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Original Article

Education Section

Role of Information Communication Technology in Higher Education: Learners Perspective in Rural Medical Schools

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ABSTRACT

Background: Higher education has undergone profound transformation due to recent technological advancements. Resultantly health profession students have a strong base to utilize information technology for their professional development. Studies over recent past reflect a striking change in pattern of technology usage amongst medical students expanding prospects exponentially by e-books, science apps, readymade power-point presentations, evidence based medicine, Wikipedia, etc.

Aim & Objectives: The study was undertaken with an aim to explore the general perceptions of medical students and faculties about the role of Information Communication Technology in higher education and to gauge student's dependence on the same for seeking knowledge and information.

Study Design: Cross-sectional, mixed research design.

Materials and Methods: The study was conducted in Department of Physiology, Datta Meghe Institute of Medical Sciences (Deemed University). Study population included students (n=150) and teaching faculty (n=10) of Ist phase of medical curriculum. The survey questionnaire (10 closed ended and 5 open ended items) and Focus group discussion (FGD) captured the perceptions and attitudes of students and faculties respectively regarding the role and relevance of technology in higher education.

Observations and Results: Quantitative analysis of closed ended responses was done by percentage distribution and Qualitative analysis of open ended responses and FGD excerpts was done by coding and observing the trends and patterns respectively. Overall the observations were in favour of increasing usability and dependability on technology as ready reference tool of subject information. Learners valued text books and technology almost equally and regarded computer training as a desirable incorporation in medical curriculum.

Conclusion: Role of technology in education should be anticipated and appropriate measures should be undertaken for its adequate and optimum utilization by proper training of students as well as facilitators.

Keywords: Higher education, Health professions, Information communication technology

INTRODUCTION

Profound transformations in higher education have occurred as a result of recent technological advancements [1-3]. It has also transformed Medical Science which has much to gain from the Internet that has revolutionized this field. International organizations such as the United Nations (UN) and the World Health Organization (WHO) have acknowledged Information Communication Technology (ICT) as a useful tool to address education in health care sector. Accordingly; most of the developed countries are investing heavily on the infrastructure for ICT and focusing on technology mediated learning approaches to match the changing learning styles among youth. Even developing countries are taking efforts to acknowledge the technological expansions. Health profession students now have a strong base to utilize information technology for their professional development [4].

Studies over the past decade reflect a striking change in usage pattern of technology amongst medical students. Earlier which was used for mails, chats, movies, videos, video games, dictionaries, entertainment has expanded prospects exponentially by e-books, science apps, readymade power-point presentations, evidence based medicine, Wikipedia etc. The rapid development leading to enhanced medical literature retrieval applications, together with increased access to personal computers have changed both the study and practice environments in health professions [5-7]. Studies depict high utilization patterns of ICT among health care professionals and learners [8]. In contrast to its extensively acknowledged importance; computer access and computer related skills demonstrate a wide diversity, both regional and within students and faculties of the same institution [9-11].

Learners; now advocate the incorporation of training in computer skills as part of their curriculum which they report, will enhance their ability to acquire, appraise, and use information in order to solve clinical and other problems quickly and efficiently in the course of their studies, and more importantly when they graduate [12,13].

Although health professional student's perceptions regarding role and relevance of ICT in their daily routine has been studied extensively in past decade; the present study goes a step further to fathom their dependence of information technology for seeking professional knowledge as compared to text books and understand their perceptions about growing dependability on technology; especially in rural set-up where resources are limited. The study also attempts to gauge the necessity of incorporating a formal basic training at both levels, i.e., learners and facilitators to enable optimum utilization of ICT in teaching learning activities.

AIM AND OBJECTIVES

Aim: The study was undertaken with an aim to explore the general attitude and perceptions of newly admitted medical students about ICT and its future role in higher education. The objectives outlined were;

- To analyze the purpose of ICT use among medical undergraduates
- To estimate the extent of ICT use among medical undergraduates
- To capture their perception regarding the need for incorporating computer education in medical curriculum
- To consider opinion of faculty members in all above mentioned aspects.

MATERIALS AND METHODS

The cross-sectional, questionnaire based study was conducted in Department of Physiology, Datta Meghe Institute of Medical Sciences (Deemed University) which has a rural base although the students come from all parts of the world. The study population included students (n = 150) in Ist phase of medical curriculum. It was ethically approved and informed consent was taken from all the participants. Since this was a qualitative study, the participants were subjected to a validated survey questionnaire which had closed and open ended items. The internal consistency of closed ended items were calculated. The study population was briefed about the nature and purpose of study. The survey questionnaire was sought from all the 150 students. It focused on the perceptions and attitudes of students who have recently joined the medical school regarding the role and relevance of technology in higher education. The students were asked to self administer the questionnaire in a lecture class. Time allotted for the same was half hour. Since the completed questionnaire was collected pairing it with attendance record, fallouts were avoided.

The survey was followed by a structured focus group discussion (n = 10) of teaching faculty for 1st year MBBS students. The participants of FGD were carefully matched for homogeneity. The selection of FGD participants were based on the balanced representation of faculty in terms of subject specialty, age, experience, cadre and involvement in teaching learning & evaluation (TLE) activities. The FGD, which lasted for two hours; was conducted by two faculty members, one as a facilitator (who was a trained faculty for conducting FGDs), and other who recorded the discussion verbatim. The FGD was an attempt to speculate the faculty's attitudes and perceptions regarding ICT and its potential role in TLE activities. A prevalidated FGD guide was used for the said purpose [Table/Fig-1].

Data collection: A validated questionnaire and one focus group discussion (guide) which probed into the knowledge, attitude and extent of utilization of IT, was used for the study.

Quantitative data: Closed ended responses of 10 items in survey questionnaire through 5 point Likert's scale

Qualitative data: Open ended responses of 5 items in survey questionnaire and excerpts of FGD

Data Analysis: Quantitative data was analysed by percentage distribution and Qualitative data by coding and categorization.

Theme: Role of Information Communication Technology in Medical Education	
Note: look for opinions about;	
1.	How technology has influenced education
2.	Factors on which extent of utilization of ICT depends amongst medical students
3.	How do they foresee the role of technology in education
4.	Technology training as a part of medical curriculum

[Table/Fig-1]: Focus group discussion guide

The transcripts of the focus group were collated and categorized according to the areas identified in FGD guide. The transcripts were then analysed for trends, patterns and findings keeping into consideration the words, framework, internal agreement, precision of responses and major findings.

OBSERVATIONS AND RESULTS

The survey questionnaire consisted of two parts:

Part A: Ten closed ended items on five point likert's scale

Part B: Five open ended items

Quantitative data analysis

The questionnaire had ten closed ended items [Table/Fig-2] with internal consistency of 0.74, which dealt with the regular use of ICT among the sample population (n=150). 70% of students strongly agreed about their comfort and expertise with technology (item no. 1). The user friendliness of technology as a source of useful information was agreed upon by 88.88% of students (item no. 2). There was a mixed response about the awareness of authentic and reliable websites for information. In fact 26.98% chose to be neutral on this aspect and 12% disagreed for the same (item no. 3). Preference for web over text books was agreed by 39.68% students whereas 57.13% preferred text books over web (item 4 & 5). 57.13 % of them preferred to visit digital library (e-books, e-journals and entertainment) during free hours, whereas 39.67 preferred Central library (books & journals). 61.88 % students agreed that contents covered in classroom are readily available on internet [Table/Fig-2].

Qualitative data analysis

The students were asked to specify the time they devote to internet daily which 58.33% reported for 1-2hrs, 16.66% for half hr and more than 2 hrs on a daily basis and 8.33% occasionally [Table/Fig-3].

41.26% of students agreed that technology can replace textbooks in coming years. The reasons put forth are categorized into; (1) Technology as user friendly, (2) Techno savvy generation (3) Vast information available 4) Technology being interactive & personalized and 5) Environment friendly. However 55% students did not support the idea and emphasized that text books cannot be replaced because; (1) they are more reliable and give authentic information, (2) there is no dependence on electricity and (3) Unavailability / inaccessibility of technology [Table/Fig-4] is a limiting factor.

84% of students agreed that in our institute technology is being utilized optimally, 14 % felt that more graphics and animation should be added in T/L activities. One important comment was that laptops should be allowed in classrooms [Table/Fig-5].

The disadvantages of technology as a learning resource material is categorized into (1) Vulnerability to misuse, (2) Unreliable resource of information and (3) Technology/electricity failure. Few students emphasized its unreliability as an information source since it can be edited by anyone [Table/Fig-6].

S. No	Item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Responded
1	You are well versed with use of technology		3.17	25.3	46.03	23.8	1.58
2	Technology is user friendly and effective in providing useful information		3.17	7.93	46.03	42.85	
3	You are aware of authentic websites from where you can get desired information about your medical subjects	3.17	9.52	26.98	38.09	19.04	3.17
4	You prefer searching web rather than going to text books	6.34	19.04	33.33	22.22	17.46	1.58
5	You prefer text books for reading rather than searching web	1.58	4.76	34.92	36.5	20.63	1.58
6	Its fun to read medical subjects textbooks		6.34	26.98	33.33	28.57	1.58
7	Its fun to surf internet for ready information about medical subjects	4.76	9.52	15.87	34.92	31.74	1.58
8	You prefer to sit in digital library during free hours	3.17	14.2	25.3	38.09	19.04	1.58
9	You prefer to sit in central library during free hours	3.17	3.17	50.79	26.98	12.69	3.17
10	Whatever is taught in classroom is available on internet	4.76	9.52	23.8	41.26	19.04	1.58

[Table/Fig-2]: Percentage of responses to closed ended items on 5 point Likert's scale

71.03% of students were in favour of including technology training in their curriculum. They felt that this can help in better handling of vast information resource and also facilitate learning. 28.04% students did not deem it necessary as they felt that most of the things can be learnt by themselves as technology is quite user friendly [Table/Fig-7].

The most frequently visited sites were facebook (92%), google (91%), e-mails (87%), followed by Wikipedia, online shopping sites and you tube [Table/Fig-8].

Focus Group Discussion of Faculty supported the hypothesis of increasing dependence of IT amongst Medical Undergraduates (as depicted in [Table/Fig-9]).

DISCUSSION

Since the development of computer and evolution of the Internet, Information Technology (IT) has had a positive impact on health care delivery systems worldwide, particularly in the areas of disease control, diagnosis, patient management and teaching [14]. Internet, one of the key developments in this field, provides instant access to latest medical information [15]. The present Institution is a Deemed University which has an annual intake of 150 medical students from India and abroad. This study was conducted (i) to analyse the attitude about role of ICT among medical undergraduates (ii) to estimate the extent and purpose of ICT use among medical undergraduates and their perception regarding the need for incorporating computer education in medical curriculum. It was observed from the responses obtained that students were expert and extremely comfortable with technology. They unanimously agreed that latest technologies in computer application makes it extremely user friendly and easy. Almost 92% of them were surfing internet daily for atleast half to more than two hrs. Majority of them (57%) however preferred textbooks for medical information rather than internet. Open ended responses also supported this belief when probed; "Do you think technology can replace text books? Give reasons" to which 55% disagreed, regarding text books as more reliable, easily accessible and not dependent on electricity. This preference is in consonance with a similar study conducted by Banerjee et al., [15] which reported primary source of medical information as textbook for Under Graduates and majority of them stated internet as a ready source of information to save time. Another study by Nurjana et al., obtained a self-reported assessment of the use of ICT by medical students at the International Medical University, Malaysia. The survey revealed that 5.7% did not use computer either in the university or at home. It stated adequate skills at word processing (55%), e-mail (78%) and web searching (67%) [13] during leisure hours. This goes on to suggest that though learners seek information through technology as a ready and practical source; the relevance of text books and literature remain as a primary source for clarifying the concepts and holistic learning.

A) For how much time do you surf internet daily?	
Occasionally	8.33%
Half hr daily	16.66%
1-2 hrs daily	58.33 %
> 2 hrs daily	16.66%
E (20%)	10.7

[Table/Fig-3]: Categorization of responses and their percentage distribution to open ended item "For how much time do you surf internet daily?"

B) Do you think technology can replace text books? Give reasons.	
Yes	41.26 %
Few excerpts	**User friendly:** • "Yes we can get many information with just one click whereas we have to read many books to get that much info" • "Yes off course, everything available in internet, digital text books, android apps and windows" • "Yes off course, everything available in internet, digital text books, android apps and windows" • "Technology helps us do our work all by own. That helps to remember the topic better" • "Yes, it is very user friendly & easy to use. Reading e-books is more fun" **Techno savvy generation:** "Teenagers have more craze for tech than textbooks" "Yes, students of this generation are more well versed with technology, than books!" **Vast information:** • "Every topic is available in details" • "Internet facility not available everywhere" • "They give simplified information with lot of animation for easy understanding" • "It has all the information at a single place" • "There are unlimited information in google or some other website and a text book". **Interactive and personalized:** • "It is interactive which helps in better understanding. It has wider scope and resources are vast. It can be easily personalized" **Environment friendly:** • "If a standard sized e book reader is made compulsory than we can carry millions of books in one e-book & it can also save millions of trees" • "Its not just limited knowledge in a book. Also it is a step towards environment friendliness"
No	55.55%
Few excerpts	**More reliable / Authentic knowledge:** • "Whatever books teach we cannot compare with technology" • "Textbooks provide collective knowledge over a particular topic whereas technology only give its background." • "Technology is entirely different from textbook. Textbooks too have knowledge if read properly" • "Its always better to be old school. Text book have a basic , to the point and fundamental information" • "Textbooks elaborate and explain topics easily" • "We can go through the books again and again and information would be there but not on net, it rather changes" • "Textbooks are reliable, easily carried around without having to worry about a proper internet connection or electricity issues" **Not dependent on electricity:** • "Textbooks do not depend on electricity" • "Technology depends on electricity which is not available to lot of places in India" **Unavailability of technology:** • "Internet facility not available everywhere" • "Not totally as everyone does not have access to technology" • "It is not possible for every civilian to have full fledged technology"
Neutral	3.17%

[Table/Fig-4]: Categorization of responses and their percentage distribution to open ended item "Do you think technology can replace text books? Give reasons

C) Is technology optimally utilized in teaching – learning activities	
Yes	84 %
No	14.0 %
	• "Graphics & animations should be added more frequently in TL activities" • "Laptop should be allowed"
Not needed	1.75 % • "It is really not needed. Textbook is enough and board-work is a bonus"

[Table/Fig-5]: Categorization of responses and their percentage distribution to open ended item "Is technology optimally utilized in teaching – learning activities"

D) Give one disadvantage of technology as a learning resource material	Some excerpts
a. Vulnerability to Misuse	• "People can misuse as they can take information which is not of their use" • "One being easily distracted while using it" • "Students see it as entertainment source. They watch movies and social networking sites" • "Lots of false information" • "Please tend to waste a lot of time searching for the required information as they may not be aware of the appropriate sites which are suitable for suitable for a particular level."
b. Unreliable resource of information	• "It does not provide a thorough study & only focus on objective teaching." • "It makes students more relaxed and rather than studying students enjoy more and concentrate less." • "Information available online doesn't always have to be right." • "As it is a man made thing, errors are a possible chance"
c. Technology/electricity failure	

[Table/Fig-6]: Categorization of responses and their percentage distribution to open ended item "Give one disadvantage of technology as a learning resource material"

E) Should the medical curriculum include computer training of students? If yes; why?	
Yes	71.03%
	"its need of the hour" "everything is dependent on internet" "its important to how to use it in the right way" "more so, in all institutes this should be mandatory" "we can use it in better way" "specially for e-learning and all"
No	28.04%
	"most of us are aware" "no need…its user friendly" "you can learn by yourself" "its really not required"

[Table/Fig-7]: Categorization of responses and their percentage distribution to open ended item "Should the medical curriculum include computer training of students? If yes; why?"

F) Enlist the sites which you browse frequently.	Responses (in %)
a. Facebook	92
b. Google	91
c. E-mails	87
d. Wikipedia	73
f. On line shopping sites (Jabong, home shop 18, fashion world etc.)	66
e. You tube	66

[Table/Fig-8]: Categorization of responses and their percentage distribution to open ended item "Should the medical curriculum include computer training of students? If yes ; why?"

Our university has well established digital library with 70 terminals. It is always occupied with students if they have any free time or after scheduled lectures. The present study supported this observation indicating digital library as a preferred place during free hours where they can access internet readily rather than central (books and journals) library. The most frequently browsed sites were reported to be Facebook, Google, personal e–mails, You tube, Wikipedia, online shopping sites in the descending order. Central library facility was availed when they had forthcoming exams or when they had to prepare for seminars or presentations.

45% students felt that learning with the help of internet and computers will be a preferred method in future due to availability of vast information, interactive and personalized media, environment and user friendliness which is more appealing for the current techno-savvy generation. This brings forth an important aspect that there should be more emphasis on computers as standard tools for learning with more use ICT in classrooms. There should be emphasis on expansion of computer-assisted learning which requires careful strategic planning, resource sharing, staff incentives, active promotion of multidisciplinary working, and effective quality control [16]. Our student population has increased over the years and is likely to overwhelm the facilities if it were not for the use of IT enabling lectures, demonstrations and illustrations to be delivered to multitudes of students simultaneously. The introduction of a structured computer training course, which includes the applicability of IT to medicine, into the curriculum of medical students, health record students, residency and continuous medical education

How technology has influenced education	Factors on which extent of utilization of ICT depends amongst medical students	How do they foresee the role of technology in education	Technology training as a part of medical curriculum
"tremendously" "times have changed …everything is available on mobiles and internets "students cannot live without cell phones at all" "everything is just click of a finger away " "there are e-books, quizzes online, so many references,etc." "As faculties we are using power points, images, videos to teach and make lectures interesting…the influence is huge!"	"more to do with their comfort and expertise with ICT usage" "most of them using it for entertainment purpose" "substantial" "they use it for making seminars and seeking immediate informations" "my son has almost shunned textbooks for reading…he is more comfortable with e-books only!" "I think they follow their teachers to some extent..if you instruct that a particular book is a must have and questions will be asked from that ; they will definitely read" "yes …evaluation is prime thing which they follow"	"Has already transformed the way of teaching, learning and evaluation at all levels of education." "it will be imperative to have sound knowledge of technology so that you can deal with a techno savvy generation" "more technically advanced T/L methods will come up" "even written examinations will be replaced by online ones!"" "but for medical field …training in hospitals with actual patients cannot be replaced..no matter how much you try to use simulations" "faculties should know how to effectively use computers and internet so that they can understand students better."	"should be incorporated" "yes it will help" "students already are much aware " "should be for faculty rather" "is a must" "more for the faculty" "not really needed" "can be thought of.." "at least they will become aware from where to seek authentic information that way!"

[Table/Fig-9]: Focus Group Discussion excerpts

Sr no	Title of the article	Author, Journal, year and Volume	Sample population & sample size	Objectives	Type of study	Results
1	Computer literacy and attitudes towards e-learning among first year medical students	Thomas Michael Link, Richard Marz, BMC Med Educ. 2006; 6: 34.	1st MBBS students, 1160	Estimated the level of students' computer skills, the number of students having difficulty with e-learning, and the number of students opposed to e-learning.	Online survey	Majority of students possessed sufficient computer skills and acknowledged the advantages of interactive and multimedia-enhanced learning material.
2	How are our medical students using the computer and internet? A study from a medical college of north India	Khan Amir Maroof, Pawan Parashar,and Rahul Bansal, Niger Med J. 2012 Apr-Jun; 53(2): 89–93.	MBBS students all phases, 272	Collected information about Internet usage patterns, knowledge about information technology, and barriers in using it.	Cross sectional Questiona- irre based study	57.4% of the students had some sort of formal training in computer and Internet use. One-fifths of the respondents used Internet for searching literature for projects from medical journals on the Internet. Majority of the respondents accessed Internet for less than 3 hours per week. About one-tenth (8.0%) of the students felt that Internet is totally useless in medical field. The major barrier (54.4% of the respondents) to using Internet was lack of time.
3	Information Technology Practices Amongst Dental Under- graduate Students at a Private Dental Institution in India	S Kumar, G Balasubramanyam, P Duraiswamy, S Kulkarni, Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran (2009; Vol. 6, No.3)	Dental undergraduate students from first to fourth year, 247 Response rate: 66%	Assessed the level of computer use among dental undergraduate students pursuing their career at a private dental institution in India.	Survey questionnaire based study	58.3% of the study population mentioned that they had access to computers. Students from preclinical years reported to be competent in IT skills more frequently than the clinical year students P=0.007). Compared to women, men used computers more regularly both for academic activities (P=0.082) and personal use (P=0.006). Students of clinical years used computers more than preclinical students for both purposes (academic activities, P=0.045; personal use, P=0.124).
4.	Knowledge and Utilization of Information Technology Among Health Care Professionals and Students in Ile-Ife, Nigeria: A Case Study of a University Teaching Hospital	Ibrahim S Bello,Fatiu A Arogundade, Abubakr A Sanusi, Ikechi T Ezeoma, Emmanuel A Abioye-Kuteyi, Adewale Akinsola, Med Internet Res. 2004 Oct-Dec; 6(4): e45.	Health care professionals and medical students,180, response rate: 82%	To assess the knowledge and utilization pattern of information technology among health care professionals and medical students in a university teaching hospital in Nigeria.	Self-structured pretested questionnaire based study	Eighty respondents (54%) had received some form of computer training. 39 respondents (26%) owned a computer. A total of 28 respondents (18.9%) demonstrated good knowledge of computers while 87 (58.8%) had average knowledge. 39.9%respondents demonstrated a good attitude and good utilization habits. 25% of students and 27% of doctors had good computer knowledge (P=.006), and only 4.3% of the records officers demonstrated the same.
5.	Role of Information Communication Technology in Higher Education: Learners Perspective in Rural Medical Schools	Tripti K Srivastava, Lalitbhushan S Waghmare, Arunita Jagzape, Suresh R Tankhiwale, Ved Prakash Mishra	Analysed the purpose, extent of ICT use among medical undergraduates and capture the perception of faculties regarding the need for incorporating computer education in medical curriculum	Ist MBBS students, 150	Cross-sectional, Questiona-irre based Study	Overall the observations were in favour of increasing usability and dependability on technology as ready reference tool of subject information. Students and faculty regarded computer training as an appropriate incorporation in medical curriculum.

[Table/Fig-10]: Comparative analysis of similar studies in the past and the current study

training (CME) programs would certainly assist in ensuring maximal utilization of the advantages offered by IT.

The present study revealed that students are more or less aware of the disadvantages attached to ICT as a reference source in terms of; 1. Vulnerability to Misuse, 2. Unreliable resource of information, 3) Prone to technology/electricity failure. In spite of the obvious disadvantages, students strongly felt that computer skills training is obligatory and should be a part of medical curriculum. The recommendation to include teaching of basic information technology to be integrated into medical studies is also served by many studies in recent past [15,17,18]. It justifies the need to incorporate internet and associated information technology into existing medical curriculum with a view towards increasing use and dependence on ICT as a ready reference tool in higher education.

Similar were the recommendations by Malaysian study [10] which suggested formal inclusion of ICT instruction in the teaching of undergraduate medicine, to enhance medical students' ability to acquire, appraise, and use information to solve clinical and other problems. A comparative analysis of the past studies and the present study is depicted in [Table/Fig-10].

The focus group discussion excerpts furthers the assumption that medical students are getting more and more influenced by technology as a ready source of information. Although, as an observation of faculties; it is the teachers/facilitators who actually influence students style of learning to a major extent. Nevertheless, the preferred learning style through ICT is becoming more and more dominant for coming generations. The faculties also support the idea of incorporating its basic training in medical curriculum, though

they feel that it is more essential for staff than students. The faculties felt that they should receive a formal training about how to optimally use Information technology for better Teaching Learning activities.

With the qualitative data so obtained, one can safely determine that ICT use amongst medical students is a part of their daily routine. Most of the students actually depend on it for ready retrieval of information. They are proficient in using technology and feel that it should be a mandatory part of higher education curriculum not only to learn how to use it efficiently, but also to realize its fallacies and inadequacies.

CONCLUSION

There is a need to foresee the role of technology in education and take appropriate measures to equip the stakeholders for adequate and optimum application of the same. Incorporation of need based basic information technology training as a part of medical curriculum should be pondered upon. A judicious admixture of time tested and newer technologies in teaching learning should be emphasized to make learning an enjoyable and memorable experience. The study also generates a new hypothesis that in consonance with changing paradigms of technology as a learning tool; it becomes mandatory for the faculty to be well versed with technology so as to facilitate and guide learning through technology.

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