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A COMPARATIVE STUDY OF E-LEARNING AWARENESS AMONG UNDERGRADUATE SCIENCE AND ENGINEERING STUDENTS IN BENGALURU, KARNATAKA

Alumu S* and Padma Thiagarajan*

Abstract: Currently, urban students of higher education in advanced countries as well as in developing countries like India have excellent access to electronic gadgets. It is well established that this phenomenon has strengthened their social networking skills to a large extent. Students are also well versed and informed about the various apps and their features. In a quest to understand whether this exposure to the electronic media is also facilitating their academic development and enhancing their technical skills, this paper attempts to compare e-learning awareness among undergraduate science and engineering students among five reputed urban colleges of Bangalore taken as samples. Findings show that engineering students were more active with respect to usage of computers and also in aspects related to subject-related online programs, enrollment onto online courses, satisfaction levels with regard to such courses and knowledge gained therein. On the other hand, science students showed more interest in informing their faculty about such programs and gaining their encouragement for the same. Such studies would help in planning and determining the electronic learning environment in India and also its role in moulding our future generation of engineers and scientists.

Keywords : Electronic learning, Science students, engineering students, online courses, course ratings.

INTRODUCTION

Electronic learning is slowly becoming a norm of study among students in all parts of the world. Enriched exposure to *e*-learning among engineering and science students in the global sphere is contributing to their overall and holistic development. It has been reported that this method of knowledge assimilation is gaining immense acceptance among libraries and information science schools of Asia, Europe, Africa, America and Oceania (Islam et al. 2011). Its related tools are widely employed in the delivery of lectures by teachers of global science institutions. It is also immensely helpful to those students who cannot pursue education by the traditional system. However, analysis of its scope and acceptance in Asian developing countries like Malaysia has revealed that this methodology is mostly encouraged in its academic libraries for the purpose of establishing better communication with students thereby making them access their resource materials more conveniently (Ayu and Abrizah, 2011). However, the infrastructure for serving this purpose is still in its nascent stages in this country and only three of the fourteen selected Malaysian libraries use this futuristic framework. A report of the impact of such learning, conducted among science students reveals its positive power on the knowledge seekers in comparison to the traditional form of learning that generally does not involve any

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information and technology based tools (Rutten, van Joolingen and van der Veen, 2012). Further, such tools serve well for the improved replacement of traditional education and also enhance traditional learning processes and their outcomes. This is mainly because they positively alter the manner in which information is visualized by science students in international institutions, especially as far as the laboratory activities are concerned. E-learning has been discussed scarcely in the context of science students perhaps due to the absence of a dedicated Bachelors' or other different courses in Science. The technological progress made in the field of education, especially medical education using a systems view has been reviewed and it has been inferred that as technological advancements are made, newer and more sophisticated review methods should be embraced (Heeyoung, Resch, & Kovach, 2013). Similarly, advanced information and communication technology, specifically in *e*-learning, using virtual classroom technology has also been assessed to find out whether such learning methods are as effective as traditional learning methods (Carbonaro et al., 2009). Empirical research on students from various disciplines of science such as Medicine, Nursing, Pharmacy, Dentistry, Therapy and Medical Laboratory Science has revealed no major differences on achievement of skills, but showed enhanced students perception of their learning. When the influence of various factors of e-learning on student satisfaction in undergraduate and graduate students was examined, it was found that student satisfaction can be greatly improved by focusing on learner-content interaction rather than learner-learner interaction in case of *e*-learning (Kuo et al. 2014). However, implementing *e*-learning in classrooms is not without its share of challenges. Consequently, a model for easier transition by integrating quality methodologies and practices with a Model Driven Architecture has been proposed (Karima & Mostafa, 2016). It is now well established that international undergraduate students of science and engineering are already exposed to e-learning tools and presence of an E-learning framework in their academic institution is immensely welcomed by them as they consider ICT based educational environment as being integral to their all round development.

An understanding of the scenario of *e*-learning in Indian academic institutions has been achieved through various studies that trace its development in this sector at different stages. It has been suggested that *e*-learning framework is actively used in India to encourage the process of distance learning for students who suffer from the constraints of traditional classroom based learning (Sharma, 2005) While researching on the application of *e*-learning tools in Indian universities and libraries, it has been proved that that ICT based framework is mostly found in the university libraries in order to enable students to access academic resources available within their university more effectively and promptly so that they can enrich their learning process (Cholin 2005). Also, in the rural sector, *e*-learning framework is presently implemented for supporting and developing the standard of rural education in India (Misra 2006). Further, through the process of *e*-learning, an attempt has been made to develop a flexible amalgamation of formal, informal and non-formal approaches in order to meet the diversified educational needs of Indian rural sector. E-learning framework primarily exists in the open universities in India in order to develop better learning environment to students pursuing education through this mode of study (Panda and Mishra 2007). Extensive use of computers and email as part of *e*-learning process generates positive attitude of Indian students towards the system of open education. However, use of *e*-learning tools in engineering education is employed in India mostly to monitor the quality of classroom teaching and standard of learning among the students (Agrawal and Khan 2008). E-learning tools such as classroom assessment techniques (CATs) and statistical process control (SPC) are mostly used for the purpose. It has been also asserted that the use of *e*-learning tools in engineering and science colleges are gaining impetus (Kaur and Manhas 2008). However, these technological tools are used by students for gaining access to informative educational resources in a cost effective manner in order to improve their learning process. The above proposition is affirmed by suggesting that awareness towards *e*-learning in engineering schools in India are rising at a fast pace (Bhattacharya 2008). National Program on Technology Enhanced Learning (NPTEL) is a common platform used by engineering students for e-learning courses. E-learning tools are not only being applied for extending the outreach of science education in India, but approaches like use of an educational satellite called the EDUSAT, use of 'virtual classrooms' and 'virtual laboratories are being employed for providing supportive learning ambience for students. E-learning is an extremely important tool in order to improve the efficiency and efficacy of teaching and learning dynamics at school and college levels. This can be achieved by delivering the teaching and learning activities with a centralized *e*-learning system (VeeraManickam & Mohanapriya 2016).

The possibility of large scale installation of *e*-learning environment in college level education in association with an non-governmental organization has been explored (Vishwanath, Kumar, & Kumar, 2016). On the other hand, an empirical studies to find out the potential of Small Private Online Courses (SPOCs) as an *e*-learning tool has also been reported (Bansal & Singh, 2015). Here it has been concluded that videos are a successful way to enhance traditional learning environments. Majority of these studies suggest that although E-learning is gaining importance in engineering and science education in India, it is still in its nascent stage as far as its wide spread implementation across the entire undergraduate and higher educational courses of the country are concerned. However, it cannot be denied either that students in urban sector are aware of the importance of *e*-learning tools in their overall learning and knowledge accruing process.

BACKGROUND OF STUDY

The main aim of this study was to compare the *e*-learning awareness levels among undergraduate science and engineering students in terms of various aspects like reasons and frequency of browsing, awareness and rating of online courses, knowledge gain through such programs, support available from colleges and faculty etc. The analysis of such data would go a long way in enhancing the learning process of these students by conducting suitable awareness and reorientation programs for better understanding of their subjects and improved knowledge assimilation.

DEMOGRAPHY

Random samples were drawn from reputed colleges in urban Bangalore, Karnataka. Not all colleges that were approached were open to such surveys. Hence the assessment was conducted only in institutions that were open to undertaking this analysis. Five hundred responses to a structured questionnaire were collected each from three and two of reputed science and engineering colleges respectively during the academic year 2015-16.

METHODOLOGY USED

TABLE 1: DEMOGRAPHY AND RESPONSES TO QUESTIONNAIRES

Demography and responses to questionnaires		
Questionnaire	*Sample size - 500 B.Sc students* *Respondents (percentage)*	*Sample size - 500 B.E students* *Respondents (percentage)*
1. How often do you use computers?	499 (99.8%)	496 (99.2%)
2. Are you aware of online programs that are available for your subject?	490 (98%)	493 (98.6%)
3. Have you undergone any of these online programs?	457 (91.4%)	470 (94%)
4. If yes, rate your learning experience through these courses	87 (17.4%)	140 (28%)
5. How comfortable are you using these web sites?	366 (73.2%)	404 (80.8%)
6. Would you take up these programs again if given a chance?	435 (87%)	428 (85.6%)

Questionnaire	*Sample size - 500 B.Sc students* *Respondents (percentage)*	*Sample size - 500 B.E students* *Respondents (percentage)*
7. Would you recommend such programs to your friends?	430 (86%)	435 (87%)
8. Do you feel well equipped with the knowledge gained from online programs as compared to traditional teaching programs?	397 (79.4%)	421 (84.2%)
9. Do you inform your teachers that you take up online programs?	443 (88.6%)	454 (90.8%)
10. Do your teachers encourage you to take up such programs to?	443 (88.6%)	457 (91.4%)
11. Do you feel that such programs can substitute the teacher?	437 (87.4%)	455 (91%)
12. In a structured curriculum, in your opinion, what can be percentage of courses which can be made available to the students online?	500 (100%)	500 (100%)

Demography and responses to questionnaires

A questionnaire constituting close-ended, dichotomous as well as open-ended questions was created. These were carefully framed to test the e learning awareness of students. It included questions to test the frequency and purpose of computer usage, awareness of online programs of their subject, comfort level of using *e*-learning courses, willingness to take up such programs and recommending the same to their friends. Students also gave their opinion about knowledge gained through *e*-learning compared to traditional learning, teacher's role and support in pursuing E-learning, percentages of online courses that can be made available to them as part of their curriculum, and the level at which such courses can be introduced in higher education. Respective principals were briefed about the objective of the study. Students were handed out questionnaires during their respective classes and given comfortably sufficient time to complete them. Faculty and students were very cooperative during the survey. Table 1 shows the questionnaire that was circulated to the students.

RESULTS AND DISCUSSION

It was seen from the survey that most of the participants (except 3.2% of science students) regularly use computers. In fact, the usage among engineering students was much higher on a daily basis (68%) as compared to the science students, wherein the usage was more on a weekly basis (59%) (Fig 1*a*). B.Sc being a non-technical program, might not be requiring an extensive knowledge as compared to engineering one. Roblyer et al (2010) observed that students are positive towards use of Facebook and other similar technologies to support their academic work. Internet usage among college students has been explored and reported by Anderson (2001). It has seen that students who have chosen hard science subjects like Physics, Chemistry, Biology, Geology etc. as their major academic subjects predominantly use internet to an extent of about 100 minutes a day. In our study, it is seen that students of computer science, electrical and electronics and information systems are equally surfing the internet. This might probably be the reason for more awareness (54%) among them about available online programs when compared to science students (36%) as seen from Fig 1(*b*). Some of the probable sites they visit for online courses may be NCBI, NPTEL, Coursera, Edx, Wiley, MIT, Code academy, W3 Schools, Edurekha, Udacity, Basic Electronic Tutorials, Solo Learn, Machine Learning, Tutorials Point etc. Some of these courses also may increase the environmental awareness among them (Uzunboylu et al, 2009).

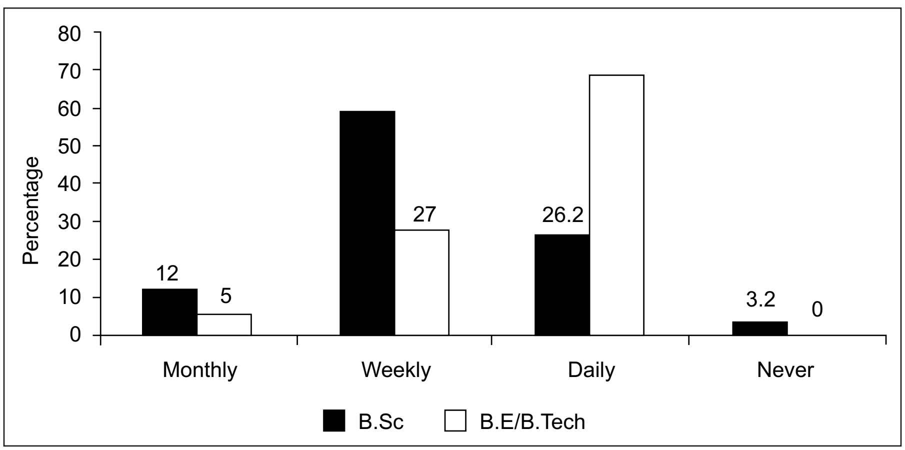

Figure 1: (*a*) Usage of computers

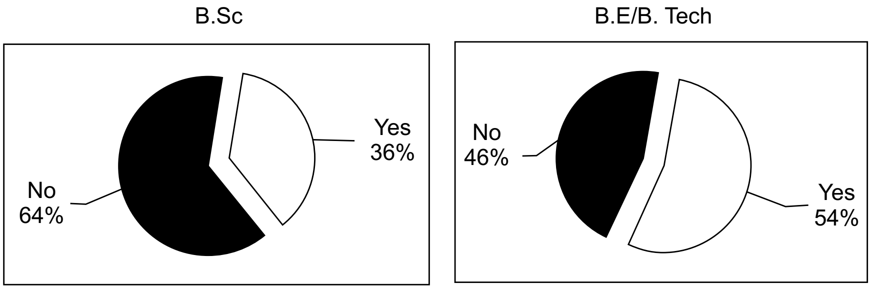

Figure 1: (*b*) Awareness about online programs that are available

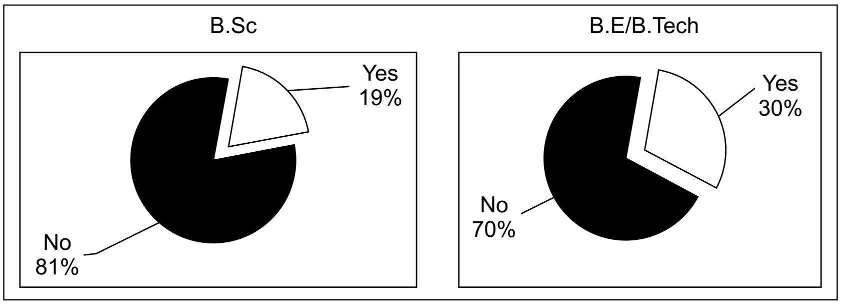

Figure 1: (*c*) Percentage of students who have undergone online programs

The increased awareness of such programs among the future engineers is however not very successful in motivating them to undertake such courses as 70% of the students had not taken them up. In case of science students, an even lower number amounting to only 19% of the total surveyed had an exposure to online programs (Fig 1*c*). It has also been reported in a case study that although an average Massive Open Online Courses (MOOCs) course generally had an enrollment of about 43,000 students, the completion rate was only about 6.5% (Jordan 2014). Also although enrollment numbers are found to be decreasing over the period of time, it is positively connected with course length. Completion rates though consistent across time and total enrollment, is found to be negatively connected with course length. A wide range of MOOC's are available to students like xMOOCs and cMOOCs (Baggley, 2013). An analysis of the quality of xMOOCs and cMOOCs revealed that they are well-packaged and scored high on organisation and presentation of material (Margaryan (2015). However, most of the MOOCs were low on quality of instructional design. This might be one of the reasons for low enrollment in *e*-learning courses. Other reasons may be regular hectic schedules in the traditional classroom teaching or negligence as *e*-learning does not carry any marks. Some students might want to take up such courses only when they begin their career as then they would find a need to empower their knowledge and skills. It is interesting to note in our study that all the students who had taken up online programs in both streams were completely satisfied with the course. Around 61% and 51% of science and engineering students respectively had rated them as good with lower numbers giving higher ratings of excellent and very good. In all ratings, the level of satisfaction was higher in science students probably due to lower expectations (Fig 1*d*). Factors that influence the e learners' satisfaction have been reported (Sun et al 2008). These include learner's computer anxiety, instructor's attitude towards *e*-learning, course flexibility, quality and usefulness, diversity of assessments and perceived ease of use. Also, self-paced, teacher-led and multimedia instructive aspects are factors that affect the learner. These parameters make the students choose *e*-learning as an effective assimilatory tool (Liaw et al, 2007).

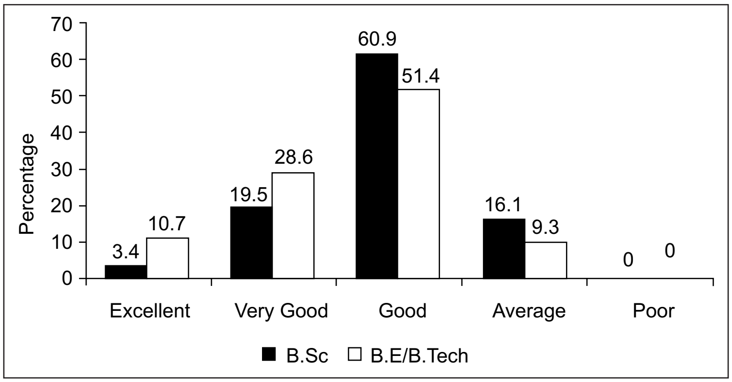

Figure 1: (*d*) Rating of learning experience of online courses

Note: Considering only those respondents saying 'Yes' to the previous query.

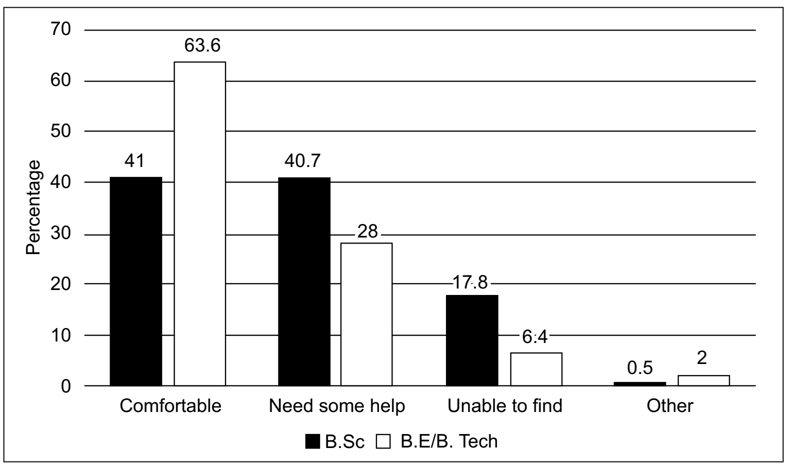

Figure 2: (*a*) Comfort in using these web sites

Some critical factors that affect students intention to use the online course websites has also been studied (Chang and Tung, 2007). They include compatibility, perceived usefulness of the course and ease of use, perceived system quality and computer self-efficacy. Awareness of these aspects would probably aid and promote development of new *e*-learning tools for students with user-friendly websites. In this context, with regard to the comfortable use of computers in our survey, it has been observed that 41% of science students are at ease with computers and an equal number find the need for some help in using it. On the other hand 64% of engineering students are at ease with computers with 28% needing help (Fig 2*a*). So it can be observed that a set of students seem to be interested, but need some help to start with. Demonstrating how to use online technologies, ways to look up to the curriculum-related video content, help to choose the best course to suite their need can be very helpful to such students in fulfilling their learning needs. An orientation course during the first year to empower such students can also be implemented in various colleges. It has been reported that students felt comfortable at two instances, one when relying on instructor's expertise and the other when they could use online technologies with ease (Song et al 2003). In our study, role of instructor's expertise is almost nil, as most of these students are independent active learners. Hence those who are skilled in using online technologies and related tools are more comfortable compared to others.

It is interesting to note that almost 88% of both science and engineering students have readily expressed their willingness to take up online programs given a chance (Fig. 2*b*). Hence these courses seem to be adding value to their academic needs. In this context, students' satisfaction levels are based on course design, content, easy access and visualization of information on teaching platform and good possibility for interaction (Rodriquez 2015). With these ingredients, students will definitely take up e-learning when given a chance. It has also been suggested that E-learning, apart from empowering graduates with academic skills, can also support them in attaining employability skills (Eraqi et al (2011). This is the inference from studies in Department of Tourism and Hotels in Egypt. Students have a positive attitude in taking up *e*-learning courses suitable to their subjects. Such students usually exhibit good time-management skills, can learn in isolation, are independent, active learners, know how to handle their freedom and are accountable for their learning. Around 12 to 13% of students have disagreed to take up such programs if given a chance. Maybe these students are oriented more towards regular teaching with face-to-face interaction with teacher or do not prefer learning in isolation or are passive learners or did not come across the right course. Providing awareness to such students will help them learn exploring skills. In a similar context, in our study, 88% and 91% of science and engineering students are ready to recommend such courses to their friends as seen from Fig 2*c*. This is a good sign among students, to share and spread the knowledge across student community. Education-based social networking sites (SNS) like Facebook, Linked In and My Space are being used by the higher education instructors to deliver distance education(Brady et al (2010). These SNS can be used as a technological tool for online communication among students for education purpose. The same will help strengthen the communication and exchange of information among students of higher education. Possible reasons for students not liking to recommend such programs for their peer group might their "not so good" experience with these courses and their difficulty in completing them. They may have also found such courses irrelevant or might have struggled to search for the right course (Fig 2*c*).

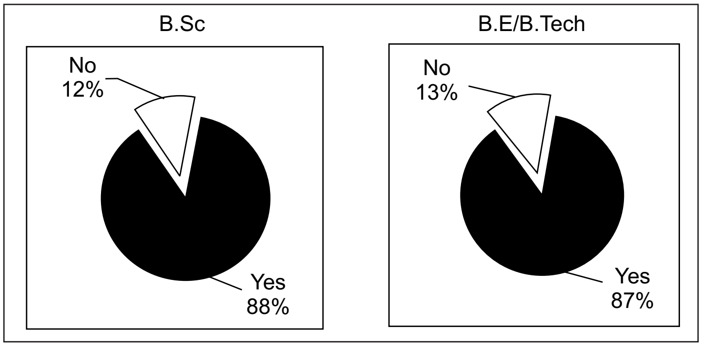

Figure 2: (*b*) Willingness to take up online programs given a chance

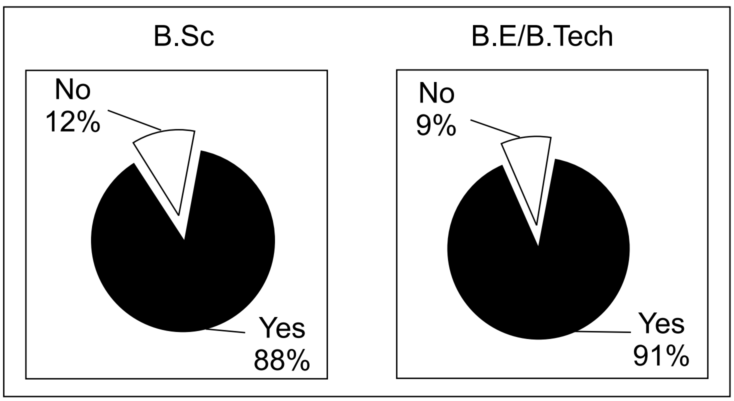

Figure 2: (*c*) Openness in recommending friends to take up such programs

In our study, 64% of science and 70% of engineering students seem to have enhanced their skills with knowledge gained through online programs compared to the traditional teaching. This is a very positive indication (Fig 2*d*). This also indicates that there are relevant courses with relevant information online through which relevant knowledge can be gained with regard to the students' curriculum. This in itself is a skill, wherein a student explores all the online resources and takes up the one that suits him the most in enhancing his knowledge needed for his progress in academics. It is relevant that both the streams have felt the knowledge gain. Only 36% of science and 30% of technical students felt that the online courses did not help them gain the relevant knowledge. This needs attention. Rovai et al (2007) have showed that e-learning students have a stronger intrinsic motivation compared to on campus students who attended the traditional face-face classes. These intrinsic motivation measures are 'to know' 'to accomplish things' and 'to experience stimulation.' Also, graduate students reported stronger intrinsic motivation compared to undergraduate in traditional courses as well as *e*-learning courses. Park et al (2014) compared learning outcomes between video-based *e*-learning and face-to-face lectures through case studies among Korean agricultural students. E-learning gave better results, suggesting that appropriate and well-planned *e*-learning courses are worth undergoing in any subject, including the ones that need hands-on experience with a lot of practical activities similar to agricultural education. If organizations take initiatives in orienting students and extending support in exploring their skills, many more students will be able to utilize these online resources to maximize the knowledge gain.

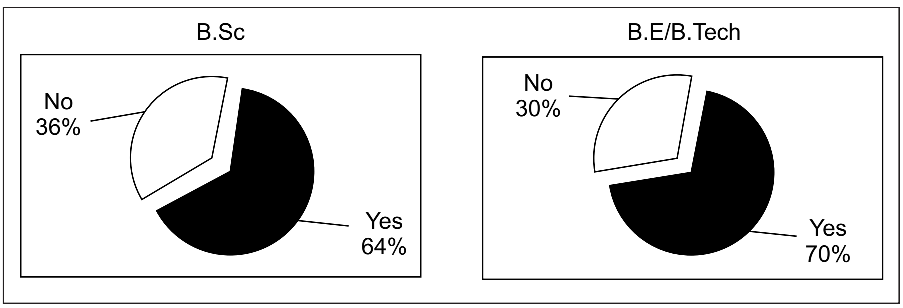

Figure 2: (*d*) Knowledge gain from online programs as compared to traditional teaching programs

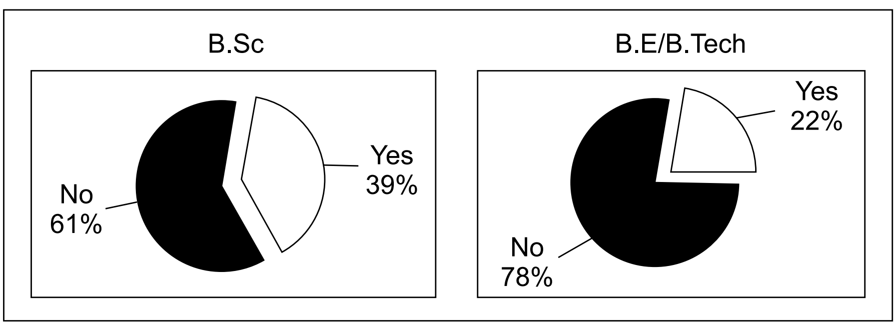

Figure 3: (*a*) Informing teachers about online programs

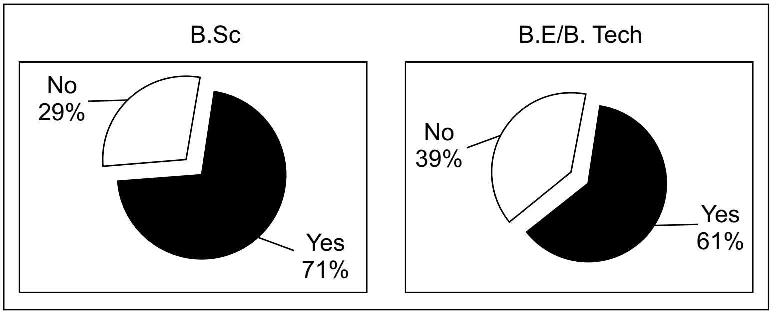

Figure 3: (*b*) Teachers encouragement towards such programs

Not many students in both streams inform their teachers about their online programs. Only 39% do so in the science stream and only 22% in the technical stream. This shows that very less percent of students interact with their teachers about the online courses (Fig 3*a*). Taylor (2006) has observed that instructors' learning curves become steeper with the use of e-learning. Their lives become more complicated till they gain proficiency in using e-learning, but believe that it will ultimately end in a very effective learning experience. A statistical analysis has shown that instructors are very positive towards e-learning and regard it as a useful teaching assisted tool (Liaw et al, 2007). It also revealed that instructors are influenced by perceived usefulness and self-efficacy of e-learning. Students need to have confidence in teachers who can definitely help them in choosing the right courses. Teachers need to be regularly updated and oriented on the online courses available to students and the same needs to be discussed in the class. This will greatly empower and encourage students to explore relevant online courses. If 20 to 25% of online curriculum is made mandatory, students will show better interaction with teachers. 71% of science students and 61% of engineering students felt their teachers encouraged them to take up such programs, whereas 29% and 39% of such students said their teachers never encouraged them (Fig 3*b*). Teacher reluctance is a major hindrance for integration of technology in teacher education (Kleiner et al 2007). Teachers who are also the instructors in e-learning are forced to assume role of content experts, graphic designers, programmers, media producers and instructional designers (Govindasamy (2001). They are expected to do six jobs, but paid only for one as instructors. This is one reason why instructors or teachers resist to the implementation of e-learning. Pierson (2014) studied how teachers at different levels of teaching abilities and technology awareness, used it to show that its use was related to general teaching practice. Factors like teachers' personal definition of technology integration, teacher learning strategies about technology, planning habits on the use of technology and altered perspectives on assessment played a role in teachers' usage of technology. Differences were also associated with individual levels of teaching expertise. In our study, teachers have been encouraging students for online programs. This shows that teachers have also progressively evolved to embrace technology in teaching. However, even with encouragement, the number of enrolments for online courses is less. Maybe students do not want to move away from face-to-face interaction of teachers or they might not be finding enough time to explore or they need some support in getting access and enrolling to such courses. 42% of science and 29% of engineering students felt that such programs can substitute teachers (Fig 3*c*). These students seem to be independent, technology savvy and active learners who do not expect much support from teachers. 58% percent of science students and 71% of engineering students felt that such courses cannot substitute the teacher. These students prefer teacher-centric learning and need support to learn. No doubt, these courses cannot substitute a teacher. Teacher can be a facilitator and guide in helping these students to utilise online resources in a fruitful way. Rodriguez et al (2013) has observed that students need professors' support in any *e*-learning course and that students look up to them for motivation towards completion of the course. This is very crucial and proves that no *e*-learning program can replace teachers at anytime.

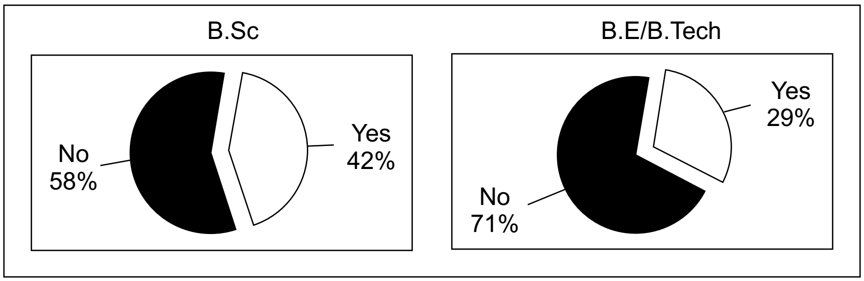

Figure 3: (*c*) Online programs, a substitute for teacher

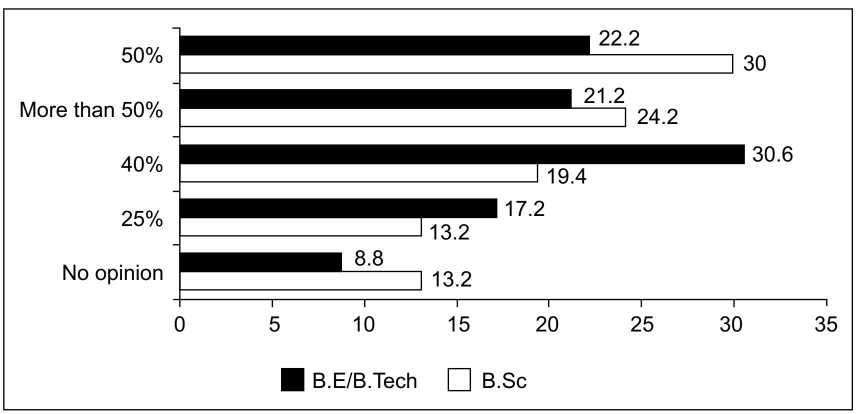

Figure 3: (*d*) Percentage of online courses made available to the students in a structured curriculum

There seems to be a scattered response towards the percentage of online courses to be made available in a structured curriculum (Fig 3*d*). The technology being new to higher education, students do not seem to have much idea about this, but they seem to recognize that it will make a difference to their academics. Lewin et al (2009) has observed that a blended learning curriculum with a combination of web-based modules and face-to-face learning can help students obtain core curricular principles. Online learning has also been called as 'Blended learning' or 'Hybrid Learning and has been defined as a "Pedagogical approach that combines the classroom teaching with technologically enhanced active learning through online" rather than a ratio of delivery modalities (Watson (2008). It has been suggested that blended learning should be approached not as a temporal construct, but as a fundamental redesign of the instructional model with a shift from lecture to learner-centric aspect where students become active and interactive. Enhancement in interaction between student-student, student-instructor, student-outside resource and student-content and lastly mechanisms for integrated formative and summative assessment is also a requirement. Initially to start with, a combination of face-to-face and online content can be made mandatory in suitable proportion. Performance and feedback can be collected from students and staff, which will give further clarity on how students are able to cope up along with the regular traditional classroom teaching. This blending is very much essential in today's Indian education system. This will help us take the higher education to the next level, which is the need of the hour.

CONCLUSION

E-learning in India is seen more in the process of distance education. Some Indian Universities also help students in accessing library resources. Also e-learning is used to further develop rural education in India. Organizations providing engineering courses are using *e*-learning to monitor the quality of classroom teaching and standard of learning in students like CATs and SPC. Engineering students are commonly seen to be using NPTEL program that is provided by Ministry of Human Resource Development. Virtual classrooms by EDUSAT are also gaining popularity.

In trying to understand the awareness of E-learning among engineering and science students, it was found that the former students were ahead in aspects like daily usage, awareness on subject-related online programs, enrolment to online courses, satisfaction levels with online courses and knowledge gained from online programs. No significant differences between the two groups with respect to aspects like willingness to take up online programs in future, recommending online programs to friends has been observed. Science students seem to be at higher level compared to engineering students with respect to informing teachers about online programs, teachers' encouragement towards students taking up online programs and online programs being a substitute to teachers. Overall, e-learning programs that are taken by students is at a very nascent stage in India and needs a lot of improvement. Introduction of blended learning in these classes will encourage the use of *e*-learning among students. Teachers also need to be empowered and trained, so that they embrace this to guide and motivate students. Teachers are yet to see the support and benefits of e-learning as an assisting tool. Changing the mind-set of teachers would be very challenging. Introduction of 'Open book exams' for these courses will also encourage students to look for more online resources, as browsing is more preferred by students than searching a book. Implementation of such programs needs management support and also encouragement to teachers. Further, creating awareness among parents who are important stakeholders will speed up the implementation process. Majority of parents are unaware of how a higher education system works. Awareness about the blended learning and open book exam among parents will definitely play a major role in implementation, as managements will start gaining parental support. Similarly involving relevant industries and all other stakeholders will definitely speed up the implementation process, as stakeholders will also be largely benefitted with these changes in higher education.

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