

IMPACT OF MODERN EDUCATIONAL TECHNOLOGIES ON LEARNING OUTCOMES

Application for e-Learning in Biomedical Engineering

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KEY TERMS

Biomedical engineering

- Multidisciplinary field of science:
 - Significant impact on human health and well-being,
 - Advanced knowledge in engineering, biology and medicine.

Educational technology

- Goal oriented problem-solving approach utilizing tools, techniques, theories and methods from multiple knowledge domain.

E-Learning

- The use of various technological tools that are either Web-based, Web-distributed or Web-capable for the purpose of education.

Virtual campus

- Open system for for the desing, deployment and evaluation of reusable learning materials.

Learning outcomes

- Statements what students are expected to achieve.



BIOMEDICAL ENGINEERING

- Bioelectromagnetism
- Biomechanics
- Prosthetic devices and artificial organs
- Medical imaging
- Biomaterials
- Biotechnology
- Tissue engineering
- Neural engineering
- Biomedical instrumentation
- Bionanotechnology
- Physiological modeling
- Rehabilitation engineering
- Medical and bioinformatics
- Clinical engineering
- Biosensors
- Medical and biological analysis
- ...



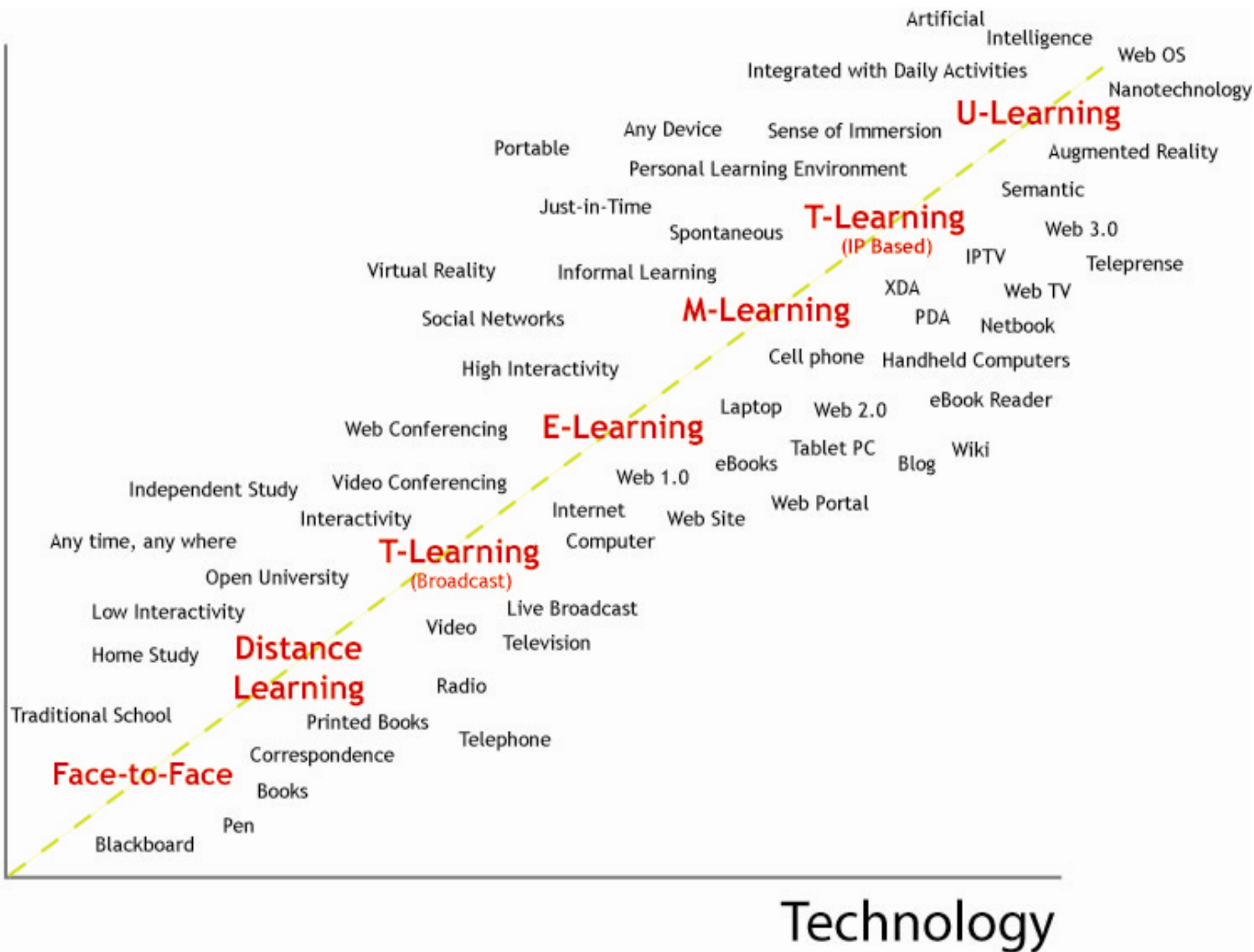
EDUCATIONAL TECHNOLOGY

- Internet and World Wide Web
 - Web-based applications
 - E-mail, chat, and instant messaging replacing traditional forms of communication
- Mobile Technologies
 - Personal handheld computers
 - Cell phones
 - Laptops
 - Wireless devices
- Video Transmission
 - Conferencing
 - Internet-based
 - Cell-phone based
- Internet2
 - Video streaming of multimedia content
 - Use of remote instruments such as microscopes

...



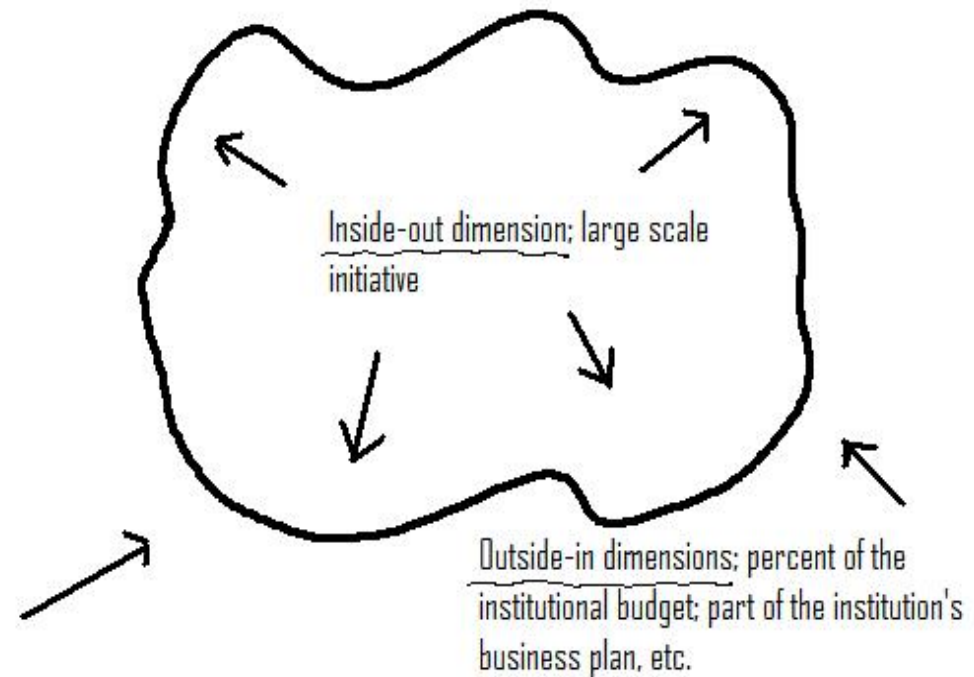
Trends



VIRTUAL CAMPUS

Actors:

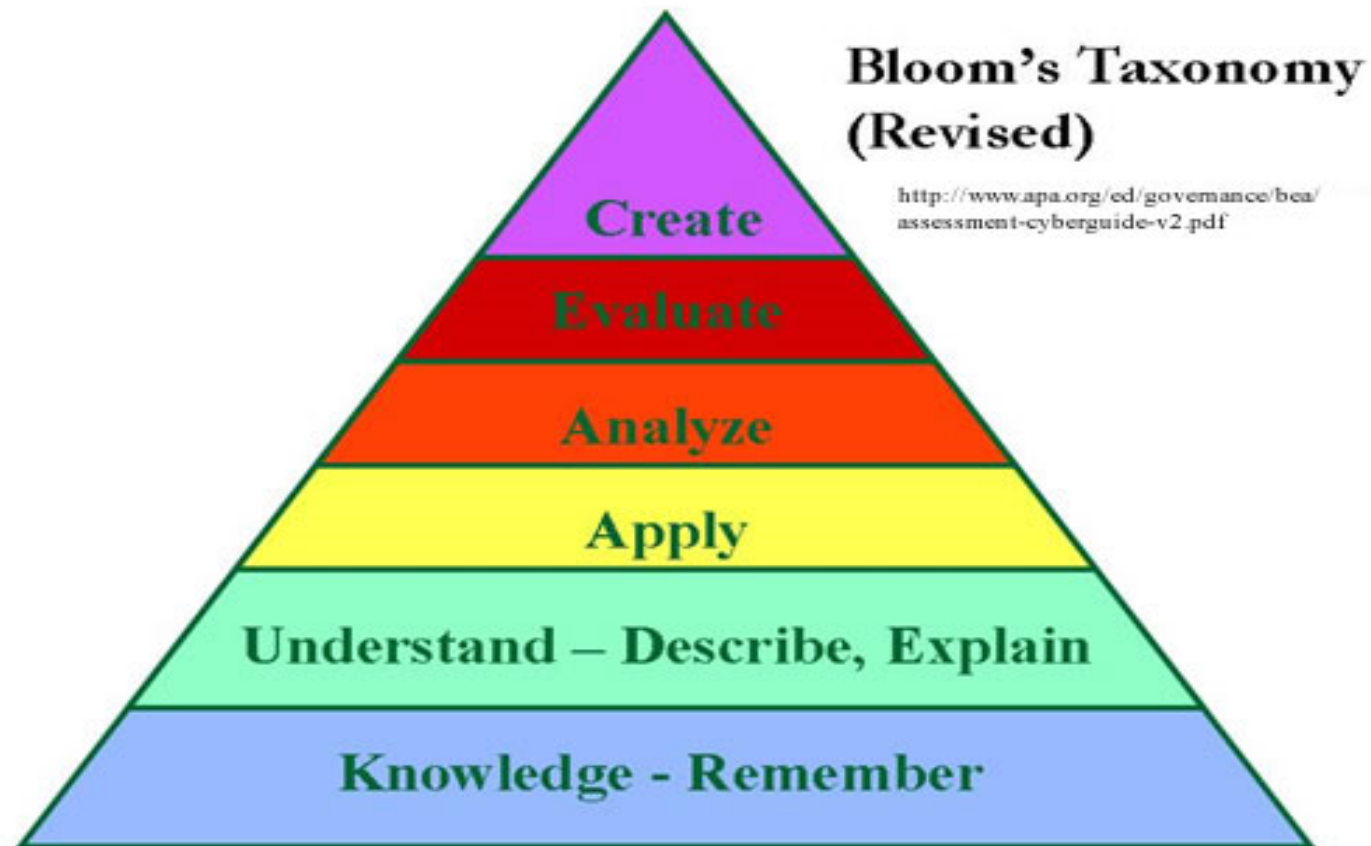
- Learner
- Teacher
- Content-expert
- Manager
- Designer



ReViCa Project



LEARNING OUTCOMES



Based on an APA adaptation of Anderson, L.W. & Krathwohl, D.R. (Eds.) (2001)



BACKGROUND

EUROPEAN VIRTUAL CAMPUS FOR BIOMEDICAL ENGINEERING, EVICAB:

- The aim to develop, build up and evaluate sustainable, dynamic solution for virtual mobility and e-learning:
 - Mutually support the harmonization of the European higher education programs.
 - Improve the quality of and comparability between the programs.
 - Advance the post-graduate studies, qualification and certification.



EVICAB

(January, 2006 - December, 2007)

Activities:

- Evaluating existing Biomedical Engineering e-curricula and strengthening the harmonization process.
- Building up a common virtual pilot Biomedical Engineering curriculum among the partners.
- Developing a model to dynamically elaborate and innovate sustainable e-courses.
- Developing new practices for e-teaching and e-learning.
- Developing new administrative practices.
- Evaluating and disseminating results.
- Managing project.



OBJECTIVES OF THE STUDY

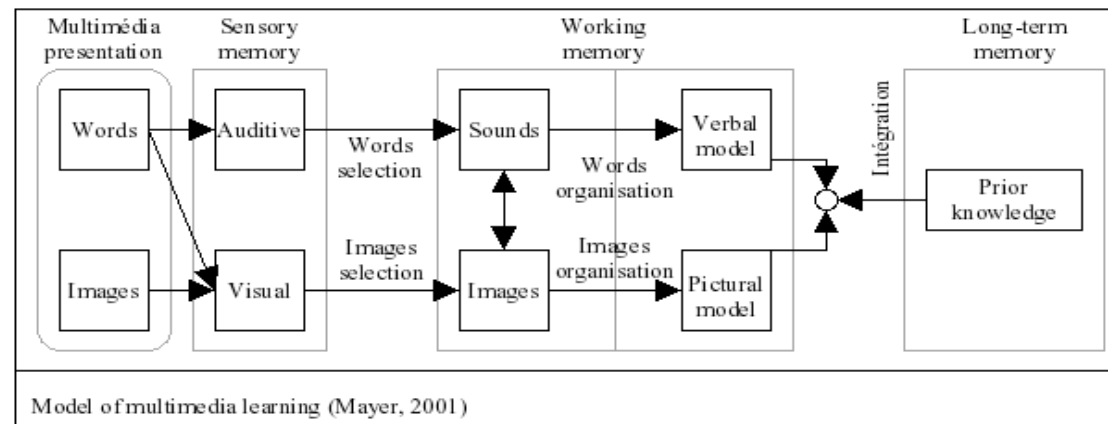
1. Review learning theories and technologies.
2. Develop the virtual campus.
3. Evaluate how students accept e-learning.
4. Analyze the development process of e-learning.



LITERATURE REVIEW

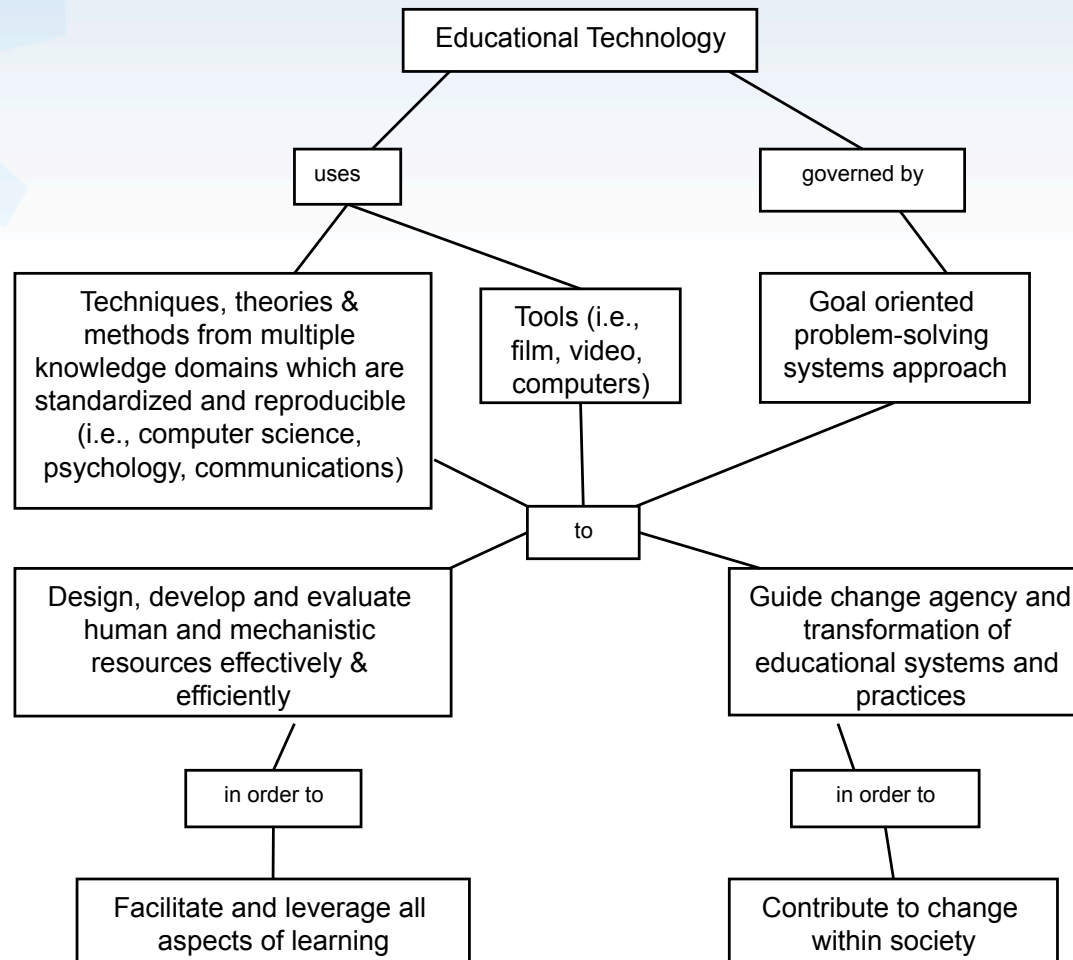
Learning theories

- Dual coding theory: visual and verbal codes.
- Cue summation theory: stimuli in multimedia environment.
- Atkinson-Shiffrin model: multi-memory model.
- Cognitive load theory: working memory.
- Generative learning theory: self-reliance among students.
- Mayer's theory of learning: multimedia learning.
- Gagner's Information processing theory: different types of learning.
- ...



LITERATURE REVIEW

Educational technology



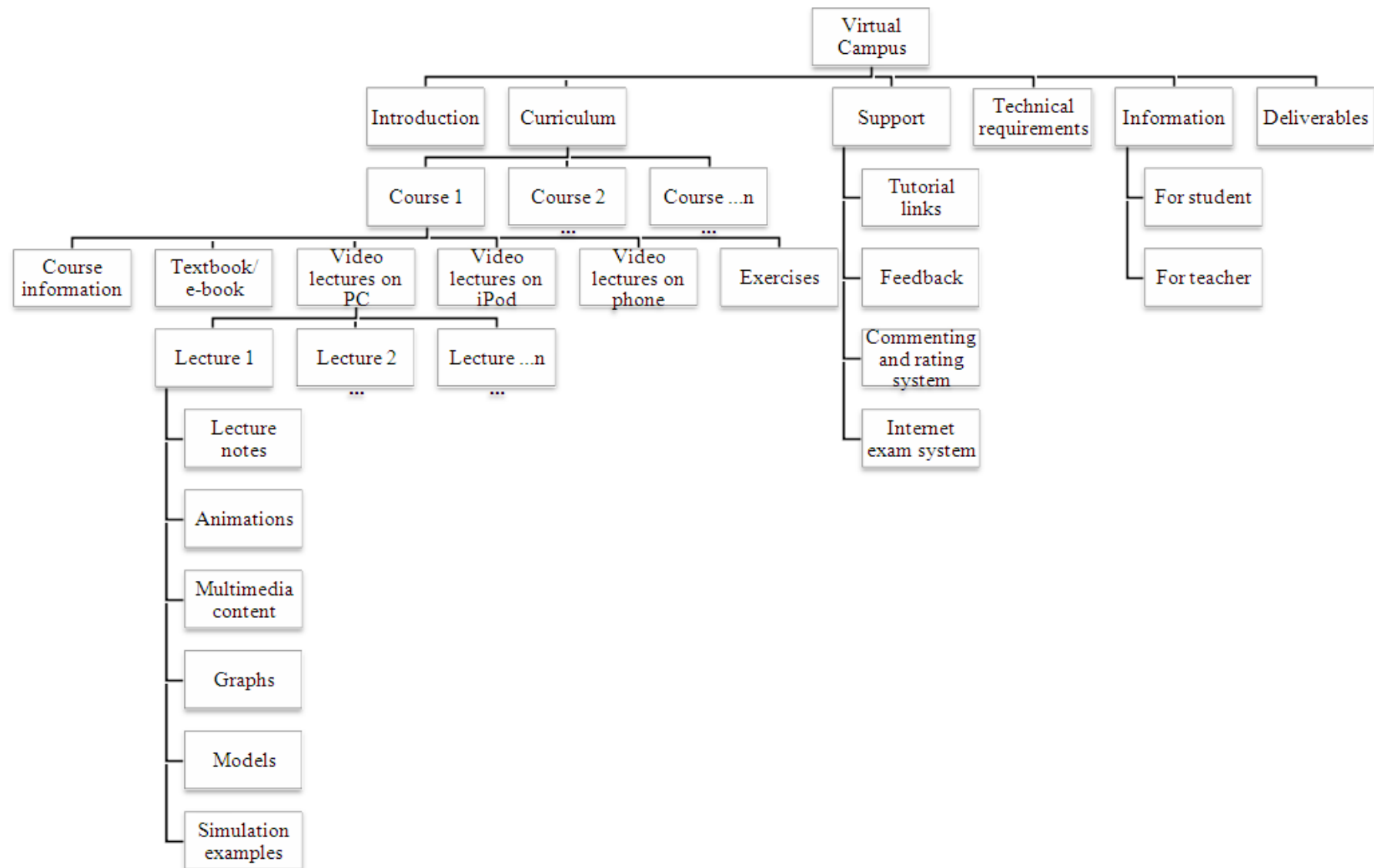
MATERIALS AND METHODS

1. Theoretical approach
 - Literature review
3. Practical approach
 - Software tools
 - Hardware tools
4. Evaluative approach
 - Questionnaires
 - Web statistics
5. Developmental approach
 - International survey





















































RESULTS

Theoretical approach




RESULTS Metadata

Biomedical Engineering Curriculum

BIOELECTROMAGNETISM							
Teacher	Course	Book	Video	iPod	Phone	Slide	Exercise
Jaakko Malmivuo: Bioelectromagnetism							
							
Frank Sachse: Computational Modelling of Cardiovascular System							
							
Risto Ilmoniemi: Transcranial Magnetic Stimulation							
							
BIOMECHANICS							
Teacher	Course	Book	Video	iPod	Phone	Slide	Exercise
Rami Korhonen: Biomechanical Modelling of Bone and Cartilage							
							
OPTICS							
Teacher	Course	Book	Video	iPod	Phone	Slide	Exercise
Goran Salerud: Biomedical Optics							
							
SIGNAL AND IMAGE ANALYSIS							
Teacher	Course	Book	Video	iPod	Phone	Slide	Exercise
Jiri Jan: Introduction to Biomedical Signal Analysis							
							
Rangaraj M. Rangayyan: Biomedical Signal Analysis							
							
Rangaraj M. Rangayyan: Biomedical Image Analysis							
							

 [Internet Education Tool in Evicab Moodle](#)

For suggestions and inquiries and for reporting on problems, please use the [Feedback Page](#) 

RESULTS

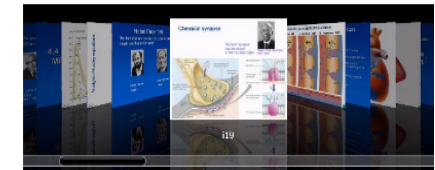
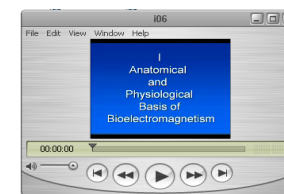
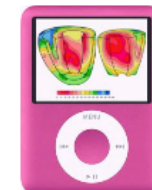
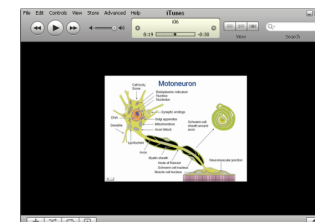
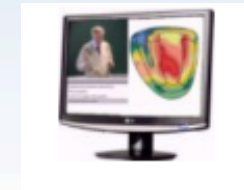
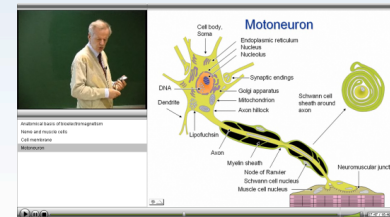
Practical approach

Software tools:

- Internet
- Media players
 - Adobe Flash
 - iTunes, Quick Time
- Video and audio editing software
 - Camtasia Studio
 - Windows Movie Maker

Hardware tools:

- Computers
 - Windows, MacOS
- Portable video and audio players
 - iPods, MP3 players
- Media phones



RESULTS

Learning objects

- Video lectures
- e-Book
- Virtual interactivity system
- Quizzes and exercises
- Lecture notes
- Animations
- Virtual models and simulations
- Internet examination
- Laboratory works
- Moodle
- Video conferencing

The screenshot shows a Moodle comment page for the entry "Bioelectromagnetism, Lecture 18". The page includes a star rating system with 5 stars, a rating of 4.0/5 based on 1 vote, and a "Leave a Reply" form with fields for Name, Mail, and Website, and a large text area for the comment. The "Submit" button is visible at the bottom right of the form.

Comments

« Bioelectromagnetism, Lecture 19 » Bioelectromagnetism, Lecture 17 » Category List
Bioelectromagnetism (19)

Bioelectromagnetism, Lecture 18
Published by Asta on January 27, 2009 in Bioelectromagnetism.

★ ★ ★ ★ ☆
Rating: 4.0/5 (1 vote cast)

« Bioelectromagnetism, Lecture 19 » Bioelectromagnetism, Lecture 17 »

0 Response to "Bioelectromagnetism, Lecture 18"
Feed for this Entry

No Comments

Leave a Reply

Name (required)
 Mail (will not be published) (required)
 Website

Submit



VIDEO LECTURES

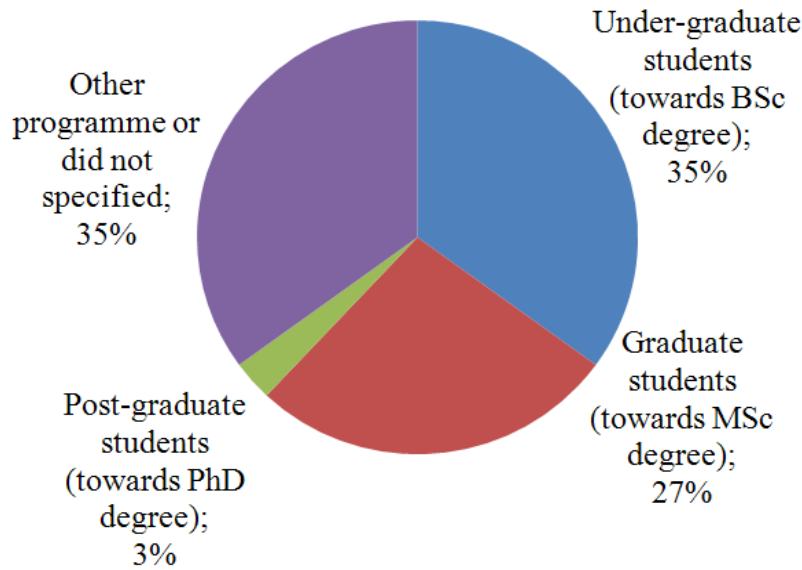
Motivation:

- To grasp students' attention and motivate them to learn.
- To provide highly realistic depiction of situation, which students would not otherwise have the occasion to see:
 - Medical procedure,
 - Lecture in another university.
- To watch again or later recorded live face-to-face lectures.

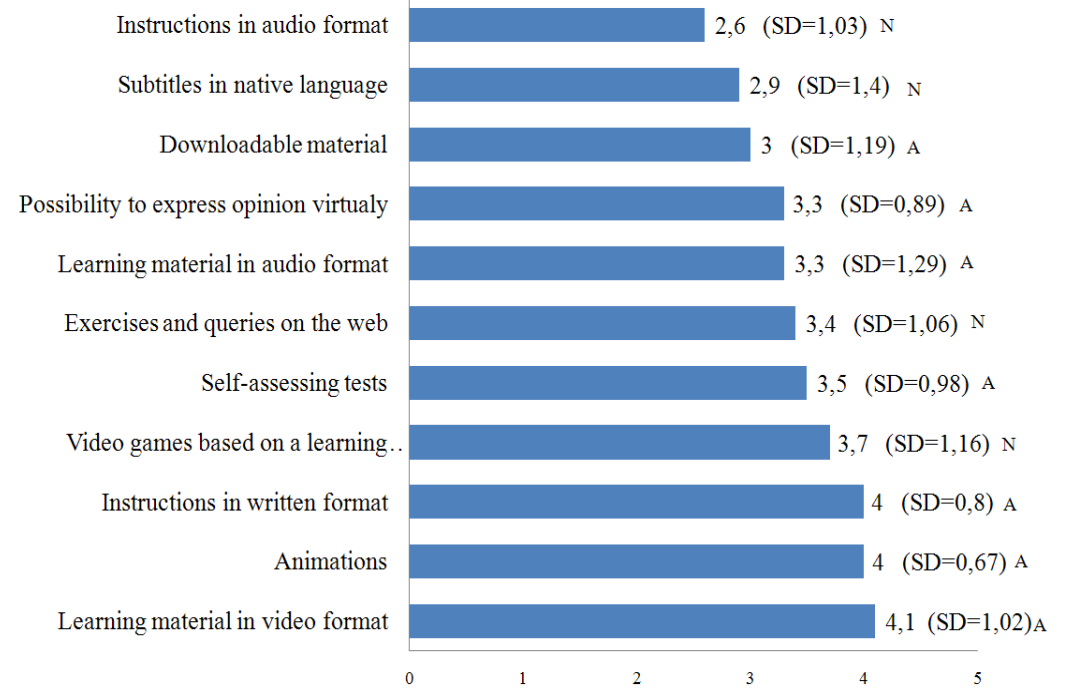


RESULTS

Questionnaire



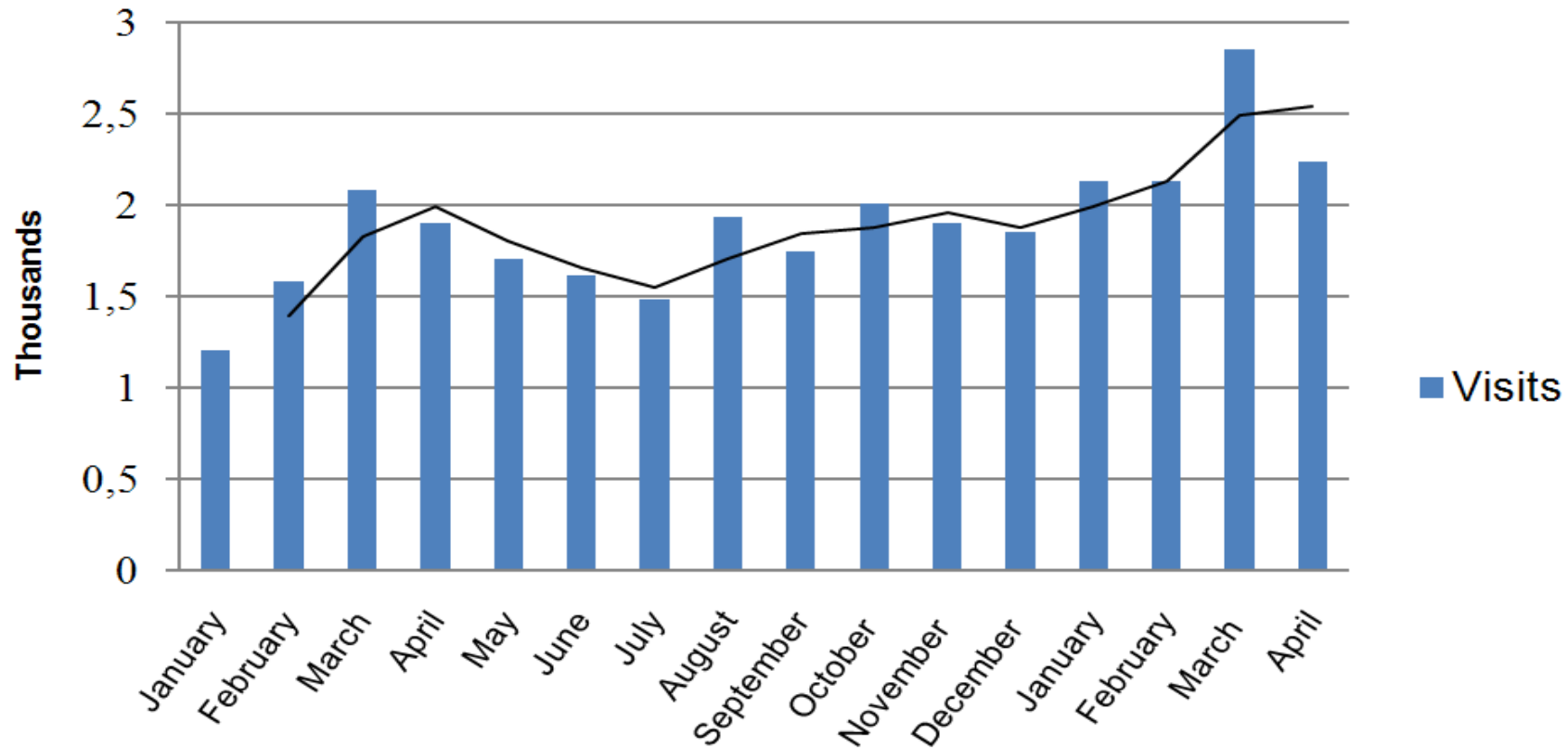
Educational background of students, who participated in the course and provided feedbacks.



Usefulness of learning elements presented as averages and standard deviations. Evaluation scale was from 1 (not useful) to 5 (very useful). A: Learning elements were available in virtual campus. Students had possibility to test them. N: Learning elements were not available in virtual campus. Students anticipated their usefulness.

RESULTS

Web log-ins



Number of visits for each month, 2009 and January-April, 2010.



RESULTS

Web log-ins

EVICAB



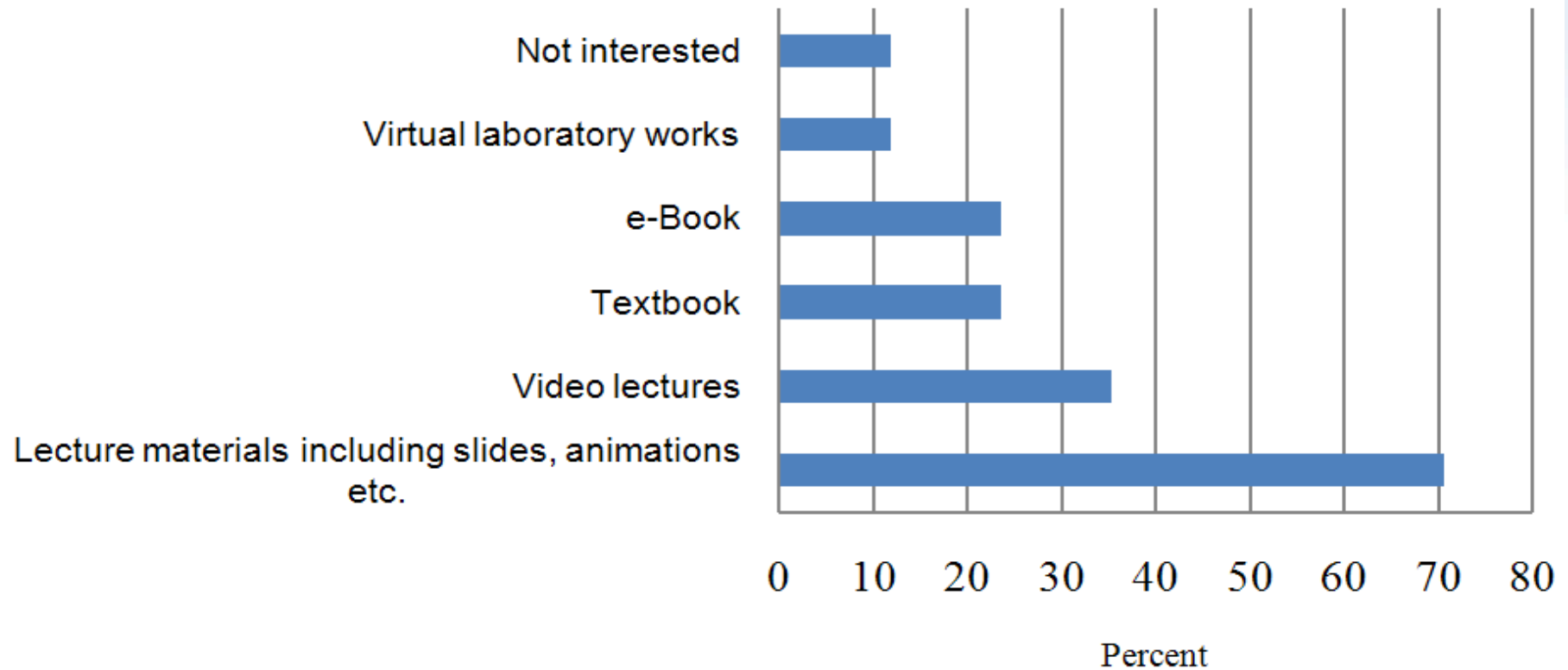
Dot sizes: ● = 1,000+ ● = 100 - 999 ● = 10 - 99 ● = 1 - 9 visits

From 12 Feb 2009 to 13 Feb 2010: Total: 2.958



RESULTS

Development



Resources that BME educators are able to provide to the virtual campus.



DISCUSSION

- Role of lecturer in e-learning.
- Recommended techniques for educators in e-learning.
- Learning with video lectures.
- Production team for good quality Internet materials.
- e-Learning depends on values and goals of organization.
- Virtual education:
 - Administrators
 - Instructions
 - Student recruitment
 - Technology
 - Library systems
 - ...



FUTURE IMPLEMENTATIONS

- Intelligent students' knowledge testing machine.
- Intelligent system with self-converting files for video lectures.
- Intelligent video lectures.

Cells in Nervous Tissue

- Neurons
- Neuroglia

NEUROGLIA are found in:

- Peripheral Nervous System**
 - Satellite cells**: Surround neuron cell bodies in PNS; regulate ion concentrations, maintain membrane levels around neurons in PNS.
 - Schwann cells**: Support all axons in PNS; responsible for myelination of peripheral axons; phagocytosis in repair process after injury.
- Central Nervous System**
 - Oligodendrocytes**: Maintain CNS axons; provide structural framework.
 - Astrocytes**: Maintain blood-brain barrier; provide structural support; regulate ion concentrations; absorb and recycle neurotransmitters; form scar tissue after injury.
 - Microglia**: Remove cell debris; waste; and pathogens; are phagocytosis.
- Ependymal cells**: Line ventricles; secrete and control central nervous system CSF; and maintain pH of cerebrospinal fluid.

What are the cells that build up nervous system?

Structural Classification of Neurons

Cell body, Dendrites, Axon, sensory only (touch, stretch), both have the structure of axon toward the periphery = dendrites

Which two organ systems coordinate and direct activities of the body?

Based on:

- multipolar
- bipolar
- four
- unipolar neurons - one process only, sensory only (touch, stretch)
- develops from a bipolar neuron in the embryo - axon and dendrite fuse and then branch into 2 branches near the soma - both have the structure of axons (propagate APs) - the axon that projects toward the periphery = dendrites

CONCLUSIONS

- Technologies for virtual education are available and relative user friendly.
- The main advantage of virtual education is the global open access.
- Virtual education does not replace or eliminate education on the university scale but support and augment on the global scale.
- e-Learning still support teacher-centered approach, where knowledge is unidirectional, i.e., transferred from teacher to students.
 - There is a great need for virtual laboratory works and exercises, where students could apply theoretical knowledge and develop practical skills.



THANK YOU !

