Design Principles and Emerging Technologies for E-content

Design

Dr. Kaushal Kumar Bhagat
Centre for Educational Technology
Indian Institute of Technology Kharagpur
Challenges

- Meaningful
- Joyful/Enjoyable
- Interactive
- Effective
What is Multimedia Learning?
Basic components

• Working memory: A cognitive system with a limited capacity that is responsible for temporarily holding information available for processing.

• Long-term memory: Place where informative knowledge is held indefinitely

• Cognitive load: the effort being used in the working memory to process the information
Types of cognitive load

• Intrinsic Cognitive Load (non-altered): those elements that must be processed simultaneously.

• Extraneous Cognitive Load (non-desirable): those elements that require additional mental processing but do not add to the learning experience.

• Germaine Cognitive Load (desirable): those elements that help the learner transfer information from short-term memory into long-term memory and vice versa.
Types of cognitive load

The Good, the Bad and the Ugly

EXTRANEOUS CL
Imposed by the manner in which information is presented to learners

INTRINSIC CL
Imposed by the learning task

GERMANE CL
Devoted to processing information, constructing & automating schemas
PRINCIPLES

- Coherence Principle
- Contiguity Principle
- Signaling Principle
- Multimedia Principle
- Image Principle
- Modality Principle
- Redundancy Principle
- Pre-Training Principle
- Personalization Principle
- Voice Principle

(Mayer, 2005)
Redundancy Principle

Animation + Narration
Animation + Narration + On-Screen Text (Redundant)
Coherence Principle

Avoid unnecessary graphics, words and sounds from the lesson.
Less is More !!!!
Multimedia Principle

Pictures + Words
Students learn more deeply from animation & narration than from animation & on-screen text.
Contiguity Principle

In the above example, the contiguity principle is followed because the labels for the parts of the brain are placed physically near the parts of the brain to which they correspond.

In the above example, the contiguity principle is violated because the labels indicating the parts of the brain are physically separated from the image of the brain.
Signaling Principle

People learn more deeply from a multimedia message when cues are added that highlight the critical aspects of the presented information.
Personalization Principle

Students learn more deeply from animation and narration when the narration is in conversational rather than formal style.
Pre-training Principle

Students learn more deeply from a multimedia when they know the names and characteristics of the main concepts.

Body VR: Journey Inside a Cell

The pre-training material

Segmenting Principle

Students learn better when multimedia message is presented in user-paced segments than a continuous unit.

Voice Principle

People learn better when narration is spoken in a human voice rather than a machine voice.
### Example

<table>
<thead>
<tr>
<th>Principle</th>
<th>Corresponding Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multimedia Principle</td>
<td>Bulleted text replaced by pictures</td>
</tr>
<tr>
<td>Coherence Principle</td>
<td>All pictures and text directly not related to context deleted</td>
</tr>
<tr>
<td>Spatial Contiguity</td>
<td>Graphs and related text appeared contiguously on the screen</td>
</tr>
<tr>
<td>Signalling Principle</td>
<td>Important points highlighted by larger font and different colour scheme</td>
</tr>
<tr>
<td>Temporal Contiguity</td>
<td>Graphs and related/explanatory text presented in same slide</td>
</tr>
<tr>
<td>Modality Principle</td>
<td>Slides representing complex phenomena converted to pictures or graphs and explained through narration</td>
</tr>
</tbody>
</table>

**Oxygen Delivery vs. Consumption**

- You can increase your delivery but you can not control your consumption as it is a function of tissue physiology.
- You have to meet your tissue’s requirements or else you will accelerate lactic acid production and tissue ischemia.
- Critical $DO_2$ is that point were $DO_2$ meets $VO_2$ and tissues are utilizing aerobic metabolism.
- Up till that point there is an inverse relation between $DO_2$ and $VO_2$ a state we call flow dependent.

---

“You are not designing for yourself”
Technologies for E-Content Development
Tools for E-content designers

- Authoring Tools
- Interactive Content Tools
- Video tools
• **Course Authoring Software**: It enable Instructional Designers to put together different types of media to create engaging and interactive course content. Example: CourseLab, Glo Maker, etc.

• **Screen capture software**: It helps to capture/record any part of their screen, video calls, audio overlays, and also screencast. Example: Open Broadcaster Software, CamStudio, etc.

• **Interactive Learning software**: To develop interacting games to teach some concepts or game-based assessments. Example: Augmented reality, Virtual reality, etc.
Emerging Technologies in the 21st Century

- Augmented reality
- Virtual reality
- Mixed reality
- H5P
What is Augmented Reality?

AR as a system having three basic characteristics:

• Combines reality with a virtual world

• Interactive in real time

• Supports 3-D visualization

Azuma (1997)
2016: The Year of Virtual Reality
2016 became "year one" of virtual reality in China, due to the fact that the sector finally truly started to grow. My company Niko Partners estimates China’s VR hardware 2016 market size will hit $300 million by the end of this month with mobile VR being the unequivocal leader in terms of hardware unit sales. Virtual reality overall has been embraced in China more than the West and Chinese consumers have shown a willingness to go out and purchase VR devices or experiences, whereas consumer interest in the West has been somewhat muted.
Definition of VR

• Technological perspective: VR is a collection of diverse technologies with interactive means. VR integrates a set of multiple media in a three-dimensional environment such as audio, text, video, image, and so on.

• Psychological perspective: VR was defined as a particular type of experience instead of a technology. It is the psychological sense of “being there” in the environment generated by VR.
Main types and Characteristics of VR
3I Characteristics of VR

- Immersion
- Interaction
- Imagination
Advantages of AR over VR

• Multimedia and multisensory display

• Portable and Cost-effective

• User friendly (no sense of nausea/motion sickness/cybersickness)
Different modes of teaching

- Traditional mode of teaching
- Flipped classroom
- Beyond flipped classroom teaching mode
Real models

Over the past decades

Simple Cubic (SC)  Body Centered Cubic (BCC)  Face Centered Cubic (FCC)  Hexagonal Close Packed (HCP)
Augmented Reality (AR)

In this study

Simple Cubic (SC)  Body Centered Cubic (BCC)  Face Centered Cubic (FCC)  Hexagonal Close Packed (HCP)
Demo
The idea is to give teachers a free platform for creating 360VR experiences. 360 images/videos with superimposed text and pictures
Features of Immersive 360 VR

Phase 1

• Teacher can upload content on the platform

• Teacher can create the story, organizes the videos and pictures based on some storyboard

• Teacher can export the experience for desktop-VR or another stand-alone device so that the student can receive it and use it
Features of Immersive 360 VR

Phase 2

• Teacher can gamify the experience (gamified assessment being part of it).

• Basic feature: teachers allows the user to take a quiz before he moves on to the next scene in the experience

• A list of gamification features can be implemented: Glossary, HotPot, Badges etc.
Features of Immersive 360 VR

Phase 3

- A feature for a guided tour, where a teacher is connected to the student’s devices and directs attention on specific points through the system.
Open Source Tools and Platforms for E-Content Development
VirtualDub

- Open source tool to record, process and watch video
- Not only making video and audio records but also can edit different parameters of both audio and video files
Blender

• Open source for 3D creation

• Modeling, rigging, animation, simulation, rendering, compositing and motion tracking, video editing and 2D animation
Open Source Simulation platform

- AnyLogic (https://www.anylogic.com/s/download-free-simulation-software-for-education/)
- PhET (https://phet.colorado.edu/)
- WISE (https://wise.berkeley.edu/about)
- GeoGebra (https://www.geogebra.org/)
- CoSci (https://cosci.tw/)
Software for AR/VR interactive content development
Copyright Licenses and Open Educational Resources
What is copyright?

• Legal rights of the owner of intellectual property.

• Intellectual property for example: includes recorded audio/video, written article, snapped photograph

• Other people can not reuse or edit your work without your permission
Creative Common License

• Publishing under a Creative Common License

• A CC License gives flexibility to decide which rights you want to give and which you want to keep
License features

**Attribution**: Others who use your work in any way must give you credit the way you request. If they want to use your work without giving you credit they must get your permission first.

**ShareAlike**: You let others copy, distribute, display, perform, and modify your work, as long as they distribute any modified work on the same terms. If they want to distribute modified works under other terms, they must get your permission first.

**NoDerivs**: You let others copy, distribute, display, perform, and modify your work, as long as they distribute any modified work on the same terms. If they want to distribute modified works under other terms, they must get your permission first.

**NonCommercial**: You let others copy, distribute, display, perform, and (unless you have chosen NoDerivs) modify and use your work for any purpose other than commercially unless they get your permission first.
Different types of Licenses

- CC BY
- CC BY-SA
- CC BY-ND
- CC BY-NC
- CC BY-NC-SA
- CC BY-NC-ND
Open Educational Resources

Open educational resources (OER) are free and openly licensed educational materials that can be used for teaching, learning, research, and other purposes.
List of OER platforms

• OER Commons (https://www.oercommons.org/)

• OASIS (https://oasis.geneseo.edu/)

• National Digital Library (https://ndl.iitkgp.ac.in/)

• Open Source Physics (https://www.compadre.org/osp/?)
Comments and Questions?

Thank you

kknntnu@hotmail.com