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RESEARCH PAPER

e-Resources for enhancing effectiveness of teaching for postgraduate students of agricultural sciences

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Abstract: Agriculture education has moved from mere graduating students to producing farmers, scientists, entrepreneurs, employers and every possible essential service provider. The combination of more than 20 different subjects in making the most sought education program in the world is migrating towards a new method of educating students. Albeit agricultural education in traditional classroom teaching had been shaping students with desired knowledge and expertise, current generation living in the information technology era demands more effective and advanced methods of learning. The engagement of e-resources for teaching Post Graduate students of Plant Pathology was studied to know their understanding of a subject, improvement in perseverance of the subject, knowledge, skill and incitation of innovativeness, creativity and other desired changes among the students. E-resources such as videos, 3D videos, live shows, virtual flow charts, life cycles, photos, illustration diagrams, and website documents were used in teaching through a computer on a projector with sound effects. The comparison between regular teaching methods and e-resources had impressive and most desired outcomes among the students. Although, many changes observed were qualitative they could make a high impact among the students and were visible in their performance during examinations. The Plant Pathology subject depends much upon detection and diagnosis of pathogens along with understanding their epidemiology. Engagement of e-resources could help in convincing students much about the subject they are learning with a virtual experience of handling the objects especially in absence of facility at the laboratory or classroom at the time teaching, these e-resources could step in easily for creating impressive and positiveenthusiasm among students. Those with difficulty in expressing their knowledge about the subject learned had the better narration of it. Videos, graphs and process charts could convince them about the subject effectively. Their skill and expertise also improved especially on knowledge and experience of disease diagnosis and deriving conclusions. Engagement of e-resources was found to improve the quality of teaching and saved more time costing for interaction and discussion. Along with conventional classroom method, integration of e-resources were found much coherent.

Key words : Computer, Education, E-resources, Internet

Introduction

The teaching profession has seen dramatic transformation compared to the past century. Ever since computers have walked in libraries and classrooms, their usage has increased many folds as compared to their counterparts namely hardbound books or bulletins, or magazines. Information technology has revolutionized teaching methods and aids. The past century has seen many transformations from classrooms to the world wide web. The scientific innovations in communications and conveyance have made learning more attractive than ever before.In the past two decades, there has been a significant in transformation from paper-based to internet-based electronic knowledge of teaching, learning and publishing. This electronic mode of knowledge got from a physical world to a virtual world in many ways like creating content, storing, transferring and accessing the same at ease and manages the entire gamut of e-resources on a fingertip. The use of e-resources in education also has an aim of enabling learners to think creatively, solve problems, communicate effectively, identify, and analyse existing information(Hungwe, 2012). the electronic resources consist of the data representing numbers, text, graphics, images, maps, moving images, music, sounds, motion pictures, animated videos presentations, etc., and different programs of teaching and instruction set either in the form of videos, e-videos, or PowerPointslides, live demonstrations, etc.

In the past two decades, along with the printed version of every publication, a parallel virtual library is being created and its content in various forms stored in hard drives representing a major source of e-resources and are found useful for teaching especially for students of higher-grade learning in many instituienus' and Universities across the world. Their worldwide access has been helping teachers and students in learning more effective (Bukaliya and Florence, 2021). Courses with a biology background such as Agriculture and Medical sciences are wide and require a detailed understanding of each subject and its content by the students. Unless the teacher has invasive knowledge, information and interesting content, he can't make learning with impressive session. Plant pathology is one such subject in agriculture graduation and post-graduation for specialization. The subject necessitates detailed learning of plant pathogenic viruses which are impossible to visualize through necked eyes and not even in stereo or compound microscope. Their complex interactions with their vectors and host have many interesting and invisible stories to understand. The detailed insightsof their genome, multiplication and transmission are "must to learn the course. The conventional teaching on blackboard with chalk pieces referring to books and journals has its difficulties in conveying the content among the students due to their varying capacity of perception and understanding (Smith and Nigel, 2009). However, it is well-known that seeing is believing and hands-on practical sessions make theory sessions more effective. But it's difficult to organize practical sessions for every topic due to various reasons

including lack of resources. Under such circumstances, e-resources could bridge the gap of conveying content among the learners throughthe visual, thoughtful and practical way.

Material and methods

The present study is aimed to understand the impact of various e-resources engaged in teaching post-graduate students of the plant pathology Department enrolled for plant virology course.Different e-resources such as documentary videos, "youtube" videos, animation videos, process charts, live shows, virtual flow charts, life cycles, photos, illustration diagrams, motion graphs, ray diagrams, web documents, online libraries, 3D diagrams, 3D pictures, graphs, live chats and model diagrams have seen used during the regular theory and practical classes. Though conventional teaching on a blackboard was continued for conveying the message and subject, above mentioned e-resources were used for making learning more interactive and interesting. At the end of the course, student's feedback was collected on their opinion for the e-resources engaged during 2017-18, 2018-19 and 201920 for each of the e-resources engaged on a scoring basis. The impact of e-resources on the performance of students in examinations, their ability to answer the questions and their overall knowledge enhancement was studied.

Results and discussion

Teaching of plant virology course for the postgraduate course had been mainly based on the knowledge and experience of the teacher. However, the present exercise enabled to realize that e-resources change the way of learning to more interesting and impactful. The current generation considers e-resources as major part of modern libraries (Kenchakkanavar, 2014) Among the different e-resources engaged, youtube videos, animation videos, and documentary videos made the highest impact and acceptance by the students with an overall rating of 5.0, 4.8 and 4.7 out of 5.0. These videos could help in teaching students the complex process of virus transmission from a source of inoculum to healthy plants by their vectors through the complex virus-vector interactions. The next best e-resource was presentation slides, where almost resemble blackboard but pre-typed and designed accordingly had a 4.9 rating among students. It could save time and convey much among the students very much. The invasive understanding of gene expression and protein synthesis was key for a detailed understanding of virus replications and this was one of the major challenges for leaving within a scheduled time frame. However, the animated videos could expose the students to this topic so effectively that students wrote the entire event stepwise in their examinations. In countries where resources are scarce and difficult to arrange sophisticated laboratories and teach all the syllabus, e-resources shall play significant role in overcoming such bottlenecks (Mawereand Sai2018).

Usually, the conventional books and notes while teaching could make teaching based on imaginations of the content, however, photos, life cycles, motion graphs and ray diagrams made it a reality in conveying the messages of virus symptoms and their structure with sound acceptability with 4.9, 4.6, 4.5 and 4.5 ratings by the students. Classification of plant viruses and their nomenclature is another key component of plant virology. The books carry the information but till their date of publication only. This drawback while teaching was over came by using online libraries of virus taxonomy with the latest classification details and had a good rating of 4.4. The internet connectivity has helped in accessing the content from anywhere being in class rooms (Morley, 2006). Live chats were arranged with foreign students and scientists working on virus disease for knowing their experience of plant virus diseases and their management. Process charts live shows, and virtual flow charts helped in teaching virus purification and antibody production which is otherwise an activity of two to three months. 3D pictures, diagrams, graphs and process diagrams were used as the useful backbone while teaching virus movement within and across the host cells. The information on plant virus management opportunities was accessed in web documents which is a part of growing library. This has helped in sourcing more and more methods of avoiding the spread, transmission and infection of viruses to new healthy plants. The knowledge of molecular approaches of virus management is quite interesting and students were eager to learn the topic in detail and was made possible by 3D diagrams. Apart from just understanding the topic e-resources could build more self confidence among students and courage to discuss and speak about the subject. Similarly, the use of e-resources and internet resources enabled learners to have a strong interest to explore opportunities (Musingafi and Chaden anga, 2014). This helped build their self-esteem and confidence among their peers and socity. Supporting this view, Suleiman (2011) noted that by

Tabe1. Response of students to e-resources employed in teaching plant virology course

Sl. No.	e-resource	2017-18	2018-19	2019-20	Average
1	Documentary videos	4.6	4.4	5.0	4.7
2	You tube videos	5.0	5.0	5.0	5.0
3	Animation videos	4.8	4.6	5.0	4.8
4	Process charts	4.0	4.2	4.1	4.1
5	Live shows	4.3	4.5	4.2	4.3
6	Virtual flow charts	4.2	4.1	4.3	4.2
7	Life cycles	4.5	4.4	4.8	4.6
8	Photos	4.8	5.0	4.9	4.9
9	Illustration diagrams	4.2	4.1	3.9	4.1
10	Motion Graphs	4.5	4.6	4.7	4.5
11	Ray Diagrams	4.4	4.7	4.3	4.5
12	Web documents	3.7	3.2	4.1	3.7
13	Online libraries	4.3	5.0	4.1	4.4
14	3D diagrams	3.9	4.3	4.5	4.2
15	3D pictures	3.4	3.5	4.0	3.6
16	Graphs	3.1	2.6	3.7	3.1
17	Live chats	4.4	3.6	5.0	4.3
18	Model diagrams	3.6	4.1	4.3	4.0
19	Presentation slides	4.8	5.0	5.0	4.9

(5: Excellent; 4: Very good; 3: Good; 2: Average; 1 Can't Say)

using internet resources in the teaching and process, learners feel good about themselves.

During the COVID-19 lockdown period when on-campus classes were suspended, the virtual teaching was made successful by successful utilization of these e-resources documented and stored in suitable devices. The internet connectivity had brought teachers and students on the single platform of the computer screen like in classrooms during theregularclasses. From the studies, it is very much evident that e-resources can support classroom teaching and make learning very successful both during on and off-campus classes. Many universities across the world are considering and ensuring separate repository of e-resources for their educational instittues based on future prospectus (Joshua and King, 2020) especially to tackle the situations like COVID-19 pandemic. Teachers canalso design their e-resources based upon the content of the syllabus using online resources.

Conclusion

The current generation and its lifestyles are driven by technological innovations and teaching has to use to transform the way it used to be. e-Resources are pillars of future teaching and can transform teaching into more perfect and powerful.

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