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Guide to E-learning
TIARA project

Contents:

1. Theoretical introduction

1.1 E-learning

E-learning is an educational process which employs computers and internet. It may be used to improve the effectiveness of the learning system as well as create the self-contained learning platform. The main features of e-learning that contribute to its large success in recent years is learning from a distance and flexibility. It allows students to chose the time to study in the way that suit them the most, thus increasing the population of students who can take part in such interactive course.

Basic elements of a successful online course are as follows:
- Familiarity with the attending students
- Creating the course basing on clearly defined goals, acquainting students with these goals
- Special attention paid to graphical interface of the course. It should enable easy navigation in the learning environment and learning. The capabilities of students should be taken into account (hardware limitations, necessity of using non-free software i.e. Matlab).
- Assuring co-operation between students and teachers, allowing constructive criticism, proper motivation and providing students with tools to evaluate the course at proper time.
- Flexible learning environment, adjusted to individual needs of the students, their interests and priorities. The courses shall be improved continuously, providing the up-to-date knowledge that is possible for students to understand.
- Technical help-center shall provide support for students as well as teachers.
- Providing links, reference materials that can be used by students who seek to enlarge their knowledge in certain topic.

Advantages of E-learning:
- Flexible learning time ensures students' comfort (especialy if they have other responsibilities)
- Easier communication among students.
- Better fit of lectures to students' interests.
- Great variety of learning methods (keeps students interested in the course).
- Studying at one's own pace.
- Minimization of fear and shyness that could appear in traditional class.
- E-learning is a kind of individual training for a student, which highly improves the his/her

motivation to study.

- Audio and video techniques allow seeing the same materials multiple times.
- Interpersonal relations might develop via different means of communication (i.e. Skype, forums, chats).
- Forum can be a place to create a learning group related to a certain course.
- Financial aspect. There is no need to pay teacher's fee every time course is being conducted, no costs of transportation for students, accomodation etc.
- Time saving for both students and teachers.
- Simple way to inspect the actual progress of the participants of the course.

1.2 MOOC – Massive Open Online Course

It is an online course aimed at unlimited participation and open access via the web. In addition to traditional course materials such as filmed lectures, readings, and problem sets, many MOOCs provide interactive user forums to support community interactions between students, professors, and teaching assistants (Tas).

Challenges while creating proper MOOC:
1. Relying on user-generated content can create a chaotic learning environment
2. Digital literacy is necessary to make use of the online materials
3. The time and effort required from participants may exceed what students are willing to commit to a free online course
4. Once the course is released, content will be reshaped and reinterpreted by the massive student body, making the course trajectory difficult for instructors to control
5. Participants must self-regulate and set their own goals

By June 2012 more than 1.5 million people had registered for classes through Coursera, Udacity and/or edX. As of 2013, the range of students registered appears to be broad, diverse and non- raditional, but concentrated among English-speakers in rich countries. By March 2013, Coursera alone had registered about 2.8 million learners. By October 2013, Coursera enrollment continued to surge, surpassing 5 million, while edX had independently reached 1.3 million.

Coursera enrollees

Country	Percentage
United States	27.7%
India	8.8%
Brazil	5.1%
United Kingdom	4.4%
Spain	4.0%
Canada	3.6%
Australia	2.3%
Russia	2.2%
Rest of world	41.9%

A very well written and informative articles on MOOC. They mostly focus on issues associated with its effectiveness. I highly recommend reading this short articles before attempting to create the MOOC!

Links:

http://elearningindustry.com/what-is-wrong-with-moocs-key-issues-to-consider-before-launching-your-first-mooc

http://www.tonybates.ca/2012/08/05/whats-right-and-whats-wrong-about-coursera-style-moocs/

2. Courses about accelerators and physics.

a) U.S. Particle Accelerator School

Link: http://uspas.fnal.gov/about/about-uspas.shtml

Rating: ★★★☆☆

Short description: The USPAS is a national graduate program that provides graduate-level educational programs in the science of particle beams and their associated accelerator technologies that are not otherwise available to the scientific and engineering communities.

Comment: This website contains highly specified series of lectures concerning i.e. "Accelerator Physics", "Cryogenic Engineering", "Laser Applications to Accelerators and many others. These lectures are updated every year. The materials are mostly presented in the form of a slidepresentation. There are only 5 videos on the website which are short movies presenting some physical phenomenons.

Under the "Course Materials >> Software Downloads" can be found some applications which are educational simulations, i.e. "Beam Optics".

b) **Course materials based on CERN's Accelerator School courses**

Link: https://www.kvi.nl/~brandenburg/courseinformation2005.htm

Rating: ★★☆☆☆

Short description: Course of "Accelerator Physics and Ion Optics" introduced in 2005/2006 for graduate students. The materials are based on the book "An Introduction to Particle Accelerators" of E.Wilson and selected materials from CERN Accelerator School courses.

Comment: Materials are available in the form of slide presentations. The interesting part of this course is that for every lecture there is prepared a set of exercises for student. The slides themselves are very easy to read due to plain and simple composition.

c) **The Theoretical Minimum Course – Particle Physics**

Link: http://theoreticalminimum.com/courses/particle-physics-1-basic-concepts/2009/fall

Rating: ★★☆☆☆

Short description: This is a series of Stanford Continuing Studies courses taught by world renowned physicist Leonard Susskind. These courses collectively teach everything required to gain a basic understanding of each area of modern physics including all of the fundamental mathematics.

Comment: The presentations here are presented as videos recorded during the lectures given by Mr Susskind. Although the explainations are very clear, the great disadvantage is the length of every video, which is approx. 1h 50min. It effectively discourages students who would like to learn from these videos. It is very difficult to focus the attention for such large amount of time. Moreover there is no subtitles for the videos (apart from

the automatically generated subtitles by youtube, which are very often wrong), which makes it difficult to follow the course for international students. Subtitles are especially important when studying materials which use highly specialized, technical language. Apart from that, the camera always follows the lecturer, which makes it impossible to see some parts of the content written on the table to which he refers.

d) Yale's university courses – physics

Link: http://oyc.yale.edu/physics

Rating:

Short description: Open Yale Courses (OYC) provides lectures and other materials from selected Yale College courses to the public free of charge via the Internet. The courses span the full range of liberal arts disciplines, including humanities, social sciences, and physical and biological sciences.

Comment: There are only 2 courses concerning topics from physics' field. Fundamentals of Physics I & Fundamentals of Physics II. Every lectures is shortly described, so that student knows what to expect in particulat video. Moreover there is a "Problem Set" and solutions to it, which helps students understand the material better. Even though lectures are about 60min long, there is a clear table of contents next to every video. This helps the student to know exactly what is being discussed at the particular moment. Another positive thing to mention about this videos is the manner of the lecturer's talking. It is very clear, not too quick, easy to understand due to correct pronunciation (this is very important while creating materials that will be posted on the internet, without the possibility of fixing them).

e) **The Great Courses webapge**

Link: http://www.thegreatcourses.com/search/?q=physics

Rating:
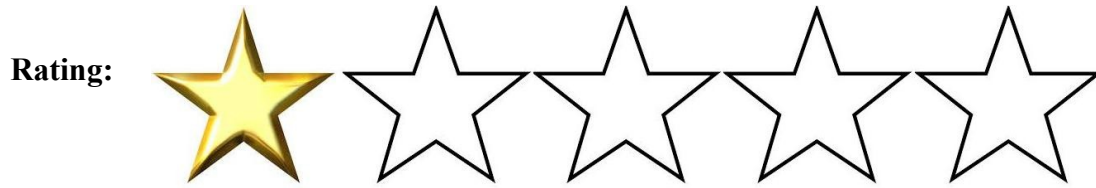
Short description: Educational platform dedicated to specialized courses.

Comment: All of the courses are paid. Prices vary from approx. $35 to even over $400. The courses comprise audio/video materials divided in approx. 20 lectures.

f) **Youtube series of courses**

Link: https://www.youtube.com/watch?v=TyQ6x4EOKCs&list=PL1LhQ_oW2fMwHytO4Mr9kU1w0jggQldBT

Rating:

Short description: Series of 200 different youtube videos about particle accelerators. They are not directly related to each other. Some of them are 30-40 min long lectures. Others are 3-5min videos made to present quickly some concepts from the field of accelerator physics. Part of them present simulations of physical phenomena or how accelerators work.

Comment: Even though these movies are not particularly good to get technical knowledge, they might be a great source of support for the real lectures. They may present in understandable way the functioning of things discussed during the lectures, which is a very good method to keep students' interest on the topic. Especially valuable are those short movies, because they do not require from student large amount of focus during watching. These might be a way for a short break from the intelectually absorbing lecture, however not losing the focus from the topic itself.

g) MIT course - particles

Link:

Rating:

Short description: This is the course of "Statistical Mechanics of Particles". It covers following topics: Thermodynamics, Probability, Kinetic Theory of Gases, Classical Statistical Mechanics, Interacting Particles, Quantum Statistical Mechanics, Ideal Quantum Gases. Course offers altogether 26 videos, each of which is approx. 1h 30min long. On the website there are available additional materials: lecture notes, exams, assignments.

Comment: This type of lecture is not highly recommended. Following a course "chalk on the blackboard" type might not be very encouraging for students. Because these videos were recorded during real lectures there are sometimes questions from the audience, which help to understand the material for students who can only watch it. Positive side of this course are additional materials like assignments and exams from previous years. They allow student to check his understanding on particular subject and to activelyfind solutions to different problems.

h) MIT course – quantum physics

Link: http://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2013/lecture-videos/

Rating:

Short description: These are 24 videos about Quantum Physics.

Comment: This course has very similar form to the one described above (g). What is worth

noticing in this set of lectures is the attitude of the lecturer towards the audience. He creates very positive atmosphere which helps keeping students' attention on the lecture. In the e-learning course, the most important thing is to keep the attention of the students as well as keep them interested in the course at all time. It is difficult to make every student who enrolled for the course finish it. In most cases after few lectures larger part of students abandon the course due to many different reasons.

3. Courses that present recommended practices

a) Coursera - Machine learning course

Link: https://www.coursera.org/learn/machine-learning/home/info

Rating:

Comments:
- Every video is about 5-15 minutes long.
- Quiz reviewing every lecture (1 lecture per week system).
- Well specified programming assignments + tools provided to accomplish them.
- Well organized forum with hints for the assignments but NO direct solution.
- The way of creating the videos is recommended. Little window with a lecturer's face helps keeping personal contact with a student. Pieces of information are put on the slides from the start, however some of them is added by the teacher (writing with an electronic-pen on the touchscreen) which makes the lecture more interactive and engaging. Most important contents might be underlined to focus students' attention on crucial matters.
- There are breaks in the videos (marked as little yellow lines on the progress bar) which signalize in-video quiz. It is usually one question referring to the recent knowledge presented. It is not graded, however it forces student to keep attention at all time.
- At the end of every lecture there is a short summary reminding what we just learned.
- Subtitles in couple different languages (english subtitles are highly recommended)

b) Coursera - Data visualization

Link: https://class.coursera.org/datavisualization-001

Rating:

Comment:

- Huge advantage of this specific course is that every week of lectures is fully described. Namely, it is pointed what goals and objectives of the following lecture, guiding questions, reasings & resources. Recommendation to watch specific videos, then to read some materials (internet links, books, etc.), after that to solve the quizz, and finally to finish the weekly assignment. Kind of a short guide for a student.
- There are also clearly set deadlines for certain parts of project, quizzes etc.
- Moreover there are specificed estimated times required for every part of the lecture (i.e. Video lectures – 2h, weekly assignment – 3h). It allows student to manage his time efficiently.
- Video materials are available to download and being watched offline. In some cases students might have problems with internet connection, so this option is worth recommending.

c) Coursera - Miracles of Human Language: An Introduction to Linguistics

Link: **https://class.coursera.org/humanlanguage-001/lecture**

Rating:

Comment (especially form of this course is noteworthy):

- In regular videos subject is being presented by a main teacher only.
- In the others there are introduced experts in related fields (it makes the course much more interesting to watch) who explain chosen topics.
- Some of the videos containt students, who act like "students" and ask questions related

to the last lecture and the teacher answering them explains more clearly the issues.

- Apart from quizzes and final exam, there is one more form of inspecting students' work for the course. So called "Peer Assignment" where student is asked to answer some specific questions. After deadline for this assignment other students review the work of their classmates, so that every assignment is verified at least once (usually every students reviews 3 different assignments). There is a step-by-step instruction how to review someone else's work, so the lecturer does not need to do it himself (which is impossible whith a huge number of the people participating in the course).

d) Coursera - Finding Hidden Messages in DNA (Bioinformatics I)

Link: https://class.coursera.org/hiddenmessages-003

Rating: ★★★★★

Comment:

- One thing that makes this course special is unique approach to interacting with students. Author of the course provides only approx. 30 min. of video material every week. However the main and the most interesting feature of this course is "interactive text" (which can be found in the "Course content" panel to the left). It allows student to read material at his/her own pace in a very unusual way. The text is written as if the teacher was addressing a student directly. There are different links, short exercises to complete before opening next page of the "textbook". Within it there are even tasks that need to be accomplished in a limited time. The console to do it is built-in part of the textbook. It was achieved using "Lessong Constructor" tools provided on the website https://stepic.org/

4. Opinions on MOOCs

(after: https://en.wikipedia.org/wiki/Massive_open_online_course**)**

Educator experience

In 2013, the Chronicle of Higher Education surveyed 103 professors who had taught MOOCs. "Typically a professor spent over 100 hours on his MOOC before it even started, by recording online lecture videos and doing other preparation", though some instructors' pre-class preparation was "a few dozen hours." The professors then spent 8–10 hours per week on the course, including participation in discussion forums.

The medians were: 33,000 students enrollees; 2,600 passing; and 1 teaching assistant helping with the class. 74% of the classes used automated grading, and 34% used peer grading. 97% of the instructors used original videos, 75% used open educational resources and 27% used other resources. 9% of the classes required a physical textbook and 5% required an e-book.

Unlike traditional courses, MOOCs require additional skills, provided by videographers, instructional designers, IT specialists and platform specialists. Georgia Tech professor Karen Head reports that 19 people work on their MOOCs and that more are needed. The platforms have availability requirements similar to media/content sharing websites, due to the large number of enrollees. MOOCs typically use cloud computing and are often created with authoring systems. Authoring tools for the creation of MOOCs are specialized packages of educational software like Elicitus, IMC Content Studio and Lectora that are easy-to-use and support e-learning standards like SCORM and AICC.

Completion rates

Completion rates are typically lower than 10%, with a steep participation drop starting in the first week. In the course *Bioelectricity, Fall 2012* at Duke University, 12,725 students enrolled, but only 7,761 ever watched a video, 3,658 attempted a quiz, 345 attempted the final exam, and 313 passed, earning a certificate.

Early data from Coursera suggest a completion rate of 7%–9%. Most registered students intend to explore the topic rather than complete the course. The completion rate for students who complete the first assignment is about 45 percent. Students paying $50 for a feature designed to prevent cheating on exams have completion rates of about 70 percent.

One online survey published a "top ten" list of reasons for dropping out. These were that

the course required too much time, or was too difficult or too basic. Reasons related to poor course design included "lecture fatigue" from courses that were just lecture videos, lack of a proper introduction to course technology and format, clunky technology and trolling on discussion boards. Hidden costs were cited, including required readings from expensive textbooks written by the instructor that also significantly limited students' access to learning material. Other non-completers were "just shopping around" when they registered, or were participating for knowledge rather than a credential. Other reasons for the poor completion rates include the workload, length and difficulty of a course. Providers are exploring multiple techniques to increase the often single-digit completion rates in many MOOCs.

About 10% of the students who sign up typically complete the course. Most participants participate peripherally ("lurk"). For example, one of the first MOOCs in 2008 had 2200 registered members, of whom 150 actively interacted at various times.

Important links about the experience and approaches of other faculty who have taught MOOCs

- Steve Kolowich, *The Chronicle of Higher Education*

  Link: http://chronicle.com/article/The-Professors-Behind-the-MOOC/137905/#id=overview

- Debbie Morrison reporting on Maria Andersen's presentation at the Sloan-C Symposium about her experience designing and delivering a MOOC

  Link: https://onlinelearninginsights.wordpress.com/2013/04/15/teaching-tips-from-a-master-mooc-maker/

  Maria's slides: http://www.slideshare.net/wyandersen/teach-a-mooc-crazy-talk-sloan-c

- Cathy Davidson on her experience preparing to teach a MOOC

  Link: https://www.hastac.org/blogs/cathy-davidson/2013/06/11/clearing-some-myths-about-moocs

- A guide written by faculty who taught some of the first MOOCs

  Link: http://davecormier.com/edblog/wp-content/uploads/MOOC_Final.pdf

5. Additional websites with various online-course

Access to these pages is free, however to browse the content of each course it might be necessary to register and enroll for specific course (free of charge).

a) **Coursera**

Link: https://www.coursera.org/

Description: Coursera is a webpage that provides over 1000 different courses (880 in english). These lectures cover wide range of topics, i.e. Computer Sciences, Engineering, Biology, Chemistry, Arts and many others. Courses are free for anyone who wishes to participate, however one can receive a special certificate of accomplishment after paying some fee. Courses are prepared by specialists in certain field from the most renowned world's universities.

b) **The Khan Academy**

Link: https://www.khanacademy.org/

Description: Khan Academy is non-profit educational organisation which provides around 3200 mini-lectures as short movies uploaded to Youtube. The lectures relate to various fields of science, i.e. Mathematics, History, Medicine, Physics, Economy, Informatics.

c) **EdX platform**

Link: https://www.edx.org

Description: EdX is a massive open online course (MOOC) provide and online learning platform. It hosts online university-level courses in a wide range of disciplines, some at no charge. EdX offers certificates of successful completion of the courses.

d) **MIT Open Courseware**

Link: http://ocw.mit.edu/courses/

Description: MIT provides free access to lectures on university-level topics. Every course comprises of videos, which present lectures recorded during lessons. Sometimes there are also some other materials to specific course, i.e. presentations, coursebook, etc.

e) **Codecademy**

Link: https://www.codecademy.com/

Description: Educational platform focusing on teaching programming languages.

It provides the opportunity to learn interactively. Courses are free of charge, however no official certificate of accomplishment is given to the student after successful accomplishment of the course.

The courses mentioned above are the most popular among students. They have professional interface, up-to-date content and mostly are free of any charge. Inspecting them might give a good insight in how successful e-learning platforms should look like, what kind of course they offer, how they are organized. They can also give the idea of how to prepare the lectures, grading system, forums' administration and most importantly interaction with a student. I have personally followed some courses in every of these platforms, and I highly recommend to search there for any inspiration in creating one's own e-learning platform.

Links to others platforms may be found under this link: http://noexcuselist.com/

6. General hints for creating a successful on-line course

	Recommended approach		Discouraged approach
🙂	System of rewards after completing the course, electronic certificate of accomplishment.	🙁	Monotonous speaking (audio-visual disadvantages are among main reasons students abandon the course).
🙂	Wel spoken english and good pronunciation.	🙁	Uploading videos that require student to download some additional software to watch them (other than most popular, like Adobe Flash Player).
🙂	Interactive videos, i.e. in-video quizzes.	🙁	Non-interactive environment is no better than simply reading a book.
🙂	Introducing main concepts of each lecture in a short list, so that the student had a brief look at it before attempting to watch the videos.	🙁	Expecting the student to have access to specific tools (software programs, programming knowledge, etc.).
🙂	Enabling the course for the mobile devices.	🙁	Projects, exercises demanding too much effort from the student.
🙂	Allowing participants to download the videos to watch them offline.	🙁	Charging students with fees just for attempting the course.
🙂	Providing slides to every lecture i.e. in .pdf format (besides the videos).	🙁	Lack of clear explaination for the assignments.

🙂	Subtitles to every video in english (might be other languages if possible).	🙁	Creating a confusing, messy course's interface.
🙂	Uploading many short videos 10-20 min(content divided in small pieces).	🙁	Uploading long videos 1h+ discourages the student from even starting to watch.
🙂	Using various techniques of presenting the study material (video-lectures, consultations, conversation with a specialist in certain topic).	🙁	Group projects in on-line environment proved to cause a lot of chaos in other courses.
🙂	Organising office hours with students every week or two via Skype (only if possible for the lecturer).	🙁	Allowing students to post direct solutions for certain problems.
🙂	Different kinds of verifying students' progress, i.e. weekly quizzes, programming assignments, final exams.	🙁	Disabling the possibility of taking the same quizz infinite number of times (2-3 should be enough).
🙂	Providing on-line tools so that the student could perform simple experiments by himself. It helps to understand the topic better.		
🙂	Creating discussion forum for participants to help each other with most difficult exercises/projects.		
🙂	Providing "homework quizzes" (which shall be ungraded) that are similar to the graded quizzes. They should also have clear & full explaination so that the student could understand it in case of any problems. Example here : https://class.coursera.org/biostats-009/quiz?quiz_type=homework		