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Wikis for textbooks, online collaboration and course presentation

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Dansk Uddrag

I denne artikel giver vi en kort og grundlæggende introduktion til hvad en wiki er og beskriver 3 cases hvor vi har brugt platformen som et redskab I vores undervisning. I alle cases har vi brugt wiki-funktionaliteten I en blended learning sammenhæng men med forskellige måder at implementere den på. I den første case brugte vi en wiki som online textbog, i den anden case som et collaborativt skrive- og samarbejdsredskab for de studerende og i den tredje case som et learning management system. Eftersom valget af den optimale software til at konstruere en wiki (f.eks MediaWiki eller Wikispaces) afhænger af hvad man skal bruge den til, beskriver vi også vores erfaringer med forskellige wiki-softwares i vore cases.

Gennem en pragmatisk tilgang og blandede metoder evaluerer vi på brugen af wikier i vore tre cases af læringsdesign.

Vi konkluderer at man kan optimere underviserens ressourcer I klasseværelset ved at integrere en textbog med øvelser I wiki format.

Vi konkluderer endvidere at man kan facilitere effektivt samarbejde mellem studerende ved at stille et wiki miljø til rådighed og at de besvarelser på opgaver der kommer ud af det har en høj kvalitet.

Vi konkluderer også at de studerende i højere grad undersøger og interagerer med læringsmaterialet når det ligger i et velkendt wiki-layout end hvis materialet ligger i universitetets officielle læringsmiljø. Vi formoder at grunden er at wiki layoutet er velkendt for de studerende så de har lettere ved at danne sig et overblik, navigere og tilgå materialet på en effektiv måde.

Abstract

In this paper we give a short introduction to wikis and describe three cases in which we have used a wiki platform as a tool for learning. In all cases the wiki was used in a blended learning setting but with different implementations in the learning design. In the first case we used it as an on-line text-book, in the second for student collaborative work and in the third as a learning management system. As the choice of optimal software for a wiki (e.g. MediaWiki, or Wikispaces) depends on the intended use, we also describe our experiences with various software in the three use-cases above.

Through a pragmatic mixed methods approach we evaluate the use of wikis in our three learning design cases.

We conclude that integrating a textbook with exercises in wiki format can optimise the use of the teacher ressources during traditional classroom exercises.

We further conclude that providing a wiki environment for students' collaborative report writing facilitates effective student collaboration with high quality output.

We also conclude that wikis implemented as a learning management system makes more students visit and engange actively with the learning material than in the official learning management system of the university. We infer that the students are more familiar with the wiki layout so they can better get an overview, navigate and access the learning material efficiently.

What is a wiki and how to get started

The wiki format has conquered the world particularly through the implementation in Wikipedia, since most people use it on a daily basis as an online encyclopedia. In the Wikipedia online encyclopedia the very definition of a wiki can also be found:

> ”A wiki (i/'wɪki/ WIK-ee) is usually a web application which allows people to add, modify, or delete content in collaboration with others. Text is usually written using a simplified markup language or a rich-text editor... While a wiki is a type of content management system, it differs from a blog or most other systems in that the content is created without any defined owner or leader, and wikis have little implicit structure, allowing structure to emerge according to the needs of the users.” (Wikipedia 2016)

While this definition describes e.g. Wikipedia itself, it doesn't cover all possible uses of wiki software. We shall describe a few other cases in the present article.

In practice, a wiki is a collection of page contents stored in a database which is then shown to the user via the wiki engine (software) as he, in his browser, clicks on various links in a web page.

There is a destinction between those who contribute material and moderation to the wiki (in Wikipedia they are called Wikipedians (Wikipedians 2016) and we will use the same terminology) and those who merely read it called the Wikiusers.

How to get started

Like any other web service, a wiki needs to be hosted somewhere which provides the wiki engine as well as web access (a wiki server). There are various companies, which host wiki servers either for free (e.g. Wikispaces) or for a fee. In that case all you need to do as a teacher is to upload your content in a predefined template.

If you want full control of functionalities (not only content) you will need your own wiki server. A wiki server consists of a web server with wiki

software. A web server in this content is a computer which is always online and has web server software installed such as LAMP (Linux+Apache+MySQL+PHP) or Nginx with PHP.

The web server can be hosted by a company such as e.g. Amazon EC2 which means the company takes care of the above two things for you. You can install several wikis on the same server along with other web services.

In order for your server to act as a wiki server you will also need to install a wiki engine (e.g. MediaWiki) and perhaps extensions to the engine in order to make special formats of your material (e.g. MathJax for mathematical expressions, ocaml for TeX scripts, Show/hide, Cite etc for Mediawiki). Optionally, if you want to analyse the user statistics in order to e.g. look at the typical length of a session or the history of clicks for the students, web analytics software such as Open Web Analysis must be installed on the web server in addition to the wiki engine.

Background for our implementation of wikis in teaching

Everyone can be Wikipedians and contribute to a wiki or even start one of their own, including teachers and students. But why would one want to make a wiki for teaching purposes?

The motivation factors to implement wikis in our learning designs included:

- it is accessible from anywhere (with internet), anytime
- it is continuously updatable in a flexible and easy way
- it is globally searchable on all words in contrast to non-digital formats
- it is easy to share specific pages via links
- it is easy to link local contents to external resources
- Wikipedia is widely used as a general knowledge database and thus the wiki format should be easy to access for many students
- the wiki format is well-established and used for information sharing among young people. This can be seen by looking at (Wikipedians) at Wikipedia which is mostly edited by young people , 53% are less than 30y and only 18% above 40y (Wikipedia demographics 2016)
- the wiki format supports an integrated communication and teaching platform via the discussion pages

- the wiki format (with suitable plugins) supports content overview as well as interactive/dynamic illustrations/self tests via the show/hide functionality
- contents in a wiki can be structured if necessary
- the wiki format promotes collaboration both among Wikipedians and Wikiusers.
- it is user friendly as a digital multimedia platform since all that is needed is a browser and it is thus (largely) independent of the device and operating system of the user. This is contrary to many other multimedia software products which often need to be installed on the users device/operating system.
- it is inexpensive to produce and distribute

We also considered some concerns that could arise by producing and presenting learning material in a wiki, mainly:

- some students may prefer to have the teaching material on paper and not all wiki engines support nice and organised printing formats.
- some teachers and students are not used to structuring information and using the software in the way needed for the creation of a successful and organised wiki.

We will address the appropriate motivations and concerns in our learning design of the three cases described below, but first we will introduce a basic e-learning concept called a learning management system (LMS).

The software which is used to build an e-learning platform with is commonly termed a learning management system (LMS). Among other features such as enrollment of students in courses they provide a means to organise content within courses. Most LMSs feature some form of built-in wiki functionality. The structure and features of the wiki functionalities however differ considerably between LMSs so it is important to keep the purpose and intended use of the wiki in mind when choosing the appropriate wiki engine.

As mentioned above, the wiki format can be utilised in many more ways than the traditional collaborative encyclopedia. Here we will describe three other ways to use a wiki as a learning tool namely

- *wikis as textbooks*
- *wikis for student (collaborative) reports*

- *wikis as learning management system*

The best choice of software for a wiki depends on the intended use, wherefore we will also describe our experiences with wiki engines in the hope that our readers may find it useful in their own learning design.

We will describe our implementation of the wiki learning tools in each of the cases below.

Case 1: Wikis as textbooks – the WIKIbook

A common problem with textbooks in a non-hypermedia format (such as e.g. a printed book or regular text file) is that they are not easily and immediately updatable and the inevitable updates not easily and immediately redistributable. When using a hypermedia such as a wiki textbook (WIKIbook) the 'recent version' can be the one which is accessible and shared. This is an advantage for the readers but may be a challenge for authors (Lin, Bonk & Sajjapanroj 2008). If the students have write-access to the contents either directly or via discussion pages they can contribute easily to the improvement and updates of the textbook and the WIKIbook thus acts as an integrated communication and teaching platform. In recent years several such WIKIbooks have been initiated outside a LMS framework and not connected to particular course, see e.g. (Wikibooks 2016) .

Being inherently a hypermedia, the contents of the WIKIbook is naturally extended by dynamic links to both internal or external references. Students are used to searching for information in the 1-page encyclopedic format, however, in order for it to act as a 'book' the contents need to be structured topically and/or progressively e.g. in a tree structure with chapters, sections and subsections. Some wiki engines only allow a flat content structure whereas others allow content to be structured in levels. The structure is provided by the authors in terms of adding links to other pages which includes the names of these pages. When building a WIKIbook it is thus important to keep an outline of the material and overview of the structure since it can be difficult to restructure the contents at a later stage.

Furthermore, creative use of a show/hide functionalities in wiki engine extensions can be implemented in order to make student exercises with hints and solutions which need to be activated by the student in order for the content to be shown. These "WIKIexercises" thus act as student self-tests. We have however not encountered this functionality in other WIKIbooks than our own.

The choice of software used to create a WIKIbook depends on the functionalities needed to generate, maintain and show the contents. We have found that the best software in terms of structuring contents (chapter, sections, subsection), providing a versatile and optional editor,

math-rendering, cross-referencing (to equations, figures, tables), citing, show/hide and user rights management is MediaWiki with an appropriate set of extensions. Although literature on the development and use of e-books in education is available, there is lack of literature which investigates the effect of using WIKIbooks instead of regular textbooks as reading material in higher education wherefore we we find it valuable to report on our experiences.

Objectives of this case study

Our main objective for investigating the potential of WIKIbooks as part of a blended learning design is directed at finding a way to help students obtain a higher learning outcome and make more efficient use of the teacher resources during classroom exercises. Furthermore, we also wanted to investigate whether the students would directly improve on the quality of the learning material given the opportunity of direct online feedback in discussion pages.

Learning design

We have implemented a WIKIbook as a central part of the learning material in the course "Neutron Scattering". It is a 7,5 ECTS science based course designed for 4th year students in physics or nanoscience. There is roughly 20 participants annually, many of which are international students. The course consists of 7 weeks blended learning at the Niels Bohr Institute + 1 week hands-on in a large-scale neutron scattering facility in Switzerland.

The reading material for the course was implemented as a WIKIbook but was also offered as a printed set of notes. The contents of the notes has been written by multiple authors with the course responsible as the main author and moderator. The contributed content was integrated with the existing text in the set of notes by the moderator before upload to the WIKIbook, thus the co-authors did not directly type in their contribution which overcame some of the obstacles such as coordination and collaboration during development of centent as mentioned by Lin, Bonk & Sajjapanroj (2008). I Our WIKIbook was implemented by the MediaWiki software on a local web server. The set of notes were organised by parts containing chapters which again contained sections sometimes containing subsections. In the WIKIbook implementation all sections and subsections have their own wiki page. The parts with sublevel chapter headings are shown on the main page of the WIKIbook which also provides quick links to the chapters, see Figure 1. When clicking on a chapter heading, a page which shows the content overview of that chapter with sections and subsections, is shown. All concepts can

be searched for and accessed directly or the contents can be traversed as a book with the back/forward buttons.

Since the course notes are formatted in an advanced markup language called LaTeX we preferred to use a simple editor in MediaWiki and upload contents from our own template but a WYSIWYG editor for MediaWikis also available. The WIKIbook features enumerated figures, tables and equations and references to these within the text. Supplementary material can be cited by [number] followed by a list of references for each page, some or all of which may be dynamic links, this is provided by the Cite extension to the MediaWiki engine. The WIKIbook is able to show equations and mathematical contents from LaTeX input both in-line and in enumerated equations, which is provided by the CrossReference extension.

Apart from reading it and browsing through it as a hypermedia we allowed the students to interact with the WIKIbook in two ways:

1) Clicking on hints and solutions to exercises. This feature is

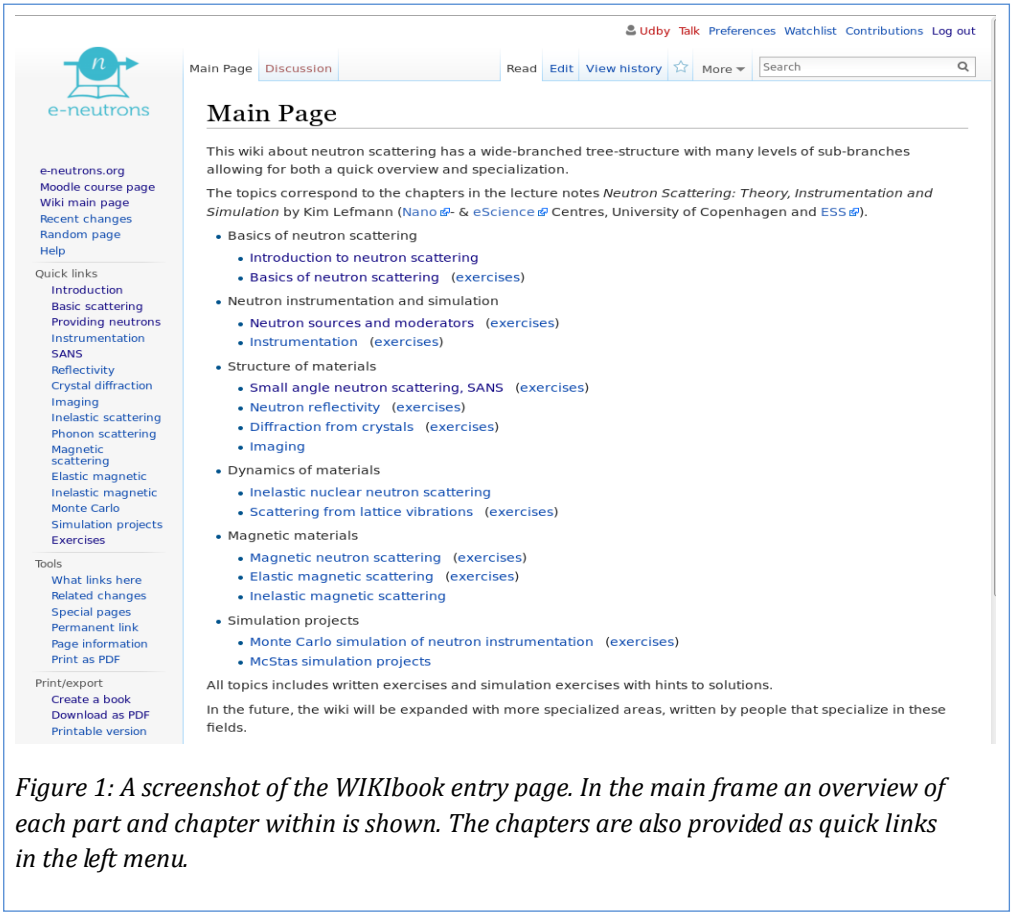

Figure 1: A screenshot of the WIKIbook entry page. In the main frame an overview of each part and chapter within is shown. The chapters are also provided as quick links in the left menu.

implemented by the Show/Hide functionality in MediaWiki, see Figure 2.

2) Commenting on the discussion page for each section/subsection in order to ask questions, report errors or suggest reformulations.

The students were in class 12 hours per week distributed on two days, each day with some amount of time (1-2 hours) dedicated to work with the WIKIexercises.

Evaluation of the learning design

After the course had ended (winter 2014) we evaluated the outcome of the implementation of the WIKIbook in our learning design. This was done by a mixed methods approach including an online survey , a focus-group interview and observation in class. As other online resources than the WIKIbook were also implemented in the course, the general considerations below do not reflect the response to the WIKIbook uniquely:

9 of the students participated in an online survey. ⅓ of the participants were bachelor level students, the rest were master students. Approximately half were international students which followed the course while studying at the University of Copenhagen.

On average the students spend 23.3h on a weekly basis following the course. 20% of the students had studied 61-80% of the learning material, 40% had studied 81-100% of the learning material and the rest didn't remember. Participation in the online and blended activities was similar : 40% participated in 61-80% of the online material while 60% had studied 81-100% of the online material.

40% of the students agreed that the blended learning format of the course helped them structure their time, 20% disagreed and the rest neither agreed nor disagreed.

All participants agreed (50%) or strongly agreed (50 %) that the use of online and blended learning resources as well as online and blended learning activities supported their attainment of the intended learning outcomes.

All participants were familiar with the online assignments in the course and 80% agreed that that they were working successfully, the rest neither agreed nor disagreed.

The survey also contained more specific comments to the WIKIbook as described below.

50 % of the students found the WIKI textbook either very user-friendly (17%) or user friendly (33%), while the rest found it neither user-friendly or not. In general this tool was rated the most user-friendly e-learning tool implemented in the Neutron Scattering course during fall 2014.

In a follow-up focus group interview the same students revealed that they used the WIKIbook extensively when solving assignments such as

quizzes and exercises. This quote from one of the students made most of the focus group participants nod affirmatively:

> "It is very nice that you have the wiki pages right next to the quizzes in the browser, especially when you sit in class and maybe don't have so much space. It is also easier to search [for specific words] in the WIKIbook than in the printed notes."
> (Student in focus group interview 2014)

Some students said that they preferred to read long paragraphs in the printed note-set but they did not seem to experience problems switching between the printed notes and the WIKIbook at their own leasure thus eliminating our concern that some students would not read the necessary material simply because it was implemented in a digital wiki format. We furthermore in class observed several students click on links to supplementary (external) material and also use the Google search engine to look up alternative definition of concepts.

Futhermore the teaching assistants reported a significant lower stress-level in class with more time to discuss the deeper learning aspects of the exercises when students could help first themselves to hints and solutions in the WIKIexercises as compared to solving the exercises as printed in the notes (without hints and solutions). The students did however only negligibly engange in the discussion pages which we mainly attribute to the in-class teaching which welcomed discussion of the WIKIbook as well as a manual collection of printed errors. The students were in general highly involved with the discussion and feedback to the learning material in class, which was however so efficient that the students did not feel motivated to also engage in online correction of the material.

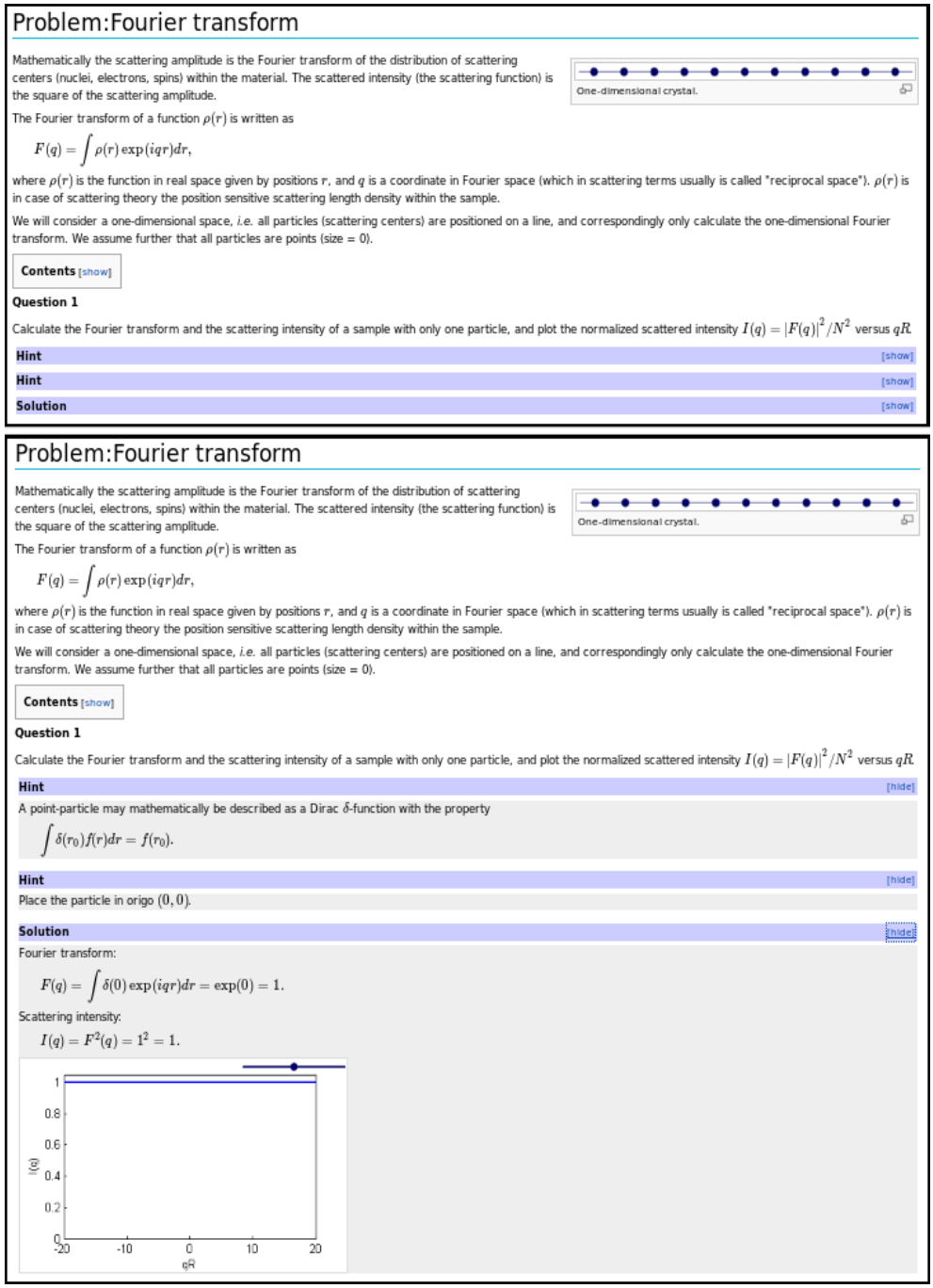

Figure 2: A combination of screenshots of a WIKIexercise in the WIKIbook. On top (bottom) is shown the exercise before (after) the student activated the 'show' button. Adapted from Udby et al (2013).

Case 2: Wikis for student collaborative reports

There are only a few studies that address the learning effects of collaborative work in a wiki environment for higher education students (e.g. Kirkwood & Price 2005; Page and Reynolds 2015). We aimed to get additional experience with the use of the wiki environment as a facilitator for students' collaborative work processes. The wiki platform has several characteristics that potentially may help to facilitate collaborative work (Lin & Kelsey 2009; Page and Reynolds 2015).

Objectives in this case study

Our main objective in this case was to get experiences with the possible use of the wiki environment as facilitating for students collaborative work process. The wiki-platform has several characteristics that potentially could help to facilitate collaborative work (e.g. Lin & Kelsey 2009).

- it is continuously updatable in a flexible and easy way
- it is easy to link local contents to external sources
- Wikipedia is widely used as a general knowledge database and thus the wiki format is easy to access.

We report our experiences from a 7 week course where 40 students used the wiki environment for collaborative report writing. The course format was a combination of lectures and classroom teaching. Each week a 2-hour session was reserved for work with assignments in the wiki environment.

Learning design

As an alternative to written assignments, we wanted the students to work in small groups on projects with a specific topic. The students should collaborate in the wiki environment with easy access from a browser on a PC, a tablet or even their mobile phone. The wiki offers an editor with features that allow students to embed youtube clips and insert links to information on other websites. In this way the students should work in the same environment as where they find the information for the assignments (the internet!) which has the great advantage that it is extremely easy and time-saving to combine information obtained from different sources. On the collaborative side instant feedback on the final product (the wikipage) can be given by fellow students. Comments and smaller corrections are logged and can be monitored continuously during

the writing process. Not least the teacher can give feedback to students via a functionality in the editor.

As a case for testing the wiki platform for student collaborative reports we have implemented it the course “Motor Development and Learning” which is targeted for students in physical education. The course is generally followed by more than 40 students in each run. The course is structured by lectures as well as work in "WIKI"-groups. Each week two hours with a teacher present were set aside for wiki-work. The students were given a selection of assignments - with the instructions that they should cover the topic and create a wiki document which should be presentable and useful for their fellow students. They started working on the document immediately after a brief introductory lecture and were to finish it the following day. All digital material could be included either linked or incorporated into the wiki environment which was accessible only to the student on the course. Students from any group were allowed to comment on the work by other groups.

Evaluation of Learning design

We experienced a high level of student activity during session set aside for work with the wiki-assignment. Within just a few hours students had collected a significant amount of information and in many instances they obtained a level of detail in their assignment which was beyond our expectations for the course in general. It seemed easy for them to find information. The quality of the topical content was high but the students appeared to be challenged when structuring and presenting the information. Even though the students were allowed to comment work by the other groups, they did not engage in this activity, wherefore we will in the future require that the student evaluation of other assignments should be done in order to pass the assignment, as also suggested by Karasavvidis (2010).

Case 3: Wikis as learning management

Wikipedia is the internet number one encyclopedic "database" which presents information in a simple and uniform manner (Leuf and Cunningham 2001; Cunningham 2002). We expect that if not all students, then at least the majority, are familiar with the presentation of information with regards to form and structure in this format. They may thus also find it more easy to navigate the course presentation and learning contents in wiki format rather than in a unique LMS format such as Absalon which is only used by the University of Copenhagen.

Objectives in this case study

Since we had previously experienced that not all students accessed all the teaching material when it was presented in the LMS Absalon which is provided for all courses at the University of Copenhagen, we decided to test an alternative course presentation method. The motivations for choosing the wiki format for course presentation and learning management were that

- it is continuously updatable in a flexible and easy way
- Wikipedia is widely used as a general knowledge database and thus the wiki format is easy to access
- the wiki format (with suitable plugins) supports content overview via the show/hide functionality
- contents in a wiki can be structured if necessary
- it is inexpensive to produce and distribute

We introduced the wiki-layout as the presentation of the course including a lecture plan, teaching material and wiki assigments. From the wiki-page statistics we evaluated the extent of use of the teaching materials put on the wiki course page.

Learning design

In contrast to the course administrative web-interface which is usually specific for each university, the MediaWiki platform (engine of Wikipedia) represents a generally well known format for structuring information. Courses of most kinds can be presented in this format with outline and planning of teaching sessions, assignments, teaching materials (e.g. quizzes, animations etc.) and a large selection of plugins are available to embed or integrate most teaching materials. We wanted to investigate if the familiarity of the wiki layout would reduce the time the students and teachers invest in getting to know the LMS and promote focus on the actual subject taught and connected learning material.

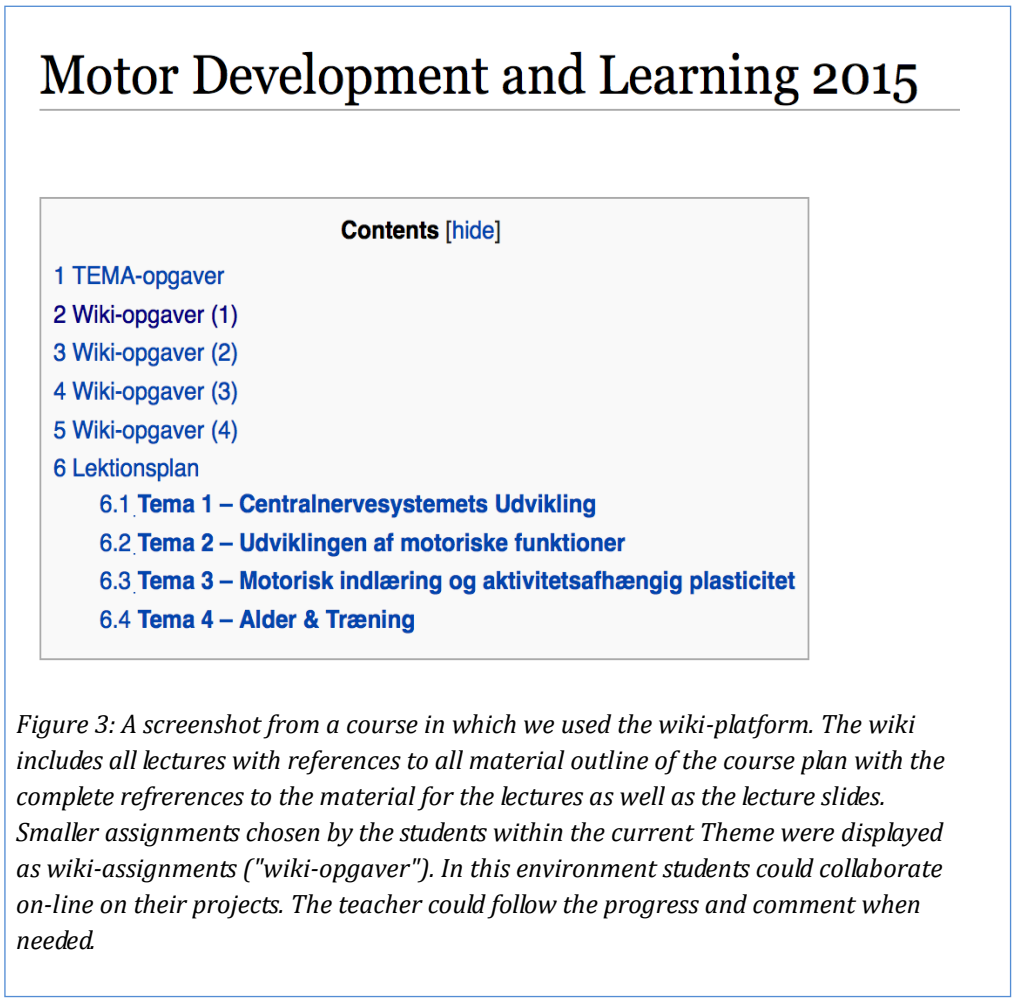

Figure 3: A screenshot from a course in which we used the wiki-platform. The wiki includes all lectures with references to all material outline of the course plan with the complete refrerences to the material for the lectures as well as the lecture slides. Smaller assignments chosen by the students within the current Theme were displayed as wiki-assignments ("wiki-opgaver"). In this environment students could collaborate on-line on their projects. The teacher could follow the progress and comment when needed.

As a case for testing wiki as course presentation and learning management we have implemented the presentation of the "Motor Development and Learning" course in MediaWiki, see Figure 3. This is done in parallel to the presentation in the LMS platform run by the University of Copenhagen (Absalon by It's Learning). With the extra ork provided by the teacher the wiki-presentation of the course at first sight looked more streamlined (homogenous) and gave a better overview of the content compared with university platform. We experienced minor difficulties with regards to speed and access to the wiki server which did cause some trouble and is a concern.

Evaluation of learning design

In previous years only a few students looked at all teaching material provided by the teachers, in particular animations and movies which were located in a dedicated folder on the official course web page. Most students never or rarely accessed this multimedia teaching material during the course. In the wiki layout the animations and other material was presented in combination with information about the lecture and teaching material on the same page. The majority of the students saw

(or at least visited) all the teaching material including animations and movie files. We speculate that the ease of access with embedded, simultaneous presentation is an important parameter for the students to engage with the additional teaching material.

In particular the show/hide option in the wiki is useful to organise teaching material under the relevant headline and gives an excellent opportunity to give an overview of the full course and with easy access to the teaching material for each topic.

However, some students complained that: "It was confusing to have two platforms for the course". For administrative and formal purposes we had to provide all course information on both the official course website and our more experimental wiki platform. This obstacle could be circumvented if the wiki presentation was to be integrated with the official system so the students would only need to access a single platform.

Conclusions and recommendations

We conclude this article by summarising that wiki functionality is a valuable tool in today's e-learning environment. When choosing the right software and structure of contents, wikis may provide an easy and engaging collaboration environment for teachers as well as students. We have pointed to didactically very different but all relevant ways of incorporating wikis in learning material of class-room courses.

As ypermedia text documents, wikis have the same possibilities and limitations as any other web-page, when seen from the students' perspective. In our study we conclude that most students find wikis user-friendly and engage with them in the same way as other web-pages, that is they prefer not to read long coherent texts in this format but find the content in the format easily accessible and are possibly more prone to follow links to further reading as well as investigate multimedia content. In one case all students agreed or strongly agreed that the use of online and blended learning resources (of a wiki was one) helped them attain their learning goals.

As such, WIKIbooks and printed out textbooks can complement each other very nicely when students navigate and build a coherent understanding of a complex field of inquiry. WIKIbooks hold the potential to activate the students more than a regular textbook and are preferred when used as a reference for solving quizzes and exercises. In our study no students found the WIKIbook not user-friendly which indicates that the format is usable to most students at least in our cases of higher education. We did not experience much success with engaging the students in the discussion pages of the WIKIbook but we attribute this

mostly to the blended learning format which allowed discussion to take place in the class.

WIKIbook exercises with student-activated hints and solutions free time for the teaching assistants which they can in turn use to discuss the exercises and solutions further with the students and thus engage them in deeper learning. However, careful consideration of the learning outcomes has to be made when implementing self-tests (WIKIexercises) with solutions that are only a single click away in WIKIbooks. We will investigate this aspect further in the future.

Wikis hold the potential of being valuable platforms for student collaboration on written products. Given the right software, teachers may follow student progress in order to give feedback and to assess students as their work progress. However, integrating wikis successfully for student collaboration depends on - among other things - student motivation and savvy towards editing and discussing wiki-pages.

As a presentation platform we conclude that a wiki is more efficient than the University of Copenhagen official LMS Absalon. This is based on the observation that more students viewed more or all of the material in the wiki than in Absalon. However having two presentation platforms is not an optimal solution for the students so we recommend to embed a wiki structure similar to MediaWiki for course presentation as well as learning management and presentation of teaching material in Absalon.

Referencer

Cunningham, Ward (2002). What is a Wiki? Retrieved December 2016 from http://www.wiki.org/wiki.cgi?WhatIsWiki

Karasavvidis, I. (2010). Wikibooks as Tools for Promoting Constructivist Learning in Higher Education: Findings from a Case Study, Technological Developments in Networking, Education and Automation, Springer Science+Business Media B.V., 133-138

Kelly L. Page and Nina Reynolds (2015). Learning from a wiki way of learning. Studies In Higher Education Vol. 40 (6), 988-1013

Kirkwood, A., and L. Price (2005). Learners and learning in the twenty first century: what do we know about students' attitudes towards and experiences of information and communication technologies that will help us design courses? Studies in Higher Education 30, no. 3, 257–74.

Leuf, B., & Cunningham, W. (2001) .The wiki way: Quick collaboration on the web. Boston: Addison Wesley.

Lin, M-F G, Bonk, C. J. & Sajjapanroj, S. (2008) : Twin Wiki Wonders?, Virtual Communities: Concepts, Methodologies, Tools and Applications, IGI global, 253-272

Lin, H. and Kelsey, K.D. (2009). Building a networked environment in wikis: The evolving phases of a collaborative learning in a wikibook project, J. Ed. Comp. Res. 40, 145-169

Udby, L. , Jensen, P. , Bruun, J. , Willendrup, P. , Schober H. , Neuhaus, J. , Nielsen J. S.B. , Pulz, J. & K. Lefmann (2013). E-learning neutron scattering. Neutron News 24(1), 18-23

Wikipedia (2016). Retrieved December 2016 from https://en.wikipedia.org/wiki/Wiki

Wikipedians (2016). Retrieved December 2016 from https://en.wikipedia.org/wiki/Wikipedia:Wikipedians

Wikispaces (2016). Retrieved December 2016 from https://www.wikispaces.com/

Wikipedian demographics (2016). Retrieved December 2016 from https://en.wikipedia.org/wiki/Wikipedia:Wikipedians#Demographics

Wikibooks (2016): Retrieved December 2016 from https://en.wikibooks.org/wiki/Main_Page.