UNIT 18   VIRTUAL CLASSROOM AND VIRTUAL REALITY

18.0   INTRODUCTION

Distance education has always been at the receiving end for being asynchronous and theory oriented. Many still believe that practical based courses can't be taught at a distance. At the same time the popular belief is that interaction increases learning. With the advancement of technology, now it is possible to have increased interaction between the teacher and the student and amongst the students on real-time basis. However, they are not available at one place, and they need only to have access to Internet, with a webcam and headphone to be present in a virtual class. Technology has increased the social presence and teacher presence in distance education courses. Many multinational companies having offices in different cities have adopted this technology to reduce travel, and costs and conduct regular meetings via web conference systems.

Practical in science and engineering areas require high tech, high cost machines; and with the advancement in virtual reality, it is possible to have virtual labs in remote areas accessed sitting in the cozy office or home of the learner. Not only the distance has been bridged due to the web conferences, but also the physical sensory touch and tactile movements are possible with the use of virtual reality. In this unit, we will give you an overview of virtual reality in education and the use of web-conference tools.

18.1   LEARNING OUTCOMES

After working through this unit, the learner will be able to:

• *Describe* the use of virtual reality in education;

• *Identify* and use simulation in education;

- *Use* different types of web conferencing tools for teaching;
- *Explain* the use of immersive learning technologies;
- *Describe* the use of Virtual Worlds in education; and
- *Discuss* the advantages of digital games.

18.2 VIRTUAL REALITY IN EDUCATION

Virtual Reality (VR) is the technology that provides almost real and/or believable experience in a synthetic or virtual way. The term refers to "a combination of high speed computers, advanced programming techniques and interactive devices designed to make computer users feel they have stepped into another world, a world constructed by computer data" (Grady, 2003).

Table 18.1: Potential Benefits of a VR Educational System

Potential Use	Benefit compared to traditional methods
Simulation of complex systems	Ability to observe system operation from a number of perspectives aided by high quality visualization and interaction.
Macroscopic and microscopic visualization	Observation of system features that would be either too small or too large to be seen on a normal scale system
Fast and slow time simulation	Ability to control timescale in a dynamic event. This feature could operate like the fast forward or rewind preview of a modern video recorder.
Allow high levels of interactivity	Most people learn faster by 'doing' and the VR system provides much greater levels of interactivity than other computer based systems. Provided that the interfaces are intuitive and easy to use then the degree of interactivity can be very beneficial.
Sense of immersion a powerful characteristic	In some applications the sense of scale is extremely important. For example, architecture is an area where a sense of scale is required to visualise the impact of a building design on the external environment and the the inhabitants.
Inherent flexibility/ adaptability	The inherent flexibility of a VR system comes from the underlying software nature of the virtual environment. A VR system can be put to many uses by loading different application environments. This means that it is feasible to use a VR system for a range of teaching applications. This means that if the system is properly applied it will soon generate cost savings.

Source: http://www.agocg.ac.uk/reports/virtual/vrtech/relevnc1.htm

Virtual reality can assist students to become immersed in a learning environment where they can participate in their own learning in a technology based environment. Though, VR applications are usually designed for training requirement like aviation and vehicle simulators, medical and military training , it can also be used to help in understanding of concepts, complex systems and processes, abstract models and other non-intuitive material. While traditional notions of learning tend to focus on purely intellectual skills, VR can successfully be used to support complex understanding by stimulating and exploring all human senses. VR may be used as a means of enhancing, motivating and stimulating understanding of

certain events, especially those for which the traditional notion of instructional learning have been found inadequate or difficult.

VR has the potential to have major impact on education if appropriately used, as it supports a number of important concepts that might make a difference to education. Table 18.1 presents the potential benefits of VR in education.

18.3   SIMULATIONS

Simulation represents a powerful set of tools that can change the way instructional designers create experiences as well as the way instructors facilitate those experiences. Well designed computer-based simulations can make valuable contribution to student learning. Well planned simulations can provide an environment for conceptualizing and allow students to internalize major concepts. However, it is important that the physical characteristics of a simulated environment must inspire a learner's imagination.

Computer simulations can be powerful tools for analyzing, designing, and interacting with complex systems or processes. Well-designed computer simulations provide a model of those elements most relevant to the immediate learning objective (Lunce, 2004).

Simulations structured by authentic rules that mirror actual results can facilitate learners to model, explore, and try out a variety of strategies. Simulations may include role-playing where they can collaboratively invent, experiment, and practice in a relatively low-risk environment. Experimental simulations provide learners the opportunity to engage in situations that would otherwise be too hazardous or costly to conduct in real situation.

18.3.1   Use in Education

Aldrich (2004) identifies the following elements in educational simulation:

*   Appropriately used linear, cyclical, and systems content
*   Simulation genres, including branching stories, virtual products/ virtual labs, interactive spreadsheets, flight simulator; and 3D maps, as well as new genres to be introduced
*   The appropriate use of genre elements, including modeling, AI, graphics, and interface
*   Creating an atmosphere similar to the atmosphere in which the content will be used
*   Presenting behavior to be modeled or recognized
*   Feedback from a decision (or series of decisions) that shows the natural consequences of the behavior

The Defense Modeling and Simulation Office of US categorizes training simulations into three types (http://en.wikipedia.org/wiki/Simulation):

*   Live simulation — real people use simulated (or "dummy") equipment in the real world;
*   Virtual simulation — real people use simulated equipment in a simulated or virtual environment viz. ;
*   Constructive simulation — simulated people use simulated equipment in a simulated environment viz. war gaming.

There are innumerable examples of use of simulations in education and training. Some important ones are elaborated here to give a glimpse of their usage in educational set up:

1) The **NASA Glenn Research Center** has developed a series of interactive computer programs for students to foster hands-on, inquiry-based learning in science and math. All of the programs are Java applet based which run in browser, on-line, over the World Wide Web. (http://www.grc.nasa.gov/WWW/k-12/freesoftware_page.htm)

2) **Real Lives 2010** is a unique, content rich and empathy-building real world, real life simulation that challenges life skills (not your hand-eye coordination) as one has to make difficult, high-stakes choices that may lead to success, or failure. **Real Lives 2010** is a role playing kind of simulation which makes the world come alive on a personal and global level. It has exciting features 3D animated graphics of all faces in the simulation, family trees, graphs of personal and country statistics, integrated Google Maps and Flickr photos, and more in a user friendly interface. (http://www.educationalsimulations.com/products.html)

3) **PhET** provides fun, interactive, research-based simulations of physical phenomena for free. To help students visually comprehend concepts, PhET simulations animate what is invisible to the eye through the use of graphics and intuitive controls such as click-and-drag manipulation, sliders and radio buttons. In order to further encourage quantitative exploration, the simulations also offer measurement instruments including rulers, stop-watches, voltmeters and thermometers. As the user manipulates these interactive tools, responses are immediately animated thus effectively illustrating cause-and-effect relationships as well as multiple linked representations (motion of the objects, graphs, and the underlying science, deepening their understanding and appreciation of the physical world. (http://phet.colorado.edu)

4) The University of Florida, Department of Anesthesiology has a **Human Patient Simulator** (HPS) technology that has revolutionized the education and training of clinicians worldwide. It also has Virtual Anesthesia Machine which is used for training purposes. http://vam.anest.ufl.edu/simulations/simulationportfolio.php

5) **SimTeacher.com** is an online simulation platform for teacher education. Pre-service teachers may become "SimTeachers" in a virtual school, applying concepts they are learning in their college courses to teaching scenarios in a simulated environment. The virtual schools contain fictional yet interactive characters that add life to the scenarios and personalize the scenario-based learning experience for learners. SimTeachers may perform routine activities, like creating lessons plans, taking attendance or completing an Individualized Educational Plan (IEP). (http://www.simteacher.com).

6) **Google Earth Flight Simulator**: Google Earth Flight Simulator requires Google Earth 4.2 and above to be downloaded into your computer for use. You can choose to fly one of two planes. The F16 is almost impossible to control for novices, so the SR22 propeller plane is the way to go (and offers better sightseeing). You can choose to start from your current position on Google Earth or you can choose from several airports around the world, including the Kathmandu one. (http://www.sajaforum.org/2007/09/web-google-eart.html)

18.3.2 Virtual Laboratories

A virtual laboratory is simply a laboratory experience without the actual laboratory. Physical distances, costly equipment and limited expertise often put constraints on performing experiments. However, it is possible to develop web enabled experiments for remote operation. The virtual labs generally comprise a user-friendly graphical interface, working in synchronization with a back-end, consisting of a simulation-engine running on a server or actual measurement data or a remotely triggered experiment. The central activity in any lab is running experiments and collecting data. For this to succeed, a real virtual lab must include real experiments from which students can collect data that are not predefined in any way.

A virtual lab could simply be a set of simulations put together in the form of Java applets, flash-based demos or interactive animations where student could manipulate various parameters of the simulation and observe the results. The other option could be a virtual lab space where users can create their own experiments by arranging objects/ equipment, or remotely connect them together, modify their properties and observe and collect data.

1) The **iLab project at MIT** provides an open portal to selected remote laboratories at MIT. Through this portal, students, educators, and self learners are given unrestricted access to some of the MIT iLabs. The vision is to create a worldwide network of shared laboratory instruments and educational materials. It is dedicated to the proposition that online laboratories (real laboratories accessed through the Internet) can enrich science and engineering education by greatly expanding the range of experiments that students are exposed to in the course of their education. http://openilabs.mit.edu/

2) **The ChemCollective virtual lab.** A Java applet based lab that allows students to design and carry out their own experiments. It is a National Science Foundation funded project, organized by a group of faculty and staff at Carnegie Mellon University for college and high school teachers who are interested in using, assessing, and/or creating engaging online activities for chemistry education. ChemCollective "Virtual Lab," allows students to design and carry out their own experiments while experiencing representations of chemistry that go beyond what is possible in a physical laboratory. (www.chemcollective.org).

3) **Cogs**. NASA's virtual lab, Connecting a Generation to Science (cogs) is a place for integrating virtual lab to classrooms and provide downloads to access a variety of advanced microscopes and specimens. The Virtual Lab is a suite of microscopes and multi-dimensional, high-resolution image datasets. It is freely available to teachers, and students. The virtual lab includes:

- The Fluorescence (Light) Microscope (LM)
- Scanning Electron Microscopy (SEM)
- Atomic Force Microscope (AFM)
- Energy Dispersive Spectrometer (EDS)

The virtual lab software allows you to access, select, and download from a range of specimens requested by science teachers. There are also tools that allow you and your students to annotate, measure and save images. The virtual lab can be used on computers without the purchase of any additional equipment or access to the Internet. (http://www.nasa-inspired.org/cogs/Cogs_learn.htm)

4) **Rice Virtual Lab in Statistics** is an excellent place to learn statistics that uses interactive multimedia, simulations and case study to learn statistics. See http://onlinestatbook.com/rvls.html

5) **Virtual Lab at Stanford University:** Started in 1998, the virtual lab media library at Stanford University has a many programs for student learning in areas related to Physiology, Biology, Immunology, Brain, Health education, etc. See http://virtuallabs.stanford.edu/

Check Your Progress 18.1

Notes: a) *Write your answers in the space given below.*

b) *Compare your answers with those given at the end of this unit.*

1) Define virtual reality.

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2) Give at lest three uses of simulation in education.

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18.4 WEB CONFERENCING

Internet facilitates real time communication through number of conferencing tools. Conferencing can be in various forms viz., audio/video conferencing, web based chats, bulletin board systems, shared white boards, etc. Conferencing can be in one-to-one, one-to-many (multicast) and many-to-many (multipoint) modes.

Web Conferencing refers to communication and collaboration for remote attendees which combines text, visual and audio for two way interaction. Web conferencing industry evolved from web-based chat and Instant Messenger (IM) software. NetMeeting introduced in late 1990s was first application to offer complete web conferencing solution.

More and more teachers are adopting video conferencing as a method of enhanced communication and instruction. Video conferencing facilitates learning by allowing remote and distant learners to meet regardless of their location.

18.4.1 Chatting

A web chat is a system that allows users to communicate in real time using easily accessible web interfaces. Chat lets you conduct real-time conversations via text, with as many people as you like. It is primarily meant to refer to direct one-on-one chat or text-based group chat (formally also known as synchronous conferencing), using tools such as instant messengers and Internet Relay Chat (IRC).

Instant messaging (IM) is a form of Internet communications that lets you talk in real time to individuals or groups of people. Users create contact lists of friends to chat with and can block people they don't know or don't want to communicate with. Instant messaging differs from traditional e-mail in the sense that communications can be sent and received instantly, in real-time basis.

The typical features of Instant Messengers

Instant messengers generally have the following features:

1) One can **set online status indicating** the availability e.g.: "busy", "away" or "available".

2) Create **contact list** (referred to as a buddy list) indicating list of contacts with whom direct communication can be opened instantly.

3) **Text chat** facility for real-time instant messaging.

4) Maintain **chat history log** to store a full record of all text exchanges with other contacts.

5) Provides **interoperability with other IM networks to** communicate with multiple IM networks simultaneously. This is available in Google Talk, Windows Live Messenger, Yahoo Messenger and ICQ.

6) Organise **group conference** facilitating exchanges among multiple users simultaneously through text chat.

7) Support **VoIP** for audio communication.

8) Support **Video** for video communication.

9) Make **calls to landline and mobile phones** by directly dialing worldwide phone numbers. This is available in Skype and Yahoo Messenger.

10) **Share files and images** directly with persons listed as contacts.

A comparative feature list of some of the popular IM applications is given in Table 18.2.

Table 18.2: Instant Messenger Facts

Features	Skype	Google Talk	Windows Live Messenger	Yahoo Messenger	AIM Pro	ICQ
URL/download	http://www.skype.com/	http://www.google.com/talk/	http://get.live.com/messenger/	http://messenger.yahoo.com/	http://aimpro.premiumservices.aol.com/	http://www.icq.com/
Cross-platform	Win, Mac,Linux, Pocket PC	Win	Win, Mac	Win, Mac, Unix	Win	Win
Web-based access	No	Yes	Yes	Yes	No	No
Multi-network	No	Yes	Yes	Yes	No	Yes
VoIP	Yes	Yes	Yes	Yes	Yes	Yes
Video	Yes	Yes	Yes	Yes	Yes	Yes
PSTN	Yes	No	No	No	No	No
SMS Enabled	Yes	No	Yes	Yes	Yes	Yes
File sending	Yes	Yes	Yes	Yes	Yes	Yes
History (text chat recording)	Yes	Yes	Yes	Yes	Yes	Yes
RSS Support	No	No	No	No	No	No
Open-source/ Proprietary	Proprietary	Proprietary	Proprietary	Proprietary	Proprietary	Proprietary
Cost	Free	Free	Free	Free	Free	Free

Adapted from: http://www.kolabora.com/news/2006/09/28/instant_messaging_tools_and_technology.htm

18.4.2 Web Telephony

In audio conferencing, voice is digitised and sent through the Internet to the final destination. For this you require a headset with earphones, a microphone and conferencing software. Internet can also be used to make telephone calls around the world at a cost of local connection. This can serve as an audio conferencing tool to make computer to computer and at times computer to telephone calls.

Web or Internet telephony refers to communications services like voice, facsimile, and/or voice-messaging applications sent through the Internet, rather than the public switched telephone network (PSTN). Voice over Internet Protocol (VoIP) is a technology that allows you to make voice calls using a broadband Internet connection instead of a regular phone line. **VoIP** is a general term used for a family of transmission technologies for delivery of voice communications over IP networks. Other terms synonymous used are IP *telephony*, *Internet telephony*, *voice over broadband* (VoBB), *broadband telephony*, and *broadband phone*. **Voice over Internet Protocol** is a method by which analog audio signals are converted into digital data that can be transmitted over the Internet. VoIP can turn a standard Internet connection for making **free phone calls.**

There are three different ways in which VoIP services are in common use today:

- **ATA** — Aanalog Telephone Adaptor (ATA) is an analog-to-digital converter that takes the analog signal from traditional phone and converts it into digital data for transmission over the Internet.

- **IP Phones** — Specialized phones that use RJ-45 Ethernet connector to connect directly to router and having all the hardware and software necessary right onboard to handle the IP call.

- **Computer-to-computer** – For this type of VoIP what is needed is application software, a microphone, speakers, a sound card and an Internet connection. There are several vendors offering free or very low-cost software that can be used for this purpose. There is usually no charge for computer-to-computer calls, whatever may be the distance other than the monthly ISP fee.

18.4.3 Video Chatting and Web Conferencing

Video conferencing via the net has enormous potential for enhancing communication in all spheres of life – business, governance, education etc. Video conferencing involves broadcasting and receiving of video signals over the Internet in real-time. For video conferencing the basic requirements are: a video camera (webcam is good enough), microphone, speakers or headphones, sound and video cards with associated software and networking components. Networking can occur over fast Ethernet, TCP/IP (the Internet), cable network or via ISDN (Integrated Services Digital Network). Video-conferencing, however, requires high speed connection for acceptable quality of video output. The bandwidth is the main hindering factor for its wide acceptance as a mode of communication for the general public.

Web conferencing applications come with different levels of facilities. The advanced applications generally have the following features:

- Two way Audio and video interaction among participants

- Slide presentations
- Document/file sharing - the ability to "push" content viz. slides, documents, images, etc. to participants.
- Shared desktop with application sharing facility which provides the instructor with the ability to share the computer desktop with participants or to give keyboard/cursor control of a shared desktop to individual students.
- Shared whiteboards with drawing and annotation tools
- Multimedia playback
- Text messaging - public (viewed by all) and private (person to person) text chat
- Online Quizzes
- Polling and survey tools to be used for assessment, voting and feedback collection
- Virtual hand raising
- Breakout rooms - the facility to "move" users (learners) into virtual rooms for small-group discussion or interaction
- Recording, archiving and playback facility of sessions for future use
- Event management (session scheduling)
- User management (role management viz. moderator, presenter or participant or accepting or blocking users for scheduled sessions)
- Content management
- Reporting and tracking

Most of the features listed above are essentially required to conduct virtual classes in an effective manner. However, all applications may not have all these features. Before procuring or installing any system it is better to assess the requirements and levels of interactivity planned for virtual class delivery.

Web conferencing as a method of communication and instruction is now being adopted by more and more teachers the world over. It enhances learning by facilitating remote or distant learners to meet in virtual space regardless of their location. It can be used in a variety of areas for educational purposes. The most obvious usage is teaching online. It has the ability to gather students to a virtual classroom; speak to them directly; and interact using text, audio and video. It provides a learning experience comparable to a live classroom. Web Conferencing from educational perspective can serve various purposes:

- Imparting distance learning
- Counseling, mentoring or technical help sessions
- Project-based work – project presentation and conducting viva voce
- Faculty and staff collaboration
- Provide access to experts in the field
- Connecting learners with prospective employers

Before adopting any web conferencing facility for imparting education certain issues will have to be dealt with and decisions to be taken for effective utilization of the facility. These are:

1) Connectivity – it is important to remember that all learners may not have access to high speed connection. It is therefore, imperative that the application is set in a way that it is accessible to all.

2) Cross platform delivery – the application must be compatible with all types of operating system and all browsers. There can be problems with pop-up blockers, firewalls, cookie settings, etc. for which proper guidance and technical support must be provided.

3) Client set up — the application must be user friendly requiring minimum intervention on user part to join live sessions. Prior check on client side configuration and online technical support for diagnosing possible technical glitches before session commences is essential for smooth conduct of virtual sessions.

4) Audio/ video quality – differences in microphones, webcams, sound cards, Internet connections, etc. can affect the quality of conference and hence must be tested before hand.

5) Possible abuse of the platform must be avoided with a clear policy on what kind of usage rights are to be given to the moderators, presenters and participants.

18.4.4 Web Conference Tools

All web conferencing tools work in the same way. The person initiating the conference sets up a new meeting in the tool and then invites participants to join by sending them an email containing the meeting's time, date, password, URL and login instructions. Some conferencing tools may ask for installing a small software in the user computer to participate, though many are entirely web-based requiring only an Internet connection. There are many web-conferencing tools, and you must decide which one to be used in your teaching-learning situation. We shall discuss some issues that you may consider while deciding on the right web-conferencing tool for your organization.

Installation and Setup: As mentioned above, some web-conferencing tools require installation of a software or browser plug in. This should be easy and simple, so that the user does not require technical help. But, a system that is completely web-based is preferred more.

Screen sharing: This is a collaborative feature to share resources in one computer with other users in the group.

Multiple presenters: Usually in one synchronous session, more than one presenter is needed to complete it, as expertise may be available in different individuals. The web-conference tool should have such a facility to enable team presentation.

Whiteboard: A collaborative whiteboard is a useful tool to organize virtual brainstorming and collate ideas synchronously. Such whiteboards normally also include drawing tools to illustrate a point using real-time drawing facility.

Annotation tool: During the presentation, participants need to capture ideas for future use. Use of annotation tools such as notes, pen and pencil with erasing facility help learners to record discussion and personalize learning.

Text-chat: This is like instant messaging. It can be used for conference chat and also for private chat. In virtual class, this is a very useful tool to ask question to the teacher and seek clarification. The use of private text chat facility helps to give individualized feedback that is not known to all the learners. Such a facility helps reduce embarrassment to adult learners, when they actually commit mistakes.

Videoconference: This is the most important feature of a web conference tool. It allows the participants to use a webcam and headphone to broadcast video and voice to other participants in the group/session. Multiple users can use such a facility in a system. However, its use by multiple users simultaneously is dependent on the bandwidth available to the users.

File formats and sharing: For presentation, we need some documents to be shared. These documents can be in different file formats, and the system should be compatible. Usually most web-conference systems allow PowerPoint file of different versions to be shared. Beside this, it is also important to have file sharing for download by the participants.

Recording: A virtual class should be available for later use by students who could not participate in synchronous session due to various reasons. The web conference system should have a facility to record and make available the sessions for asynchronous use.

Price: The cost of a web conference system is probably as important as its features. While there are many Open Source applications such as DimDim, OpenMeeting, etc., are available, most institutions use proprietary tools for web conference for ease and support available. However, if you have technical competence available in your institution, an open source system would reduce your costs considerably. There are different types of cost mechanisms that are negotiable with the vendors for using web conference systems. Some of these are: Hosting - pay per use, hosting – annual, perpetual (hosting by the user organization). We suggest you to negotiate with the vendor for a specific costing for your institutional use.

Table 18.3 gives a comparison of features of some of the popular web conference tools.

Table 18.3: Web conference Tools: A Comparison

APPLICATION	Adobe Acrobat ConnectPro	DimDim	Cisco WebEx Meeting	Elluminate Live	Horizon Wimba
Website	http://www.adobe.com/ products/acrobat connectpro	http://www.dim dim.com	http://www.webex.co. in	http://www.ellu minate.com/	http://www.wimba. com/
Software Required	No downloads, supports instant web conferencing for any Windows, Mac, orLinux operating system.	No downloads, supports instant web conferencing for any Windows, Mac, or Linux operating system.	No downloads for participants, will run on any internet server or smart phone mobile device.	Supports Windows, Mac and Linux operating systems, requires Java download	Supports Windows and Mac operating systems, requires Java download
Screen Sharing	Desktop and Applications	Desktop and Applications	Desktop and Applications	Desktop and Applications	Desktop and Applications
Multiple Presenters	Yes	Yes - Max of 4	Yes	Yes	Yes
Annotating Tools	Yes	Yes	Yes	Yes	Yes
Whiteboard	Yes	Yes	Yes	Yes	Yes
Text Chat	Yes	Yes	Yes	Yes	Yes
VoIP	Yes	Yes	Yes	Yes	Yes
Videoconferencing	Yes	Yes	Yes	Yes	Yes
Recording	Yes	Yes with Pro	Yes	Yes	Yes
Polling and Survey	Yes	Yes with Pro	Yes	Yes	Yes
Post-Meeting Reports	Yes	Yes with Pro	Yes	Yes	Yes
Open Source/ Proprietary	Proprietary	Open Source; hosting option with subscription available	Proprietary	Proprietary	Proprietary

18.5 IMMERSIVE LEARNING

Immersive learning refers to an online educational experience which is highly interactive in which the learner is engaged with the content to facilitate the learning. Immersive learning includes the games, online simulations and virtual learning worlds. Immersive experiences extend learning beyond the classroom. It includes the use of virtual worlds and educational games, simulations, role plays, and virtual environments, technologies and activities that support collaboration and enable the learner to be immersed in their learning experience. Immersive learning is not restricted to virtual worlds and may include offline as well as online components and a mixed range of technologies and user experiences.

In immersive virtual environment (IVE) user is perceptually surrounded by his or her sense of presence or actually being within it. People interact with a VE by using any of the perceptual channels, viz. visual (by wearing a head-mounted display or sitting in a projection room eg. caves that project visual display in VE), auditory (e.g., by wearing earphones that help localize sound in VEs), haptic (wearing gloves or other hand held devices that use mechanical feedback on contact with objects), or olfactory (by wearing a nosepiece or collar that releases different smells on approaching different objects in VEs).

Immersive learning is an intense learning and developmental activity that requires a student to progress well beyond merely learning to realize the intention and goal of education. The immersive learning experience is designed to bridge content knowledge, skill of application, societal need, and lifelong learning. Use of virtual immersive environment has several advantages for educational use:

• It helps practicing real world skills with rich feedback in a safe environment

• Mastering a technique, behavior or method through guided rehearsals

• Emotionally connecting the learning to the learner

• Embedding the learning in the proper context by providing a simulation of the actual environment

• Ability for geographically dispersed learners to meet together in a virtual environment

The future of online learning will include IVEs as part of the learning toolkit and has immense potential of enriching the distance learning experience. In the following sections we will be discussing the immersive learning applications viz. Digital games and virtual worlds.

18.5.1 Digital Games

Digital games are defined as "applications using the characteristics of video and computer games to create engaging and immersive learning experiences for delivering specified learning goals, outcomes and experiences" (de Freitas, 2007, p.9). In order to understand digital games better, let us define related terminologies: play, games, computer games and video games.

One of the early proponents of digital games in education is M. Prenskey, who defined *play* as something a person chooses to do as a source of pleasure that is intensely and utterly absorbing and promotes the formation of social groupings (Prensky, 2001). Play has a fun perspective, though it is also engaging and helps us to learn. According to Prensky (2001), a *game* is recognized and organized play that gives us enjoyment and pleasure. *Computer games* are characterized by six elements: rules, challenge, goals and objectives, interaction, outcomes and feedback, and story or representation. Video games and computer games are used synonymously, and now-a-days, the term digital games is becoming more popular. Whitton (2010) says, digital game should be defined on the basis of its key characteristics, and it may also be noted that all games will not exhibit all the characteristics. Table 18.4 shows ten characteristics with their explanations.

Table 18.4: Defining characteristics of Games

Characteristics	Explanations
Competition	The goal is to achieve an outcomes that is superior to others.
Challenge	Tasks require efforts and are non-trivial.
Exploration	There is a context-sensitive environment that can be investigated.
Fantasy	Existence of a make-believe environment, characters or narrative.
Goals	There are explicit aims and objectives.
Interaction	An action will change the state of play and generate feedback.
Outcomes	There are measurable results from game play (e.g. scoring)
People	Other individuals take part.
Rules	The activity is bounded by artificial constraints.
Safety	The activity ha sno consequences in the real world.

Source: Whitton (2010).

Digital games can be categorized into three generations (Egenfeldt-Nielson, 2005):

- **Generation 1:** It has an edutainment perspective with control, inputs, and direct learning as in behaviorism. The tasks are very repetitive and give opportunity to practice certain skills.
- **Generation 2:** It has a cognitive approach, and learner is at the centre of attention. The information is presented in such a way that is appropriate to specific learner. Second generation games use scaffolding, chunking etc. for presentation of information.
- **Generation 3:** The third generation games focus on the use of computer games for education in a meaningful, social situation that facilitated asking the right question and going to the right places for response.

While it is difficult to categorize digital games in the above three generations, as many games fall in more than one group, Gros (2007) lists the following broad genres available:

- **Action Games:** These are reaction based; most of the games are action games.
- **Adventure Games:** The player solves a number of tests in order to progress a virtual world.
- **Fighting Games:** These games involve fighting against computer-controlled characters or those controlled by other people.
- **Role-playing Games:** Human players assume the characters of some person or creature.
- **Simulation:** The player has to succeed within some simplified recreation of a place or situation to achieve a particular goal.
- **Sports Games:** These games are based on sports.
- **Strategy Games:** These games re-create a historical or fictional situation to allow a player to devise an appropriate strategy to achieve a goal.

There are different types of hardware associated with digital games (Mitchell & Savill-Smith, 2004):

- Game machines located in amusement arcades
- Specialized games 'consoles' (powerful computers with high specification graphics capability for use in home, e.g. the Sony PlayStation 2, Microsoft Xbox and Nintendo GameCube)
- Personal computers
- Handheld devices, such as the Nintendo Game Boy, Nintendo DS, PlayStation Portable (PSP), palmtop computers
- Mobile phones
- Other specialized applications (such as airline seats, wristwatches, etc.)

Digital games provide a learning environment that engages the learner, and help them acquire knowledge. They help the learners to adapt to the culture of the information society, which is likely to have long term consequences. It can improve spatial skills ad visual literacy of the learner. The digital games have certain inherent characteristics that help the learners to be engaged. Prensky (2001) identified 12 such characteristics, and Table 18.5 gives how these contribute to learners' engagement. For example, the 'winning' characteristics satisfies 'ego gratification'; 'interaction' leads to 'social group' formation etc.

Table 18.5: Game Characteristics and Engagement

Characteristics	Contribution to engagement
Fun	Enjoyment and pleasure
Play	Intense and passionate involvement
Rules	Structure
Goals	Motivation
Interactive	Doing the activity
Outcomes and feedback	Learning
Adaptive	Flow
Winning	Ego gratification
Conflict/Competition/Challenge	Adrenaline
Problem solving	Sparks creativity
Interaction	Social groups
Story or representation	Emotion

(*Source*: Attewell and Savill-Smith, 2003).

Digital games highlight the eight learning principles given by Oblinger (2004):

- **Active learning:** As the games require the player to interact and progress, the learners are engaged in active learning. Often the rules of a game are built to help mastery learning and skill development through active and repetitive participation.

- **Assessment:** Active gamers can assess their progress within a game and can reflect on skills they require further to achieve the goals. As most games provide score, they can compare their achievement and progress.

- **Feedback:** Being interactive, the games provide immediate feedback, and convey the consequences of correct or incorrect choices. This feature enables the learner/player to learn from their successes and mistakes.

- **Individualization**: Games are designed to help the learner to be immersed through individualized approach of setting names/ persona and levels of complexity.

- **Motivation**: When the tasks in a game are meaningful, and rewarding, the learner becomes motivated. This leads to more time spent by the learners on the game to achieve goals.

- **Scaffolding**: The levels provided in the games provide a gradual increase in complexity, knowledge and skill requirements. At each level, agents may provide relevant, just-in-time support to the learners to gradually progress in a step-by-step manner.

- **Social**: As some of the games can be played in multiplayer mode, they can grow into large communities.

- **Transfer**: Knowledge and skill transfer are the biggest challenges in education. Use of digital games that are realistic and give simulated representation of the real world help transfer better.

18.5.2 Virtual Worlds

"A virtual world is an internet-based, simulated environment where users interact via motionable avatars, graphical images that represent people" (Antonacci et al. 2008). Use of virtual world can foster collaborative learning, and give opportunity to carry out tasks that could be difficult in the real world. Since the virtual words are 3-D environments, they can be used in a variety of ways:

- Discovery learning by clicking on objects
- Reinforcement of learning by offering a repository of learning aids and tools
- Collaborative workspaces, encouraging informal discussions
- Traditional instructor-led learning at a distance
- Simulated learning by modeling a process or interaction that closely resembles the real world

The virtual worlds are platforms enabled by multi-user three dimensional (3D) software environments to provide an effect of real world scenario. Most discussions on virtual worlds today focus on Second Life (see http://secondlife.com). However, there are other virtual worlds such as Kaneva (see http://www.kaneva.com/), Twinity (see http://www.twinity.com/en), The Palace (see http://www.thepalace.com/), etc. These virtual world environments provide broadly four characteristics (Robbins-Bell, 2008):

- *Persistence:* A virtual world can't be paused; it exits whether or not a user is logged in.
- *Multiuser:* A virtual world must be populated or at least have the potential for population.
- *Avatars:* Rather than offering an icon to represent a user, a virtual world allows a user to create an agent that takes action, an avatar that can perform action on the request of the user.
- *Wide Area Network:* A virtual world is facilitated via a wide area network rather than a local machine or a network of workplace.

Virtual worlds show potential and promise for improving teaching and learning by motivating and stimulating the learners through engagement and immersion in the learning event/process. So, it is believed that virtual worlds can be used as a constructivist approach (Coffman and Klinger, 2007). The virtual world environment such as Second Life (SL) provides opportunities for both the student and the teacher to create and manipulate objects in the virtual environment leading to a dynamic and rich learning environment. Subjects like History to Marine Science could be taught using virtual world that would have 'real effect' of teaching in the past or going down the sea. In the learning process, the individual students through their personalized avatars should also be engaged in discussion, debate, designing and decision-making as in a real world. Robbins and Butler (2009) present a pedagogical model for choice of virtual world as a learning platform. They present taxonomy of virtual worlds (first person simulations, gaming world, emergent worlds such as the SL, and task worlds). They further go on to use teaching (objectivist - constructivist) and learning (declarative knowledge – procedural skills) as two dimensions and suggest that use of virtual world in education should be based on clear purpose and adequate planning.

Using Virtual Worlds

To start with you can create a free account in the website of SL. This asks you to create a name for your avatar, and see how you would look like in the virtual world. Though this gives you limited options, it is quite interesting to see oneself in a disguised way! Once you complete the required processes, including the email authentication, you need to download the desktop application and run it in your computer. The minimum system requirements to run the application in Windows are: XP or Vista Operating System, 800 MHz Pentium III or Athlon, or better, 512 MB RAM, 1024X768 pixel screen resolution, On board Graphics Card with NVIDIA GeForce 6600 or better, and Cable or DSL Internet connection. It is better that you have higher

recommended system requirements to run the application without problem, as the heavy multimedia environment requires more RAM and high speed broadband connection. This is surely a limitation for the developing countries to make full usage of the virtual worlds. The SL provides you with orientation to use the system effectively, and then you can use the teleport facility to go to a specific address by using the secondlife universal resource locater (slurl).

As a teacher what you can do is limited by your imagination. Here follows some tips:

- You can use existing virtual worlds (as activity) to design teaching-learning around it. So, you direct your students to a specific slurl and allow them to discover, interact, discuss and prepare reports.
- Create simulation for role-play such as in a business environment.
- Provide virtual experience of space, sea and historical events through existing resources or create your own applications.
- Teach interpersonal communication, team spirit and other soft skills.
- Provide internship opportunities in virtual world.

In whatever way you use virtual worlds, do not forget to provide initial orientation to the learners about the technology, avatars, user interfaces, keyboard short-cuts, etc. (Calongne, 2008). Some time spent on these activities help students to feel not only comfortable about the technology, but also develop social skills required for learning. Based on review of virtual worlds, de Freitas (2008) presents a set of attributes and related questions to be asked while using virtual world. It is presented in Table-18.6 for your reference and use.

Table-18.6: Considering the attributes of virtual worlds for usage

Attributes	Description	Questions for consideration
Learner control	Learner/user control and interactivity through the creation of an avatar.	Would the learner require engagement? Would interactivity help to engage the learner or learner group?
Collaboration	Emphasis upon collaboration and community building.	Are the learning outcomes facilitated through collaborative rather than independent learning approaches? Are the learning outcomes supported through community building and ongoing support?
Persistence	Persistence of the world has led to the capacity for immediacy and synchronous use of the world has appeal.	Would the group require support beyond the seminar face-to-face contact times? Are the learners distributed across a wide geographical area?
Requirement for 3D interactions and experiences	While the user interface is often 3D, this is not always the case. Some social worlds, particularly social worlds for children, are animated and 2D, and some mash-up applications of mirror worlds are distinctly non-3D but rely upon a layering of data and data sets.	Would the learners learn more effectively in a closer to real situation? Are there scenarios of practice that could be role played in virtual worlds? Would experience-based learning benefit the learner group? Could social software and games be integrated into the experience?
Inclusion of sharable and user generated digital content	Most of the virtual worlds have included digital interactive content, be it games (which are particularly popular) or content generated by users to share with others.	Would the learners benefit from a multimodal approach which would use visual and social software tools? Are the learners engaged and motivated by making their own content and sharing it with others?
Immersion and interactivity	Immersion and interactivity are the additional characteristics to include in any list of requirements for a serious virtual world; the user must feel immersed in the environment and fully engaged in the activities being undertaken. This is normally achieved through the representation of the user and environment in-world.	How immersive does the learning experience need to be to convey the learning outcomes? What level of detail is required? Does the learner perform better with more control over what they are attempting?

(*Source*: de Frietas, 2008).

Some examples of virtual worlds are:

- Active Worlds: http://www.activeworlds.com/
- Cyber Town: http://www.cybertown.com/main_ieframes.html
- NASA World Wind: http://worldwind.arc.nasa.gov/
- Media Grid: Immersive Education: http://immersiveeducation.org/
- Qwaq Forum: http://www.qwaq.com/

Check Your Progress 18.3

Notes: a) *Write your answers in the space given below.*

b) *Compare your answers with those given at the end of this unit.*

1) List the defining characteristics of digital games.

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2) List at least four genre of digital games.

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3) What are the characteristics of virtual worlds?

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18.6 LET US SUM UP

In this unit, we discussed the potentials of virtual reality in education, and described the use of simulations, virtual laboratories, virtual worlds, and digital games. We also discussed about the virtual class related technologies such as the Instant Messaging for chatting and web conference tools for conduct of virtual meetings and virtual class. We have given large number of examples in this unit to help you further explore the world of virtual reality. The use of instant messaging has become a common activity in day to day life with the use of GoogleTalk and a number of other messengers, including Skype. While the web conference tools such as Adobe Connect Pro and other proprietary software are quite effective, and need sophisticated server to host, there are also hosting options available with many vendors, which provide trial versions. We identified the criteria to look for while deciding the right web conference tool for your organization. In the end we discussed

the concept on immersive learning that is provided by the digital games and virtual worlds. There are different types of games, and because of their inherent characteristics, these are truly engaging. However, it may be noted that not all characteristics of digital game are present in all the games available in the market. The emergence of SecondLife and many other platforms of virtual world have given a lot of scope for teachers to design and use virtual reality for developing technical skills as well as social skills.

18.7 KEYWORDS

Avatar is a computer user's representation of himself/herself or alter ego in the form of a three-dimensional model used in computer games.

Digital games are applications using the characteristics of video and computer games to create engaging and immersive learning experiences for delivering specified learning goals, outcomes and experiences.

Simulation is the imitation of some real thing, state of affairs, or process.

Virtual reality: is an artificial environment that is created with software and presented to the user in such a way that the user accepts it as a real environment.

Virtual world is an internet-based, simulated environment where users interact via motionable avatars, graphical images that represent people

18.8 REFERENCES AND FURTHER READINGS

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18.9 FEEDBACK TO CHECK YOUR PROGRESS QUESTIONS

Check Your Progress 18.1

1) It is an environment created with a combination of high speed computer, advanced programming techniques, and interactive haptic devices to give the user a feeling of a real world in effect.

2) Simulations are structures by authentic rules. Your response may include any of the following:
   - It can be as simple as interactive spreadsheet for income tax calculation.
   - It can be used for modeling system before actual design.
   - It can help take decision by considering multiple factors, as in the game SimCity.
   - Teach high risk skills such as aviation and sophisticated medial surgery.
   - Teach space science and technology.
   - Create science labs.

Check Your Progress 18.2

1) Common features of Instant Messaging software, such as MSN, YahooMessanger, Skype, GoogleTalk, etc. are:
   - Online status showing busy, available, away
   - Contact list
   - Text chat

- Chat history
- Group conference
- VoIP
- Video communication
- Calls to alndline and mobile phones
- File sharing, etc.

2) Three ways to VoIP use are: use of analog to digital converter, specialized IP phones, and software enabled applications.

3) Main features of a web-conference tool are:
- Video conference
- Whiteboard
- Screen sharing
- Multiple presenters
- Annotation
- Text chat (public and private)
- File sharing
- Session recording

Check Your Progress 18.3

1) The defining characteristics of digital games are: competition, challenge, exploration, fantasy, goal, interaction, outcomes, people, rules and safety.

2) Your response may include any four of the following:
- Adventure games
- Action games
- Fighting games
- Sports games
- Role playing games
- Simulations
- Strategy games

3) The virtual world environments have the following four characteristics:
- Persistence – the environment exist whether or not users are online
- Multiuser – it must be populated with more than one user, or have the potential for the same
- Avatars – Rather than using icons to represent users, it should have avatar to present themselves
- Wide Area Network – the virtual words are not desktop applications, and they are available only on the Internet.