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Flipped, Online and Blended Learning: Digitalization in TAMK

1. Different levels of digitalization in education

Digitalization is present in many levels in education. Starting from the top level, all administrative systems in universities are of course digital. What comes to different courses, many of them use some kind of learning management system (LMS) like Moodle. LMS offers many ways for teachers and administration to investigate students' online behaviour and success with learning analytics (LA) [1, 2].

Digitalization in education is present in many ongoing research projects as well. The projects can for example aim to find meaningful ways to exploit digitalisation to enhance learning [3] or increase teaching accessibility [4]. This can mean the usage of smart phones and tablets to take the learning outside classroom – to the nature, historical sites, museums etc. With smart phones' powerful processors and set of different sensors it is possible to let the students make measurements by themselves in very many different locations for physics courses' needs, for example [5].

The smallest level of digitalization in education is different (one-task) tools teacher can use to enhance learning. These tools can be mobile apps or web sites.

2. Digimentors

In many cases digital tools and methods in education are tested and taken into usage by enthusiastic individual teachers, whereas most of the other teachers haven't even heard about those and lack the courage, time or interest to test them. In many cases they don't have a clear idea how digital tools would be beneficial in teaching. To overcome this bottleneck, Tampere University of Applied Sciences (TAMK) has established a "digimentor"-network in 2015. Teachers sometimes need a little push towards the new and the main idea in the digimentor network is that a colleague in the same field is the best to inform a teacher about the benefits and usage of a certain digital tool. In TAMK each university's field of education (called schools) has one or two digimentors. This mean that one digimentor has typically 30-50 colleagues to guide and altogether there are 11 digimentoris in TAMK. Also the normal helpdesk and ICT services are available to faculty members. Digimentors share information regularly among each other and therefore they can together cover wider range

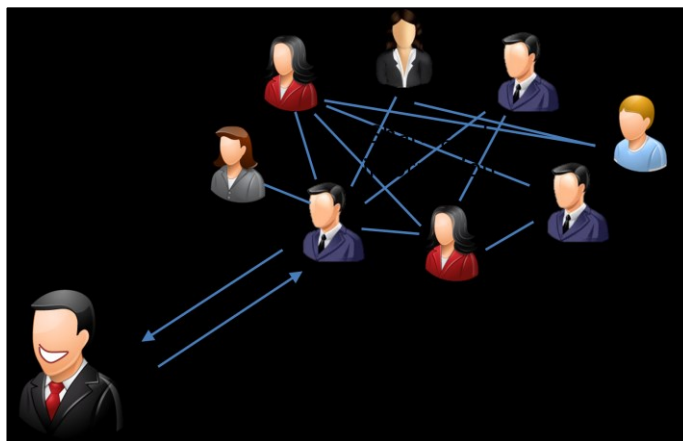


Figure 1: Digimentor network.

of tools and methods than single enthusiastic teachers alone. The digimentors help colleagues typically in two ways: either arranging workshops for a group of teachers in certain topics depending on their needs, or giving on-site help on a short notice for individual teachers on specific topics like “How to create a channel in YouTube”. At TAMK, a part of working time is allocated for this helping function for digimentors, but majority of their workload comes still from their normal duties, in most cases classroom and online teaching.

3. Tools and Tips

Jane Hart's website “Centre for Learning and Performance Technologies” [6] has presented the ranking list for different digital tools in education since 2007. The ranking is based on user survey among teachers and educators. This year's survey got 1238 answers from 64 countries and the list is shown as a screen shot in Figure 2. In actual website, it is possible to get some hints and tips for usage by clicking the names of the tools. Many of the tools are widespread

1. YouTube (1)	26. Audacity (28)	51. Movie Maker (77)	76. iMovie (69)
2. Google Docs/Drive (5)	27. Evernote (17)	52. Google Classroom (80)	77. Piktochart (85)
3. PowerPoint (4)	28. Office Mix (42)	53. Adobe Captivate (39)	78. GoAnimate (89)
4. Google Search (2)	29. Trello (43)	54. edPuzzle (81)	79. TodaysMeet (94)
5. Twitter (3)	30. iSpring (44)	55. Easygenerator (51)	80. OneDrive (103)
6. Dropbox (10)	31. Google Maps (49)	56. Udutu (61)	81. eXe (114)
7. Prezi (14)	32. Khan Academy (52)	57. Scoopit (72)	82. Animoto (115)
8. Kahoot (15)	33. Quizlet (53)	58. Edmodo (86)	83. Blackboard
9. Powtoon (22)	34. Wikipedia (11)	59. Weebly (88)	Collaborate (123)
10. Word (16)	35. Snagit (26)	60. ThingLink (90)	84. Zoom (65)
11. Moodle (27)	36. Socrative 55	61. Clarify (92)	85. Turnitin (126)
12. Screencast-O-Matic (31)	37. iPad & Apps 58	62. Explain Everything (95)	86. Grammarly (128)
13. WordPress (9)	38. Sway (59)	63. Google Sites (96)	87. Pixton (130)
14. Google Chrome (33)	39. Google Hangouts (41)	64. Blackboard (99)	88. Sakai (131)
15. Facebook (6)	40. Google Plus (45)	65. Mahara 100	89. BigBlueButton (146)
16. Google Forms (34)	41. Blogger (56)	66. Webex 36	90. Schoology (150)
17. Skype (7)	42. Adobe Connect (62)	67. Desire2Learn (D2) (108)	91. Notability (152)
18. Padlet 35	43. Whats App 13	68. Jing (109)	92. Kaltura (155)
19. Google Apps for	44. Articulate 25	69. SharePoint (38)	93. Moovly (156)
Education (GAPE) (40)	45. Excel 46	70. Nearpod (110)	94. Explaindio (157)
20. Camtasia (24)	46. Diigo 54	71. Outlook (50)	95. Zeetings (158)
21. Slideshare 18	47. Google Scholar 60	72. Wix (112)	96. ILIAS (159)
22. OneNote (19)	48. Canvas 67	73. Canva (57)	97. Remind (160)
23. Pinterest 29	49. Poll Everywhere 68	74. Keynote (64)	98. WeVideo (161)
24. Gmail (32)	50. SurveyMonkey 70	75. Firefox (65)	99. Showbie (162)
25. TED Talks/Ed (21)			100. PlayPosit (165)

Figure 2: Top 100 Tools for Education (2016) [6].

and need no introduction, whereas some are rather unknown. In the next chapters, a few of the not so well-known tools are viewed a bit deeper.

3.1 PlayPosit

PlayPosit is an online learning environment to create interaction to videos. These interactive videos are called “bulbs” and they can be shared among teachers and can be assigned to student groups. Teachers begin with any online video (Khan Academy, YouTube, etc.) and

build multiple-choice or open questions on top of it. The video stops automatically for presenting the questions at the chosen time instants. Teachers access the answers via web interface. The idea is presented in Figure 3.

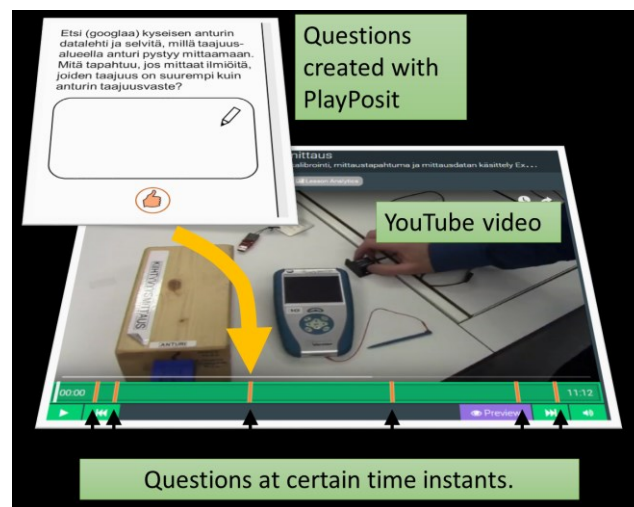


Figure 3: The principle of PlayPosit.

3.2 PollEverywhere

As the name suggests PollEverywhere (www.pollerywhere.com) is used to pose polls and surveys to students. There is an option to make answer anonymous. Sometimes students are shy to present their ideas. Part of the student group may also want to withdraw and stay passive. With anonymous polls and surveys it is possible to give voice to the silent and shy ones. Moreover, it activates the passive students to participate and to contribute. The questions are either multiple choice, open ended or in picture format. The latter allows user to define clickable areas on the picture and the students then answer by choosing and clicking different areas. Other way is to let students freely click different locations on the picture. What comes to pedagogy, PollEverywhere can for example be used to quickly gather students' prior knowledge in the beginning of lectures. With suitable questions the possible misconceptions of the presented topic can be surveyed and then corrected right away. PollEverywhere with

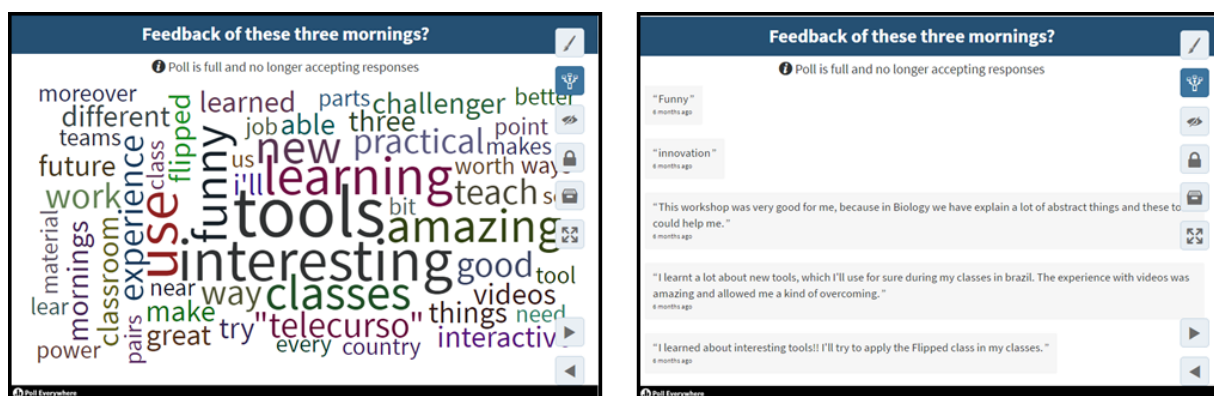


Figure 4: PollEverywhere answers seen as word cloud (left) and text wall (right).

open ended text questions can be used as a text wall. To hide individual answers but still present the “average answer” of the group, the display can be changed from a line view to word cloud view in which the word font size depends on the number of times it had been mentioned.

3.3 Kahoot

Kahoot (<https://getkahoot.com/>) is another polling website/software, but it differs from PollEverywhere by having a competitive nature. In Kahoot it is possible to present four different answer choices. In the competitive mode the speed of giving right answer is converted to points a student gets. After the polling the ranking can be shown (using nicknames) and the student with the highest point count can be prized.

3.4 YouTube and videos

Almost everyone is familiar with YouTube from the watcher's side. But fewer teachers and instructors have own account and channels in YouTube despite its benefits as a tool to present lecture recordings and short educational video clips. Educational videos have enabled new teaching methods like flipped classroom, just in time teaching and peer Instruction [7 - 9] and videos can be used as tutorials or instructions for laboratory work [10 - 12]. The main idea is to use videos for one directional sharing of information and free valuable face-to-face time for active learning, which is demonstrated to increase learning outcomes [13]. Short video clips and activating learning methods can be combined to enhance learning, both in face-to-face and online implementations [5, 14].

At TAMK Physics, all educational videos are produced by the physics teachers. Why not just link existing online videos to the course material? One reason is the lack of Finnish university level educational physics videos. There was no other option. In three years, the video count has increase to 1000 and they have been watched over 110 000 times for 350 000 minutes. The number of freshmen in engineering studies at TAMK is approximately 400-500 annually

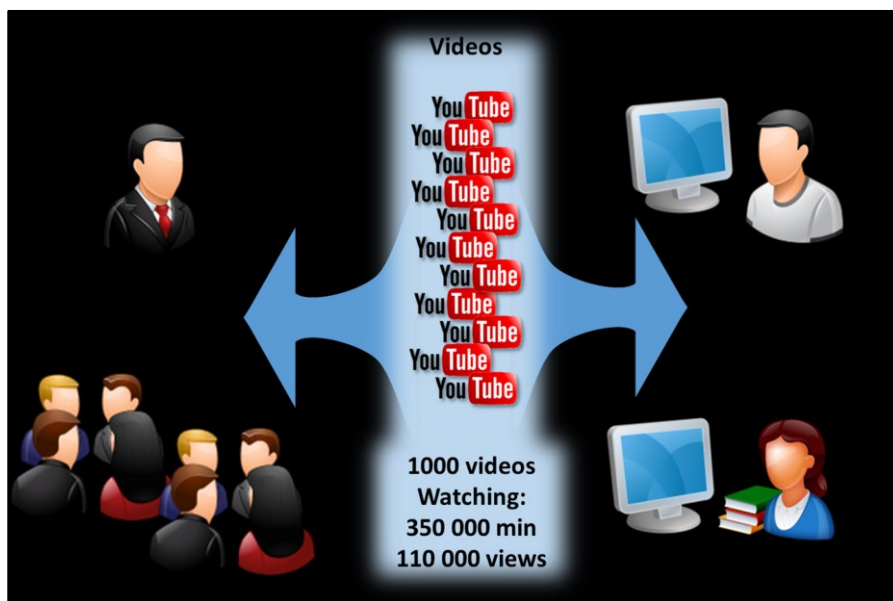


Figure 5: Short video clips are produced at TAMK and used for blended and online learning.

and physics is taught during the first two years. In relation to this number of students, the videos seem to be well in use.

Teachers are usually rather busy and there is no extra time to spend on video production. Therefore, very simple methods were chosen at TAMK Physics and any teacher can start using

similar methods rather easily. Depending on the purpose and content of the video, as well as teachers' preferences, the following methods are used:

- iPad + pen + paper (Figure 6 A)
 - This is a very simple and straight-forward way to produce for example calculus-based solutions to homework exercises. iPad is placed to a holder above empty paper. iPad's camera and microphone are then used to record the video as the teacher carries out calculations etc. on the paper explaining it simultaneously aloud. These are fast to do, and pen and paper are an easy interface for anyone to learn. The drawbacks are that the graphics quality depends on the artistic skills of the teacher and once a mistake is made, everything has to be started over.
- iPad + ExplainEverything (Figure 6 B)
 - ExplainEverything is an app for iPad which can be used to simultaneously record the teacher's voice and his/her drawings and writings on iPad's screen with a stylus pen. As such, this is a digital counterpart for the pen&paper method. When needed due to mistakes, the recording can be paused anytime, rewound to a certain time-instant and re-recorded
- PowerPoint videos (Figure 6 C & D)
 - Presumably all teachers have PowerPoints. It is possible and easy to record timing to a PowerPoint presentation and then convert to video format. The video can include teacher's narration and highlights with "laser pointer" as any live presentation does. Moreover, in PowerPoint it is easy to build simple animations or include a video clip or audio file in the slide.
- Video camera and cameraman (Figure 6 E)
 - For example, to explain the proper handling of laboratory equipment or to present a demonstration of a law of physics, video camera can be used similarly as in recording holiday videos. In many cases two teachers need to cooperate: one is performing the actual measurement or set-up of laboratory equipment and simultaneously explaining what is being done. The other one is a cameraman who is responsible for aiming and zooming the camera.
- Screen capture (Figure 6 F)
 - Screen capturing is best suitable to present how to use a certain computer program like CAD or Excel. The recording can be taken from the screen alone or alternatively a talking head can be included by recording it simultaneously using a web cam. Naturally, both computer audio and narration are recorded.

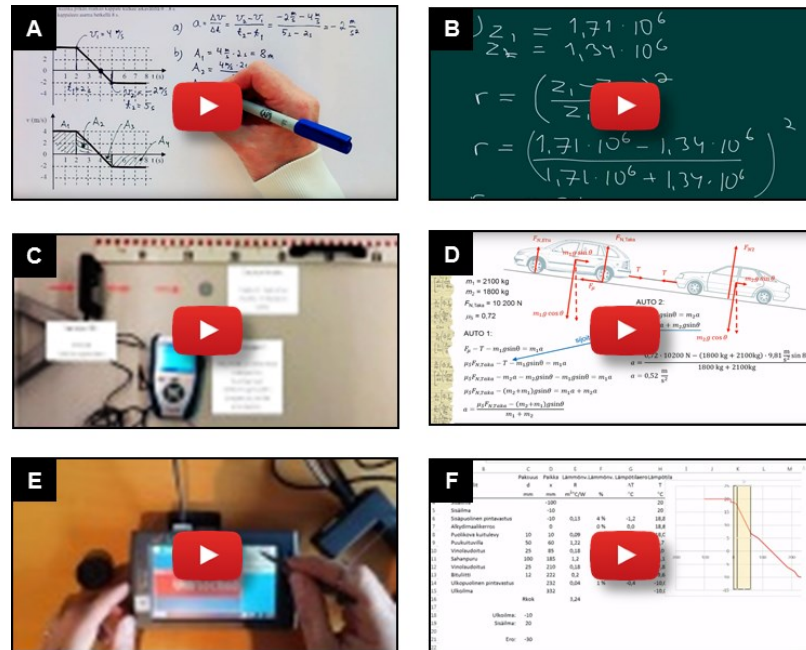


Figure 6: Different ways to produce short educational video clips.

4. Learning analytics

Learning analytics means the measurement, collection, analysis, reporting and visualizing of data about learners. Many learning managements systems (LMS) offer built-in tools to record, view and analyse student's online activity. Typically, opening of different learning activities, posting messages to forums etc. are recorded to log files. The times, durations and sequences of these activities can be recorded and analysed. Based on the log data it is possible to tailor students study paths, suggest certain supportive study materials or use it as an alarming system for interventions to reduce drop-out rate from courses.

At TAMK, the LMS in use is Moodle. It offers some build-in learning analytics tools, but for deeper analysis the event log data can be transferred to Excel, in which it can be categorized according to various parameters. In Moodle, the log shows all actions taken in the highest level of hierarchy in Moodle's structure, whereas deeper structures are not recorded. For example, opening a folder containing many links to videos is logged only as one event. Opening the individual videos is not logged. Therefore, all activities which need to be analysed, have to be on the highest level of hierarchy. All actions and their timestamps are recorded individually for each student. This way it was possible to analyse at what time a student has taken a certain action: opened a homework assignment, watched a solution video or handed out his/her own solutions to problems, and what is the time difference between actions. It should be noted, however, that learning analytics can't reach the effectiveness and intensity of studying, nor can it record such learning activities as reading a book.

A few examples of different ways to use learning analytic data is shown below. Figure 7 shows the correlation between student's video watching activity versus course's final grade [1]. Clearly, the percentage of videos watched tells about studying, since it has a correlation with final grade up to mark 4. Interestingly, the students who got the highest mark (5) didn't watch videos as much as other passed students (grades 1-4). One possible explanation is that the

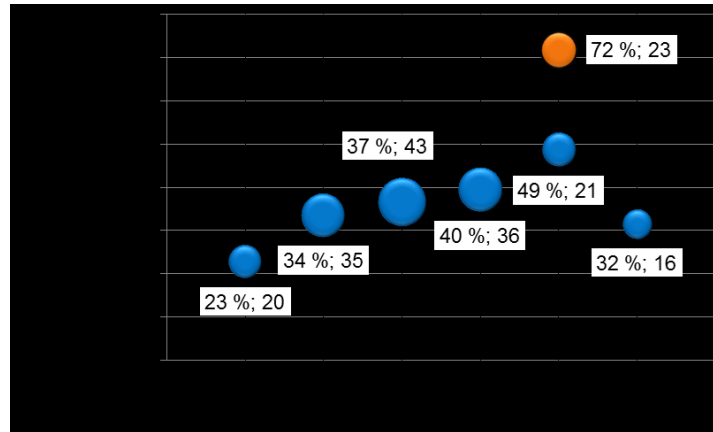


Figure 7: The correlation between video watching and final grade [1].

good ones know that they know – therefore they don't need to watch the videos so much to get the confirmation for their knowledge.

In Figure 8 students' daily online learning activity is presented as a function of time of day for two identical online course implementations. Based on the graph, it can be noted that most of the studying takes place after normal working hours. If a teacher genuinely wants to help his/her students this result recommends that the teacher should be online in the evenings. At TAMK, some of the teachers have organized online "office hours" at 20-21 o'clock once a week to be able to serve the students and answer their questions at suitable times. Nevertheless, willingness to do so depends very much on the teacher.

In addition to LMS log data, also Google Analytics can be used to survey students' online activity. The amount of views and watching times are easily accessible, together with a large variety of other options (time, traffic sources, percentages watched, location, device, etc.).

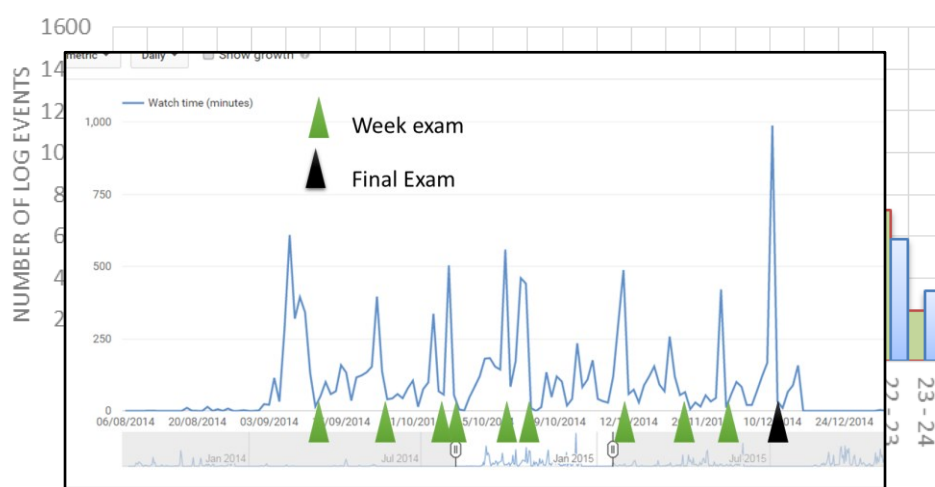


Figure 9: The temporal distribution of number of video openings from Google Analytics.

Figure 9 presents Google analytics data of a physics course. It clearly shows the highest activities just before week exams and final exam. Traditionally, learning outcomes are tested at the end of the course using final examination. When using this type of summative assessment, the studying activity tends to be highest just before the final examination. By changing to continuous assessment or to assignments with deadlines every week, it is possible to encourage the students to spread their studying more evenly throughout the course.

5. References

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