Monica Singh
Subject Matter Specialist,
Department of Agricultural
Extension, ICAR-Central Costal
Agricultural Research Institute-
Krishi Vigyan Kendra, North
Goa, Old Goa, Ella, Goa, India

Sandeep Deshmukh
Subject Matter Specialist,
Department of Agricultural
Extension, Dr. Balasaheb
Sawant Konkan Krishi
Vidyapeeth ((DBSKKV))- an
agricultural university; Krishi
Vigyan Kendra (KVK), Lanja,
Ratnagiri, Maharashtra, India

Use of semantic reusable learning objects technology in virtual learning

Monica Singh and Sandeep Deshmukh

Abstract
There is a growing awareness of the important role of open and distance learning in higher education. Also, Open and distance education contributes to social and economic growth and is quickly becoming a recognized and necessary component of educational institutions in both developed and developing countries. Open Distance Learning (ODL) is increasingly seen as the most viable means of expanding educational access while improving educational quality, promoting peer-to-peer cooperation, and providing learners with a greater sense of autonomy and responsibility for learning. It is a type of education in which students work independently at home or at work and connect with teachers and other students using e-mail, electronic forums, videoconferencing, chat rooms, bulletin boards, instant messaging, and other computer-based communication methods. Now a day a new concept of Re-usable Learning Objects (RLO) is used in ODL. It is semantic in approach i.e., computer performs the tasks required to find, search and aggregate information and provide communication with each other more autonomously. RLO is defined as an independent and self-standing unit of learning content that is predisposed to reuse in multiple instruction contextes. It is digital, re-usable, self-contained, small in size (ranging from 2-15 minutes), standardized, searchable (metadata tagging), flexible and cost effective in characteristic. This is a digital educational asset available in a centralized online repository that can be employed, recycled, expanded, and distributed to facilitate teaching and learning. Each RLO supports a single learning objective and uses wide range of multimedia such as text, graphics, image, animation, audio, and video. Some developed RLOs related to Agriculture are available on website www.agrilore.org for five areas namely Nursery Management, High Value Crop production, Integrated Nutrient Management, Integrated Pest Management and Post Harvest Management and Value Addition.

Keywords: Reusable learning objects, virtual learning, distance education

Introduction
The growing accessibility of innovative educational methods and the rising demand for education have placed immense pressure on the conventional education system. Moreover, traditional universities are struggling to meet the needs of countless individuals aspiring to learn. Globalization and increased trade have created a youth-centric market, making it less feasible to quit jobs for higher education. This is where open and distance education emerges as a solution. Open and Distance Education, also known as Open and Distance Learning (ODL), is a well-established educational approach that welcomes all learners.

Distance learning has a history spanning over a century, encompassing various instructional methods, and adapting to technological advancements in delivering educational content and facilitating communication between educators and learners. It involves an educational model where the central aspect of learning is utilizing learning resources instead of attending traditional classroom sessions. In distance learning, learners are physically separated from the educational institution and engage with the content through written communication (letters, emails, fax, or online conferencing), verbal communication (telephone, audio conferencing, video conferencing), or face-to-face tutorials. Learners work with resources independently, with or without the guidance of a tutor or mentor. The objectives of open learners vary widely, from achieving formal qualifications to acquiring job-related skills or pursuing personal interests.

Redecker *et al*. (2009) [5] meticulously dissected the inherent knowledge interwoven within a myriad of web-based applications, encompassing e-learning courses and virtual education platforms. With the advent of semantic web-based technologies, an entire realm of innovative educational opportunities has been unfurled for educators and students alike.

Corresponding Author:
Monica Singh
Subject Matter Specialist,
Department of Agricultural
Extension, ICAR-Central Costal
Agricultural Research Institute-
Krishi Vigyan Kendra, North
Goa, Old Goa, Ella, Goa, India

Hsu (2012) [3], along with the profound insights of Redecker *et al*. (2009) [5] and the astute observations of Yarandi *et al*. (2011) [8], delved into uncharted territory by exploring ground breaking educational methodologies and models that are intricately woven with semantic technologies and applications. These scholars passionately underscore the manifold advantages that reverberate for both educators and students, ushering in an era of enriched educational dynamics. Platforms like Discussion Forums are designed to facilitate dialogue and idea exchange among educators and learners. On a global scale, e-learning equips individuals with intercultural competence, enhancing social and global awareness. Semantic web technologies enable educators and learners to approach topics from diverse cultural, national, and religious viewpoints, which is challenging to achieve in traditional lessons.

e-Learning provides a chance to acquire knowledge while staying in the workplace, utilizing various semantic technologies and applications. Based on research data analysis, several papers explore how semantic web technologies can improve learning processes and outcomes. These technologies are widely recognized as finely attuned to the evolved cognitive mechanisms and learning paradigms shaped by the pervasive influence of information and communication technologies, thereby streamlining the acquisition of knowledge. Moreover, learning objects rooted in semantic technologies serve a diverse spectrum of users, augmenting educational encounters tailored to individual preferences. This methodology empowers adaptable and widely dispersed learning, bestowing learners with a rich tapestry of options to actively participate and immerse themselves in the learning journey.

Features of distance education
Geographical separation between learner and instructor
In distance education, learners and instructors are geographically distant from each other. Unlike traditional education where teachers and students often share a physical location, distance education involves minimal face-to-face interaction. While some contact occurs during counselling, tutoring sessions, summer schools, or personal meetings, the majority of the learning experience is conducted remotely.

Collaborative efforts of educational organizations
Distance education is not the endeavour of a lone instructor; it is a collaborative and organized effort involving multiple individuals within an educational institution. Courses are developed and structured in a way that facilitates learning for students who are physically distant from the institution itself.

Integration of ICTs and multimedia
Traditional education often relies on verbal communication within the classroom, along with tools like overhead projectors and audio-visual aids. In contrast, distance education leverages various mechanical and electronic media-

print, audio, video, teleconferencing, broadcasts, and computers-to deliver content effectively.

Establishment of two-way communication
Distance education places significant emphasis on fostering two-way communication through avenues such as telephone calls, teleconferencing, counselling sessions, and assignments. This helps maintain engagement and interaction between learners and instructors.

Separation from learning cohorts
While group learning is a cornerstone of traditional education, distance education typically separates learners from one another, limiting opportunities for collaborative peer learning. However, advancements in computer technologies have enabled the introduction of group learning through email and computer-mediated conferencing (CMC). Still, the learner remains somewhat detached from the learning cohort.

Industrialized format of education
Distance education follows an industrialized approach. It involves mass production and distribution of learning materials, division of labor, logistical coordination for a large student and counsellor population, and structured operational units that draw from industrial principles and practices.

Learner-centric approach
Distance education is often characterized as learner-centred, with the learner at the core of all teaching and learning interactions. This means that course design and development revolve around the needs and preferences of the learner, in contrast to the traditional system's teacher-centred approach.

Changes in distance education over time
In the past few decades, the Information Communication Technologies revolution has paved the way for the emergence of online learning in distance education. Moreover, distance learning is undergoing transformation due to the following well-established factors:
- Shifts in economic and social contexts
- Escalating youth unemployment rates
- Transition from knowledge creation to knowledge management as primary drivers of change
- Swift expansion of knowledge with a diminishing lifespan
- Emphasis on enhancing human capital through capacity building
- Recognition that investing in human resources is imperative for sustainable development

These shifts have prompted changes in the approach to delivering distance education. The subsequent table illustrates the changing landscape of distance education delivery over time.

Table 1: Generation time features technologies

Generation	Time	Features	Technologies
First	End of 19th-beginning of 20th century	Correspondence learning	Printed material, customized textbooks
Second	Early 1970s	Teleconference (radio & television)	Correspondence, radio, television, audio-tapes, telephone
Third	Early 1980s	One-way video two-way audio communication, real time interaction, two ways videoconference	Communication networks (satellites), audio, video, CD-ROMs, bulletin boards
Fourth	1996 and onwards	Interaction and collaboration, shift from instructor-led to learner-centred approach, student-student interaction	Cyber technologies *viz*., Télécommunications, Internet, Multi-media

Distance education in agriculture

India predominantly relies on agriculture as its primary economic activity. The occupation of the majority of rural inhabitants revolves around farming. It is evident that a significant number of farmers are engaged in subsistence farming due to a lack of formal education. These individuals have been involved in agricultural work since a young age, leaving them with insufficient time for traditional schooling. Additionally, they experience geographical and social isolation, dedicating long hours to their solitary endeavors. Participating in lengthy conventional courses is often not feasible for them. Amidst these circumstances, one crucial aspect emerges: farming practices evolve rapidly alongside advancements in technology. Recognizing this challenge, a handful of institutions in India have taken steps to provide distance education in the field of agriculture. These institutions offer both short-term and extended certificate courses as well as vocational programs focused on agricultural subjects. Within this context, the integration of e-learning and multimedia components has assumed a pivotal role. These tools facilitate education and the enhancement of farmers' capacities by imparting technological knowledge and agricultural expertise.

e-learning/Virtual learning

Despite the substantial role that distance education plays, a significant portion of the population still lacks access to higher education. When examining the landscape of higher education, it becomes evident that despite the proliferation of educational institutions and resources, only a mere 6% of the relevant age group is able to pursue higher education (UNESCO). In this context, the potential of e-learning becomes crucial. E-learning encompasses a diverse range of digitally supported learning and teaching methods. Information and communication systems, whether networked or standalone, serve as specific mediums for implementing the learning process. The term is likely to continue being used to describe both technology-assisted educational experiences that occur within and outside the traditional classroom setting, as technological advancements and curriculum improvements persist. At its core, e-learning involves the transfer of skills and knowledge facilitated by computers and networks. E-learning encompasses a variety of applications and processes, including web-based learning, computer-based learning, opportunities for virtual classrooms, and digital collaboration. Content is disseminated through channels such as the Internet, intranet/extranet, audio or video tapes, satellite TV, and CD-ROMs. Learning can be self-paced or instructor-led, incorporating various media formats such as text, images, animations, streaming videos, and audio.

Here are some advantages and disadvantages associated with e-learning.

Advantages of e-Learning
- Scheduling of classwork can be tailored to accommodate personal and professional commitments.
- Cuts down on expenses and time associated with commuting to and from school.
- Learners are empowered to choose learning materials aligned with their current knowledge level and interests. Studying becomes feasible wherever there's access to a computer and the Internet.
- Learners can engage with self-paced learning modules, allowing them to progress at their individual speed.
- The flexibility to participate in threaded discussions on bulletin boards at any time, as well as virtually connect with peers and instructors through chat rooms, is provided.
- Diverse learning styles are catered to, and learning facilitation occurs through a variety of activities.
- Computer and Internet skills are developed, which can be applied to other aspects of the learners' lives.
- Successful completion of online or computer-based courses fosters self-awareness and self-assurance, motivating students to assume responsibility for their learning journey.

Disadvantages of e-Learning
- Learners who lack motivation or possess inadequate study habits might experience setbacks.
- Adjusting to an unfamiliar structure and routine could require a period of adaptation.
- Students might sense isolation or yearn for social interactions they're accustomed to.
- Instructors may not be instantly accessible at all times.
- Frustration can arise due to sluggish or unstable Internet connections.
- Navigating learning software might entail a learning curve.
- Simulating certain courses, particularly those involving hands-on experiences, can present challenges.

Designing Re-usable learning objects (RLOs)

Crafting e-learning content holds immense significance. In the past, simple hypertext was employed for material design. However, as technology advanced and the era of web 2.0 emerged, the potential to devise engaging and interactive learning materials using diverse multimedia elements arose. These learning materials are often just one facet of the design equation, working in tandem with online activities and collaborative tools. Consequently, the content forms a dynamic amalgamation of materials in varying formats derived from an array of sources, including the learners themselves. In contemporary times, a novel concept is taking shape within the realm of e-learning, referred to as Re-usable Learning Objects. These objects are characterized as follows.

Characteristics of RLOs
- Digitized (accessible around the clock)
- Self-contained – each learning unit stands alone, allowing independent use
- Reusability – a single RLO can serve diverse contexts and purposes
- Discoverable – learning materials are effortlessly locatable, with each RLO tagged using metadata
- RLOs encompass concise learning segments (5-15 minutes) that avoid overwhelming learners
- Adaptable – easily updated and modified to remain relevant
- Uniform – adhere to a consistent organizational framework
- Aggregable – learning objects readily combine into broader content collections, including conventional course structures
- Foster interoperability – seamlessly integrate into Learning Management Systems (e.g., WebCT Vista, Moodle)
- Accommodate the modern learner – tailored to the "Net-

generation learner" adept at multitasking and digital tools
▪ Elevate student-centered learning

These Reusable Learning Objects (RLOs) are meticulously crafted by integrating diverse multimedia components such as text, graphics, animations, audio, and videos. This multimedia blend enhances learners' comprehension and retention. Their profound utilization is particularly notable in technical realms like engineering and medicine, significantly contributing to cohesive student learning experiences. This educational tool garners widespread appreciation in the field of academia.

In the contemporary context, the urgency to replicate such successful initiatives for the agricultural sector is evident. Strides made by exemplary models like Kissan, Agropedia, and Information Kiosk underscore the potential of harnessing the Internet and web platforms to disseminate agricultural knowledge. Recognizing these aspects, the School of Agriculture has pioneered a platform named AgriLORE, with its website domain being www.agrilore.org. This platform serves as a repository for hosting RLOs centered around agriculture. It boasts semantic search capabilities and fosters social interaction through features like discussion boards, one-on-one chats, and group chats.

Agri. LORE's network structure facilitates seamless connections among learners accessing the same RLO, RLOs prepared by a common author, and similar RLOs. The prepared RLOs are meticulously crafted into PowerPoint presentations, aimed at a level of comprehension suitable for individuals with an 8th-grade education. The content is presented in a simple and easily graspable manner, enriched with visuals such as pictures, graphics, and videos where necessary to enhance concept clarity. Special emphasis is placed on conveying knowledge through visual means, utilizing animations and graphics.

These RLOs encompass five overarching themes: nursery management, high-value crop production, integrated nutrient management, integrated pest management, and post-harvest management along with value addition. By opening up these prepared RLOs as educational resources, they become "digitized materials offered freely and openly for educators, students, and self-learners to use and reuse for teaching, learning, and research." These resources are released under intellectual property licenses that permit their free utilization or adaptation by others without any charge.

Conclusions and implications
Open education holds tremendous potential in the upcoming era. It serves as a solution to multifaceted challenges, including teacher shortages, remote learning needs, insufficient funding, and the limitations of small-scale educational institutions in offering specialized subjects. At present, it complements traditional universities, but the trajectory suggests that it may eventually supplant them. E-learning stands as the modern embodiment of distance education, establishing its influence across diverse domains. Traditional universities have embraced this evolution, acknowledging the growing dominance of e-learning. Consequently, prominent traditional universities are transitioning into the virtual realm, signifying a future where virtual universities may replace their brick-and-mortar counterparts. Considering the delivery of content through e-learning, Reusable Learning Objects (RLOs) emerge as a premier content delivery method. RLOs present information through diverse multimedia formats, enabling learners to comprehensively grasp the essence of the conveyed knowledge. In the context of agriculture, the pivotal roles of distance learning and e-learning are poised to bring about transformative effects. Their substantial impact will manifest in the agricultural landscape, offering a pertinent solution for disseminating contemporary and geographically tailored knowledge. This convergence is poised to bridge the divide among farmers, scientists, extension workers, and policy makers, fostering effective collaboration and knowledge exchange.

References
1. Daniel P. Distance Education. 2011; http://tecfa.unige.ch/edu-comp/edu-ws94/contrib/peraya.fm.html
2. Hema N. The future of distance education, 2010. Available on http://www.egyankosh.ac.in/bitstream/123456789/25011/1/Unit2.pdf
3. Hsu IC. Intelligent discovery for learning objects using SW technologies. Educational Technology & Society. 2012;15(1):298–312.
4. Jonathan C. Distance education for Agriculture and Rural Development: The Third Wave, Background paper presented on workshop on Distance education for Agriculture and Rural Development at Reading University on 17-18th; c1998 Feb.
5. Redecker C, Ala-Mutka K, Bacigalupo M, Ferrari A, Punie Y. Learning 2.0: the impact of web 2.0 innovations on education and training in Europe. 2009; Final report, European Commission-Joint Research Centre-Institute for Prospective Technological Studies, Seville.
6. Rutkauskien D, Mark R, Kubiliunas R, Gudonien D. Functional architecture of a service-oriented integrated learning environment. In: Proceedings of European Conference on e-Learning, Nice, France; c2013. p. 431-439.
7. Schmohl R, Baumgarten, U. Context-aware computing: a survey preparing a generalized approach. Engineers and Computer Scientists. 2008;(l):19–21.
8. Yarandi M, Jahankhani. J, Tawil R.A. A personalized adaptive e-learning approach based on SW technology. Webology. 2011;10(2):2011.
9. Zheng Y, Li, L, Zheng, F. Context-awareness support for content recommendation in e-learning environments. Information Management, Innovation Management, and Industrial Engineering. 2009;3:514–517.