommends products based on your own preferences. The H&M bot uses photo options and asks questions about style to create a comprehensive profile of what consumer like.
14. **Engazify** : Engazify Bot is a faster and better way to appreciate your teammates, capture all your team wins, and save it for everyone to see.
15. **Fit Circle** : FitCircle is a health and fitness Chatbot which offers users personalized weight loss workouts, personalized yoga guidance, and similar features. It also offers nutrition guidance.
16. **GoHeroAI** : It assists you in booking flight, hotel, taxis etc. It integrates with messaging apps to use sophisticated algorithms and understand traveler's preference.
17. **HDFC Eva** : Eva is India's first AI-based banking chatbot and can answer millions of customer queries across multiple channels instantly, HDFC Bank said in a statement.
18. **Ruhh** : A Chatbots developed by Microsoft India team, especially for Indian market. You can talk in English as well as in Hindi.
19. **Lawbot** : This Chennai-based chatbot or rather Lawbot analyses and reviews legal documents, like license agreements, which can help you save time, money and simplify the process.
20. **Haptik** : Haptik can perform a wide array of activities ranging from finding the best shopping deals, checking train status, book movie tickets, get food delivered, and book flight/train tickets among others.
21. **IxiBaba** : A chatbot that can answer all your travel queries, brought to you by Ixigo is the perfect example of how companies are improving on interacting with customers and enhancing customer experience.
22. **Yana** : YANA helps users to book cabs, order groceries, etc. The chatbot's intelligence has been developed by its more than 50,000 messages that it has received over time.
23. **Yatra** : Yatra has launched what it claims is the first Facebook Messenger chatbot in the Indian

online travel sector. The intelligent chatbot helps customers search and book flights directly from their Facebook Messenger.

24. **Prepathon** : Prepathon messages students the topic of the day, it answers questions and also sends across motivational messages. Aimed at helping students perform better at their exams, this Chatbot is making their life easier.
25. **RechargeBot** : Payjo is India's first messenger bot that lets you recharge your phone, sets the reminder for recharge and shows suitable plans for your number.

Limitations and Possibilities

The retail sector companies strive to combine physical experience and digital in one amalgam. They recognize the opportunity to reduce costs and boost efficiency in one stroke. Still, bear in mind that Chatbots are not a one-size-fits-all solution. They have to be used in the right context to understand client needs and ensure a proper response.

Eventually, one of the main limitations of Chatbots is the lack of ability to properly empathize. Also, some people are merely weary of interacting with bots. That is why an e-commerce business should always have a human representative ready to jump in. This brings us to the point that Chatbots still far from replacing humans, or even apps and websites. Besides, they need to be maintained and "educated" by humans through machine learning. That does not change the fact that they are the incredible asset to a multichannel chat strategy and a powerful automation tool

Implementing AI software is a good solution for companies that have to struggle with a lot of queries and need to hire a lot of agents. Chatbots can handle repetitive questions from the clients. Sometimes, clients are unsatisfied with an agent that can answer only fundamental issues in most cases and want to continue the conversation with only human staff.

Retailers tend to overrate these new technological possibilities. They often use self-service opportunities because they believe clients hate

connecting with employees. But the cause of it is that live service is struggling, through high turnover and lack of training. Clients prefer high quality live customer service.

The technology has several pitfalls. such as, brands don't have entire control over the client's experience, so developing excellent services will be very tough. Clients want to get quick responses and the opportunity to buy necessary things quick and easy. The conversational interface with Bot-guided commerce may bring a better shopping experience. Chatbots can handle the flow of information from millions of requests at the same time and build meaningful responses. They provide product recommendations and use their expertise to improve the conversations. Chatbots may improve the entire retail service as well by capturing feedback and product reviews from the users.

Future Scope and Recommendations

In a recent survey by Oracle, 80% of business owners stated they want to implement Chatbots by 2020. Understanding the context brings deeper insight into the possibilities to improve customer experience. Additional information such as location and time allows ensuring a contextual response. Also, use images to build more crucial conversations and clarify the client's need when having trouble understanding.

Experts ensure that it is very cheap to develop a Chatbot, but it's very challenging to create a very efficient bot. Build it around the client experience, and genuinely implement into e-commerce backend frames. One needs to make it flexible and include all innovative chatbot technologies. Global revenue from artificial intelligence is expected from \$643.7 million in 2016 to \$36.8 billion by 2025. And by the looks of things, e-commerce brands will take a fair share of the pie¹³.

Chatbots, artificial intelligence is not just for cutting-edge tech companies like Google and IBM Watson. Chatbots can come with a mix of machine learning, natural language processing, and live operators to perform all types of tasks that help businesses better serve their customers. They are growing in popularity on Skype, Facebook

Messenger, Kik, Slack, and by Chatbots. It will make possible to solve issues and refine customers' engagement through AI, connecting to a human assistant rarely.

In the close future, Chatbots will understand the emotional state of clients to serve them better. Nowadays, they cannot identify your mood and openness for jokes or further conversation. Soon, these conversational apps will be gaining by itself new points and provide more relevant and sympathetic response. Developers work on the real application as well.

Implementation of Chatbots helps to be proactive regulating status changes on any deal. Conversational commerce allows companies to tackle the steady growth that has appeared in mobile commerce up to 30% in 2015¹⁴. With such a significant increase, organizations need to sell to clients through any app, especially through messaging that is used very often.

Chatbots allow attracting clients one-on-one where they already spend their time and develop new buying opportunities. The retail sector has made a huge contribution in combining physical and digital channels together to refine customer experience. Many retailers apply messaging, digital helpers, automated dialogue to bring direct accommodation with the personal approach and decision maintenance that a client wants to get.

Chatbots are here to rock the world of e-commerce. They are changing the face of the industry, delivering information efficiently than humans ever could. Hence, numerous companies are in a position to explore buying opportunities and tap into new markets. Chatbots, however, do not yield results by merely existing: They must actively contribute to the effort of taking customer experience and service to the next level.

Experts predict that in the future a mix of storytelling, service and product exploration will be guided by Chatbots. It will make possible to solve issues and refine customers' engagement through AI, connecting to a human assistant rarely. In the close future, Chatbots will understand the emotional state of clients to serve them better.

In this age where everyone seems to be snapping photos, it only makes sense for future bots to be able to "speak" through images. Visual search represents the future of e-Commerce and Chatbots alike. Through Fashwell's visual search technology, customers and brands alike benefit from a more personalized shopping experience.

Deployed artificial intelligence platforms in today's business world augment processes at a more rapid pace than they replace them. While we have yet to determine the exact impact of Artificial Intelligence, a recent report from the World Economic Forum estimates automation will return at least five million jobs by 2022. Now AI is driving fundamental changes in how people conduct their jobs and how companies think about staffing for the future.

The forthcoming years will witness newer innovations and technologies continuing to revolutionize the consumer shopping experience and churn more online sales. Powered by technological innovations, E-Retail is already on the brink of a significant transformation. That is why Apple and Amazon both announced that they are currently focusing on machine learning technology this year.

According to Satya Nadella, the Microsoft CEO, "bots are the new apps". According to recent research, by 2018, if companies don't implement Chatbots in their business, then their sales will suffer¹⁵.

According to Aji Issac Mathew, Co-Founder, and CEO of Indus Net Techshu¹⁶, Chatbots will gain more momentum shortly. The information available on the internet is too much for our brain to consume. Bots will consolidate the data, process it and pass it onto retailers in a simplified format and this result in better quality control and faster decision-making.

According to Gartner by 2017, only one-third of the overall customer service interactions will need the efforts of a human being. Though it is difficult to predict whether Chatbots will replace mobile applications, one thing is for sure: the future of the Chatbot looks promising. And for the time being, Chatbots seem to be the latest face of technology.

Conclusion

Artificial Intelligence is currently the buzzword, empowering marketers and brands and with valuable customer intelligence. These insights not only improve but also help anticipate futuristic consumer needs and make decisions for them.

E-Retailers can leverage this Virtual Reality to provide a better and transformational, virtual shopping experience, with a touch and feel concept while doing away with the brick and mortar concept. Brands can create bolster customer experience, personalized customer experiences and eliminate the pain points effectively.

Chatbots, next-gen platforms can serve e-retailers with cost-effective benefits and aid in tasks automation. With the help of Chatbot, companies can make more comfortable and more personal conversation flow, build a better brand presence, help customers better understand things they have interest for, drive sales, and grow their business, and optimize the customer service. Using e-commerce Chatbots now results in double-sided benefit – for customers and e-retailers- which are surely the primary reason to try this new technology in e-commerce.

In today's world, messaging apps have become the most natural and most effective form of communication. Now Chatbots, powered by Artificial Intelligence (AI), has become the critical method customers interact with business. From booking dinner reservations, ordering flowers to renew insurance policies, Chatbots have probably made our life manageable, more relaxed and productive.

According to Business Insider, messaging apps now have more users than social media networks and the trend continues to grow. We may not be too far from such time when the customers no longer shop at superstores, but within personal, real conversations privately. Shopping Chatbots will improve in the coming years. Chatbot design and architecture will evolve to the point that shopping bots will become standard for retail.

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Designer Milk : A Promising Future of Dairy Industry

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Abstract

Milk is identified as one of the best food supplement from several years around the globe. Naturally the milk is rich source of Fat, Proteins, Carbohydrate, Vitamins, and Minerals and full of calcium. Even in Charak Sanhita several benefits of milk were drawn, and a complete therapy name "Dudh Kalp" was claimed for good health. With the evolution of technology in Dairy Science several enrichments were performed with milk to boost its quality and benefits. The result of milk engineering and advances is Designer Milk, which is low and fat and rich in protein. This article will present the description of the alteration performed under Dairy Sciences to transform ordinary milk into Designer Milk.

Keywords: Designer Milk, Fat, Proteins, Carbohydrate

Introduction

Milk is considered a natural complete food containing Fat, Proteins, Carbohydrate, essential Vitamins and Minerals and is also of available Calcium. It has good nutritional value and major diet component worldwide. Now a day's consumer awareness increased significantly, so milk constituents fixed according to customer's desire and health aspects. For example, some customers show lactose intolerance and allergic symptoms against milk proteins which is considered allergens. Hence, milk in future has to be designed by altering its fat, protein and lactose constituents. In general, Designer milk can be defined as the milk which has been modified from standard milk in its composition keeping human health benefits in view. In designer milk primary concern are fat, protein and lactose. It has certain specific functions and health benefits like prevention of

lactose intolerance. The designer milk will generally have low fat, rich in protein which is devoid of β -lactoglobulin and lactose free for human health point of view¹. So designer food is that food or food products specifically formulated/modified to have higher amount of nutrients than naturally occurring in that food and gives beneficial effect on human. By linking the nutritional and genetic interventions approaches, scientists are developing "Designer Milk" tailored to customer preferences.

Alteration in Fat/Lipid

Milk fat is composed of more saturated and less unsaturated fatty acids. Peoples wants less dietary fat intake due to health awareness, which results increase in demand of low fat milk and milk products. Designing milk means decreasing saturated fatty acids and increasing linoleic acid (unsaturated fatty acids) in milk fat. Linoleic Acid is converted to conjugated linoleic acid (CLA) with biohydrogenation process by rumen microbes and even by probiotics. The various approaches to manipulate CLA are:

- CLA is naturally occurring anti-carcinogenic milk fat component. The concentration of CLA in bovine milk is significantly changed by modification in diet and can be manipulated upto 10 folds of natural content.
- Feeding of unsaturated fats in an encapsulated or protected form (by pass fat) results in a prompt rise in the degree of unsaturation of serum lipids, tissue fat and milk fat and enables dairy animals to produce CLA. By pass fat be produced by oils seeds treated with formaldehyde, hydrogenated fats and preparations of calcium salts of fatty acids oil.
- Addition of fish oil, soyabean oil, increased feeding of fresh green grass and dietary inclusion of CLA in feed will increase its presence in milk.
- Feeding of fresh grass to cows also increases the

CLA content in milk.

- Inclusion of probiotics like *Butyrovibrio fibrosolvens* in feed shown increased linoleic acid component in milk.

Alteration/Modification in Protein

Generally milk protein contains Casein (80%) and whey protein (20% comprising of α -lactalbumin, Ig and BSA). Milk casein consisting of casein is subdivided into αS_1 , αS_2 , β and κ -casein. A higher amount of αS_2 shows increased nutritional value and κ -casein improves heat stability of milk. The main allergy component for infants in milk is β -Ig which is absent in human milk. Its production in bovine milk can be controlled by genetic manipulations using a knock out transgene. The use of ribosome anti β -lactoglobulin mRNA to prevent synthesis of β -lactoglobulin in bovine species is found to be helpful. By using this technology various variants of Beta- casein like A1 and A₂ can also be manipulated. The A₁ milk is expected to be risk concern for health like type-1 diabetes, coronary heart diseases, schizophrenia as well as sudden infant death syndrome.²

Modification in Carbohydrate (Lactose)

The milk sugar is lactose which is hydrolyzed in glucose and galactose and then used by various metabolic pathways. Many peoples especially children have the inability or insufficient ability to digest lactose (sugar found in milk and milk products) which is known as lactose intolerance. It is caused by a deficiency of the enzyme LACTASE, which is produced by cells lining in the small intestine. These deficiencies cause many symptoms like abdominal pain, gas accumulation, diarrhoea affecting calcium absorption and nausea, resulting in lactose intolerance. It can be prevented by avoid dietary lactose and using fermented milk products supplemented with lactase enzyme.

Humanisation of Milk

Humanisation of milk means to produce/develop milk which resembles human breast milk composition. It involves alteration in fat and protein fraction and inclusion of oligosaccharides.

Proteins

- Alteration of cow milk casein to human sequence casein by insertion of human identical genes into animal genome
- Reduction of β -lactoglobulin protein by applying knockout transgene
- Increase of lactoferrin and introduction of lysozyme enzyme by amplification of human genes in bovine

Fats

- Change in palmitic acid profile position in bovine milk

Oligosaccharides

- Oligosaccharides are an important compound of breast milk for establishing probiotic bacteria in the gut of infant. Cows do not produce it in their milk, which may be produced by genetic manipulation.³

Lactoferrin

- Lactoferrin content in human milk is 1gm/lit and in cow milk is 0.1g/lit. Lactoferrin is an iron binding protein which shows bacteriostatic and bacteriocidal properties. By using transgenic technology, buffalo/cow can be subjected to lactoferrin gene to produce milk resembles to human milk.

Increase in Therapeutic Values of Milk

- Milk can be modified by transgenesis⁴ to treat diseases like phenylketonuria, hereditary emphysema pancreatic insufficiency and cystic fibrosis.
- Production of milk with blood clotting factors to

treat haemophilia patients.

- Production of antibodies in mammary gland produced through transgene and its secretion through milk have proved efficient to avoid mastitis and some human diseases also.
- The transgenic animals contain certain factors like α -antitrypsin ATT, pasmin inhibitors which have therapeutic values⁴.

Conclusion and Future Perspective

In today's world, the consumers becoming more and more health and diet conscious, so there are lot of new market opportunities for milk and milk products with enhanced nutrients and therapeutic values. The milk designed according to need and desire of consumers to fulfil various deficiencies and humanization of milk is going to be game changer in future considering increase in purchasing power of customers. The future of designed milk will depend on key factors e.g. Animal safety, scientifically justified safety of product, enhanced health benefits of product and profitability compared with traditional products. The designed milk produced by using genetic engineering should fulfil the various legal, ethical, environmental and social aspects before introducing it for human consumption.

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The Internet of Things (IOT) – Future of School and Higher Education

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Abstract

The continuous growth and technological advancements in the field of information technology and allied services are dramatically affecting the Internet. Internet has started spreading its wings with widen and unimaginable opportunities and challenges in web based education and learning. The conventional form of the education and learning over the internet started as a read only medium; then after form of learning environment changed into read/write medium with the advanced internet technologies. Now, the recent advancement of Web 3.0, Cloud Architecture is the most technically enriched medium or form of learning over internet which allows the users to read/write/execute and also allows the electronic and non electronic machines to execute the interactive learning so far accepted from the human beings as the advancement of education or learning. In a short time, Internet of Things has introduced new opportunities and possibilities with its tools and technologies for facilitating education & learning either over web or in classroom and offers improved teaching and learning processes and educational institutions communications with its stakeholders. This paper present and discusses about the some key description of the Internet of Things, evolution and its features. Next, section presents the potential of IoT services in the area of education and learning.

Keywords: Web 3.0, Cloud Architecture, Internet of Things, Web Based Education and Learning

Introduction

The growth and evolution in the World Wide Web (WWW) is fundamentally being used in improving interactivity, online collaboration, sharing of the common resources, market the active and interactive learning framework, and delivering of education even in virtual learning approach through online credentials, distribution of projects works in virtual teams, online training materials and tutorials and much more. After the introduction of the term “Internet of Things” in 1999 by Britain Kevin Ashton, a conceptual change has been observed which introduced a new change through the Internet, anything,

anywhere can get connected with the Internet and becomes 'Smart' by formation of the network of equipments entrenched with sensors, software, and any other service in form of hardware or software connected to the Internet, following the International Telecommunication Union's Global Standards.¹ "The Internet of Things (IoT) is the network of physical objects that contains embedded technology to communicate and sense or interact with their internal states or the external environment."²

From the Gartner standpoint presented in the report there would be 20.8 billion numbers of things over the internet IoT for use by 2020, as 30% (6.4 Billion connected things) rise was observed in 2016 in comparison from 2015 and a budget of 3010 Billion US\$ will be spend over IoT by both the consumer and business stakeholders.³

This paper will present the IoT technologies, and services potential in the areas of education and learning which are or may be helpful for teachers in planning suitable course delivery structure, sharing goals of learning, and activities for their courses with the students or learners through IoT frameworks with real-time.

Basic Components of IoT

The advancements in the fields of information technology, communication techniques and sensing techniques leads to the formation of IoT with the fundamental objectives of developing compatible and affordable wireless systems with less power consumption. This advancement had influenced social, economical and technological fields dramatically especially industries working over voluminous data such as education, healthcare, energy sector etc. Seamless connectivity for the IoT framework is offered through:

1. **Hardware** : Hardware such as sensing devices, actuators, entrenched communication hardware, smart and portable devices with wireless communication features, interactive devices, and many more.

2. **Computing and Storage ware** : On line or on demand data analytic capacities and storage for all the type of applications.
3. **Visualization** : Easy and interactive visualization and interpretation tools and techniques for wide access of cross-platform applications and services which are developed for different purpose and industry.

As portrayed by the Internet Architecture Board characteristic and features of IoT refers to the following communication models:

1. **D2D Model** - Device-to-Device model is direct linkage between two or more than two devices for the purpose of communication; this linkage can be established through intermediary application server, other type of networks, including IP networks or the Internet.
2. **D2C Model** - Device-to-Cloud model represents the communication linkage between the devices and Internet Cloud service.
3. **D2G Model** - Device-to-Gateway model presents the intermediary between the device and Cloud, intermediary may be a software application offering several functionalities and security features.
4. **BES Model** - Back-end-Data-sharing model enables analyzing and exporting the data objects from Cloud with other data sets of other sources.

IoT for Education Character Mapping

"Four groups of applications of IoT in education are energy management and real-time ecosystem monitoring, monitoring student's healthcare, classroom access control and improving teaching and learning".⁴ Internet and allied technologies offers several characteristics which can improve the education and learning, broadly these characteristics can be clubbed into following

categories:

1. **Intelligence** - Incorporating internet with intelligence will lead the applications to work intelligently with the help of human intelligence and for this different Artificial Intelligence (AI) tools and techniques may be useful.
2. **Personalization** - A system with human intelligence will consider the personal user oriented preferences throughout activities performed by the individual such as searching, processing of information, and personalizing the portal.⁵
3. **Interoperability** - Provide a communicative medium for knowledge and information exchange. IoT applications customization would be easy and can independently work on different kinds of platforms and devices.
4. **Virtualization** - High speed internet and High dimensional graphics environment will increase the interactivity and real time operability for the application to its user end.

All above stated technological advancement in IoT has played significant role in connecting and educating learners and thus revolving meaning of education for both student and teacher.

Internet of Things (IoT) improves learning and teaching by several ways such as:

1. Through offering the teaching or learning material availability on any device connected over the prescribed network
2. By offering integration of intelligent and interactive devices with the smart classrooms
3. More improved and admissible form of data collection related to the students' overall performance through sensors and wearable devices and monitoring the same simultaneously
4. Promoting the educational social software within a context of IoT such as Wikis, Weblogs

and support for collaborating activities over them for knowledge building.

So, ultimately IoT offers the capacity and practices of reforming and changing the teaching and learning practices and methods followed in the campus, for example, the IoT believes in making the campus to train students anytime and anywhere as a full range of learning and training.⁶ The learning or education through IoT tools and practices mainly focuses on the positive participation of users and interaction among educational communities, either through social network tools or any other social communication tools to foster more open approach of learning and education. IoT is actively getting acceptance as a teaching and research medium in the field education and learning. "Integrating IoT as a new actor in educational environments can facilitate the interaction of students and teachers and physical and virtual objects in the academic environment."⁷ Next, we describe briefly some of the IoT technologies which are quite useful for the education:

1. **Smart Education Environment** - The concept of smart environment focuses on the integration of smart devices available in the campus for the purpose of learning, reasoning and predicting. Thus a smart environment is that where one can obtain and relate knowledge about environment to advance the experience for environment. A Smart Educational Campus integrates multiple smart things into a single system which may include following:
 - a. **Smart tutorial and learning applications with IoT** - Tutorial and interactive learning modules, completely programmed according to students' class standard, syllabus and age group and can better synchronized with the smart handheld devices.
 - b. **Smart Classrooms with IoT** - The smart classroom integrates technologically enabled

interactive boards, printers, books, handhelds, CCTV surveillance, smart HVAC system, light and fan manager, room temperature organizer, attendance manager, information synchronization management etc. Smart classrooms offer interactivity in between teachers and students which help the teacher to know the way student want to learn the current topic which is good and quite knowledge enhancing for both faculty and students.⁹

- c. **Smart Labs with IoT** - Online virtual laboratories, completely programmed labs which can understand the need of the student according to their standard, syllabus and age group and related content can be better organized for qualitative assessment of the student.
- d. Smart Collaboration tools and applications with IoT
- e. IoT Sensors for all the smart devices
- f. IoT enabled hotspot for campus⁸
- g. IoT enabled 3D-Wikis / Virtual 3D Encyclopaedia
- h. IoT enabled Intelligent Search Engines
- i. IoT enabled Simulations and multi dimensional Web
- j. IoT enabled Research Computing
2. **IoT Analytics** - This concept allows analytical processing of the huge amount of information and suggests new and specific analytical practices to derive a particular output.
3. **IoT Processors** - Even after having the technical characteristics of integrating multitude devices over IoT still there is need to defined the characteristics of processors and architectures followed over the network, such as security characteristics and encryption followed, detail about the power utilization, operating systems compatibility etc.

For the integration of IoT with the academia there is

ultimate need of the optimal technical solution to be IoT Platforms with real-time, limited-area service provision using Cloud Computing services.

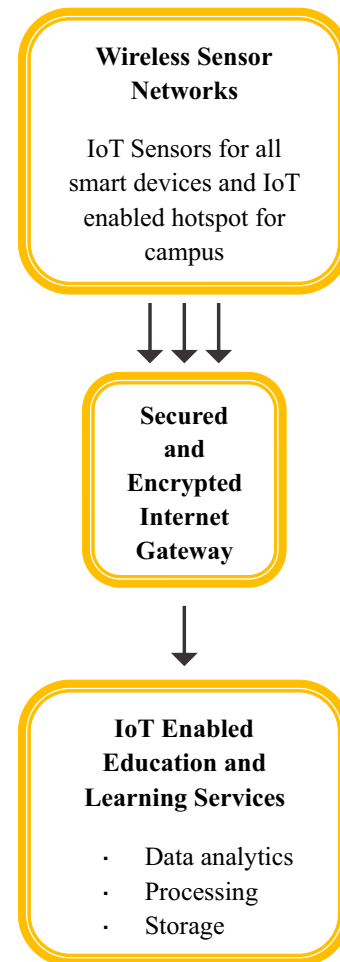


Figure 1: Model of IoT Enabled Education and Learning Services

IoT Potential to Influence the Academia

A. Influence on Higher Education -

1. Higher educational institutions can work over cross platform disciplines and can also lead the progress of the IoT technologies with the contemporary business models, ethical practices, and IoT powered economy.

2. Universities are developing the IoT enabled labs for leading the potential advantages in the sector.
3. Technical institutions are integrating with business colleges for developing new IoT courses to formulating new business models according to the contemporary need.
4. With the help of leveraged solutions such as radio frequency identification and cloud services over IoT technologies, institutions will be able to analyse and manage Big Data.
5. Main lead of IoT with academia is focused on continuous advancement of students, adoption and adaption of new teaching practices with innovative platforms, development of educational middleware support such as apps and hardware, interactive and graphically enriched learning environment development with simulation characteristics.
6. With IoT enabled teaching practices identical learning experience can be obtained by the student in classrooms as well as at homes or any other convenient place also.
7. New edge of learning by doing concept through virtual labs, group learning through collaborative learning and gamification in learning is introduced.
8. Growth and integration of mobile technology with IoT improves the safety measures of premise.

B. Influence on Teachers and Students –

1. It is creating more interactive and flexible learning environment for students and offering more commanding teaching control over the students. Teachers can pull together information about each student's overall performance and then assists in determining that which students need more care and attention.
2. IoT tools offer more appealing and experimental mode of education.
3. Professors can focus on each student and can give personal attention over their grooming, and they can collaborate, with each of the students, adapting their course and practical activities.¹⁰
4. Advanced teaching practices and methods are offering attractive learning methods to students (such as 3D Graphics Presentation and featuring videos etc.) and new teaching opportunities for teachers.¹¹
5. IoT tools and principles are positive for education and helps in nourishing the learning processes.
6. IoT integrated sensing devices helps to monitor cognitive activities of students and on the basis of their ECG patters of student specific activities and exercises are suggested to them to redirect their attention.
7. IoT is adding values in education and learning experience of students and teachers by improved operational efficiency, enhancing asset intelligence and enriching knowledge and learning experiences.

Conclusions

Internet-of-Things practices have unrevealed possibilities to remove all the limitations and barriers of the existing education system, such as dependency over physical location to get the knowledge and information sharing, language mismatch and incompatibility with hardware and economic disparities. The amalgamation of information technology and allied technologies with education and learning practices and system leads to improved level of knowledge and quality of students. This amalgamation has invited new and innovative ways and ideas that can bring simplicity and enrichments in the learning of both students and teachers. Ubiquitous IoT tools and technologies will develop a junction in between the real and virtual platforms of education and

learning, where the user can seamlessly come into contact with humans and machines either through virtual means or in the real world. The fundamental aim of this study was identify the potential of IoT in higher education.

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