

E-learning next step – learning materials for students

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Abstract: E-learning materials were first introduced at the university level education in last years of previous century in Slovenia. From the initial steps and pilot projects we learned the trade and participate in many e-learning material developments for primary and secondary schools. But in the recent years we regretful discovered that the university's e-learning materials are not in the same league as lower level education e-learning materials. It is true that students' population is different from kids but "*digi-kids*" have grown up and become students and they are familiar with the e-learning materials. It is the fundamental difference between lower level education and university level education. Lower levels education e-learning materials were funded by the government but university does not have funds for e-learning materials production. Up until now lecturers used LCMS for communication and documents sharing. But it is become evident that this is not enough and upgrade of e-learning material is required. It is evident that this process will take time and should be efficient from all perspective (didactically suitable, cheap, and fast). In the last year e-learning materials was prepared for students to test what suits them most. A lecture for a whole course was prepared with the different composition of text, sound and video. In forthcoming semester we are going to test our e-learning materials and receive feedback from the students. Article presents the learning materials specification, expected didactical results, aesthetical considerations, individual preferences (visual, audio, kinaesthetic), and client's browser's limitations. It is still not clear if university level students require more elaborate learning materials than PDF which was their favourite type up to now.

Keywords: distance education, e-learning, learning materials, design, verification and validation

I. INTRODUCTION

Since 1998 when we first prepare web study materials for a whole course Multimedia for teachers [1] many years and many projects have passed. These initial steps were the first glimpse to the future of learning materials preparation. For a decade we have upgraded materials according to the advancement in the software technology and IT infrastructure. We were always one step ahead in the anticipation what are going to be the technologically feasible and acceptable by students. In all these years we have again and again witnessed the students' ICT paradox [2]. Older the students less they were familiar with the technology and more are conservative in their preferences.

Even today we still have students that print their web materials and learn from paper.

From initial web textbooks we advanced to the more elaborate learning materials where we used animation (made of successive images) to shorten the learning process of certain skills. As the infrastructure advanced and computer processing power increased we started experimenting with video in education [3] [4] [5] [6]. In the beginning videos were post stamp size but it gives us valuable experiences with video editing. We experienced and studied the information overflow [7]. In those early years the aesthetic of e-learning materials was not an issue. The existence of e-learning materials was inherent aesthetic achievements.

In 2006 projects for better cooperation of educational institutions started [8]. In course of this project different e-learning materials were made (from distance learning didactics to support for teachers practical training in schools). These e-learning materials were the blueprints for later production of e-learning materials.

In 2008 projects for development of e-learning materials for primary and secondary schools were funded by European Social Fund and Ministry of Education and Sport of Slovenia [9]. What was started as an enthusiastic pilot project was now expand into the high quality production. The team was established and project started with tight schedule and different technological constraints. We have managed to prepare e-learning materials for primary and secondary schools and learn many pitfalls of distance education. Learning material was not enough for successful distance learning. Two years later (2010) the productions of e-learning materials were refined and more suitable for all participants in the educational processes – especially for teachers [10].

Whatever experiences we gained were for lower levels of education. In the same time we did not survey ours students. Information we get was just from the informal interview with the students. At that time we were happy to see more and more of lecturer using courses in Moodle than pay particular attention to the e-learning materials attributes. Moodle was mainly used for communication and file repository [11]. After lecturers have acquired basic knowledge they start to use Moodle for students' report submission too. Lecturers have acquired different styles for their materials structuring and some classes the structure was really opaque and annoying for students. Too many topics spread in too many divisions and

submission in different topics with practically the same names proves to be unsuccessful. Clear structure of the course is definitely successful approach and favoured by any users.

II. STUDENTS' PREFERENCES

Students' generation changes in different perspective [12]. Digital natives have come to the faculties. If it was a rare sight around five years to see students using laptops at the faculties then now it is a common sight. Students have laptops in our halls and corridors during their free time. They browse the web; read learning materials; or just watch YouTube videos. Current Wi-Fi architecture becomes congested and prevents users from accessing web on some occasions. Students generally occupy two connection one for laptop and the other for smart-phone. Inside the classroom we discovered that students generally do not use computer but they also write less notes as few years ago. Some of the students admit that they type faster than they write text by hand but our classroom equipment did not follow new needs. Especially electrical connections are insufficient and unavailable to the students therefore they preserve battery for other more needed tasks. Implicitly they only listen the lecturers and access learning materials on the web later. In our practice we have deep insight to the different students' groups. Observations of students from general pedagogy, art education and elementary education are presented in this topic.

In the winter semester of 2013/2014 we have a course of "*Didactics strategies information support*". This course enables us to work with postgraduate students of general pedagogy and acquire information about their preferences in studying and learning materials usage. Their future job will be understanding and organizing the educational activities and help students and teachers to perform better in the educational systems. Many of those graduates are later employed outside the educational system and works for different companies to organize in-house education or work on public relations or human resource management. In general they are specialist for learning. During their years of education they express that they acquire *spatially specific learning methods*.

1. In the classroom they listen to the lecturer and rarely actively participate. They could not explain their general passive behaviour in the discussion but from the lecturer perspective there are multiple reasons for their passiveness. Students in Slovenia are more or less shy in the classroom. They do not want to be regarded as silly if they ask something what others may already know. Unless they are explicitly instructed to do something they rather stay in the anonymity. The second reason is that students are focused on acquiring the data during the lecture and they do not process the data at the same time. This corresponds with the traditional structure of the courses where lectures are for knowledge acquisition, laboratory work or seminar is for discussion. Any deviation from "tradition" is new to the students. They are not accustomed to public improvisation and creative problem solving in the classroom therefore they are rather "*safely passive*".

2. During the laboratory work student prefer the detailed instructions what to do and how to do. Student often do not like open problems with multiple solutions. If we give students assignment to make a report of their research work about how can they use production of promotion materials in education, they generally ask what kind of promotion and how many pages should report have. Even if we give them option that they could use any type of promotion, they would generally all pick the same type and the creativity in their work is very limited. From students perspective they often express that they have a lot of work and they would like to know exactly: what to do; how to do; and it should not take them more than 2 hours of their precious time.
3. Their home or dormitory is for deep study; mental reasoning; and creative work. Most of them require their own study workspace (like protective cocoon where everything is at hand) and if they are not there they are often less effective and sometimes even incapable to do the required tasks. They often express that they need a certain time span to start the work. It they know they have less than three hours' time they rather not start the work at all.

Feedback from the student of art education is a bit different. They generally use laptops, tablets computers are still rare, but most of them use smart-phones regularly. Art students use ICT in multilevel approach:

1. On the **primary level** students use their ICT for communication and social networking. Both positive and negative impact can be observed. We do not approve their attempts to cheat on written exams and other types of knowledge assessments.
2. On the **second level** they use ICT in study processes. Some academic content in the professional and artistic courses require knowledge and creative use of computer tools for processing images and video materials. Freeware software is used for this purpose because they faculty does not provide licensed programs to improve the quality of their visual content creation on both technical and artistic level. Student acquire their basic knowledge to use these software tools on the web pages; specialised forums; and YouTube. The course Information and communication technology is scheduled in the 9th semester of study. This is too late and huge disadvantage for them because in the previous courses they have already acquired most of their professional and pedagogical content. Regarding the objectives of ICT course, which states that the student will achieve information literacy; understand and know the basics of computer science and digital technologies; and know how to use computer applications, we see that this course definitely scheduled too late. ICT skills are need at the beginning. Students should use them during their studies to see usefulness and effectiveness of ICT in education. To continue in the objectives of the ICT course curriculum we can read that the student will be able to electronically communicate with synchronous and asynchronous tools; known e-learning

technologies; be familiar with computer graphics; digital recording; media formats and possibilities of interactivity and multimedia. All these topics are required preconditions before they study them in details in other processional courses [13]. Despite the general ICT literacy of students they acquire in previous education, we see that they could perform better during their studies and professional and didactical assignments.

3. On the **tertiary level** use of ICT in didactical practical training (lectures in schools and pedagogical practice). ICT in education is mandatory and art education students should use them in full extend. Data sources for visualization of art assignments are available on the web. Contemporary information can be recorded on mobile phones or other recording devices. Images, video and web are building blocks for multimedia learning materials that are used in the classrooms. PowerPoint as a tool of choice can be used for static or dynamic presentations. In art education it is very important dynamic building of the visual presentation to highlight the graphics elements (central perspective lines, layers of colouristic perspective, contrasts presentations, colour lessons, etc). Animations in this occasion are not ornamental add-ons but fundamental necessity to teach the artistic expression. Students are aware of importance of multiple communication channels but beside images, video, animations and occasionally text they rarely use sound. Sound component of their presentation is included as their speech and explanation during presentation. It should be know to students that ICT is actually limited in the art education. It does not provide stimuli for all valuable modalities (sight, hear, touch, smell and taste) yet we know that students achieve better results in data processing and comprehensive information acquisition using multiple concurrent modalities. In their pedagogical practice the production and use of such materials prove to be highly motivational in the classroom; enhance the quality of content acquisition; and contribute to the deeper understanding of artistic phenomena. All this is the good basis for the practical art exercise solving and understanding the theoretical and history of art facts. Students prepare their own presentation for the pedagogical practice and no use of already prepared materials was observed.

Students of art pedagogy are sufficiently ICT literate for their own communicational and social. The less skilled are when they use ICT for education. No gender difference or social status difference was observed regarding the use of ICT. Only students' personal preferences make the differences.

Student for elementary school teachers study do not use tablets but they extensively use smart-phones. Observations show that less than half of them use laptops. Interestingly they do not use smart-phones for access to the LMS and they work exclusively with computers or laptops. Geographically they access the e-learning materials mainly from home or dormitories, and rarely between breaks on faculty.

During the laboratory work in computer room they do access the learning materials because they have to. The amount of access to the LMS increases before the exam and seminar work submission deadlines. Interestingly we have discovered from the log files on the LMS Moodle that students excessively visit the same topics again and again despite they should already acquired them during the lecture and lab-work.

Students use computers for word processing and communication. Social networking is ranked high in their computer activities where significant number of students started using smart-phones. Much less computers are used for preparation of multimedia elements for their study and pedagogical practice.

Life long students (part-time study) show different behaviour. They access the LMS even outside regular pedagogical activities. Their acquired knowledge is more effective used. Reasons are different and one is the limited ability to communicate with the lecturers face-to-face. Therefore electronic communication has higher value in their study process.

For formal communication with the lecturers e-mails are used. Informal communication between colleagues and other acquaintances is done in social networks and mobile communication (phone calls or SMS).

III. E-LEARNING MATERIALS PREPARATION

Our students are accustomed to the use of LMS Moodle and different types of learning materials. But those materials are generally all in separate files. We want to break this tradition and prepare learning materials differently. From the review of courses in our Moodle it is clear that courses mainly have learning materials in PDF, Word and PowerPoint files. Much less often additional types of learning materials are used (Excel, SPSS, images, and animations outside PowerPoint). Even rarely lecturers use video learning materials and video lectures. Video in education may be didactically controversial. A link to the YouTube video that last for an hour where important part of video for the students is only five minutes somewhere in between is not favourable between our students. Right composition and volume of data is crucial. In the past we discovered that we need to use different types of e-learning materials to boost the retention level but we need carefully orchestrated environment not to trigger information overflow [7].

Most of students start their study from the PowerPoint presentations and some students even stay there. PowerPoint should be used as a reminder and table of content of the lecture. The knowledge behind the slides is presented by the lecturer and/or can be found in the textbooks. But some lecturers prepare their PowerPoint presentation with the full text. Despite the bad taste of such presentations students actually like them. To pass the exam they often need no additional literature; web sources; journals; and textbooks. From aesthetic perspective such presentations are rubbish and bad didactical practice. From practical viewpoint it should be banned because some students actually think that is the way to produce presentations. This bad influence can be seen at the diploma theses presentations.

Our task was therefore not only to prepare learning material that is suitable for students but also present the good practice how to prepare e-learning materials and slides. We know who will use our learning materials therefore we could make a mental thinking (modelling?) about the intended users. From our previous researches we discovered that there is statistically significant difference between students who attend the lectures and those who study by themselves. Even 10% difference in grades can be observed. We have decided to prepare learning materials in blended learning paradigm. Blended learning materials is good for those who attended the lectures and wants additional explanations. In some occasion they can be used for self-study but little less successful without additional learning materials.

One would argue that with the better learning materials we make students even more passive they already are but the efficiency is the only thing that counts. If it is hard for students to switch from one learning material to another due to different reasons why not to ease this step. Regarding the research that shows increased efficiency in working with larger monitor or two monitors [14] due to more visible information on the screen; we therefore decide to prepare *integrated learning materials*.

In the preparation of integrated e-learning materials we wanted to address the different aspects: technical, practical, didactical and aesthetical.

Simple procedure and use of known tools were desired because we would need to support a lot of courses.

A. Technical aspect

In recent year there are shifts in the computer market. Number of sold PC declines and number of different tablets sale raises. We don't have enough funds to customize e-learning materials for different hardware therefore our product should be available for computers, tablets and smart phones. It is not going to be an application but a web page and it should look good and work in all browsers.

We already have experience with the production of e-learning materials for primary and secondary school that still works like a charm. It was produced using Adobe Flash technology that has many benefits over other technology but also some drawbacks. In general flash technology is not supported on new version of Android, iOS and Windows mobile. Therefore whatever we know and learned about the flash production it is out-dated. But in the recent years we have get almost working HTML5 browsers. We still have to figure out how to made resizable viewport for equal presentation of content on different screen sizes.

From technical viewpoint we need common encoding the diacritical characters present in the text which is solved with UTF-8 encoding, we need images in JPG or PNG encoding, we need support for MP3 audio encoding and MP4 video encoding. Text and image is supported in all browsers but the MP3 and MP4 are not. Though Firefox browser support MP4 from the version 23 upward (now version 26 is available) this is true in Windows and MacOS operating systems. In Linux this is not true by the default and additional settings that are a bit beyond the

abilities of normal computer users are needed. All our requirements are covered with the Chrome browser that is available for practically every operating system.

B. Practical aspect

From the practical aspect we would like to reuse a large amount of already produced learning materials. Since we have no authoring tool available some things have to be done manually and we would like to minimize that. Authoring tools are generally limited but they enable authors to focus on content and not on the technology. In previous developments we were able to transform PowerPoint presentation to the FLASH. We have not tried commercial PPT to HTML5 conversion tools. Trial version and free conversion tools are not really what we want. Conversion is packed in the predefined layouts and these are not what we want. We did try the commercial product Hype authoring tool for HTML5 but it works on MacOS only and the produced HTML5 is hard to change.

Since we found from the feedback from the students that they are satisfied with the PDF files of presentations we do not need too much attention to the animated effects of the PowerPoint's presentations. If in general static image of presentation is enough then we can use free tools to do much of our work and only specific post processing are added later. This compromise enables us to reuse already made learning materials. Authors upgrade their existing PowerPoint presentations with the notes text. This PowerPoint can later be exported as HTML; include into the desired layout; and upgraded with HTML5 components. We managed to prepare the two hours blended learning materials in less than 2 hours if all multimedia components were available.



Figure 1: Sound narrated slides



Figure 2: Video narrated slides

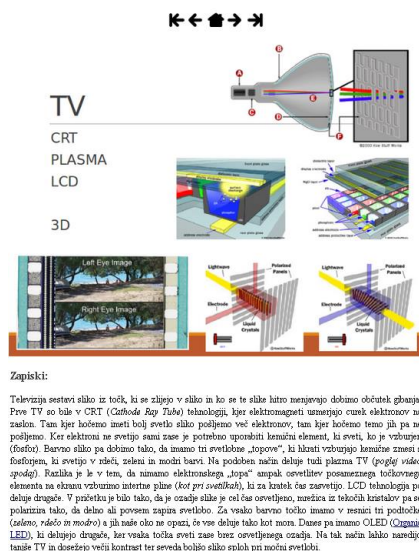


Figure 3: Integrated learning materials

C. Didactical aspect

Graduate level didactics is a bit different than those in primary and secondary schools. It is not even the part of general andragogy (learning of adults). We deal with the students who already have highly developed learning processes. We do not need to teach them how to study. In the preparation of e-learning materials we need to consider time constraint – topics should not require more than 15 min to process and we need to provide clear and unambiguous explanations. We can add outside sources and links to additional materials but for the time management it is still desired to include most important components into the package.

From the feedback of the students about the learning materials we discovered they do not care much about distractions which are necessary during the lectures. They are happy with PDF files but switch to additional materials is distracting. Either they skip the additional materials when reading the text and study it later or they do go visit other materials and have return problems. Even if they are using web daily they still have problems with browsing. By design the author can open link in the same window or in the new window. Browsers in general do not allow opening new window they open new tab instead. In the process of high concentration users too often close the window after reading the content of the tab and not only the current tab. In these occasions they cannot get back to the text they supposed to study further. Finding the e-learning materials takes time and additional effort is required to ascertain the position where to continue study. Such unwanted pauses lower the efficiency of study process.

Though we have not yet tested the new e-learning materials we have tested the components. We know that video is good for teaching skills. Sound is quite effective because it can be used where other types of learning materials are less appropriate (busses and walking). Text can be read on mobile phones. But on the other hand we discovered that even if we record the lecturer in the classroom and upload the video on the web students rarely watch such video. From the Moodle log file analysis we discovered that half of the students never even start playing the video. Around three quarter of students that start the video stops watching the video after 5 min. Only handful of students watch video for 15 min and no one watch entire video – except the lecturer. Therefore if we use video in the e-learning materials it should be short (no more than 5 minutes).

Data gathered from the faculty library shows that students rarely use audio books. Mainly students with special needs use audio books. Even on overcrowded buses or during their walks they rather listen to the music.

For the purpose of better communication between students we have bulletin board software. Analysing the posts we discovered that there is a huge free market for student's notes. In general we could not see the content of the notes but in some rare occasions someone have made the electronic version of the notes where we could analyse the content. Despite we do not know the content of the notes we can assume what is written from students' questions. From those sources we have highly confident insight that students sometimes makes a factual mistakes in the notes and those mistakes are not corrected and they live through multiple students' generations. Study literature and lecturer are available to the students' questions but students rarely use them.

D. Aesthetical aspect

In the e-learning materials each screen need to be designed according to the multiple parameters: technical, didactical, and aesthetical. Creatively designed e-learning materials must have following characteristics:

- *Applicable value* – assessed in pedagogical and didactical review;
- *Novelty* – new fresh idea, rarity, unusual and positive motivational impact
- *Appropriateness* – material must meet the problem based teaching [15]

High quality visualization is not important only for aesthetic pleasure. It gives the integrity of materials and learning for better processing of knowledge from e-learning materials. Contemporary upbringing and education build on the concept that activates auditory, haptic and visual perception. Those concepts therefore need to be fundamental part of e-learning materials. Through long observations we perceived preference shift toward visual perception. It is known that processing of same amount of information delivered through verbal messages takes more time than delivered through visual messages [16]. Therefore it is reasonable that authors extensively use visual perception activation concept in their e-learning materials design. The use of e-learning materials attracts visual capabilities. It requires an

organized observation, mental, emotional and other activities for processing the visual stimuli. The text takes much more time for processing and visuals are therefore more effective [17]. E-learning materials should be designed so that the introductory or intermediate sequence confronts the student with aesthetically ordered textual and visualized data to accept the content. *“The happiness regarding the transparent and organized screen with new content leads to the intrinsic motivation that positively affects the content acceptance”* [15]. Transparency and orderliness of screen can be achieved if elements (text, images, interactive elements, etc.) are positioned into the virtual orthogonal grid. Such perpendicular arrangement gives the required static and designed psychological simplicity and highlights isolation [18]. Unfortunately this arrangement also causes optical burden, inactivity and stiffness of composition. Important elements should therefore be positioned outside the grid. Such new composition achieves the correlation between content, importance, aesthetical attractiveness, and versatility.

Some authors [19] recommend that designers of e-learning materials should prepare the answers to the following questions before they set the design concept:

1. What is the overall structure of the e-learning materials?
2. Are the contents didactically appropriate and sufficiently reasonable?
3. How the information flows between screens from user perspective?
4. Can e-learning materials be used intuitively?
5. Which media elements are going to be used for visualization of individual content?

Additional multimedia elements have broad cognitive, educational, cultural, technical and social functions. With these we achieve a higher educational effectiveness in both educational directions wideness of knowledge and depth of knowledge [20]. It is therefore evident that for quality information transmission both aspects are important: learning content aspect and the presentation technique aspect. Didactically suitable structured e-learning materials have to be technically flawless and aesthetically pleased in order to achieve pedagogical objectives.

IV. RESEARCH

E-learning materials for course of 15 ECTS was made (15 hours lectures and 15 hours laboratory work). Apart of the lectures and laboratory work we also provide Moodle quizzes for self-assessment. Due to huge workload we did not provide the same topics in different composition but we prepare different topics in different composition (text, audio, video and integrated learning materials). Different compositions allow us to test the differences in human preferences on learning materials. It is known for a long time that people have different preferences in learning style (visual, audio or kinaesthetic) and some research shows that there are possible to get equal effectiveness in face to face as in online education [21].

Because we prepared learning material for blended learning we are going to allow access to the specific materials only after corresponding lecture. Students'

performance will be tested with the quizzes and after that they will grade the materials according to different aspects.

A. Presentation and narrative text

Two types of presentation and narrative text are available to the students:

- Flash presentation where narrative text is displayed on demand, and
- PDF where each slide is accompanied with the narrative text.

In these two types of e-learning materials we would like to test students preference toward PDF files.



Figure 4: Presentation and narrative text – Flash technology



Čeprav danes veliko govorimo o prostorskem zvoku je zanimivo to, da lahko zelo dober prostorski učinek dosežemo že s pomočjo stereo zvoka. Seveda moramo v takšnem primeru snemati tako kot bi slišali – s pomočjo umetne glave. Posnetek je neverjetno dober, doživeti pa ga je mogoče le z uporabo slušalk. V prostoru namenjenem za več ljudi je potrebno posvetiti pozornost ozvočenju. Odvisno od velikosti prostora in števila poslušalcev je potrebno razmišljati o geometriji postavitve zvočnikov in jakosti zvoka posameznih zvočnikov.

Figure 5: Presentation and narrative text – PDF file

B. Presentation and audio

Each slide in this presentation is accompanied with the audio that narrates the slide. To emphasise the value of audio we prepared slides with text only. This type of presentation has some advantage because everything is on one screen and no scrolling is needed. Students get feedback about the length of audio on the audio control slider.

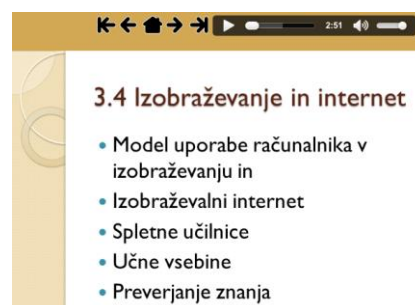


Figure 6: Presentation and audio narration

C. Presentation and video

Video was added to each slide to narrate slide. Since video occupy space and covers the part of the slide we add the control to hide the video. Hidden video still plays sound and enables students to hear the narrated voice of the slide. We have prepared this type of presentation according to observation of students' behaviour. They would never watch the whole video but in this occasion it is cut to the smaller chunks that covers only one slide. All video are in the time span of less than 5 minutes.



Figure 7: Presentation and video narration

D. Presentation and text, images, links, video (integrated learning materials)

This is probably the most favoured type of learning materials. It has drawbacks in the scrolling. Reviewers who have experience with the design and development or e-learning materials give higher score. Such materials are probably easier to implement since we do not need to record (sound or video) of lecturer. The only think we need is the narrated text and additional elements. But we need to check this finding with the students' preferences.



Figure 8: Integrated learning materials

E. Research questions and intended users

The research is going to go in two distinct directions: appropriateness and effectiveness. The first direction can be achieved easily in one generation but the second needs more time and search of trends through many generations of students.

Research questions:

- Number of perceived informations and layout.
- Ease of navigation.
- Personal preference to the tested type of e-learning materials.
- E-learning materials' building blocks preferences.
- How useful are controls on the e-learning materials (sound level control, hide/show video, pause, etc.)?
- How e-learning materials influence their understanding and knowledge acquisition?
- What devices were used for e-learning materials viewing?

In the summer semester of 2013/2014 we are going to test these materials for two distinct groups of students: natural science students and social sciences students.

V. CONCLUSION

University level student population is different than other students. They are highly skilled learners with established preferences in learning. Today's students are known as digital natives. This can be seen in different levels. They type better than write and they use ICT throughout whole day for different purposes. They are accustomed to different type of learning materials and only the lack of handy portable devices still bound them to the paper. During past years a lot of effort and funds were assigned to the production of e-learning materials for primary and secondary schools. University level education was not part of these projects and no funds were given to the e-learning materials production. E-learning materials were therefore limited to most common types of files (PDF, Word, and PowerPoint). Students therefore rarely make their notes and they study from PowerPoint slides. In the past we would fail such students but in recent years we see that this is not an option since we would need to fail almost all of them. Students therefore have huge width but at the same time very shallow knowledge. It becomes hard for them to search learning materials on different locations.

In an effort to enhance e-learning material and provide students with easier study we prepare different type of e-learning materials. To test their preferences we combine presentation and different narration types (text, audio and video) and prepare the integrated e-learning materials. According to their feedback we will provide support for e-learning materials production in other courses and gradually change all learning materials. We hope that this will positively influence the knowledge retention and provide good practice for further e-learning materials development.

VI. LITERATURE

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