Knowledge Management & E-Learning
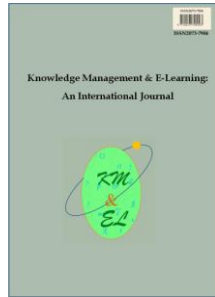
Remediation of print: On the current restructuration of higher education

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Abstract: The educational establishment was built and structured on a communication pattern at the core of the *Gutenberg Galaxy* that combines the spoken word with printed and handwritten resources. The current digitization of text is a pacesetter for retooling the workplace in the "industries of signs", for replacing skills on a broad scale and for developing new formal and informal social relationships. In addition to technological developments, a strong driver of this process is the cost of the mainly manual modes of academic operation. Core inhibitors to change are century-old traditions embedded in brick-and-mortar institutions, the impossibility of enforcing industrial-type organization on knowledge work and an elitist and scholastic bent in the academic concept of self. The field is thus in need of a new *Grammar of Schooling* that reflects technologically and socially driven participation modes that better address educational needs and cost considerations. The educational institution is challenged to develop a new logic of production in its educational mission.

Keywords: Remediation; Print; Restructuration; Higher education

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1. Digitization of print

Throughout the late 18th and the entire 19th century higher education was formalized and institutionalized as part of the wider movement for economic industrialization and cultural modernization. This educational establishment was built and structured on a communication pattern at the core of McLuhan's "Gutenberg Galaxy" (McLuhan, 1962; Sauerberg, 2009). Activities and performances combined the spoken word with printed and handwritten resources. But the mass-produced books were by themselves also

quintessential industrial in nature. The early history of book publishing heralded the upcoming industrial era.

Early printed artefacts were circumscribed by social structures and processes for creation, curation, storage, discovery and retrieval, dissemination and use. Books, newspapers and magazines are thus better seen as part of a socio-material field rather than as discrete entities. Academic publishing for personal use and collective access through libraries was for instance foundational for increased participation in higher education. Early on university studies comprised an elite 1-2% of the cohort. This number has steadily grown to the 30-60% that we see in higher education in many countries today.
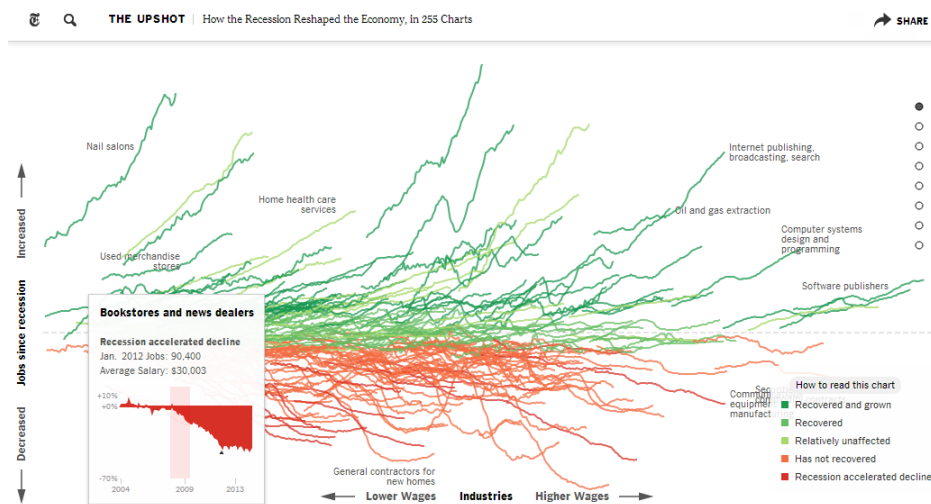

Fig. 1. US workforce developments 2004-2014.

Similarly the current digitization of text is a pacesetter for retooling academia and other parts of the "symbol industries". We see a parallel and grand replacement of skills along with the development of new formal and informal social relationships. As an example consider the change in the publication sector of the US labor force as presented in a rich interactive diagram in New York Times June 5th 2014 (Fig. 1). On average there was an approximate 40% decline in jobs from 1.4 million to the current level of 840.000 in newspaper and periodicals publishing, printing in general and bookstores. Digital publishing, broadcasting and search increased 70% from 120.000 to 205.000 positions. The diagram itself is a striking example of the difference between paper print and the digital screen. A selection of a single thread in the screen rendition will, as illustrated, bring forth an interactive diagram presenting numbers of jobs and salary levels each year.

Using these data one might say that for each additional digital job the traditional paper crafts lost two. The English weekly The Economist organized an online debate in 2008 that provided a stern perspective:

Any repetitive services task, which can be exhaustively described in rules ... will ultimately be computerized and require human input only from the customer him/herself. The result (of) the rapid expansion of education, particularly in developing Asia, during the last decades of the 20th century (is that) Western middle classes will struggle to sustain their much higher standards of living in an increasingly integrated global economy. (Kirkegaard, 2008)

2. Remediation

Jay Bolter and Richard Grusin redefined the term "remediation" as the act of reworking a text that is carried and encapsulated by one media type so that it is delivered in accordance with the requirements of another (Bolter, 1991; Bolter & Grusin, 1999). The nominal aspect of this is obvious as when we try to define a book. There is no absolute or transcendental meaning to this term.
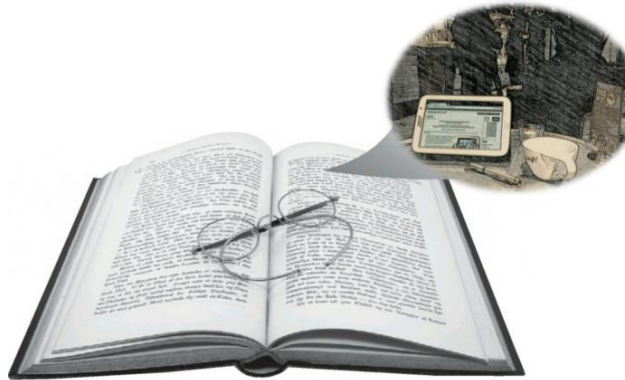

Fig. 2. What's in a name? Reconceptualizing the new textbooks

Wikipedia states for instance that:

A book *is a set of written, printed, illustrated, or blank sheets, made of* ink, paper, parchment*, or other materials, usually fastened together to hinge at one side. A single sheet within a book is called a leaf, and each side of a leaf is called a* page*.*

But the term may also refer to a main division of a literary work (*The Book of Genesis*) or the Bible itself (*The Book of Books*), a factual record (*balancing the book*) or an imaginative record or a set of regulations (*done according to the book*). But then again Wikipedia describes the *electronic* book, which obviously is not hinged, as more of a simulacrum. It is described as:

A book-length publication in digital form, consisting of text, images, or both, and produced on, published through, and readable on computers or other electronic devices.

Since they relate to the materiality of printed or handwritten volumes, the earlier definitions tend to presuppose a static rendition of text. But with digitalization, the expressive regime becomes more dynamic. The definitions turn even more fluid. Typical remediated formats are books into ebooks and magazines into ezines. Other examples are diary/blog, telegram/microblog, letter/email, spreadsheet/[digital] spreadsheet, photos/slideshow, radio/podcast, movie/tube, television/tube, scrapbook/digital scrapbook, blackboard/smartboard and lecture/screencast.

This has thrown the production system into disarray and lead to new delimitations, relationships and social roles as evidence by recent developments in the newspaper, publishing and music recording industries. Many accept as a fact of life that students may buy a textbook in a bookstore or rent a videotaped movie. But there are growing pains when they may purchase recorded lectures. Some universities feel threatened by the availability of high-grade material from more prestigious institutions. This déjà-vu situation repeats itself. From medieval guilds to the large record labels of our time, the

dominant players with sunset technologies establish roadblocks to new solutions and agencies. In the long run they either have to join in the sunrise or lose out. This is an acute problem for the providers of higher education today.

I believe the wise approach for Higher Education is to "join them". This implies to implement a production model whereby established educational publishing and presentation modes are incrementally transformed to and blended with computer-supported collaborative work. This is not only in order to become adept at playing with the new rules of the game. Of greater importance is that this change in the logic of production will lead to more focus on contextually aware knowledge engineering. The teaching and learning processes as such become the object of scrutiny and improvement.

The full impact of digitalization has yet to be felt in higher education. Warnings have been raised since the 1980's. But there is probably more substance to these warnings today as expressed by analyst Mary Meeker (2014) when she suggests that education along with health care have reached the inflection point. The institutions are challenged to develop new business logics that absorb and relate to changes in the production and reproduction of texts.

3.   Delivery mechanisms

An important and early entrant in the field of online teaching and learning was PLATO for Programmed Logic for Automatic Teaching Operations that went live in 1960 and faded away in the late 1980's. It was made for mainframe and minicomputer delivery, and a failed transfer to the micro revolution starting with Apple II and IBM PC around 1980. After a period of mainly standalone software for the PC, the delivery mechanism has primarily been a web-based client-server configuration with browsers as the main client. One key factor to understand long-term developments lies here. The servers are now virtualized processes running on server farms that are located around the globe. Both Amazon and Google are main providers, but Microsoft, Oracle and others are also strengthening their presence.
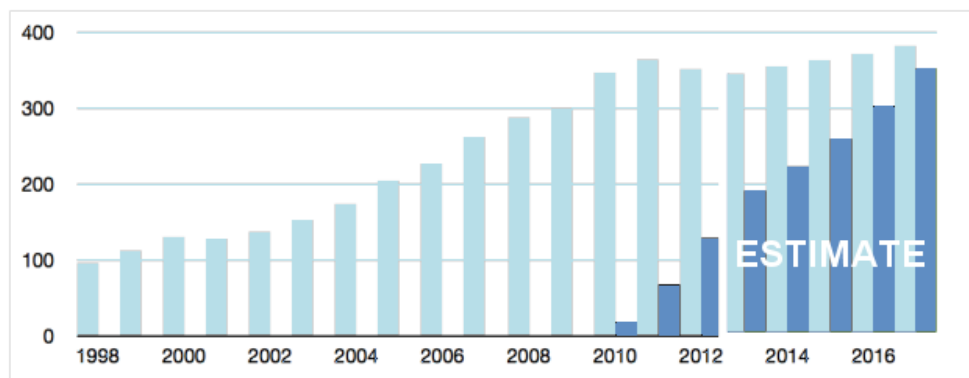

Fig. 3. Worldwide shipment (million units) of PC's (light) and tablets (dark) 1998-2016. Source: International Data Corporation as published in The Guardiann by Arthur (2013)

The charts in Fig. 3 and 4 show the shipments of personal computers and tablets 1998-2012 with a forecast for 2013-2016. It is estimated that tablets will surpass PC's n

2017. The latter devices are more geared to consumption of digital content, whereas the PC is more production-oriented. The following graph gives a breakdown on desktop PCs, notebooks and tablets shipsments since 1995. The latter surpassed the other two in late 2012.

Conceptually the course models have been built on these experiences with the PC interface from the 1980-2010 period. Students are supposedly positioned in front of their personal computer at a desk and more often than not using a clamshell version of the PC. But since 2010 portable screens in the guise of smartphones and tablets have made strong inroads.
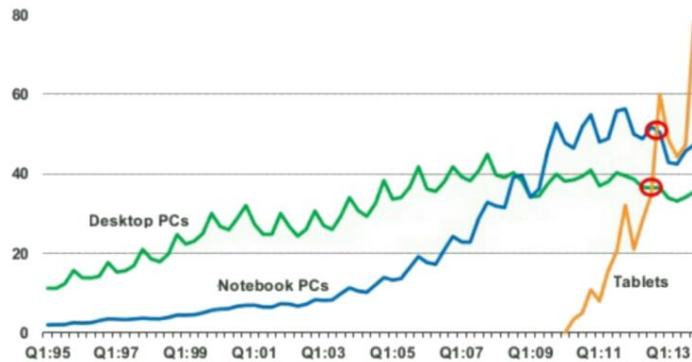

Fig. 4. Quarterly global shipments of desktops, notebooks and tablets 1995-2013. Source: Morgan Stanley Research as presented in Meeker (2014)
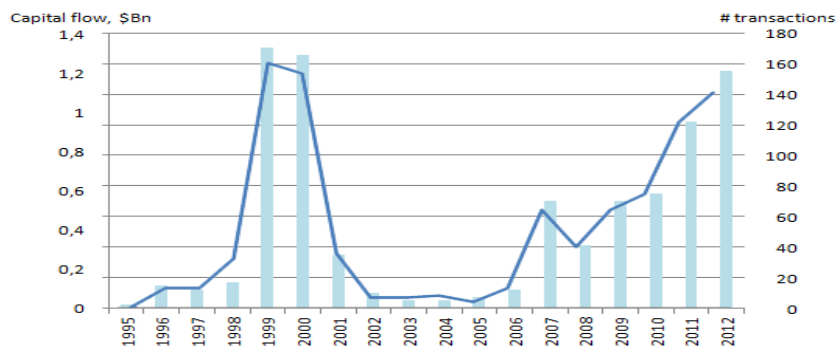
Fig. 5. US venture-capital investments in education. Source: Bill & Melinda Gates Foundation as presented in The Economist (2013)

We should continue to look for long term currents and take into consideration both technical and business dimensions. How the market reacts is certainly of importance to evaluate other trends. Based on data from Bill and Melinda Gates Foundation, the June 2013 issue of The Economist presented commercial transactions and capital flows into the US educational market, - see Fig. 5. After a significant upturn in the late 1990ies interest fell sharply when the Internet bubble burst in 2000. It took another ten years before the field regained its previous strength. Fresh capital inflows are an important driver behind the MOOC phenomena today. It is also worth noting that there seems to be a move towards seed investments. Investments in K-12 student-facing digital products

increased two-fold between 2010 and 2013 from 143.4 to 262.1 million dollars, but this entailed a 9-fold increase in the number of projects. The reason was a turn towards smaller seed investments. (Bill & Melinda Gates Foundation, 2014).

This is already a strongly competitive field which requires agility, good infrastructure and strong financial muscles. EdX is endorsed by top level universities, but more importantly by Google. Amazon is a dark horse. This is based on the company's strong presence as a cloud services company and with its Kindle ebook format and online bookstore. By creating cloud-based links between book titles and between annotations within such books across a variety of reading devices, Kindle textbooks are positioned to become a full-fledged Learning Management System on its own. The well-established Whispercast system is a prime candidate. Amazon sells highly discounted physical and digital textbooks and students may also rent time-limited access to expensive titles.

In this respect much attention is directed at Massive Open Online Courses (MOOCs). This course format was given legitimacy by the joint initiative from the presidents of Harvard University and Massachusetts Institute of Technology (MIT) in May 2012.

It was founded on successful tests at each of these institutions as well as that of other providers. They launched the shared edX initiative to provide elite grade university courses online and for free. What followed was a rapidly growing number of courses available from providers like edX and its Arabic and Chinese siblings Edraak and XuetangX, from the pan-European OpenupEd and from Coursera, Udacity, Open2Study, Iversity, FutureLearn, Khan Academy, Udemy, Canvas.net, NoveEd, ed2go, Alison, OpenLearning and many more. Former employees working on the Symbian-based and open-source initiative MeGoo at Nokia have launched Eliademy which is a mobile oriented MOOC platform. Blackboard, which is the dominant US Learning Management System, has been retooling for the MOOC movement with Blackboard-Learn and their CourseSites solutions.

Fig. 6. MOOC history: The first 4 years. Adapted from Hill (2013)

As indicated to the right in Fig. 6, the MOOC solutions are not without problems and challenges. Four main areas of concern have received particular attention, namely pedagogics and course completion, student authentication, credentialing and revenue models. Empirical data from the first few years indicate that participating students may be grouped in those who take a brief look and then disappears. These are the "lurkers" or

"drop-outs" (Hill 2013). In this group one may distinguish between those who register, but never "shows up", and those who participate in the first few activities of the course.

Together they constitute more than 50% of registered participants. They retract from the courses within a week or so. The "drop-ins" are also peripheral but more long-term participants. They might delimit themselves to particular areas of the course, watch a few videos etc. The remaining are participants who may be described as passive or active. The passive kind follows the course, watches videos and may do quizzes. But they do not take an active part and rarely show up in discussions. The final group, the Active Participants are (in Hills words) the *students who fully intend to participate in the MOOC, including consuming content, taking quizzes and exams, taking part in activities such as writing assignments and peer grading, and actively participate in discussions via discussion forums, blogs, twitter, Google+, or other forms of social media*. The course completion rate is much higher in this group and even more so when some participants decide to meet in person. Even if the initial registration is counted in tens of thousands, a completion rate of 50-60% for smaller groups of a few thousand is still significant. Further research might align such tendencies with Ito's participation typology described above.

4. Social media: Genres of participation

Let us add to this yet another statistics showing social media usage among different US age groups in Fig. 7. Not surprisingly the 50+ age groups are less conversant with social media than the younger cohorts. Close to 90% of the 18-29 year olds use social media on a daily basis. Social media are now firmly linked to portability. One may use Twitter and Facebook or Weibo and Youku on a traditional PC, but increasingly it is the smart phones and tablets that counts. Let us summarize these three developments as (1) a global turn towards mobile computing that is (2) spearheaded by Internet-savvy youth who populate or have recently left the educational field and (3) a significant uptake in venture capital investment in this area with educational institution – and through them - these youngsters as their ultimate target group.
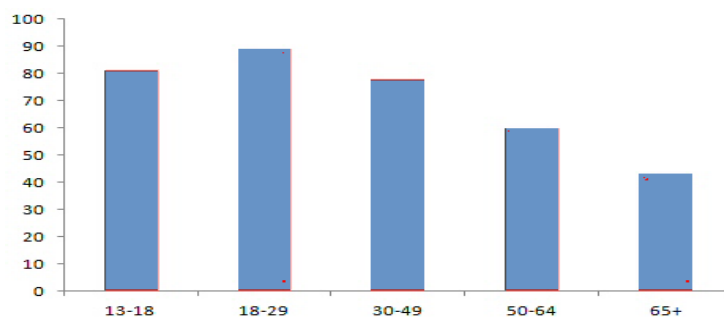

Fig. 7. Media usage across age groups. Adapted from Duggan and Smith (2013)

These communication technologies have given rise to new genres of social participation, to borrow a core phrase from the large-scale ethnographic studies that Mizuko Ito and her colleagues have carried out (Ito et al., 2008). She identified three main modes – or genres or recurrent patterns of behavior - which youth employ online to extend friendships and collaborations. Somewhat whimsically they are called *Hanging*

Out, Messing Around, and Geeking Out. A main dividing line goes between friendship-driven and interest- or topic-driven engagements.

A friendship-driven genre of participation is the mainstream activity with peers that stems from steady encounters in a neighborhood, a school and other recurring activities. This is described as *Hanging Out*, i.e. an activity that does not seem to be too directed and learning-oriented. But looking closer, one will find that this mode plays an important in developing tastes in music, analyzing television and movies, sharing knowledge of computer games and also social identity and the sense of self.

Interest-driven activities, on the other hand, are based on a particular topic, activity or artifact. This also entails friendships, of course, but they are subordinate to the shared interest beyond the immediate social relationship. *Messing Around* is an activity type where youngsters explore possible areas of interest using new media, but not in a very committed way. But this stage can lead to a growing interest and specialization as in *Geeking Out*. This is where the youngster goes deeply into a topical area of practical and theoretical study and is eager to obtain advice and insights from more experienced practitioners. He or she might spend countless hours and reach a high level of expertise. A social graph can depict such relationships with nodes as the agents and edges as their communicative relationships. Data from KPCB's Internet Trends 2014 (Meeker, 2014) seem to indicate a change in this social graph from the importance of centrality, i.e. the number of contacts or edges radiating from a node, towards their weight or intensity. Agents interact more frequently but with a diminished number of other agents.

5. Serialization: MOOCs and eBooks

Postscript is a computer language that simplifies the handling of vector images, as shown in Fig. 8. It has been successfully implemented to describe and sent layout instructions for content reproduction on laser printers. The Portable Data Format (PDF) was initially constructed by Adobe Systems on the back of Postscript as a way of presenting pages on screen in similar manner. The screen mimics the printed page.
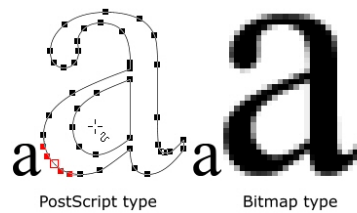

PostScript type   Bitmap type

Fig. 8. Postscript/PDF

This state of affairs was productive as long as computers were used to compose texts that was printed for reading on paper. The PDF format allowed the author to decide on the look-and-feel of the printed page, also when it was transferred between computers. But the PDF-format was not well suited for different screen sizes. This has been rectified in later versions where content is now reflowed to negotiate a fit between font size and screen sizes as well as screen orientation. New functions for annotation, support for forms, signature etc. have also been added and has transformed PDF into a useful ebook publishing format. This development mimic the overall and long term developments from publishing on traditional paper to using screens or "digital paper".

But the competing ePUB format was born digital. It has been chosen as the standard format for electronic publishing and supersedes the earlier Open eBook standard. An ePUB file is a compressed file archive for the different resources that is used in the ebook where textual content is contained in XHTML files, layout is managed by Cascading Style Sheets (CSS) and there are well-defined formats for still images, audio and video. As with PDF an ePUB reader should show XHTML-files in a specific sequence or reading order. But after intense community discussions, the ePUB format has also included programmable functions and fine-grained addressability down to the individual letter. An ebook may thus be interactive and integrated in larger dynamic repositories and – in our context – online learning management systems.

The ePUB specification has thus several similar features to an online MOOC, the only difference being that the former is contained in a compressed file archive while the latter resides in the cloud. Both are accessed through browsers (with an ePUB plugin) or a mobile app. Since ePUB books may address ePUB content online including other ePUB files, the two formats are functionally similar. A MOOC may thus take on many of the features of an ebook, and the ebook is a website or a MOOC "in-a-box". We may consider both to be serialized versions of more traditional web sites. As shown in Fig. 9 and Fig. 10, serialization of pages as expressed by a table of content is a shared trait of MOOCs and ebooks.
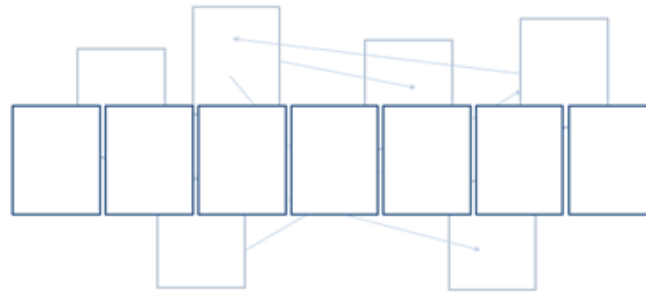

Fig. 9. Serialization of pages

6. Interaction design

A feature that so far seems to be shared across e-learning implementations is a subdivision in topically coherent units.

To focus at the active or dynamic side of this, we might refer to this as learning events. One such event should contain topical content as such and a meta level which is a description of what the event and the related material is about and what the learner is supposed to learn by engaging with it. This is commonly popularized through engaging introduction or explanatory text. The event contains illustrations and video material, usually also recorded mini lectures. There are a few assignments and importantly: The written text, animations and video material is interspersed by "stop-and-think-for-yourself-moments", i.e. automatically graded quizzes or assignments that are uploaded for review by peers or teacher assistants.

Course content is navigated in "drip-feed" manner one lesson at a time with visual clues of progress or by access mechanisms like internal searches and table of contents with one or more levels in a hierarchical and foldable structure. The production plan for

one current MOOC under development by this author may illustrate the type and amount of learning objects involved. 1500 hours of coursework will give successful students 60 credits in the European Credit Transfer System (ECTS). The online components to support this are interspersed with face-to-face seminars every 6 months over a two-year period. Content will comprise approximately 60 groups of interactive quizzes, 250 still images, 100 podcasts of 3-5 minutes each,100 video casts of 5-10 minutes and a total of 60 written pages of lesson texts in addition to a reading list of additional 4.500 pages in machine-readable format like ePUB and PDF.
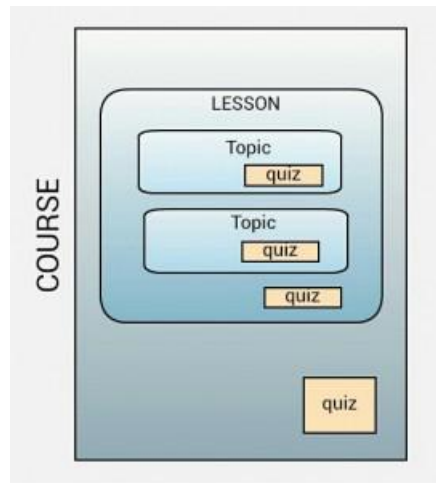
Fig. 10. MOOC Components

A quiz is an online interactive questionnaire that uses components from the HTML FORM element and extension to this. In most cased they are evaluated by computer programs. Typical quiz types are true/false and multiple choice questions, multiple answer questions where several answers may be correct, free-text answers, term and image matching as illustrated in Fig. 11 and image hotspots. In the latter case a student answers by identifying and clicking on specific areas of an image, for instance to identify anomalies in an x-ray photograph. Free-texts answers put a heavier burden on the automatic evaluation system, but may in some cases be implemented using pattern matching and additional programming when needed.

Fig. 11. Online quiz example: Term matching

As an alternative to machine evaluation, students evaluate each other or themselves. An important function in MOOC software is to support group formation and the farming out of answers for student peer assessment. These elements are crucial for online courses with massive attendance. Lecturers and teaching assistants are unable to respond to each student in person. It is straight-forward to pose online questions-and-answer-sessions that will disclose whether a given text has been read or not, for instance by asking about non-trivial facts. This requires a certain element of memorization on the part of students, but not deep thinking.

The difficulty is to compose questions and answers in such a way that they distinguish between those who really understand and those who imitate such behavior. Let us consider this in light of the Turing test or Turing's imitation game. This is a test of the ability of a computing machine to mimic intelligent behavior so that it is indistinguishable from that of a human. The concept was put forward by Alan Turing and has later been refined:

> *I believe that in about fifty years' time it will be possible, to programme computers, with a storage capacity of about 109, to make them play the imitation game so well that an average interrogator will not have more than 70 per cent chance of making the right identification after five minutes of questioning. (Turing, 1950)*

A recent press release from the University of Reading stated that a computer program had indeed convinced a sufficient number of questioners that they were communicating with a 13 year old boy (University of Reading, 2014). Others have questioned that the details of the experiment were not in accordance with Turing's requirements. But whether the test has been or will be passed in the not too distant future, good online quizzes are a special category of similar questions. From this we may deduct a renewed emphasis on knowledge-engineering and the analytics required to produce content and the wording of questions and answers, including invalid ones. The educational institutions will be faced with the challenge of working through its subject areas and develop quiz repositories as potential high-grade Turing tests. They should not be easily passed by using mundane on-line searches or Jeopardy-style or topic-oriented conversational quiz programs, but still be appealing to thousands of online students with access to hugely increasing computational tools.

7. Talk-back

We are thus dealing with constructionist and dialogical component in the pedagogical design that requires demanding feed-back mechanisms. Such systems are, of course, readily available as discussion boards and comment systems.

The following example points to a convergence of formats that supports such developments. It is based on the structure for feedback and discussion of newspaper content (see Fig. 12 and Fig. 13). But added to this function is the collation of all contributions from each individual contributor. Through active participation each user is thus building a portfolio or a text collection that may be taken as notes or pre-writing for one or more comprehensive contributions to the topic at hand.

Fig. 12. Online discussion illustrated by a digital newspaper and the structure of comments

As our case we have chosen the independent KHRONO.NO newspaper published by Oslo and Akershus University College in Oslo. After one year of operation this wholly digital newspaper won an award as Norway's best trade journal in 2013. The discussion facility is based on the Disqus software that is used by a number of online publications including the main daily of that country. It also works with other online solutions like blogs, content management systems, MOOC platforms etc. The system has three main components:

- A set of discussion threads that is linked to each individual document items like news story or article in the main body of the publication. ("MAIN STORIES")
- A sequential list of recent entries across threads ("COMMENTS")
- A collection of entries from each particular author ("OWN COMMENTS")

The background part of the image below shows a screen shot of an online newspaper. To each of the main stories any (registered) reader may provide his comments. They are stored in discussion threads and linked to each individual newspaper entry. The most recent comments are showed in LIFO (Last In First Out) manner in the right pane. Comments from an individual commentator are also collated under his or her name by the host discussion system as shown in.
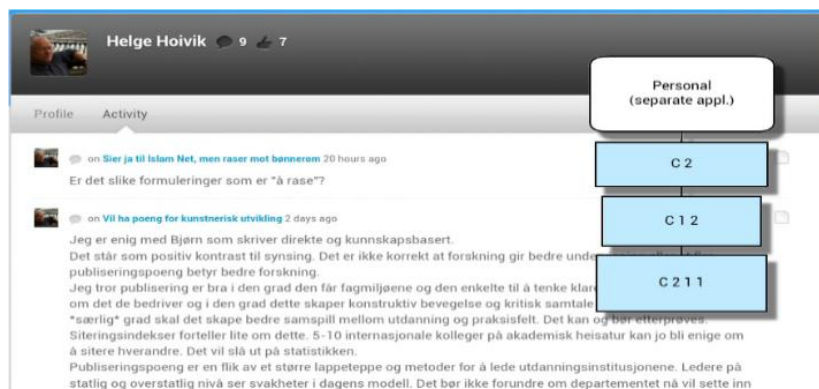

Fig. 13. Personal entries as collated by the discussion system

They can be read in their entirety. The author can log in and make changes later. Others may register as a "follower" of posts by this author. His or her contribution thus appears as a micro blog in its own right.

Similar features are available for ebooks whereby students may highlight or annotate their materials. All entries may be collated into a new document. They are shareable between devices and potentially between users. A teacher may for instance attach a question to a particular passage in a book, and this shows up for students to answer in the book instance on their own device. Students may share annotations between themselves etc. In this way textbooks become entry points to a learning system in its own right.

8. Logic of production

This is no small feat and will require extensive changes to the culture and the modus operandi of Higher Education. The following diagram illustrates main point of a text-oriented production logic that may be introduced to such institutions today.
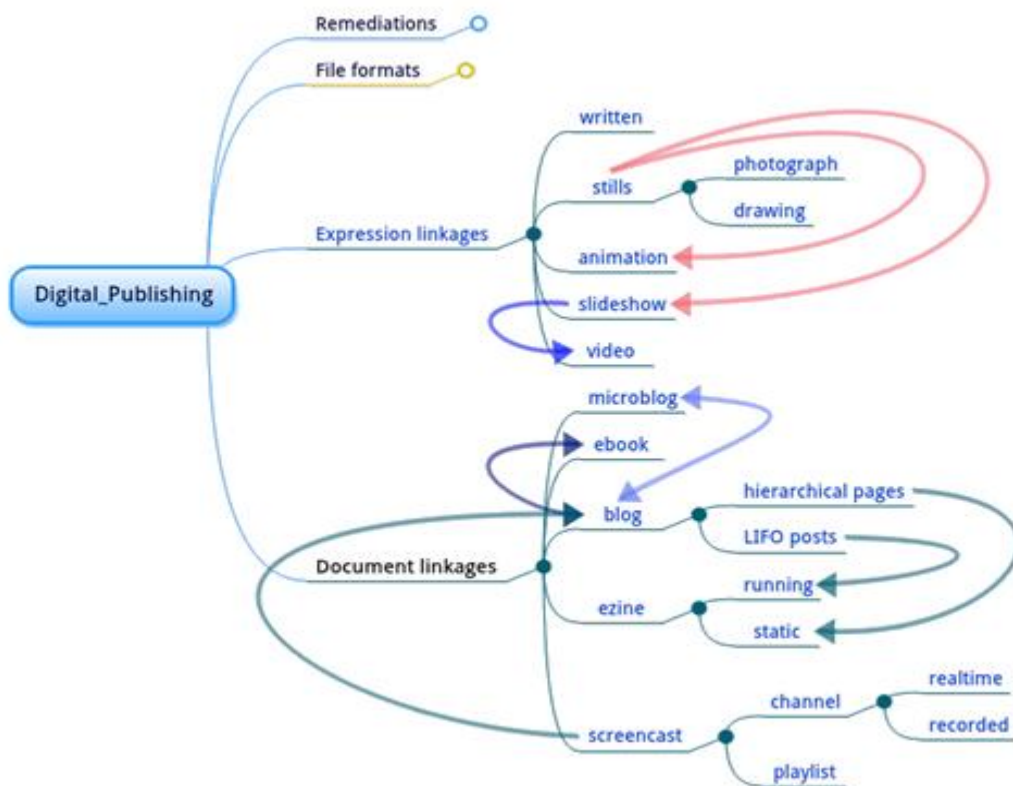

Fig. 14. Text-oriented production logic showing potential relationships between expression and document types

The remediation categories that were mentioned above are not interesting in and by themselves and the categories are collapsed in the mind map in Fig. 14. But they

simplify the analysis of how different formats and artifacts link to each other to form production processes and workflows. Here we have in mind the linkages that we may empirically identify between expressive chunks of material and how they combine when creating learning-oriented digital documents, - for instance a MOOC.

Neither do we deal specifically with the technical formats like DOCX and ODT for word processing, HTML and XML for web documents and GIF, JPG, PNG etc for still images etc. At this level they are technicalities and may furthermore translate one to the other. But in practice, the variety of formats and how they are store, integrated and delivered may pose substantial challenges.

But two entries in the classification schema are unfolded to reveal the subordinate categories. The first refer to the different modes and "chunks" of expression. Each mode corresponds to one or more generic file formats. But it is more relevant to think about this as the generic types rather than specific file formats. We may therefore focus on the expressive type as such. It is the logic of the operations on this expressive instance that counts. Whether we use JPEG or PNG for a picture does not really matter since both are supported by most image editing and display programs. On this level of abstraction we thus propose to work with the following categories: *written text, still images* that are handmade or recorded, *animation, audio recordings, slideshow sequences and one or more video snippets* or scenes.

These expressive chunks are brought together to form digital documents. We distinguish between *blogs* and *micro blogs*, digital magazines (*ezines*) and digital books (*ebooks*) and as a final category *screencasts*. The ebook and ezine formats may fill the function of traditional textbooks, while blogs and micro blogs are similar to lecture notes and hints/messages. Ezines may be based on static content that is manually revised or based on streams of content that, from the perspective of the editor, is automatically updated. A blog may be of the typical LIFO (Last-In First-Out) or sequential nature, or it may allow hierarchical ordering of pages. The screencast group is further divided into *casting channels and playlists*. A casting channel is orchestrated by the performer or a team including the performer as part of a performance. It may be accessed live, i.e. that performance time equals runtime or it may be recorded for time-shifted runs. Combining both approaches gives a certain economy of scope. The structure of a playlist, on the other hand, is based on an ordered set of more elementary expressive elements or digital documents that string together at runtime. In our view there is currently some overlap and even terminological confusion between the two mechanisms that needs to be resolved.

From these categories and linkages we may derive several types of production sequences or *production logics* based on expression types. As an example we may use a "combo lecture". The "combo" moniker refers to the different usage modes including face-to-face, streaming and recorded versions. These presentation formats are different and require different modes of presentation and different scenography to be engaging. The quality of interaction face-to-face does not easily translate high quality in a recording or real-time lecture streams. As with a good television debate we may arrive there, but the academic community is far from that level now. And the younger target audience does expect performances on a par with online materials elsewhere. But the material used for the presentations may be the same. One may use the same slides, keywords, sound bites and movie snippets in a lecture theater as a video cast and a video recording as indicated in Fig. 15.
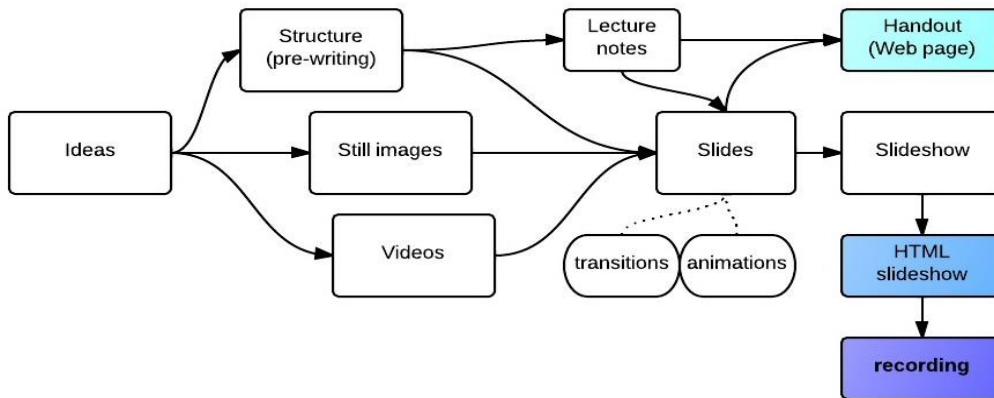
Fig. 15. Production logic for a FSR lecture

The lecturer start out with an overall idea that he wants to convey. This is researched for expansion and precision as well as for imagery and video recordings. He imposes a structure ("pre-writing") that ends up as lecture notes, while text, still images and videos become the screen content or slides of a presentation. From this material one may derive handouts on paper and as web, including MOOC, pages. Adding transitions and animations to this presentation, the author creates a slideshow. This may be translated to a HTML format for online distribution. All elements up to this stage may be used in live, streaming and recorded mode. By going through the presentation on camera, the lecturer may easily create a recorded presentation that may be integrated in the web (and MOOC) pages. A similar performance, but with the option for real time feedback, is used for online streaming. It is useful to have the prerecorded presentation available for preparation or review. The same obviously goes for Face-2-Face encounters.

The new logic of production is closely linked to digital curation of materials. Wikipedia defines "sheer curation" as *an approach to digital curation where curation activities are quietly integrated into the normal work flow of those creating and managing data and other digital assets. The word sheer is used to emphasize the lightweight and virtually transparent nature of these curation activities*. And this is precisely what students and teachers do when they traverse online resources and repurpose them for their own contexts, tasks and social interactions. The production model above is therefore just as relevant for student work.

We thus arrive at a model where our productive design supports – and may require – student-driven "pull" as well as the traditional "push" from the academic lecturer. In our experience we find this to be a useful, economical and a necessary extension of the pedagogical toolbox. Students contribute at several levels from finding or making a single, but striking pictogram (that renders the tangible) or ideogram (that explicates a state, process or conceptual structure) to video triggers or entire lectures. To include such work has proved useful for MOOCs. Students should be exposed to and develop materials in advance and between face-to-face interactions as prescribed for the flipped classroom. In this they will have significant input as to which areas of the content domain that they explore. They work better with some degrees of freedom.

The lecturer, on the other hand, may focus on "lean lecturing" that combines short, but high-level framing of main concepts, problem areas and methodology with content-oriented facilitation or curatorial activities as described above.

9.   There is an app for that

A well-received 2009 iPhone advertisement posed a series of question of what to do in various circumstances, and answered each one with *There is an app for that*. We may paraphrase Kirkegaard cited earlier that any *repetitive task which can be exhaustively described in rule is a prime candidate for being targeted by apps*. This is certainly turning out to be the case for teaching and learning as illustrated by the screenshot below (see Fig. 16). The MOOCs4U app presents a directory of the thousands of online courses being offered by edX, Coursera and others. My Study Life is a directory to organize lectures, exams and other events of relevance. Evernote and INKredible may illustrate note-taking apps, the former by keyboard and the latter with handwritten input. Mindjet is one of the many efficient apps for mind mapping that is useful to jot down notes or structure a document or plan. The Connect app lets the student link to online lectures in the Adobe Connect format, while Coursera is similarly an app to follow courses from that provider. Etc.
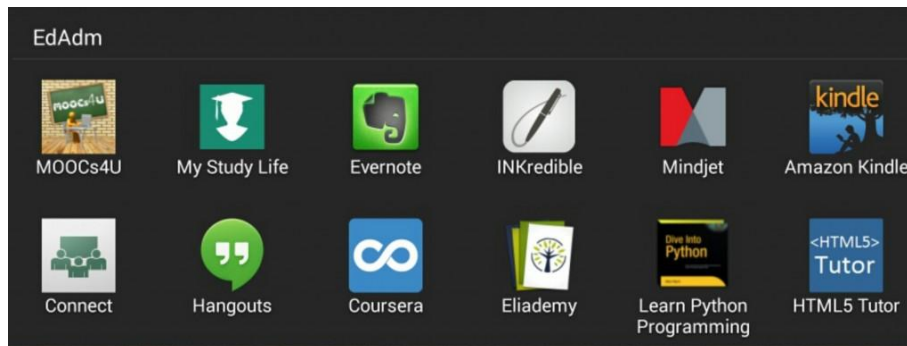

Fig. 16. Apps for individual organization of learning events of whole courses (from the author's collection of educational apps)

Power resides in many forms and guises. The ability to define when, where and how an individual may interact on the institutional level is one of them. The emerging ecology of mobile apps are thus of importance for restructuring the relationship between students and education providers. Armed with a plethora of apps that gives access to texts, tools, presentations and procedures from competing agents the students become better positioned to select and to organize their learning environment. One would expect that this add to the pressure on institutions to support exchangeable credit points.

10. A new grammar of schooling

We may understand the current changes with reference to Tyack and Tobin's (1994) notion of an entrenched grammar of schooling which is:

patterned slots of time and space where students and teachers are classified and subjected to well-defined rules and rites for entry, behavior and exit and where knowledge domains are refactored into delimited taught subjects.

These *rules* and *rites* that define traditional schooling are but a special case of the socio-psychological complex that Pierre Bourdieu called *habitus* (Bourdieu, 1979). Habitus is not individual, but recognizable between individuals. It expresses itself as a junction between the social and the psychological and between the structural and procedural. Habitus is the persistent tendency of behavior that manifests itself through typical actions in response to a given social situation. It is habit that is understood as volatile and half- and sub-consciously controlled sociality.

The social norms that develop between young people in this way are essential to understand the potentials for online teaching and learning. Take away the confinement of face-to-face classes, and students are more at liberty to define their own behavior.

To the extent that the educational establishment will engage with the new technological and social developments, it is this "grammar of schooling" that comes into play. Observing the daily chores of students, colleagues and ourselves, we ask: What can we perceive and conceive as the *emerging* rules and rites of education at this stage? How will such changes impact services and institutional structure and even more importantly – how do they push for a new image of self within the academic sector? If the MOOCs movement manages to overcome their obvious obstacles, what should constitute a valid approach to these change processes?

Here we are dealing with two interaction spaces. One is given by the online environment as it is currently experienced by several hundred thousand if not millions of students and teachers. Among other online learning activities, they are now testing the MOOC waters. Of particular importance are the interactions with online materials that have or might have an educational purpose. They refer to textual content as encountered along a dimension of decreasing social structuration from formalized learning to the virtual collection of texts in the wide sense,- covering the written word, audio and still- and moving images. This can no longer be distinguished from the software tools, the *apps*, of production and interaction that is currently provided for mobile devices. Together they represent a shared global experience by any owner of a smart phone or a pad. The other is given by the virtual and physical interaction space between students and teachers as they collaborate – or confront each other – within the realm of formal education. Students consume a daily or weekly mix of long and short writings as well as audio and video clips; and commentary and exchanges from friends and fellow students. They contribute themselves to such online discussions. As part of their wider socialization and of formal education they publish to blogs, micro blogs and upload to video repositories. The following is a brief scenario description of core elements in an alternative pattern of behavior. We will refer to the subject of such these behaviors as the *Digitally Engaged Youngster* (DEY) rather than that of a Geek. He or she might be casual in the approach. But activities may also be constrained by work or social requirements, or a psychologically given need to be *au courant* with online events within a circle of friends.

This youngster uses text feeds in the Real Simple Syndication (RSS) format on to access digital journals as they are delivered by Flipboard, Feedly, Pulse or Google Currents. All of them are available on the PC or as iOS and Android apps. They also give themselves to face-to-face or online lecturing. They give access to daily updated news, comment and analysis.

In addition to these dailies, our Digitally Engaged Youth downloads a monthly set of magazines with more deeply argued materials. One example in the computer-oriented area of interest, - which is a *geek field par* excellence -, he might subscribe to magazines, journals and other research and learning materials from Communications of the Association for Computing Machinery (CACM). If this resource is too demanding, he alternates with digital versions of PC Magazine or Wired or any other title from the large number of similar online publications. He may absorb weekly or daily lectures from the TED (Technology, Education and Design) repository and other video outlets. All this content may be consumed on the phone, a pad or the laptop or transferred to the big screen displays at home, at work or in school and – potentially – as a hovering display in the field of vision when using Google glasses. Information flows easily from the net to any such screen estate, and increasingly so between them as well.

Our idealized reader is also a writer. He or she publishes comments and musings to the public using blog servers in the cloud. The same goes for Twitter/Weibo, YouTube/Youkou and other socially (many-to-many) distributed – media. With the existing Google Currents Producer or the recent rewrite of Flipboard that was re-launched in May 2013, this user may equally define his own news magazines. He may include both his own home-grown and external sources to his personal edition. Our student is no longer an avid reader-writer only, but also a digital curator, editor and librarian.

It is these activities and role dimensions that are addressed and integrated into teaching and learning by the MOOCs movement. More than that: The MOOC process is not primarily a question of one or another technological platform per se. We need to factor in the availability and popularity of social media as such and the various participation patterns among youngsters. They are counted by the tens of thousands on each MOOC course and are recruited from all over the world. Among other important effects, this implies that the "lights never go out". It is driven by activities that most probably will develop according to the Pareto distribution. Here a large part, say 80%, of the contribution to a certain activity emanates from a small part of providers, say 20%. This is numerous enough for a popular MOOC to maintain rapid and extensive online activity 24/7, - 24 hours a day 7 days a week.

11. Conclusion: From scholasticism to skills

Higher education experience tumultuous times. It is driven by technological developments with roots in the mid 20th century and with additional developments that will continue unabated far into the 21st. Parallel sectors in the field of text and symbolic production like newspapers, publishing house, book stores, movie theaters and record companies are already strongly affected.

Technological push is mediated or harnessed by institutional and cultural constraints. Higher education is framed by century-old institutions and a concept of (academic) self that reflects its historical elitist functions. Drivers and inhibitors are thus tugging at each other with increasing intensity. So far the educational institution has not changed that much.

This is bound to change for one important reason. Compared to the productivity of other sectors, the institutions of higher education are becoming increasingly costly. This is mostly due to the manual character of lecturing and supervision and to the rapid increase in student numbers with the ensuing requirements of added brick-and-mortar facilities. It is not here a question of what constitutes the best possible education per se,

but a question of what will be good enough in comparison to its societal and individual cost. It is from this perspective one should interpret the renewed interest in education by venture capital. This jury has returned from its deliberations. The verdict is out. The educational domain has an untapped potential for reengineering. Sooner or later the interplay of these forces is bound to transform the educational field.

As institutions of investigation, research and societal critique, the universities will continue to play an important role, even as computerization is changing traditional modes of behavior. We will see that computers contribute even more as abstracting, translation and curatorial machines and as analytical tools that harness and discover patterns in large repositories of empirical and descriptive material (Parr, 2013).

Education becomes commoditized. This is not so much a question of being paid for by students or governments, but the underlying logic of production. In this respect, educators and institutions who display too much concern for form and formality, i.e. that is scholasticism, will end up in dire straits. They are asked to deliver tangible results as researchers, where competition is already stiff, or as educators where the MOOC movement point towards a new competitive environment. The brick and mortar of established institutions do not protect against the latter as it did in the past. In the long term it is of course of some importance whether new universities are created as for-profit ventures or whether old universities reinvent themselves. In both cases the ratio of tenured teachers to lower-paid assistants will diminish. The computerized component will increase. As a matter of fact, this development is already easily observable. The MOOC movement is but one statement to this effect.

But as the educational fields get crowded and competition intensifies, there are also windows of opportunity. The OECD Frascati manual describes for instance knowledge-generating "experimental development" as:

systematic work, drawing on existing knowledge drawn from research and/or practical experience, which is directed to producing new materials, products and devices, to installing new processes, systems and services, or to improving substantially those already produced or installed. (OECD, 2002)

Such new products, processes, devices, systems and services are localized and context-dependent. This gives a broad avenue for creative work that is not easily automated or out-sourced. They need highly qualified domain expertise. There is a thus a systemic need to reduce the scholastic bent in academia and give more attention to "experimental development" of its educational products.

When the learning system taps into the online behaviors of young people this will obviously lead to a new dynamism and new types of learning environments. Add to that the current commercial interest in such solutions, and we may be faced with an explosive mix.

That this is also strange and unfamiliar terrain should not come as a surprise. The welcoming video for course on Python programming from Rice University used the term *class* as an integrative reference 30 times during the first 3 minutes of the presentation (Rice University, 2012). It was as if the lecturer felt a strong need to conjure its existence. But *class* is hardly the right moniker for 100.000 globally dispersed students.

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