

Designing learner-centric e-learning in STEM disciplines
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Lecture - 21
Selection and Analysis of Effective Technology

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Technology can be used to foster learning by:

- Exploring resources
- Constructing knowledge
- Connecting to real-world problems
- Connecting to online communities for collaboration



Hello to all as we all know technology can be used to foster learning in various ways. This includes exploring different resources on the internet, constructing your knowledge using tools such as concept maps, connecting to real whole problems using simulations and game based learning or connecting to various online communities for collaboration.

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However, an important thing to remember here is that mere use of technology cannot help in promoting effective learning. Technology works best in partnership with effective pedagogical strategies which implies that we need to consider effective integration of technology for meaningful learning.

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Effective Integration of ICT

ICT functioning as an integral or mediated tool to accomplish specific teaching or learning activities to meet certain instructional objectives (Lim & Hang, 2003).

Effective integration of ICT is achieved when instructors design student centered, active learning activities exploiting the affordances of the ICT tool (Mishra & Koehler, 2006; Angeli & Valanides, 2009; Tsai & Chai, 2014).

Learner-centric Design of E-learning

Effective integration of ICT is often interpreted as ICT function as an integral or a mediated tool to accomplish specific teaching and learning our activities to meet certain instructional objectives. Also studies have suggested that effective integration of ICT is achieved when instructors design student centered active learning activities exploiting the affordances of the ICT tool.

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The slide features a woman on the left side, speaking. The background is a light orange color. At the top, there is a dark orange banner with the text "Reflection Spot" and several small icons. The main text asks for an opinion on three different technology integration goals. The slide also includes a small logo in the bottom left corner and the text "Learner-centric Design of E-learning" at the bottom center.

Reflection Spot

Three instructors integrated sophisticated technologies into their e-learning content; however with different goals in mind. According to you, which of the following instructors seem to follow an effective integration of technology?

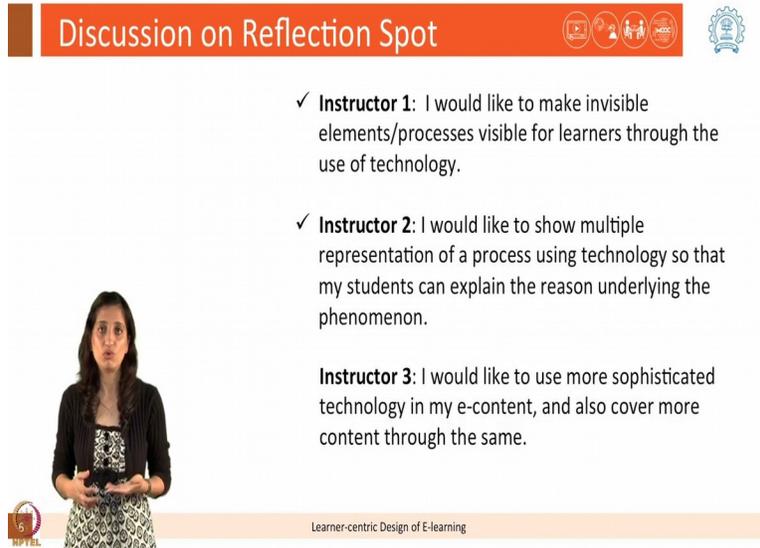
- **Instructor 1:** I would like to make invisible elements/processes visible for learners through the use of technology.
- **Instructor 2:** I would like to show multiple representation of a process using technology so that my students can explain the reason underlying the phenomenon.
- **Instructor 3:** I would like to use more sophisticated technology in my e-content, and also cover more content through the same.

Learner-centric Design of E-learning

Before we get to know more on integration of technology, let us do a reflection spott. Three instructors integrated sophisticated technology into their e-learning content; however, with different goals in mind. According to you which of the following instructors seem to follow effective integration of technology?

Instructor 1 says that I would like to make invisible elements processes visible for learners through the use of technology. Instructor 2 says that I would like to show multiple representations of a process using technology so, that my students can explain the reason underlying the phenomenon. Whereas, instructors 3 says that I would like to use more sophisticated technology in my content and would also like to cover more content through the same.

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The slide features a title bar with the text "Discussion on Reflection Spot" and several icons. Below the title bar, there are three bullet points, each starting with a checkmark and the label "Instructor 1:", "Instructor 2:", and "Instructor 3:". To the left of the text is a small video frame showing a woman with dark hair, wearing a black cardigan over a patterned dress, speaking. At the bottom left of the slide is a small circular logo with the number "5" and the text "NPTEL". At the bottom center is a light orange bar with the text "Learner-centric Design of E-learning".

Discussion on Reflection Spot

- ✓ **Instructor 1:** I would like to make invisible elements/processes visible for learners through the use of technology.
- ✓ **Instructor 2:** I would like to show multiple representation of a process using technology so that my students can explain the reason underlying the phenomenon.
- Instructor 3:** I would like to use more sophisticated technology in my e-content, and also cover more content through the same.

5 NPTEL

Learner-centric Design of E-learning

Well instructor 1 seems to focus on learning and emphasizes on making some invisible processes, elements visible to the learners with the use of technology which seems like an effective use of technology. Instructor 2 again wants to exploit the affordances of technology to make learners understand the underlying phenomenon which again is an effective use of technology.

Now, instructor 3 seems to have two goals here one of which is to use more sophisticated technology in the e-content which itself does not accomplish any teaching learning objectives and thus does not seem like an effective integration of technology. However, the second point stated here is that instructor wants to cover more content which may imply enhancing efficiency by use of visualizations to demonstrate complicated molecular reactions in the cells which may save time, effort as well as resources.

So, from that perspective it may be partially correct thus the instructional designers are likely to use technology if they clearly see the benefits of technology over the old traditional practices of teaching. They are a different kinds of relative advantages of technology that may be considered.

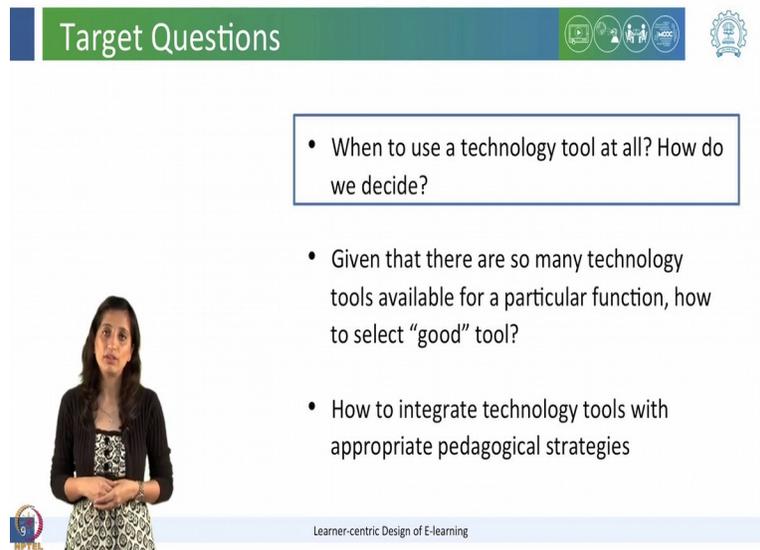
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Relative Advantage of Technology	
Effectiveness Learning of content/skills Making invisible processes/elements visible	Accessibility Scale Large numbers and diverse groups
Attractiveness Attracting learner Engagement, motivation, visual attractiveness	Efficiency Saving resources Cost, time, effort, manpower, space



Here is a technology enhanced learning metrics which includes effectiveness which entails learning of content and skills, it includes accessibility which entails reaching to large numbers and diverse groups attractiveness which entails attracting learners by engaging them, motivating them and visual attractiveness. And, efficiency as we discussed which entails saving of resources such as cost time manpower or space. However, in this LED we will mostly focus on the relative advantage of technology in learning of content and skills.

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The slide features a green header with the text "Target Questions". To the right of the header are four circular icons representing different aspects of e-learning: a person at a computer, a person with a gear, a person with a lightbulb, and a person with a gear. Further right is a circular logo with a gear and a person. Below the header, a woman in a black and white patterned dress stands with her hands clasped. To her right, a blue-bordered box contains three bullet points. At the bottom left is the NPTEL logo, and at the bottom center is the text "Learner-centric Design of E-learning".

Target Questions

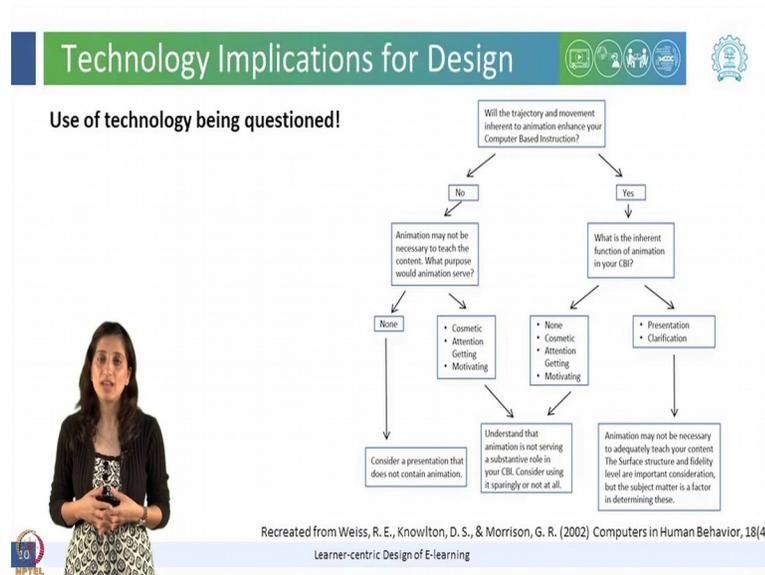
- When to use a technology tool at all? How do we decide?
- Given that there are so many technology tools available for a particular function, how to select “good” tool?
- How to integrate technology tools with appropriate pedagogical strategies

Learner-centric Design of E-learning

So, here we will try to address three important questions. First when to use a technology tool at all? How do we decide that? The second is given that there are so many technology tools available for a particular function how to select a good tool? And third is how to integrate technology with appropriate pedagogical strategies? So, let us start with the question when to use a technology tool at all.

As opportunities for sophisticated ICT tools have increased tremendously, it has become very easy for instructional designers to incorporate a range of these technology tools or software in the design of their e-content. Designers should; however, first ask for the potential of the technology to contribute to student learning before investing the resources and development.

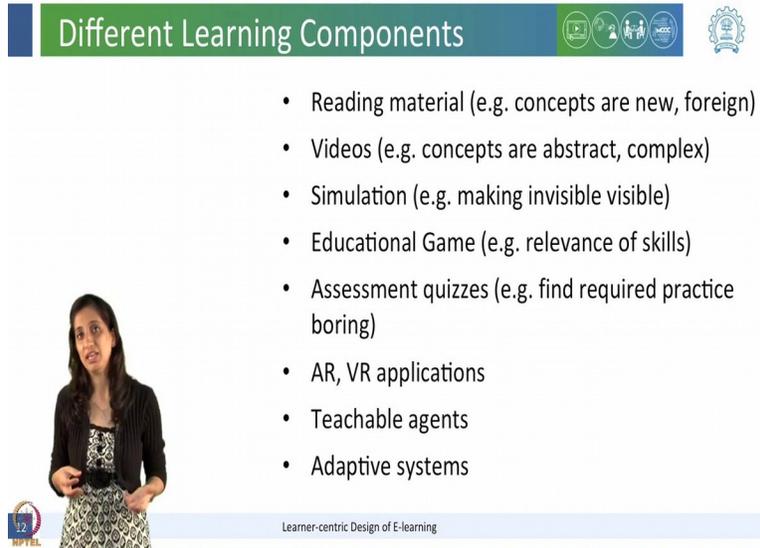
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One such example is shown from a study which questions the viability of using animations in multimedia and computer based instructions. Here the questions have been asked such as will animation be able to enhance computer based instruction; if not what is the purpose that animation is serving? Is it cosmetic getting attention or others?

If yes what is the function of animation in your instructional design? The point is that it is very important for an instructional designer to have a clear understanding about the fit of a particular technology for its purpose. Now, given that there are so many technology tools available for a particular function how to select a good tool?

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The slide features a green header with the title "Different Learning Components". To the right of the title are four circular icons representing different learning methods: a book, a video camera, a person at a computer, and a gear. Further right is a circular logo with a gear and a person. Below the header is a bulleted list of learning components. On the left side of the slide, there is a small image of a woman in a black jacket and patterned dress, holding a microphone. At the bottom left is a small logo with the number "12" and the text "NPTEL". At the bottom center, there is a light blue bar with the text "Learner-centric Design of E-learning".

Different Learning Components

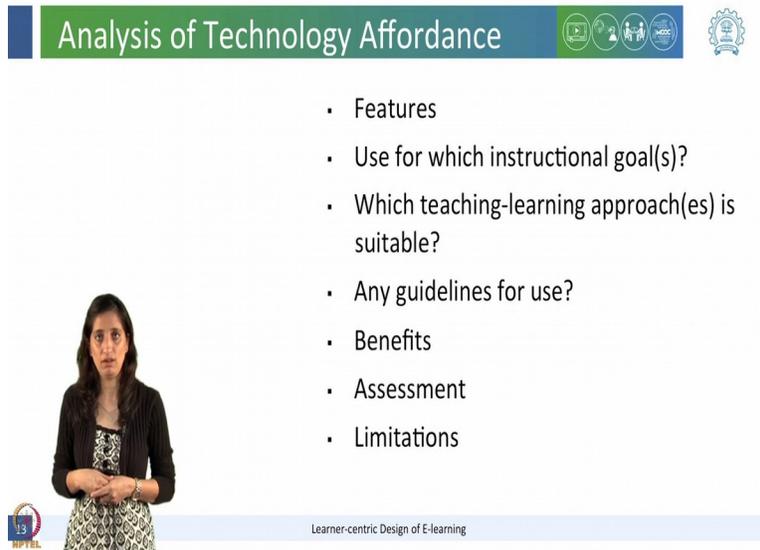
- Reading material (e.g. concepts are new, foreign)
- Videos (e.g. concepts are abstract, complex)
- Simulation (e.g. making invisible visible)
- Educational Game (e.g. relevance of skills)
- Assessment quizzes (e.g. find required practice boring)
- AR, VR applications
- Teachable agents
- Adaptive systems

Learner-centric Design of E-learning

So, the e-learning content can comprise of various learning elements including reading materials, videos, simulation, educational games, assessment, quizzes, teachable agents, adaptive systems. But, these different learning components are utilized for different purposes like reading material is used when the concepts are new or foreign.

Videos are used when the concepts are abstract or complex simulations are used when you want to make invisible processes or elements visible. Educational games can make learners understand the relevance of skills and so forth and so on. However, it should start with clearly defining the learning outcomes and then exploiting the functionality and affordances of the technology tools to answer if the tool is able to best achieve those learning outcomes. There is a set of criteria which can be used to analyze the technology affordances and if it best fits the purpose of the learning outcome.

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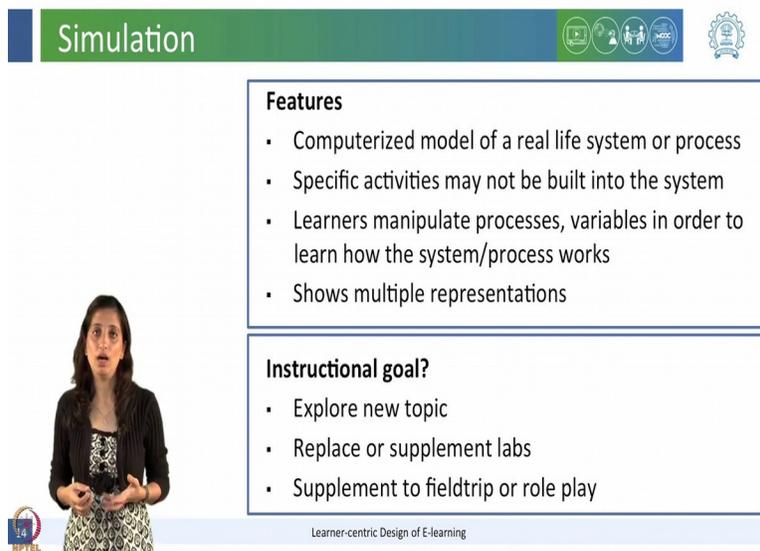
Analysis of Technology Affordance

- Features
- Use for which instructional goal(s)?
- Which teaching-learning approach(es) is suitable?
- Any guidelines for use?
- Benefits
- Assessment
- Limitations

Learner-centric Design of E-learning

The analysis stands for listing down the features of the tool understanding as to which instructional goals does it serve? Which teaching learning approaches will be suitable with this tool? Are there any guidelines to use this tool? The use of the tool in assessment and any limitations, if there are.

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Simulation

Features

- Computerized model of a real life system or process
- Specific activities may not be built into the system
- Learners manipulate processes, variables in order to learn how the system/process works
- Shows multiple representations

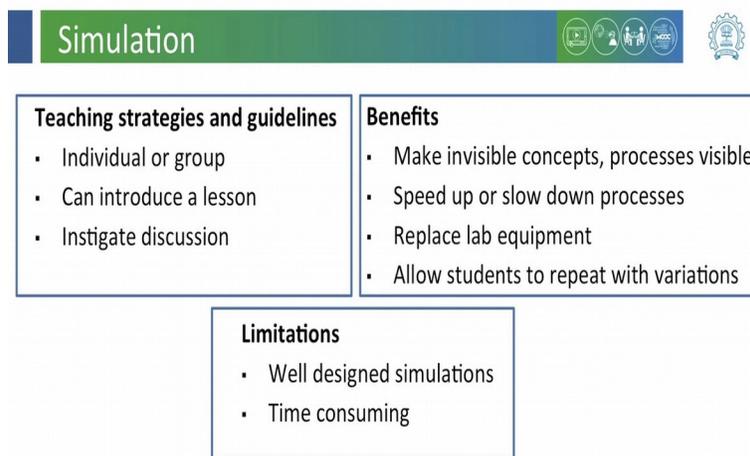
Instructional goal?

- Explore new topic
- Replace or supplement labs
- Supplement to fieldtrip or role play

Learner-centric Design of E-learning

Here we will use example of simulation to show you how we can analyze the affordances of a technology tool. Simulation for example, is a computerized model of a real life system or process where specific activities may not be built into the system learners can manipulate processes variables to learn how the system process works. Or it may also show multiple representations of the process like a graph diagram, equations etcetera. The instructional goal of a simulation can be to explore a new topic a replace or supplement lab work a supplement to field trip or role play.

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Simulation can be given as an individual or a group task, it can be used to introduce new lesson by students having to play with it or it can be used to instigate a discussion. An important benefit of simulation is that it helps make invisible processes, concepts visible for example, atoms molecules molecular reactions it can speed up processes like how earthquake falls developed, population growth or slow down processes like what happens when the ball is bounced, bounces off the floor.

It can replace lab equipments if they are unavailable or they are expensive or they are unsafe, also allows the students to repeat with variations. While one of the limitations here is that we need to choose well designed simulations for accurate depiction of models which if not done

appropriately can lead to misconceptions amongst learners, also it can be time consuming to design such simulations.

Hence, it is very important to understand these affordances and limitations of technology before integrating them in our e-content. We will continue to discuss more about the integration of technology in e-content in our next LED.

Thank you.