EBOOKS AS PDF FILES, IN EPUB FORMAT OR AS INTERACTIVE IBOOKS? DIGITAL BOOKS IN PHYSICS LESSONS OF SECONDARY EDUCATION

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ABSTRACT

This paper outlines the different capabilities of ebooks in the pdf, epub and ibook format in science teaching evaluated at the BG/BRG Schwechat. Over the recent years the school equipped with 100 personal computers and 28 iPads has become one of the leading e-learning schools in Austria.

iPads show their advantages in the context of blended learning sequences: the devices are instantly ready to use and allow pure haptic interaction with the content. The iPad appeals with its simple interface and very stable operating system. It encourages teachers to implement e-learning with the usage of ebooks into their lessons.

Significant differences between ebooks as pdf format, epub format and ibook format are evident in the integration of interactive elements: only ibooks support the integration of various interactive objects beside basic functionalities like the use of dictionaries and tagging tools. This format of ibooks meets the demands of teachers and pupils in ebooks in almost every point with the disadvantage that they are available only for iPads.

The creation of ebooks goes smoothly with the use of the software pages available for Mac OS and iOS, which is appropriate for the epub format, the production of interactive ibooks succeeds with the software iBooks Author available only for Mac OS.

The evaluation of this paper was done with the feedback tools of the learning platform Moodle asking students about their views. Through two e-lectures with teachers and a presentation at the national conference called "Tablet User Days 2013" at the Pedagogical University in Melk, a validation of this work was accomplished.

KEYWORDS

ebooks, e-learning, mobile – learning, tablets, competence– based science teaching

1. INTRODUCTION

Our world has developed in last decade to a place at which a life is hardly conceivable without digital devices and online tools. In the professional life and occupational world profunde knowledge of new technologies is essential. Desktop PCs, tablet computers and Smartphones are fixed components of our everyday life. New digital developments arise and influence our everyday life. Nowadays above all young people can hardly live without internet, mobile phone or computer.

The digital world, which is an important component of the social life of many youngsters, wins a bigger and bigger meaning in schools during the last years.

At many schools the use of online learning tools and platforms spreads more and more, during the last years there were initiatives over and over again to make the digital work in the classrooms the standard. *(Hummer et al., 2013)*

The benefits that come with the use of learning platforms for educational purposes have been evaluated and tested excessively in various national and international projects. A prime example of such a project in Austria is the eLSA project which has resulted in the implemented of e-learning in everyday school life in over 200 schools. *(Hummer et al., 2013)*

Young people spend a large part of their time online, social interaction, procurement of information, entertainment and still a lot more youngsters search today in the virtual world.

Under these conditions digital learning platforms and the reinforced application of new media in teaching affects positively the learning process.

However, during the last years an important area of the learning and teaching remained far behind the use of digital tools: the schoolbook. Schoolbooks are used like in recent decades still as workbooks or textbooks printed on paper, which pupils carry in her schoolbags to the school and home again.

The results of the „Kids & Family Reading of report in 2012" show that the amount of the children who have read an eBook has risen from 2010 to 2012 on 46% and has almost doubled. *(Harrison Group, 2012)*

In this work the question is discussed which kind of eBooks can improve the quality of teaching and learning in Physics in secondary education. As there are only very few ebooks offered as schoolbooks for physics lessons by educational publishers the possibilities for teachers to create ebooks are examined.

2. DIGITAL BOOKS IN PHYSICS LESSONS

There is a huge emphasis on competence- based learning and practical orientation in teaching natural science. In order to further improve on these concepts the competence model sets not only standards in the field of acquiring knowledge but also in the field of acquiring learning skills such as: organizing knowledge, gaining insight, drawing conclusions and designing. *(Hopf, et al. 2012)*

The implementation of interactive graphs and digital animations makes it easier for students to understand complex processes in natural science. (*Ebner, et al. 2011*)

This leads to the assumption that digital books with the integrated feature of displaying digital content support pupils to achieve their learning skills.

Digital books as pdf files, in ePub format or as interactive ibooks – which kind of ebooks can be used in the framework of competence based teaching and satisfy the requirements of a modern school with a focus in elearning?

The approach to answer the research questions was done in 3 fields:
1. What are the requirements of teachers, who have experiences with teaching and learning with PCs and iPads as well as with learning platforms, in eBooks?
2. Which software on a Windows PC or on a computer with Apple Mac operating system is suitable for a teacher to create interactive eBooks without programming knowledge?
3. Pupils at the age of 13 and 14 years experienced with eLearning with PCs and iPads were asked for their opinion about learning with eBooks.

2.1 Description of the Sample of Pupils and Teachers and the Didactic Approach

At the BG / BRG Schwechat for several years now, the focus has been on eLearning, using 3 computer rooms with a total of over 100 PCs.

The BG / BRG Schwechat is a school with about 1000 students aged 10 to 18 years, employing about 90 teachers. To allow eLearning not only in computer rooms but also in all 40 classrooms, a mobile solution was implemented: There are 28 iPads stored in a cart, which makes transportation and synchronization of the devices easier. This mobile e-learning unit is available to all teachers as long as they reserve via a custom made reservation system accessible online. In order to optimize this system a projector was installed in every class room and full Wi-Fi coverage was set up in all parts of the school building.

The teaching methodology of the e-learning sequences in physics was developed in cooperation with the committee for "new graduation standards for Physics" and meets the requests of the competency model for physics.

Competency based teaching has become very important especially in teaching natural science. In order to further improve on the concept the competency model sets not only standards in the field of acquiring knowledge were defined but also in the field of acquiring learning skills such as: organizing knowledge, gaining insight, drawing conclusions and designing. *(Hopf, et al. 2012)*

The lessons for this study were designed following the concept of "inquiry based learning" based on investigation of questions asked in the subject physics. Questions and working instruction were provided at the learning platform moodle, students were able to log in using the Safari browser of the iPad.

To answer the questions mentioned above about digital books for teaching purposes, the following approach was chosen: a sample of 7 teachers teaching scientific subjects and with some experiences with

learning platforms and other digital media was interviewed about their requirements to digital school books. As another aspect it was examined whether digital schoolbooks, which are offered by schoolbook publishers correspond to the demands expressed by the teachers.

In order to investigate the feedback of pupils to the use of ebooks the author provided 2 ebooks covering topics of the curricula of the 4th grade. 25 pupils of a 4th class aged 13 and 14 had the possibility to collect practical experiences with learning with ebooks during their physics lessons. Implementing the blended learning approach pupils chosen for this project had collected experiences in the use of the learning platform moodle as well as in learning with iPads.

As didactic approach the learning model of inquiry based learning was chosen: first pupils compiled tasks of a chapter with the help of the physics book; beside the school book iPads were used to communicate with the teacher on the moodle platform and to deliver results of pupils' work or to answer online test questions. As next step the author of this work wrote an ebook provided as pdf format. Using this ebook pupils had to compile a chapter of the curriculum without the use of the printed physics book.

The next chapter of the curriculum the pupils had to manage with an ebook provided as an epub file.

In order to get informed about the topic *light and shadow in Astronomy* the interactive ibook "Solar Eclipses" written by the author was used by the pupils.

As already mentioned every pupil had the possibility to use an iPad at school and ebooks were read in each case with an iPad. iPads were available to the pupils in the concept „iPads for everybody - the mobile computer lab" only at school, pupils had not the possibility to work with iPads at home.

To compare the capabilities of programs offered for the creation of ebooks the free software Calibre (available for Windows and Mac OS), the program Adobe InDesign (available for Windows and Mac) as well as the Mac OS software Pages and iBooks Author were used; in addition pupils used the application "Book creator" with the iPads to produce an ebook in the epub format.

After the pupils had finished their tasks using and creating ebooks, they were asked with the help of the anonymous feedback tool integrated in moodle about their opinion about their learning experiences.
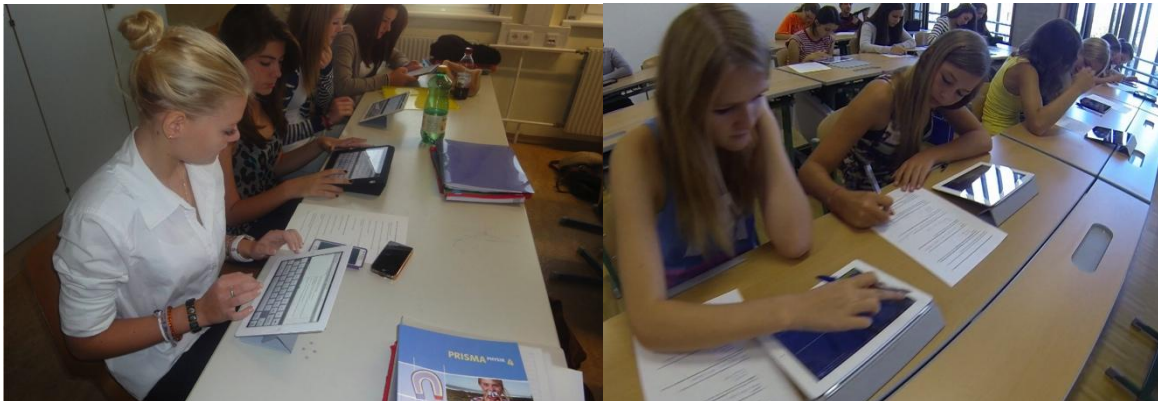

Figure 1. Learning with interactive ibooks

2.2 Requirements in ebooks – Investigation of Various Formats

Asked about requirements in ebooks for teaching purposes all teachers mentioned at first that it should be possible to make comments and to highlight text. The vast majority of the interviewed teaching staff expect the following basic functionalities from ebooks for the use in scientific teaching: ebooks must be easily available for mobile learning on tablet PCs, ebooks must offer an easy browsing to pages or chapters, display of hyperlinks in a browser as well as searching functions and bookmarks.

Moreover, the surveyed teachers expressed that ebooks which satisfy the didactic needs of the method of inquiry based learning should allow to set marks and notes, an access to dictionaries or encyclopaedia should be integrated and interactive quizzes and tests to verify educational objectives should be available. Functionalities supporting collaborative learning are also desirable.

It was agreed by everybody that the usage of multimedia content like photos, videos and 3D animations in scientific teaching proves an essential advantage of ebooks in comparison to books printed on paper.

Approved digital schoolbooks offered by publishers in Austria fulfil the requirements mentioned above only to a low part: the printed schoolbooks are offered as a digital version which are readable only after the installation of software from a CD at a PC, in a network or on a tablet PC they are not available. Digital schoolbooks are based on printed books, with some additional functions, which claim to support teachers in preparation of their lessons, multimedia contents is complete absent.

The comparison of different formats of ebooks results in the following findings:

Ebooks available as pdf files offer no multimedia and interactive contents, however, they can be read with the help of an ebook reader application on a tablet PC. Ebook readers are offering searching functions and access to dictionaries which allows looking up in an encyclopaedia, and however, also on the internet.

If one wants to add remarks or notes to an ebook in pdf format, this is only possible when the ebook is opened on the tablet with another application as for example "Good Reader".

The epub format allows the display of text with an animation for turning the pages and an adaptation of the text size. Nevertheless, this dynamic formatting prevents an addressing to a certain book page what is often helpful in lessons. However, jumping to single chapters of the books is possible, searching functions and dictionaries are also integrated. The epub format enables to mark text or to add notes to text. Another advantage of the epub format is the possibility to integrate audio files or video clips in the ebook, which can be played directly in the ebook. A text from the ebook in epub format can be posted directly from the book to social networks like Twitter or Facebook, and can be sent also as email or SMS. Nevertheless, using these features the question about copyright laws arises.
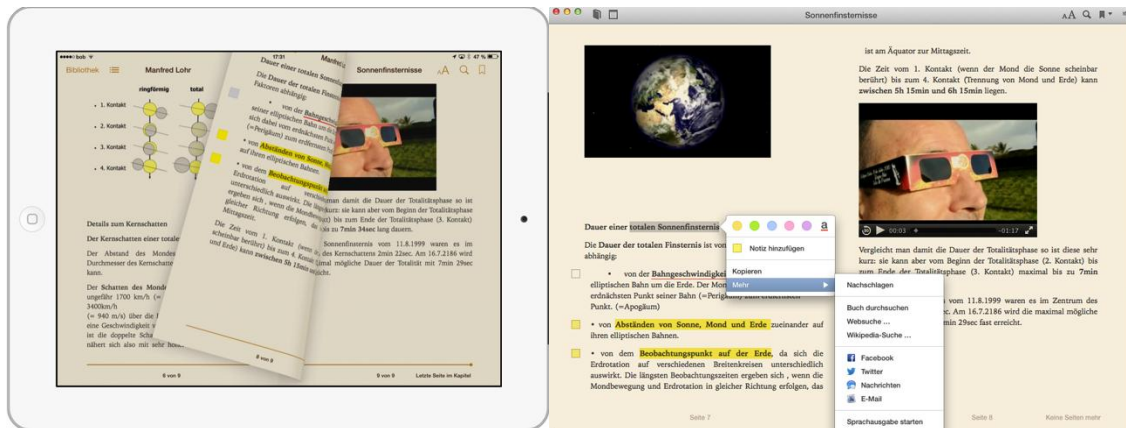

Figure 2. The epub format on iPad (left) and Mac PC (right)

The iBook format developed for Apple operating system enables to use multimedia contents and interactive elements in an ebook. In this format the author has the possibility to provide interactive pictures and 3D objects beside picture galleries and videos. Quizzes and multiple - choice questions of different types help to control the educational objectives. Access to dictionaries or encyclopaedia is built in, postings on Twitter and Facebook are possible in this format as well as the integration of diagrams, tables and mathematical formulas. Using the iBook format the author can install a glossary for example to define scientific terms, power point or keynote presentations can be viewed directly in the book.

2.3 Creation of ebooks – Investigation of Various Software

As no multimedia enhanced ebooks with content related to the curriculum of Physics are offered by Austrian schoolbook publishers this chapter deals with the creation of ebooks by a teacher without advanced programming knowledge. This study was done by the usage of Windows PCs compared to Mac OS PCs and iPads.

A simple way to design ebooks with a Windows PC is the free software Calibre, which enables the user to convert text files of some formats (for example word documents, pdf files) to the epub format. Unfortunately Calibre doesn't support any multimedia files, therefore it seems not suitable to create digital books following the user needs of teachers in science subjects.

However, the text processing program *Pages* which is available for the operating system Mac OS as well as for iOS on iPad and iPhone allows an easy export of text to the ePub format with the integration of audio and video files. *Pages* opens text files provided with Microsoft Word too; audio files and video clips simply can be dragged into the document, after exporting to the epub format these clips can be played directly during reading the ebook.

The usage of an iPad with iOS 7 enables to record audio files and videos clips directly with the device and to transfer them with one click to *Pages*. After the export of the document to the epub format the ebook is available in the application *ibooks* on the iPad or in another ebook reader application like for example *kindle*. This approach is also applicable for pupils to create digital books in order to present or to reflect a topic.

Another simple possibility to compile ebooks is the usage of the application *"Book Creator"* available for iPads, similar applications are also available for tablets running with the operating system Android.

In the framework of the described project pupils of the 4th class had to fulfil the task to produce a summary about some chapters of their physics curriculum with the help of the application *"Book Creator"*. This application offers similar possibilities like Pages with a little bit fewer formatting options. It was obvious that pupils were very motivated and engaged to provide an ebook with the use of iPads. During this task pupils learnt to reflect upon the chapters done and to present physical laws in short audio or video podcasts. They practiced to present scientific laws with creative tools on mobile devices.

After the creation of the ebook was finished the pupils opened their ebooks with the application *iBooks* and saw their results without delay. They sent their ebook to their private mobile devices and by doing this they created mobile content which motivated them to deal with scientific topics at home.

As final task in the activity described above pupils had to upload their ebook to the moodle platform where the teacher assessed and commented the ebooks of the pupils.
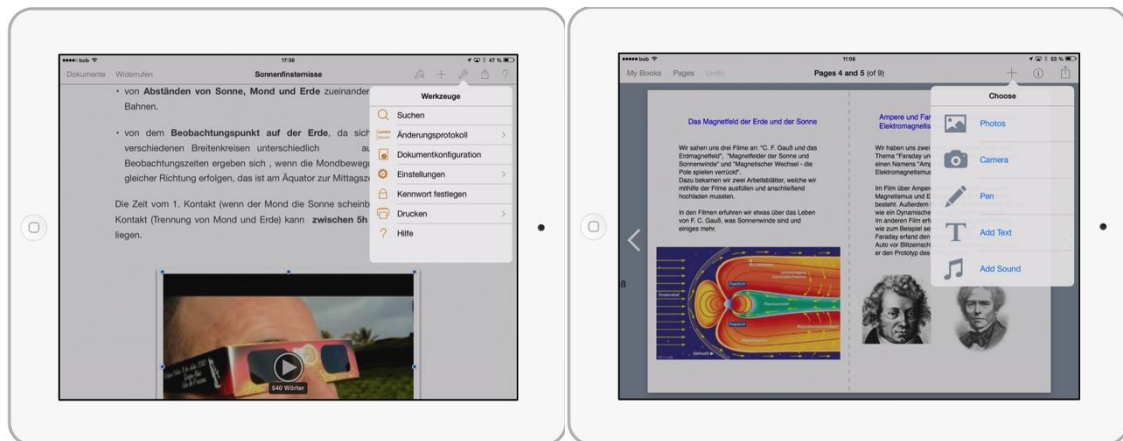

Figure 3. Creating ebooks on iPad with Pages (left) and Book Creator (right)

During the assessment of the ebooks by the teacher the need of opening digital books with a desktop PC became important. Apple PCs with the operating system mavericks 10.9 offer the program *ibooks* which presents the ebook with the same layout and features as on a mobile device (with the exception of the animation for changing pages): you can highlight and underline text, add comments to text, set bookmarks, use dictionaries, browse the internet and post to facebook or Twitter. (see Fig. 2. right picture)

In order to read an ebook given in the epub format with a Windows PC one can use for example the software Calibre or Adobe Digitally Editions; using these software text and hyperlinks are displayed very well, nevertheless, the reproduction of video and audio clips doesn't work. Additional features which are available in the *ibooks* program are missing.

The present work continued to find out how to create ebooks of the next level, which means ebooks with interactive elements. The investigation of software for the creation of interactive ibooks started with the search for software for Windows PCs because this operating system is the standard in schools in Austria.

A short summarize of the result of the efforts is that there are only few programs available: a professional software available for Windows PCs to create ebooks with interactive elements is *"Adobe InDesign"*.

Demanding that the creation of ebooks should be possible without knowledge in programming and without a time-consuming procedure, "*InDesign*" is not suitable: this result was obtained after the software was tested by 2 teachers, who expressed the assessment that the usability of this software doesn't meet the needs of teachers in producing ebooks.

The Mac operating system offers the free software *"iBooks Author"* which enables users with average knowledge in the work with PCs to produce impressive interactive ebooks: *"iBooks Author"* provides some precast layouts, the contents are moved by drag and drop to the ebook: thus not only interactive pictures, picture galleries and video clips are produced, but also 3D objects which can be taken for example from a collection of *SketchUp* objects available in the web or produced by the software *"SketchUp"*. Doing a few simple steps one can provide text with a scrollbar, produce popover texts and quizzes of different kinds. During the creation of the ibook the software *"iBooks Author"* provides a preview of the ibook at an iPad connected to the PC. *"iBooks Author"* is a programme which enables in intuitive manner to provide ebooks with various interactive elements.

As disadvantage must be marked that this program is available only for the operating system Mac OS. There are also some limitations regarding the output formats: *"iBooks Author"* offers as main output format the ibooks format, which unfortunately only can be displayed on iPads or iPhones, smartphones and tablet PCs with another operating system cannot open this format. Since September 2013 interactive ibooks created with *"iBooks Author"* can be read on Mac PCs using the operating system Mavericks 10.9. As second option *"iBooks Author"* allows the output as pdf format with the disadvantage of the loss of all interactive elements.
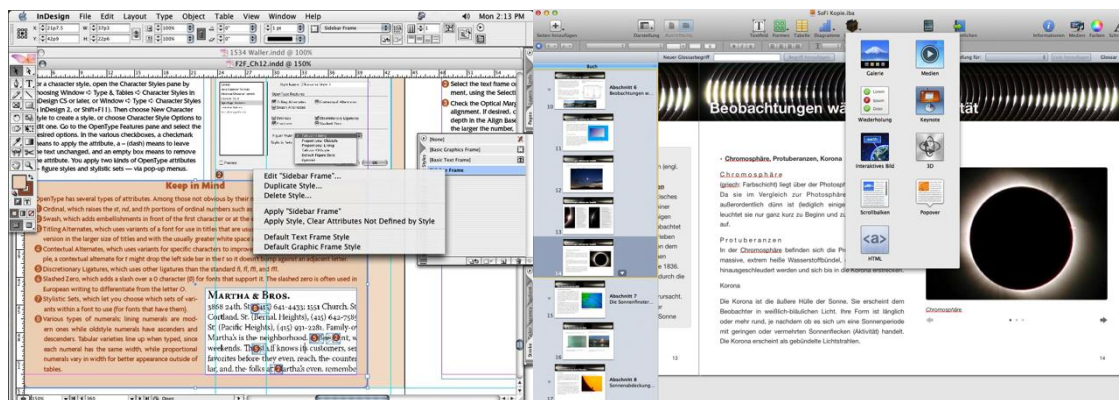

Figure 4. Adobe InDesgin (left) compared to iBooks Author (right)

2.4 Feedback of Pupils – Motivation and Advantages

The feedback of the pupils was collected with the anonymous feedback tool of moodle. Pupils completed a questionnaire with 5 categories for answering each question and some open questions with free comments.

Only by one quarter of the pupils preferred ebooks in pdf format instead of printed books for learning purposes, nevertheless, the vast majority of pupils rated the usage of iPads as very motivating.

The feedback of the pupils about books in epub format was clearly better: 62% totally agreed to work rather with ebooks in this format than with printed books. They mentioned the representation of the text with the animation to change pages as well as the integrated videos as motivating features of ebooks in the epub format, dictionaries and notifications were hardly used by pupils in this age group.

The observation of the engagement of the pupils during the lessons gave to the following significant result: pupils participated very engaged in solving their tasks with iPads and ebooks, the usage of these digitals devices and software tools caused a higher motivation than with teaching forms without these digital tools.

A clear increase of the positive feedback of the pupils appeared concerning the questions asked about the use of interactive ibooks: 81% strongly agreed to the statement to work rather with an ibook than with a normal book, only just 10% preferred normal books. Pupils had no difficulties to control ibooks with swipe gestures well known on their smartphones, the interactive elements were also properly used by almost all pupils without the need of any instructions of the teacher. Asked about their preferences in the field of tests

pupils favoured the interactive quizzes instead of written tests. A majority of pupils stated that interactive pictures or 3D pictures helped them to improve their understandings of scientific content.

The vast majority of the pupils valued creating books with the application *"Book Creator"* very positively. 72% agreed that the use of the virtual keyboard of the iPad caused no problems, the creation of ebooks was valued almost by everybody as an important enrichment of the lessons.

69% stated that they have learnt better by this kind of repetition of syllabus than by other methods.

Other aspects of the use of ebooks on iPads are described very well by the following comment of a boy: „It would be great if we had all school books as ebooks – we could never forget books and wouldn't have to drag heavy schoolbags!"

3. CONCLUSION

The project has proved that learning and teaching with digital books in physics lessons helps and supports pupils to understand complicated scientific conceptions.

The comparison of the used ebook formats pointed out that ibooks with their numerous interactive elements are very suitably for scientific lessons in the age group of 13 and 14: the haptic interaction with the content ensures new learning experiences which are very important in view of competence-oriented learning in natural sciences. A better individualisation of lesson becomes possible because pupils can choose their own learning rate and can repeat interactive explanations as well as quizzes as often as they like.

Potentially the epub format has a bigger meaning for older pupils: they have a very easy access to scientific literature or can read free of charge many classics of the world literature on tablet PCs.

At the moment the creation of ebooks and ibooks for teachers with realistic effort is possible only with the usage of the operating system Mac OS and the software *Pages* for the epub format or with the software "*iBooks Author"* for the ibook format.

The experiences with the present project allow the conclusion that ebooks will have an important meaning in the school of the future. The author is highly confident that interactive ibooks have everything they need to perform as an excellent tool for (science) teaching. In the opinion of the author publishers of schoolbooks should start to make some efforts in order to provide interactive ebooks for the pupils of the school of tomorrow.

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REFERENCES

Book

Bönsch, et al. 2010. *Kompetenzorientierter Unterricht. Selbständiges Lernen in der Grundschule.* Westermann, Braunschweig.

Darling-Hammond, et al. 2008. *Powerful Learning: What we know about teaching for understanding.* Jossey-Bass, San Francisco.

Ebner, et al. 2011. *Lehrbuch für Lernen und Lehren mit Technologien.* TU Graz, Graz

Hopf, et al. 2012. *Die kompetenzorientierte Reifeprüfung aus Physik.* Bundesministerium für Unterricht, Kunst und Kultur, Wien.

Hummer, et al. 2013. *Darf ich helfen, Frau Lehrer? Voneinander und miteinander lernen - so verändern digitale Medien unsere Schulen.* New Academic Press, Wien.

Klippert, 2008. *Pädagogische Schulentwicklung. Planungs- und Arbeitshilfen zur Förderung einer neuen Lernkultur.* Beltz, Weinheim/Basel.

Müller, 2006. *Eigentlich wäre Lernen geil. Wie Schule (auch) sein kann: alles aussergewöhnlich.* hep Verlag, Bern.

eBook

Thissen, et al. 2013. *Mobiles Lernen in der Schule.* iBooks, iBooks Store.

Web article

Harrison Group, 2012. *Kids & Family Reading of report.* http://mediaroom.scholastic.com/files/kfrr2013-noappendix.pdf