OECD STUDY ON DIGITAL LEARNING RESOURCES AS SYSTEMIC INNOVATION

COUNTRY CASE STUDY REPORT ON DENMARK

Final

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1. INTRODUCTION

This is one in a series of country case reports prepared as part of the study on Digital Learning Resources as Systemic Innovation being conducted by CERI/OECD during 2008. It focuses on three case studies of systemic innovation in the Danish school system and draws on:

- background information provided by Danish officials on the three case studies and

- meetings and interviews conducted during a study visit in Denmark that took place on $2^{nd} – 4^{th}$ June 2008.

The visiting team consisted of Ferry de Rijcke from the Ministry of Economic Affairs in the Netherlands and President of the European organisation of education inspectorates (SICI); Matti Sinko, University of Helsinki and Helsinki University of Technology in Finland; Sang Min Whang, professor of psychology at Yonsei University, South Korea; Katerina Ananiadou, analyst at the OECD/CERI Secretariat; Francesc Pedro senior analyst at the OECD/CERI Secretariat; and Jan Hylén, consultant to the OECD/CERI Secretariat. During the visit the team met with 28 stakeholders involved in the different cases selected by the national coordinator for detailed study in the context of the project. A complete list of participants' details is given in Annex 1.

The overall aim of the study is to review and evaluate the process of innovation involved in policies and public as well as private initiatives designed to promote the development, distribution and use of DLR for the school sector. In so doing, the activity will bring together evidence of:

- how countries go about initiating ICT-based educational innovations related to DLR, the players and processes involved, the knowledge base which is drawn on, and the procedures and criteria for assessing progress and outcomes;

- what factors influence the success of policies aimed at promoting ICT-based educational innovations, particularly those related to the production, distribution and use of DLR including user involvement in the production process and new actors such as the gaming industry and media companies;

- user-driven innovations related to DLR, carried out by learners and teachers, such as innovative production and use of DLR, and how the educational system responds to such innovations.

Accordingly, instead of focusing on discrete institutional innovations, this activity aims at a better understanding of how the process of systemic innovation works best in relation to DLR, and of which factors, including governance and financing, influence its development.

The definition of systemic innovation adopted here is: *any kind of dynamic, system-wide change that is intended to add value to the educational processes and outcomes*. The aim is to analyse innovation systems and strategies regarding the production, distribution and use of DLR by bringing together evidence of the drivers for systemic innovation in the five Nordic countries: Denmark, Finland, Iceland, Norway, and Sweden. All countries participating in the study have selected at least three case studies of recent DLR innovations for in-depth analysis by the expert team. The expert team received country reports in which the participating countries presented the state of development concerning ICT in education, including information on the selected cases.

The term "learning resources" is intentionally chosen to distinguish the artefacts we will study from traditional textbooks. Digital learning resources are different from traditional physical textbook in many ways. One obvious difference is that digital learning resources can be multi-modal, which means that the communication can be made both visually and auditory. Furthermore, visual presentations in digital format can be made not only as still pictures but also as short video sequences or animations. Another difference is that digital learning resources can be constructed as simulations, where the simulator

represents a physical environment in which it is safe and inexpensive to make dynamic experiments. Sometimes the learning resource can be made into a representation of the subject matter, like a business or a farm. A digital learning resource is both an artefact and a semiotic tool with a bigger potential than traditional textbooks. One further dissimilarity is that most textbooks have been developed within the framework of the public school system with its specific traditions and rules regarding what kind of goals students should reach. Many digital learning resources have a different story – not necessarily emanating from the needs of the school system but a broader commercial market or social context.

A "learning resource" can refer either to any resource used by teachers and students for the purpose of learning, or to only resources particularly designed to be used in learning settings. It is both a strength and a weakness of the former definition that it is very general – it can refer to anything from a stone or a feather, to Encyclopaedia Britannica or advanced databases, as long as it is used for learning. The second definition is more limited and hence more easy to use. But it excludes resources like online newspaper articles, most computer games, and applications such as Google Earth. Although ease of use is important the Secretariat advocates the use of the broader definition in this study. Since the project is about innovations and innovative practices it would be unwise to restrict the artefacts studied on formal grounds. To conclude, this means that by "digital learning resources" we understand any digital resource that is actually used by teachers and learners for the purpose of learning.

This introductory section provides a brief overview of information and communication technologies (ICT) in the Danish educational system followed by a short description of the different case studies selected for the study. As these form the main focus of this report they are described and discussed in more depth in later sections of the report. The cases were selected by Danish officials, in collaboration with the OECD/CERI Secretariat.

2. CONTEXT

Denmark has a population of approximately 5.4 million and has a size of 43.000 km^2. The population primarily lives in cities or other urbanized areas. With a GDP per capita on USD 35 704 it is a wealthy nation. Furthermore Denmark is among the leading countries in use of ICT in both the public and the private sector. There is a governmental objective to make public administration more effective and at the same time efforts are made to increasingly encourage citizens to make use of digital technologies. ICT use and internet access in private homes is also widespread in Denmark. In 2005, more than 98% of Danish households had access to a broadband internet connection.

Danish education is free of charge throughout the education system. The Danish Public school is municipal. The local authorities own and run the schools paying salaries, buildings, educational resources etc. This means that money from the state is given in block grants to the municipalities. Only in extraordinary situations the state subsidizes with "seed" money.

2.1 ICT in Danish Education

During the last 10 – 20 years Danish governments have formed a number of ICT policies in education. The major ICT strategies have been related to large projects funded by the Government. At the end of the 1990's, there were heavy investments in infrastructure in the form of internet access. Before and after that DLR have received a large portion of the funding. This has primarily gone to primary and lower secondary school. In the last ten years, ICT initiatives have been dominated by the three large projects, *IT, Media and the Danish Folkeskole* (ITMF, 2001 – 2004), *The Virtual Gymnasium* (2001 – 2005) and *IT in the Danish Folkeskole* (ITIF, 2004 – 2007). During the last 10 – 15 years, ICT policies within education have primarily focused on:

- Infrastructure

- Development of learning resources

- Integration of ICT in subject matters

- ICT education for teachers (and pupils)

In this period, the policies have in general pointed towards a certain level of maturity. Policies have moved from a focus on computers, later towards a focus on internet connections, development of DLR and towards integration of ICT in the subject matters and making ICT an integral part of the daily school life. However, the latest initiative (ITIF) did, to a large extent, put the focus back on the infrastructure. A large part of the latest project was to provide 3rd grade pupils with computers.

Danish schools and teachers have freedom of method, which means that there are no national regulations on teaching methods. However, there are Ministry goals for each subject and national tests which evaluate whether these goals have been achieved.

The Danish pedagogic tradition emphasises the development of independent and critical individuals. This has two implications. Firstly, Danish teachers tend to demand high quality from learning resources. They will not easily accept DLR that do not enable the kind of sophisticated teaching and learning they value. Secondly, DLR, as other learning resources, should in their view have an open character. Rather than just being geared for the transfer of knowledge, they should enable constructive learning as well.

The ICT infrastructure seems to be well-developed in Danish schools. Some barriers for ICT and DLR use in schools still exist, but they rather seem to be related to access to computers outside designated computer labs. Large parts of the teaching force seem also to have good ICT qualifications.

3. CASE 1: EMU

3.1 Background

The national Background Report describes EMU as follows:

The EMU (www.emu.dk) is the national portal for learning resources for schools, colleges and adult education. It is initiated and funded by the Ministry of Education. It [was] launched in 1999, and it is developed and run by UNI-C. EMU stands [literally] for" Electronic Meeting Place for the Educational World". The EMU is a web portal for all kinds of information and resources of relevance to pupils, students, teachers and parents. The idea of the EMU is to have one central portal for information of relevance to the educational world. The EMU hosts a number of sub web sites. Among them are The Subject Matter Infoguide, the E-museum, SkoDa, and The National Repository of Learning Resources (Materialeplatformen). Most of these services are free [of charge].

The producers of DLR support the National Repository of Learning Resources for managing DLR, and they always produce the necessary metadata for their DLR. However, it is believed that the portal is primarily an advantage to smaller companies, whose products are made visible at the

portal. The larger companies – well known by schools – tend to focus more on their own websites as the place to promote and sell their DLR.--.

UNI-Login *is a universal login [of UNI-C] for several web services. It means that you – as a pupil or teacher – only have to login once on your computer, and you will have access to several web services that are subscribed to by the school. UNI-C uses the login for its own services, but the login can also be used by the commercial services. --.*

SkoDa (skoda.emu.dk) is a database service for schools. The service provides access to a range of databases such as encyclopaedias and newspaper articles. (SkoDa is a commercial site run by UNI-C).

Skolekom *(web.skolekom.emu.dk) is a conference system (based on FirstClass) for schools in Denmark. The system offers mail and conferences. Among the conferences are subject specific conferences, in which teachers can discuss and exchange. Skolekom is offered by UNI-C, and schools can buy subscriptions to the system, which is run and managed by UNI-C.*

Skolekom was introduced in 1989 in a line based version. When a new First Class based version was introduced in 1994 it provided all teachers with an e-mail address. In 1997 all students got an e-mail address via Skolekom, too. Today, Skolekom has 300.000 active users. Skolekom is now a commercial service run by UNI-C.

3.2 Importance of EMU in the context of the national educational ICT/DLR policy

Observations of the OECD expert group fully confirmed the description of the Danish report of the EMU portal service being the backbone of the entire Danish DLR system and thus the major tool for the implementation of the national ICT and DLR policy in the area of education. It has been managed to pool in the EMU portal the majority of the most relevant national DLR offerings, private as well as public together and easily accessible by the entire Danish education community. Thus it plays the most pivotal role in implementing the national eLearning strategy.

Denmark seems to have managed to continuously adjust and thus maintain a delicate balance between the public and private sectors in implementing the national educational ICT strategy which has required continuous deliberate and unprejudiced readiness to redefine and refine the roles and mandates of public and private. Moreover it has required readiness to realign resources and responsibilities between the national and local policy making and policy implementation. UNI-C as the education ICT policy arm seems to have been the most pivotal and also from time to time controversial agent for launching and consolidating new services. Many of the core Danish educational ICT initiatives proposed by the government, like EMU, have been designated to UNI-C to implement. Later on UNI-C in many cases has been phased out when the service has been believed mature enough to be run and regulated by the market. At least for the time being EMU continues to be managed and maintained by UNI-C with the government mandate and funding. Therefore understanding and analysing EMU one has to see it in the context of the service provider UNI-C, which plays such a special role in the Danish education innovation ecology.

In addition to being the portal through which educators as well as learners have access to the online and digital education resources and tools the EMU service is responsible of developing and maintaining a number of specific DLRs under the EMU umbrella. They have been well described by the national report and quoted in short above. A substantial number of these services have their historic origins in and are reflecting the successive development phases of ICT in education in Denmark thus making the EMU as a whole look and feel quite original, endemic and symbiotic by nature.

3.3 The process of initiating and designing the innovation

The EMU portal was not set up from scratch but it inherited on birth the earlier services incorporated in and/or developed and maintained by UNI-C as described and discussed above. So designing and launching the service could capitalise on the experience the users had of the preceding UNI-C services.

The UNI-Login access system, created by UNI-C, is one of these preceding services. It was crucial to include this substantial initial user-base to start building the critical mass of users necessary for a substantial and sustainable national on-line education culture. It guaranteed that the entire education community that was already using net based services like email was included from the start. As soon as a subscription contract has been signed a message is sent to the UNI-Login administrators who then enable access for a school or for individual students. From a user's point of view, it means that you only have to login once to have access to all the services that are subscribed to by the school.

Moreover EMU has been wisely piggybacking the other national DLR initiatives of boosting ICT usage in schools. A portal, even national, without rich content from the start would not have gathered necessary momentum without such proactive spurring.

The clear mandate, undaunted political support and substantial public funding to UNI-C from the Ministry of Education to set up, maintain and develop the EMU service has been a prerequisite for the success and solid base for consolidating the initiative and allowing it to nourish its innovative features.

For all these reasons reaching critical mass for sustainable service provision has been feasible and taking place. Designating the EMU service to UNI-C by the Ministry of Education was a sensible choice thus allowing to capitalize on the experience and e-learning community already there.

3.4 The use of the knowledge base

Reaching a critical and sustainable user base has, however, not been an easy task which is demonstrated by the fairly slowly growing EMU user statistics.

Table 1: The EMU unique users per week according to the UNI-C statistics

Universes" (subject content areas for students and teachers)	115,000
SkoleKom (mail and conference service)	40,000
SkoDa (collection of databases)	20,000
Infoguide (validated quality links)	10,000
Total	**185,000**

The above UNI-C statistics indicate that there are unique users per week ca 185,000 which constitutes about 25 percent of the potential entire Danish primary and secondary education community. The statistic below shows the usage frequency over the school year from 2003 to 2008. It reveals that the growth of the user rate has been steady but not dramatic allowing yet plenty of room for further growth. Moreover it indicates that the usage is clearly accummulating to school days implying emphasis being on the curriculum based formal education usage. The usage outside school terms and hours is low. It looks like attempts have not been made to solicit non- and informal out-of school learning usage or they have not been particularly successful.
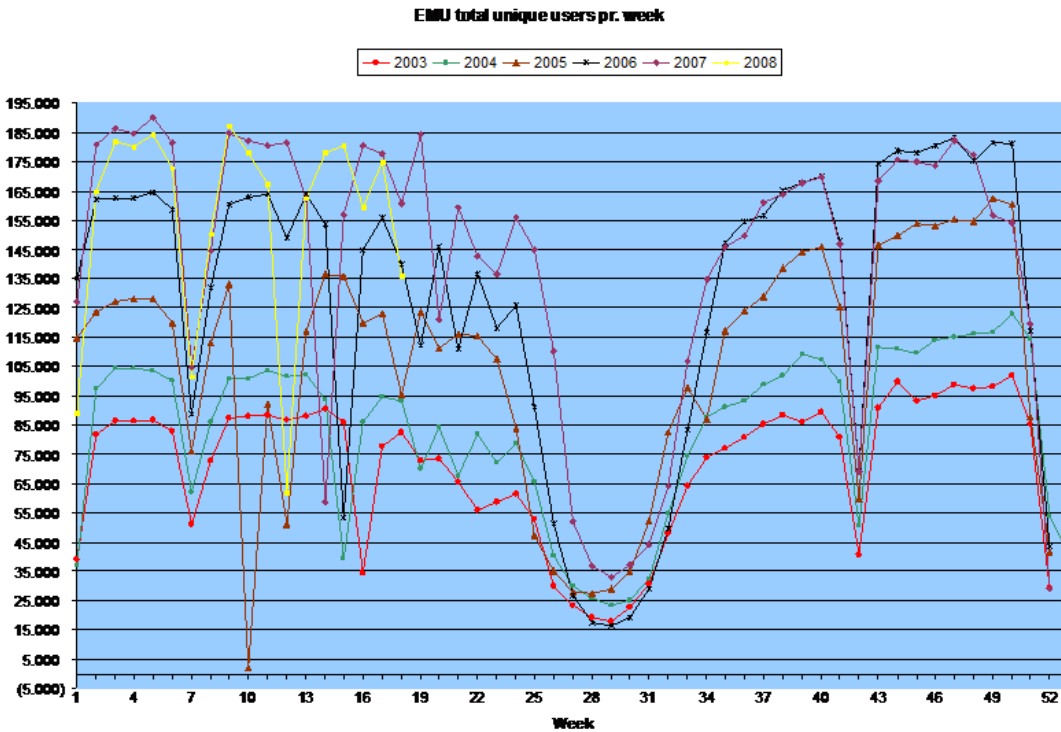
EMU total unique users pr. week

Figure 1: EMU unique users per week 2003-2008 as per UNI-C statistics

3.5 Implementation

The structure of the EMU portal is such that it consists of a number of so-called universes and a substantial number of web services.

Universes are according to the UNI-C designated thematic user areas such as:

- Primary and lower secondary education
  - Pupils' areas for the pre-school and first form up to the 2nd grade
  - Pupils' areas for intermediate level (3rd-6th grades)
  - Pupils' areas for the 7th, 8th, 9th and 10th grade
- Teachers for primary and lower secondary levels
- Upper secondary general education
- Vocational education
- Adult vocational training
- Teacher training

Services comprise the following types of web services:

- SkoleKom: Mail and conference system

- SkoDa: Collection of content databases

- Infoguide: High quality links

- Learning Resources Repository: Catalogue of Danish learning resources

- Subject-related themes

- Educational sequences

- Good examples and stories

- Surveys

- Links

- News

- Tools

- Dialogue and exchange of experiences

- Events and competitions

EMU does not develop educational materials for pupils and students using public funds. Materials are designed and provided by external partners, e.g. publishers.

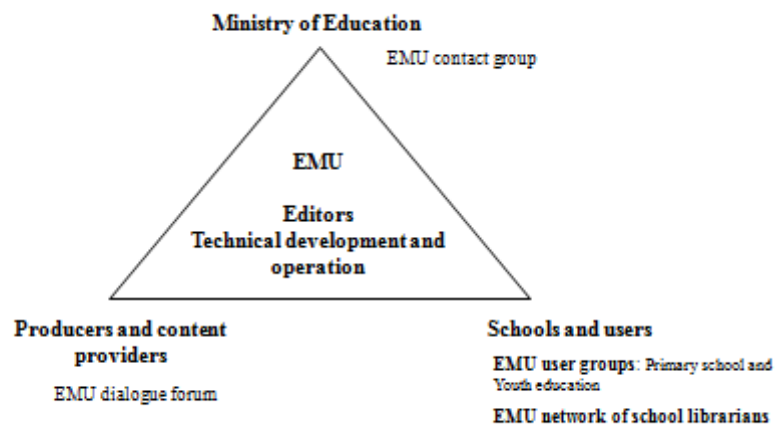The organogram of EMU is according to the UNI-C presentation slide as follows:

Figure 2: The organogram of EMU according to the UNI-C presentation slide

The organogram indicates that EMU encompasses the whole primary and secondary education community within its perimeters. It is not, however, entirely clear where is the thin line between proprietary software providers in one corner of the triangle and the user-community driven content provision in another corner. The community of practice is further described by UNI-C in the Figure 3 below.
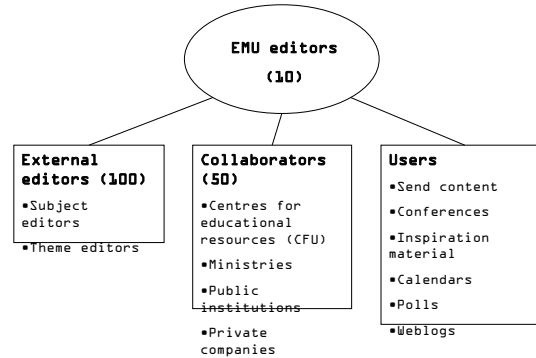
Figure 3: Content provision system for EMU according to UNI-C

3.6 Monitoring and evaluation

The Danish education system seems to have a well-established and in a sense fairly parochial education culture with direct and fairly informal discussion and feedback mechanisms particularly in larger local communities and between them, UNI-C and the representatives of the Ministry of education. In a small country with small population and short geographical distances, the conception of the state of the art seems to be fairly much shared between the grass-root level and the top ministry level.

It seems that monitoring the success e.g. EMU is based primarily on qualitative data gathered informally by each of the stakeholders respectively. Statistics and user feedback has not been systematically designed and implemented. User statistics gathered by UNI-C is of fairly general nature. Slight improvements are planned in the statistical monitoring in the foreseeable future.

There seems to be very little research-based evaluation of EMU in particular or the DLR altogether. The most critical voices towards the evidence-based policy evaluation of the impact of the ICT policies seemed to originate from the academia. Prof Kristen Drotner of the Danish research centre on education and advanced media (DREAM, http://www.sdu.dk/Om_SDU/Institutter_centre/Dream.aspx) confirmed the lack of evaluation data. She advocates a combined approach of academic evalauation and analyses and "Mode-II"[1] evaluations by practitioners. The ministry seems to acknowledge this as a weakness in the development of the systemic innovation in DLR based on research on media, information society and education policy, but it could be solved on the political level only.

The lack of systematic evaluation and research could be understood partly because of a mismatch between the traditional education research and the need for more quickly exploitable policy oriented action research on the one hand and the discrepancy between national research funding and education policy-making on the other, the former being under the Ministry of Research and Technology and the latter under the Ministry of Education.

3.7 Lessons learned

Assessing EMU as part of the Danish DLR system calls for following conclusions:

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[1] As opposed to 'academic' (Mode I) knowledge, Mode II knowledge does not claim universal validity, but aims to be meaningful to practitioners in a certain context. In this sense Mode II evaluations do not pretend to ascertain the value of for instance a DLR in any situation, but provide information of its value, effectiveness in a given context. Other practitioners can then decide whether this could apply in their situation and act accordingly.

1. EMU *has received consistent and substantial political, administrative* and *financial support* from the Danish Government.
2. Denmark has pursued *consistent innovation policy* in the area of DLR for years. EMU is a timeous and logical component in the trajectory of the Danish DLR policy.
3. EMU is clearly a pivotal component in the entire Danish DLR innovation system. It is *run by* UNI-C, which is the *primary* and *reliable agent* of the Ministry of Education in implementing its educational ICT strategy. EMU is, so to say, in trusted hands. To run successful DLR innovation policy requires such agents that are capable of implementing adopted policies. UNI-C has a contested record in the field and the best national experts.
4. EMU has managed to *exploit all previous knowledge* and *relational capital* and *managed to get a head start* for its operation. EMU pooled all existing educational e-services so far and could thus provide trustworthy service. Moreover it got a consolidated substantial and solid user-base from the earlier internet access subscriber base of UNI-C.
5. There is *still considerable inertia to be overcome* in the potential user constituency to be fully penetrated. The saturation point is likely to be no less than 80 per cent within a foreseeable future.
6. The development of EMU has been based on visionary and sustained policy-making, exploiting high-level expertise as well as active user group policy. This all should be continued.
7. The lack of *sufficient and appropriate evaluation and research has been and should be acknowledged*. The further development of EMU should be supported by *stronger and much more systematic monitoring and evaluation*. Moreover *action and media research oriented research should be organised* in support of future development of the services under the EMU umbrella.

4. CASE 2: SUBSCRIPTIONS

4.1 Background

As in most countries in Western Europe, the history of digital learning resources (DLR) in Denmark is one of trial and error, sometimes bold moves and serious disappointments. Two features, however, stand out as characteristic of the Danish experience. One is the active involvement of the Ministry of Education and its agency UNI-C. The other concerns the solutions that have been found for the challenge to produce high-standard DLR for a small language market.

Educational publishers in Denmark have encountered an ambiguous situation. The Ministry of Education has chosen and maintained ICT in education as an important priority in its policies. This has been the case since the early nineties. In 2008, at a time when ICT has all but disappeared from the education agenda in many European countries, the Danish authorities continue to take energetic initiatives in this field. The role of UNI-C, funded by but relatively independent from the Ministry has been and still is pivotal in this.

This positive context for ICT in education has, for publishers, also had a hindering component. UNI-C has been very active in the production and distribution of DLR. Thereby it has been a direct competitor on the DLR market.

As has been the regular practice with printed learning resources, DLR produced by commercial publishers were sold to schools or learners on an individual basis. Publishers found it difficult, if not impossible to produce and sell DLR on this basis. Profitable products were rare exceptions, and hence it was not possible to fully use the functionalities of digital resources, especially regular updating of content and the use of online resources.

To solve these problems, Mikro Værkstedet, a private developer of DLR, in 1999 introduced the concept of schools' subscriptions. Within a few months, Orfeus, another developer of DLR, followed with a similar initiative. The main idea behind school subscriptions is that schools pay for learning resources and services on a yearly basis. Schools subscribe to a package, which is regularly updated and expanded by

new additions. For developers of DLR this means that they get a better overview of their financial situation, because they have a more steady income. This has made it easier to plan for future products and developments. For schools, subscriptions mean that they constantly receive new learning resources, and that the resources are always up-to-date.

Further, the concept of web-based school subscriptions has turned out to be a favourable condition for development of learning resources in the form of web portals, which gather large amounts of resources that are constantly updated and change according to events.

A very important factor in the success of subscription is the UNI-login.

A further interesting feature of the way publishers use subscription, is by providing access not only to schools, but also to individuals for out-of-school use, especially to parents.

The introduction of school subscriptions had a significant influence on the spread of DLR in schools. The model of subscriptions has become a widespread practice in Denmark. Other publishers are moving in the same direction introducing subscriptions for DLR.

4.2 Examples

Skole Aftale and SkolePro

Skole Aftale

Skole Aftale is developed by Mikro Værkstedet. The target group is primary and lower secondary school. The subscription contains a range of DLR for different subject matters and different grades (http://www.mikrov.dk/sw203.asp). The resources are software programs (training programs or support tools).
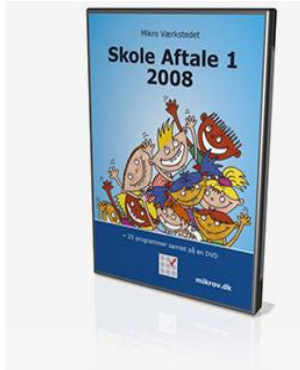
Today, more than 80% of Danish compulsory schools have a subscription to Skole Aftale.

SkolePro

SkolePro was originally produced by Orfeus, but was later taken over by UNI-C. In 2007, SkolePro was taken over by Malling Beck, a private publisher of learning resources now merged with Alinea, a member of the Egmont Group. The SkolePro subscription is comparable to Skole Aftale. The target group for SkolePro is also primary and lower secondary school. It also contains a range of learning resources for different subjects and grades (https://materialehylden.emu.dk/skolepro_web/skolepro.php).

/skole and /gymnasium
/skole (http://www.dr.dk/skole/) and /gymasium (http://www.dr.dk/gymnasium/) are developed by the Danish national broadcasting company (DR). In 2001, /skole was supported by the Ministry of Education

by 50 million DKK (€ 6,7 million) as a part of the ITMF project. The target groups for /skole are primary schools and lower secondary schools and for /gymnasium, upper secondary schools respectively. The resources differ from Skole Aftale and SkolePro. Whereas Skole Atale and SkolePro are collections of different kinds of software products, /skole and /gymnasium are websites with collections of content-based resources such as video and audio clips. /skole and /gymnasium are large collections of different kinds of media resources organized within themes. There are more than 20,000 media resources in the collections. The websites are dynamic resources in the sense that they are updated regularly with new media resources.

Other examples are digibib (http://digibib.dk/), a digital school library portal, operated by the publishing house Gyldendal and http://elevunivers.dk which offers learning resources for a wide range of subjects for secondary education, operated by the Alinea publishing house.

Once again the UNI-Login functions as an important feature in all subscriptions, as explained in section 3.1.

4.3 Assessment

What is the meaning of this initiative in terms of innovation?

- One must take into account that the size of Denmark, with 5.4 million Danish speakers, poses special challenges to the task of creating a market for DLR for such a small language community. Mikro Værkstedet estimates the market for educational software in Denmark on EUR15 million per year.

  The idea of subscription to learning resources is an innovative way of making these available to schools for an acceptable price. This is probably the only way to achieve a good availability and affordability in the Danish situation.

  Development of materials is costly. The purchasing power of schools is limited. At the same time, DLR do not keep like books (used to) do. Their value is optimal when they are regularly updated and when links to resources they contain are up to date, as well.

  The subscription solution is certainly successful in terms of quantity: schools have subscribed massively. It is also a success for publishers that have managed to make a profit through this way of distributing materials.

  It can be concluded that the subscription system is an innovation in terms of creating a sustainable market for online learning materials. This demonstrated by the fact that Mikro Vaerkstedet has expanded its operation to Norway Sweden and other countries, marketing not only their own products but also materials of other producers.

- It is not possible to make a similar statement about whether subscription has also led to didactical and pedagogical innovation. School subscriptions have not been evaluated in these aspects, which means that there is no documentation that evaluates their effect or impact on use of DLR. Publishers have carried out market tests themselves. For instance, MikroVærkstetet sends a questionnaire to all schools every year to ask feedback from teachers on its products and reports them to have responded very positively. But this does not make up for the absence of reliable evaluation data. A number of sources interviewed during the visit speak of the conservative didactical character of DLR, not meeting the needs of teachers who are looking for innovative tools.

  As explained in section 3.6 there is a lack in evaluation data regarding the use of DLR. One way of overcoming this deficiency might be "Mode II" evaluations by practitioners. The expert group observed a good example of this during a visit to the Grantofteskolen in Ballerup. The school team systematically shared good practices, experiences and expertise.

The ministry of Education plans an evaluation of the subscription practice involving 16 municipalities. This evaluation will include both the commercial model and the educational effects, while emphasising qualitative and consultative methods. The ministry also promotes teamwork in schools and encourages municipalities to give teachers a more active role in the selection of materials.

- There is some doubt about the consequences of subscription for the free choice of materials by teachers. Traditionally, the Danish education system highly values the responsibility of schools and individual teachers for their professional work. Deciding on what learning materials to use is crucial in this respect. Subscription, however, implies, that individual teachers have less choice than they might want, as it is mostly schools and municipalities that decide on the contracts. So there is freedom of choice for schools and municipalities, as they can choose between different publishers. But, due to economic constraints, once the purchase has been made by the school, the teachers have a very limited choice.

   There is a dilemma here. More flexibility makes the scheme less profitable for publishers. At this moment publishers are looking into options for making subscription more flexible, leaving more choice for individual teachers or subject-sections in schools.

   Schools, and teachers are not happy with the fact that subscription is attached to packages of materials. They would prefer to have a contract for the materials they value positive and want to use, rather than for a complete set of which considerable number of components they might not consider good enough or appropriate for their situation. All publishers are aware of this position of teachers and are working on more flexible provision of DLR, enabling teachers to make choices within the context of the school's contract.

   It has to be noted also, that publishers have a slightly different view on the extent and type of freedom teachers want: "We are providing freedom to the teachers, by providing them with materials that cover the national curriculum and that they can use in their classes, so they do not have to worry about that."

- Schools place a second question mark in terms of budgets. Subscriptions consume a large share of the schools' budgets for learning materials. They realise that publishers must make a profit and do not demand lower prices, but a higher budget. Publishers of course agree on this with them.

   The expert team has posed the question whether the Danish education system, being financed on one of the highest levels within the OECD, really needs more money. It might rather be a matter of reallocating available funds.

- It seems that the role of UNI-C has rightly shifted from direct producer of learning materials to enabler of production and access. A good balance between responsibilities of the private and public sector now seems to have been reached. Publishers no longer see UNI-C as disturbing the market, since it stopped selling DLR in 2007. It is quite certain, that this stage would not have been reached without the strong involvement of UNI-C, also in areas that now are left to the private sector.

5. CASE 3: ITIF

This case is chosen to get a general picture of DLR in Denmark, and to identify the potential impacts and actors for the deployment of DLR in Denmark. There are four main actors for this case: government officers, publishers, school teachers, and educational software/contents developers. This case report will

summarize the nature of ITIF (ICT in the Public School), and the potential impact of this DLR to the educational practices in Danish schools. The objective of ITIF is to develop new, structured net based learning resources and services that support the differentiated training and learning of basic skills and increasing the subject level of pupils at all forms. It is one of several DLR initiatives in Denmark.

Importantly, ITIF followed another major Government initiative, ITMF (IT og Medier i Folkeskolen; IT and media in compulsory education). ITMF took its bottom-up point of departure at schools and from the teachers. It was up to the schools to define DLR projects and to establish alliances with publishers and researchers. The objective of the programme was that these best practice results from the local projects should spread to all schools. However, evaluation studies revealed that innovation occurred locally but also that dissemination of experiences and DLR all over the country did not happen to the expected degree. This inspired the Ministry of education to take a more 'centralistic' top-down approach for ITIF.

5.1 Case Description

ICT in public schools, ITIF, is an ongoing project and the initial outcome, such as Digital Textbook, was implemented in classrooms from the autumn semester of 2008. This was one of key governmental ICT initiatives for primary and lower secondary education. The ITIF project had a budget of 495 million DKK (€ 66,5 million) of which 75%, 370 million DKK (€ 49,7 million) were used for the acquisition of computers for pupils in 3rd grade. Another important purpose of the ITIF project is to develop and make available web-based learning resources. From 2004 to 2007, 48 million DKK (€ 6, 5 million) were invested in the development of DLR and other web-based materials as a part of the ITIF project. Currently, ITIF aims to adopt and spread the usage of DLR, which will substantially complement the traditional textbooks used in classrooms. With this purpose in mind, the Danish government, along with textbook publishers initiated a number of pilot projects that aim to develop completely new kinds of learning resources.

Important development partners for ITIF were the Danish school book publishers and academic software developers. Companies marketing DLR were encouraged to submit proposals for web-based DLR. The initiative focused on three stages/areas: primary (6 – 9 years), lower secondary (11 – 15 years) and special education. The government's objective was to encourage the use of DLR at an earlier stage and to consolidate it at secondary level.

The MoE/UNI-C arranged 11 project competitions following EU regulations for tenders. An independent review committee of experts from the relevant subject areas selected 3 winners from each of the 11 competition areas. The winners received 200,000 DKK (€ 27,000) and other bidders received 100,000 DKK. The three winners continued in a tender process with negotiations, and eventually one winner was selected from each of the 11 project subjects. The learning resources cover diverse subjects such as Danish, English, Math, Art, Nature/Technology, Special education and differentiated teaching. UNI-C closely monitored the development of the learning resources, among other things with face-to-face meetings, and tried to accommodate diverse approaches to develop the DRLs.

5.2 Assessment

According to the report from MoE/UNI-C, only less than 7% of Danish school teachers feel uncomfortable with ICT. Danish schools are all solidly connected to the internet. ITIF in Danish schools has increased the number of computers in classrooms. The same is true for the number of digital white boards. So, two basic conditions for the use of ICT in teaching and learning, teachers' digital literacy and infrastructure, seem to have been met.

Until now the use of DLR has not constituted much change of the teaching practice in Danish schools. Although the tools are new they seem mainly to be used to reproduce the traditional way of teaching.

Instead of finding innovative access to learning resources, teacher activities, and students' collaborative works, novel ways of utilizing DLRs is progressing slowly. Teachers are well aware of the youth culture in cyberspace developing among their students, but they do not have the time, interest or curiosity to actually try to understand what this culture entails, and how they are related to their current usage of digital media. There was a chasm between how teachers and publishers perceived ITIF and how the students adopted the digital media in daily activities, which implies two different views of DLR for education.

There were no specified pedagogical goals and agenda and no one really proposed possible adoption strategies for utilizing these DLR in classrooms. An implied consensus may have been that teachers and students will use DLR nearly in the same way they used hardcover textbooks and exercise books before. From this perspective, DLR initiatives in Danish schools are continuous implementations of new digital media and learning resources without actually creating dramatically innovative changes in current practices. In 2008, the project is at the stage of implementing the web based learning resources, focusing on the Digital Text Books in school. However, there is no clear deployment strategy of DLR in classroom.

The pre-made digital contents or DLR have not produced significant changes in educational activities of teachers and students. Most teachers feel more comfortable using their own materials. As a result, it was not easy to find any strong desire from teachers to adopt or use(?) DLR from publishers or software vendors. Teachers do not know exactly what to expect from DLR and they feel more comfortable teaching the way they are currently teaching. In addition, it seemed as though there were not many things they want to change willingly because teachers' satisfaction level on the current class performances and their practices was quite high. Interestingly, consideration or incorporation of youth culture or voices of students were not identified. Students were simply recipients of this digital learning innovation process.

ICT started with a profound assumption that most pupils like to have ICT related activities. So, if it gets implemented in a classroom, students' academic achievement would improve. However, this is only a speculated assumption and has not been proven. Nevertheless there was a clear intention to use ITIF for improving the practices of basic skills in school, especially for pupils who have low motivation for studying, and at present, it is true that most students accept the digital media and DRLs as just new ways of interactions in classroom. Another avenue for the benefits of ICT in schools may be for the special education students. This was also on the initial agenda of ITIF.

The well-established textbook publishing houses have been the main suppliers of traditional learning resources to schools in Denmark. It is interesting to note that they earn most of their income from publishing books for the education sector, but at the same time, they feel the need to work towards ITIF. Most school publishers joined the ICT trend but failed. The small market size was mentioned as one of the main reasons.

Undoubtedly, publishers strongly want to have a new market for business, but they seem to have difficulties understanding the digital paradigm to guide the DLR. Many felt that they had to take sides: DLR or traditional schoolbook business. They are undoubtedly also very fixed to producing products the way they have always done. As a consequence, publishing houses do not strongly commit themselves to developing DLR, and tend to interpret DLR in traditional ways. Another weakness is a lack of demand from teachers and lack of their incentives to stimulate development of DLR.

The publishing sector makes a large share of their income from the traditional production of books for the education sector, which would make it risky for them to invest too much funds into experimenting with alternative resources. The deployment of digitalized textbooks is a clear representation of the supply-centered approach. These publishing companies do participate in ITIF, but they do not take account of youth culture related to digital usage. The main job of publishing houses has been to transfer their current textbook contents into digital forms. In addition, the national broadcasting company (DR) is developing digital learning materials based on video clips that they have accumulated for decades and indexed for ease of use. However, all this knowledge base has so far mainly functioned as a mere clearing house,

rather than being a new type of learning resources for students or teachers promoting different learning practices.

One must be aware of the underlying dilemma. In previous projects publishers and policy makers have tried the innovative path of DLR that encourages teachers to change learning practices in schools. In most cases they failed. In ITIF they followed the path of a digital textbook. In this way they hope that teachers will use their resources as the threshold is lower.

Textbook publishers participated in ITIF as much as they would have participated making hardcover books. It should be noted that ITIF is just one, although a major, development project, and traditional publishing is still by far the main business for the publishing houses. Typical contents included skills practices on languages and math. Although the form or medium of the text has changed from hardcopy to digital, the differences between these two distinct textbooks were minimal. Such outcome is inevitable in a way because almost all authors and software designers are or used to be teachers and have strong background in and connections with schools.

Due to earlier economic failures most publishers are reluctant to redesign their teaching and learning materials to be based on new concepts of learning exploiting the unique new qualities and potential of digital format. They prefer to simply transfer their current conception of learning materials into a digital format. The youth culture in digital usage has hardly any place in the development. Making changes in current textbooks or educational practices seem not to be in the interests of the publishing houses. They are not concerned about bringing improvements to the school practices which may be compatible with DLR.

Other software companies are also key players. As in many countries they were at first excited of and blinded by ICT in itself but teachers were not. Then to be accepted in current school system, their efforts were next focused on the business transactions, rather than developing new learning materials to improve students' performances. In conclusion, although the DLR in Danish schools may have provided a strong support to current educational practices, the innovations or changes have for the time being not been so apparent.

The "Mingoville" from DELC which focused on teaching English for 3rd graders had a clear pedagogical goal, claiming "learning English the fun way." By the summer of 2008, 28% of the school simple consented to start experimenting with this new digital material package. Teachers have very strong tendency to keep the current practices, and DLRs are used to aid their works. The producers of learning resources continue to believe in the position of the textbook, though they acknowledge that an increasing number of teachers are combining books with DLR offers. There is no follow-up to the ITIF project because it is expected to be completed by the end of 2008. The case report is based on the meetings with government officers (MoE/UNI-C), publishers (DELC, Mikro Værkstedet, DR, Alinea, Gyldendal) and school teachers (ICT experts & librarians from the schools of six cities). The digital text books mostly cover subjects of language learning and mathematics.

The development of DLR should be viewed in light of the Danish pedagogical tradition, which suggests that DLR are for individual usage, communication, and collaboration. At present, ITIF is much more focused on developing the web based learning materials or digitized textbook, rather than trying to change the current learning activities. Danish education is organized based on school districts, and parents seem to have high trust and expectation on public education system. Based on this evaluation, it would be wise to monitor progresses for each school district. The ITIF has not fully incorporated the pedagogical spirit of the Danish educational tradition. The use of DLR as an innovative medium of education in Denmark appeared to be somewhat diffused and fragmented. Several teachers expressed great uncertainty both in regard to the actual learning benefits of ICT in the educational context, and whether the time spent was used optimally. The ITIF case showed the weakness and strengths of DLR as a media of innovation in education.

The ITIF has been an impressive experiment for the information society, but it is not fully realizing what qualities or achievements children should have for the future. If Denmark adheres to the old goals in education, they should keep doing what they were doing, but if it wants to set up new goals and achievement levels, it will need DLR to take other deployment strategy.

At present, the Danish education system and schools in general seem to provide plenty of opportunities and academically stimulating environments. But the implementation of ICT for general educational subjects in its weakest instances seem merely to provide a digital replica of current school teaching, and does not utilize the innovative features of DLRs. Some of these weaknesses come from the government initiation of ITIF. Teachers are more focused on the use of DLR than to harness the necessary pedagogical methods to take the full advantage of the promise of DLR. Teachers and students also use ICT as consumers rather than producers.

5.3 Lessons learned

Generally speaking, the ITIF project in Denmark as an exemplary case project for DLR is focused on the digitalization of textbooks, without fully assuming a special consideration of digital kids (the new Millennium learners) of Denmark and pedagogical changes in digital age. According to the interviews, it started with a presumption that students like to have ICT in their classrooms and the ICT or DLR may make them learn or study more. Fun and enjoyment are quite important for the learning, but they should not overtake learning. The DLR do not guarantee the substantial outcome or achievement of learning. The ITIF could have had more specified goals to achieve with this particular DLR project.

For the implementation of ITIF, the concept of socio-cultural appropriation has to be given special attention. The ICT is not a technology, but a media which can be used in different ways depending on the socio-cultural context. The ITIF project has not given enough attention to this issue. The importance has to be given to municipalities and schools to take the initiative to think about pedagogic aspects and assist their schools in the change process. Compared to other countries that have incorporated ICT in order to solve current educational problems, Danish schools so far have not changed their teaching practices due to the use of DLR. Because of this reason, the implementation did not require particular changes or preparations by teachers and students.

Although there was a government voice emphasizing that ITIF has been initiated as an attempt to increase the level of academic achievements of low level school pupils, the actual usage of ICT and the development of DLR do not have direct relationship with this rationale. This speculation of ITIF demonstrates that the goal of current implementation is quite ambiguous. There has to be more specific purposes and goals to achieve. From the perspective of looking at DLR as a systemic innovation, the ITIF's main focus was on digitalization rather than understanding the usage of the DLR ("digital" meaning e-books, web-based portals, and digitalising of learning materials, such as cultural heritage and media materials). In other words, the target for DLR is not clear. Without fully understanding how these resources would be used, ITIF focused more on providing such supplies.

6. GENERAL CONCLUSIONS AND RECOMMENDATIONS

This project is not about assessing the Danish education policy on ICT in education. Its goal is a better understanding of practices with DLR and how these can contribute to systemic innovation as an integral part of innovation processes. The OECD-group realises that a visit of 3 days is inadequate to acquire sufficient insight in the complex education reality. We express our thoughts, aware of this. Finally we have taken into account that the size of Denmark, with 5.4 million speaking Danish, poses special challenges to the task of creating a market for DLR for a small language community. This is a characteristic shared with all the Nordic countries which might prove that projects like the OECD project on DLR offers valuable opportunities to learn from neighbouring countries.

The team draws the following general conclusions:

The active role of the ministry is remarkable, in a time in which in many countries politicians and education ministries seem to have lost the zest for active policies on ICT in education. Denmark has pursued consistent innovation policy in the area of DLR for years.

The idea of the "Coffee Club", in which education, local and national government and industry informally discuss what should be done and how shared objectives can be achieved, is a very good one, and will hopefully prove a successful tool in securing funds and ambitious goals.

The role of UNI-C is also very important. A specialised agency that focuses on helping schools to achieve their goals is crucial for any innovation. Also, it seems UNI-C has stepped back at the right moments, i.e. when the market could take over.

The UNI-login has by all interlocutors been praised as a very useful tool, both for end-users and producers/providers.

A large number of resources are available by means of EMU, Danmark Radio as well as commercial publishers and software houses. The web statistics and the number of subscription contracts reveal a wide acquaintance of and interest in these resources. EMU has received consistent and substantial political, administrative and financial support from the Danish Government.

EMU is clearly a pivotal component in the entire Danish DLR innovation system. It is run by UNI-C, which is the primary and reliable agent of the Ministry of Education in implementing its educational ICT strategy.

EMU has managed to exploit all previous knowledge and relational capital and managed to get a head start for its operation. EMU pooled all existing educational e-services so far and could thus provide trustworthy service. Moreover it got a consolidated substantial and solid user-base from the earlier internet access subscriber base of UNI-C.

There is still considerable inertia to be overcome in the potential user constituency to be fully penetrated. Now the penetration level is about 25 per cent of the national potential. The saturation point is likely to be no less than 80 per cent within a foreseeable future.

The development of EMU has been based on visionary and sustained policy-making, exploiting high-level expertise as well as active user group policy. This all should be continued. A sustained political and financial support will cater for EMU continuing to function as the backbone of the Danish DLR system. This should preferably be combined with more systematic research and a development strategy for the consolidation and further advancement through evidence-based policy-making.

The lack of sufficient and appropriate evaluation and research has been and should be acknowledged. The further development of EMU should be supported by stronger and much more systematic monitoring and evaluation. Moreover action and media oriented research should be organised in support of future development of the services under the EMU umbrella.

The idea of subscription to learning resources is an innovative way of making these available to schools for an acceptable price. This is probably the only way to achieve a good availability and affordability in the Danish situation. This solution does imply, that individual teachers have less choice than they might want, as it is schools and municipalities that decide on the contracts. The future should be to create as much flexibility as possible, while maintaining a sustainable business model.

The subscription system is an innovation in terms of creating a sustainable market for online learning materials.

It is not possible to make a similar statement about whether subscription has also led to didactical and pedagogical innovation. School subscriptions have not been evaluated in these aspects, which means that there is no documentation that evaluates their effect or impact on use of DLR.

Overall there seem to be a lack of evaluation and research on the effects of innovations on teaching and learning. Many interlocutors pointed at a lack of qualitative evaluation of materials and practices, a deficiency somewhat remediated by already initiated evaluations. There is a need for quick insights in what works and what does not regarding business models, subscriptions and school practices in relation to youth culture and out of school use of digital artefacts. Also more fundamental research is needed for deeper understanding of underlying learning processes. As far as qualitative impressions exist (and for what they are worth), the role of digital resources still seem to be rather marginal in the teaching methods of most teachers, in addition to printed material, not as a substitution. The promotion of teamwork in schools is one of the promising routes for further development. The OECD-team saw a good example of that in the Grantofte primary school in Ballerup near Copenhagen.

The ITIF initiative still has to prove itself in terms of the value of its 11 products although it is a positive sign that the municipality of Copenhagen has bought subscriptions to 9 of the 11 ITIF products and provides assistance to schools in using them. The city will also undertake evaluation of the use and effects of the products. The initiative is regarded positive in the sense that it has enabled smaller publishing companies to enter the market, and made it possible for companies to invest more in the development of products than would have been possible without seed money from the government.

The first issue in ITIF case may be related to the issue of integration; the purpose of ITIF with the Danish pedagogical philosophy, the classroom activities, and the youth cultures in digital age with the ICT. Without considering the pedagogical issues, the digitalization of educational materials alone would not have any significant impact on educational settings. Digitalization may produce large numbers of DLR but this does not necessarily mean that these DLR alone would benefit teachers and pupils. ITIF developed plethora of digital contents but they are not widely used. The future outcomes of ITIF may be dependent on the pedagogical philosophy behind the digital texts production. The "Mingoville" from DELC seems to be a kind of new software that has potential impact on children's learning and teachers' teaching. It seems to incorporate something essential of the Danish pedagogical philosophy and transformes it to touch needs of students in the digital age.

The new Danish national curriculum has set a new perspective on DLR since it defines the use of digital tools as a key component and basic skill for all subject domains. This creates a situation where the demand for such resources could be highlighted. This is a strength.

Second thing we have learned from the ITIF in Denmark is related to the role of teachers for implementing the DRLs in classrooms. Although most teachers feel comfortable with internet and web-materials, this does not mean they will willingly incorporate the DLR instead of the old style books. They love to make their own materials and modify for their usages in the classroom. This is the reason why the digital whiteboard is so popular among teachers, but educational software or pre-made web-materials are not. Teachers and students alike refuse to be mere recipients of knowledge.

Third, in order to properly identify the impacts of DLR in educational innovation, we may need a new program for International Student Assessment (PISA) in digital age. Current assessment factors, such as students' access to and the use of ICT may not reflect the actual changes in classroom and school activities. Still, many resources have been produced. In addition to the publishing houses that have produced DLR for some time now, new actors from gaming industries and ICT enterprises have also been involved in DLR. These actors have introduced new dimensions and perspectives on the development of DLRs, which differ radically from the perspectives on the development of the traditional textbooks.

Fourth, the real challenges and innovation might be related to the teachers' willingness to use DLR and digital learning contents. The DRLs should incorporate the teachers' confidence, which could be materialized with respect to their professional knowledge, skills and experiences. They want to have the

opportunities to use their own or self-produced materials. ICT in schools in Denmark could have more teacher initiated work. In order for the schools to demand the use of DLR, there also has to be a market for finding relevant resources. However, the market is fragile as the DLR has not been in demand extensively. The digital spelling test was one of success cases of DLR. It substituted the school test which saved time and energy for school teachers. This is also a clear example that the DLR in Denmark is adopted as a media to still primarily support and facilitate current school activities.

The last lesson from ITIF has to do with the value of the 'informal learning' that takes place in the youth's own digital culture.There seems to be a contrast between the Danish tradition of a strong, independent position of individual teachers and schools, on the one hand, and the strongly centrally steered DLR initiatives of the Ministry. Since the teachers are the professionals in the system, innovation should be borne by them, rather than 'imposed' by the Ministry. Although we recognize that ITIF was preceded by ITMF with a different focus, there seems to be a gap between the ideology of primacy of the school level and the disappointment in the degree to which innovation actually takes place.

In the views of the developers and publishers, many teachers depend on books and methods for their teaching to be adequate and in accordance with the national curriculum. If this is the case, it will be more difficult for them to be the initiators of innovative practices. Such initiatives require real professional mastering of subjects, content and didactics.

There seem, as is the case in many Western countries, to be mixed messages forthcoming from the national policy platforms. On the one hand politicians and society demand an adequate preparation of children for life and work in the knowledge or information society, on the other from these same platforms (though not necessarily from the same individuals) we hear a call for traditional assessment of traditional basic skills. It is up to schools to make up their minds how to respond: innovate and take the risk of making mistakes, or stick to proven practices and possibly fail the future and certainly fail their pupils. This poses an impossible choice for them to make, and is not an incentive to innovation. Traditional and new skills are equally important. The pendulum has to swing in the right balance which is not easy to achieve. A national sense of direction seems to be needed here.

Schools seem to be wary of the intensity of national initiatives. There is a need for a period in which running projects and actions are given time and resources to prove themselves and to consolidate emerging praxis. The ministry recognises and understands the demand for a period of consolidation.

Assistance to schools and teachers in implementing DLR should be an important component in policies of schools and municipalities. It is also important to further support the trend now visible in municipalities to involve users in decisions of purchasing and lease contracts of DLR. A corresponding trend is that UNI-C and the government have started to encourage a more active role of municipalities. They will produce annual quality reports and many are in the process of investing in support for schools.

Reliability of technology continues to be a point of concern as well as teachers' insecurity in using ICT in their teaching. This, in combination with a feeling of insecurity regarding the subject knowledge on the part of some teachers in the Folkeskole, makes them inclined to cling to traditional books and methods, although the situation is gradually improving. In the Gymnasia this seems to be different due to the greater confidence of teachers in their professional capacities in that sector of education.

One of the points that puzzled the reviewers is the complaint that not enough money is available. The level of spending on education in Denmark is one of the highest in OECD countries. We have been given the impression that funds are not easy to divert from fixed expenses, such as staff, to designing, experimenting and providing appropriate resources, learning environments, facilities etc. Should there be more flexibility in allocating and reallocating resources on the municipal level.

ANNEX 1

List of participants

Ministry of Education

Ms. Lilla Voss, Chief consultant

Mr. Sten Lassen, Subject adviser

UNI•C

Mr. Claus Berg, Chief consultant

Mr. Leo Højsholt-Poulsen, Head of education

Aarhus University

Mr. Christian Dalsgaard, post doc.

University of Southern Denmark

DREAM: Danish research centre on education and advanced media materials

Ms. Kirsten Drotner, professor

The 6-cities group

Education experts representing the user and local authorities

København: Center for Informatik

Ms. Merete Arent

Mr. Johnny Jensen

Mr. Torben Nielsen

Ms. Jette Risgaard

Odense: Pædagogisk MedieCenter

Ms. Lisbet Kühn

Ribe Kommune Børn & Familie, Pædagogisk Udvikling

Mr. Jan Meesenburg

Mr. Lars Galtung

Århus: Videncenter for Pædagogisk Udvikling

Ms.Vibeke Ingerslev

Århus: Skolernes Læringscenter

Mr. Jens Nygaard

Randers: Pædagogisk Center

Ms. Helen Guldbæk Christensen

Mr. Steen Jensen

Randers: PU Randers

Ms. Kirsten Høgholm

Ålborg: DAKS

Mr. Erling Schmidt

Mr. Flemming Holt

Education Publishers

Mr. Niels Askær, Managing director, Mikro Værkstedet

Mr. Jens Erik Rasmussen, New Business Manager, Mikro Værkstedet

Ms. Anne Mette Wahlberg, Head of IT, Alinea

Mr. Troels Rydahl, Chief sub-editor, Gyldendal

Mr. Stephan Stephensen, Managing director, DELC

Grantofteskolen, Ballerup

Mr. Jan Møller, Headmaster

Danish Radio, DR

Mr. Ole Hjortdal, Chief sub-editor

Ms. Lene Kristoffersen, Project manager