

Creating Knowledge IV: Empowering the Student through Cross-Institutional Collaboration

**International Conference at The Royal Library and University of Copenhagen, Copenhagen
August 16 – 18, 2006**

ArchiMedia: The development, Implementation and Support of an E-Learning Environment

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Abstract

The increasing use of ICT in the educational world affects the whole educational system. For the last decade or two research have primarily been focusing on the relation between ICT and pedagogy, discussing the effects upon the learning environments represented by the learners – both educators and students – and upon the learning space mediated by technology and constituted by the activities. Focus has been sparse upon the educational organisation per se regarding the existing procedures and administrative practises when it comes to coordinating the virtual learning environments within the existing physical educational environment. Utilising ICT, represented by e-learning, in a large-scale educational setting will however in some way force the tacit knowledge embedded in these organisational structures into becoming a visible construct.

The distinction between conventional and distance education have been described as becoming meaningless in the near future when applying new telecommunications technologies in the educational setting (Bates, 1995). Can the concept of e-learning likewise be defined as only a temporary concept in education?

Thus e-learning works as an “Archi-Media”, a construct based upon the concept of Archimedes’ law of displacement, where the intrinsic properties are density and the volume of an irregular object.

The aim of this paper is to

- Present the case of an actual development, implementation and support of an e-learning environment
- Discuss the common problems related to e-learning.
- Discuss whether e-learning is a root metaphor or a temporary concept as a result of the human minds’ attempt to catalogue / map new tools, and
- Propose useful paths of conducting research and development within the field

Key words: Action Research, Design Based Research, E-learning, generalisability, meta-learning, scalability, taxonomy, the learning organisation, Universities.

Introduction and background

This paper is the result of four years of experiences with the development, implementation and support of an e-learning environment in a Danish academic institution providing tertiary education.

The area of these experiences covers a lot of various variables:

- Technical challenges and solutions
- Economic issues
- Design issues
- Support issues
- Political issues
- Organisational issues

The research has been conducted based on action research but during the period new research paradigms have started to emerge.

To understand the how the concept of the term e-learning has been formed, we need to take a short look at the traditions and history of distance education and the role e-learning has come to play in distance education up until now.

Variations of traditions and needs in the Nordic countries

In a Nordic perspective e-learning have taken two directions;

E-learning as distance education

In Norway and Sweden, two countries Denmark usually compares with in lots of areas because of the numerous similarities in the socio-economic infrastructure, political system and welfare, e-learning has, due to these countries' geographical conditions and the small populations, had a long tradition within distance education. Politically there has been a wish of solving the problem of bringing education to the areas in the countryside. It has been seen as part of solving the problem of distance and time, and keeping the small communities in the countryside "alive and kicking".

Thus e-learning has mostly been performed as distance education (Keegan, 1988b) – electronically distributed distance courses, and – also partly due to these countries' industrial development and natural resources been used primarily within the technical educations like math, engineering and the likes.

In Denmark the geography is somewhat different. Denmark covers a small area (when excluding the Faroe Islands and Greenland) with relatively small distances between the cities, and the infrastructure of transportation is well built. Distance education in Denmark has traditionally been conducted in the auspices of technical schools as letter courses in the '50ties and 60ties, but has never had the same importance nor spread as far in the educational system as in Norway and Sweden. In Denmark the issue has not been distance, but time. People taking distance education courses in the technical schools usually where farmers or employed in the industry, and therefore did not have the opportunity to attend to courses during day-time.

This notion of e-learning as a smooth and effective technological solution to geographical distances and taking courses outside of day hours still exist, but has not to a large scale contributed to the development of new pedagogical methods nor had any significant impact upon the traditional educational system. The structure of distance education has to a great part been determined by the theories of industrialisation (Peters, 1988). The two systems have been living their separate lives for decades.

E-learning in blended mode

However with the changing challenges of transforming from countries where the work force mainly has been occupied within farming and industry to countries being able to cope with globalisation and fast changing markets and needs, thus a coping with a need of a flexible and well educated work force, the challenges of e-learning also changes (Lindberg & Olofsson, 2006).

E-learning now and in the future will be a more and more integrated part of the traditional educational system, existing in a traditional curriculum, and not as a parallel system living its own life in cyberspace.

E-learning will, like the challenges of globalisation also affect the way the traditional educational system is structured.

The increasing use of e-learning in the educational institutions in Denmark has one significant result: the discovery of all the practical difficulties in implementing various technologies under the concept of e-learning in the organisational systems. It is possible to condense the overall problem related to the use of digital tools for e-learning to one, and one only: access (Lindberg & Olofsson, 2006).

This particular problem - simple as it may seem - is none the less a quite complicated problem looking closer into the nature of the context of learning.

The term access is to be understood as access to the system (-s), using the facilities of the system (-s), access to the Educational Online Learning Community, that is; bridging the gap of distance between the learners and the educators, and the conceptual understanding of the context being the learning space (constituted by the above) and the curriculum.

Not only does the learner or the educator need access to the e-learning tool (-s), a problem that is addressed in several ways, but all depending of the organisational infrastructure in the educational institution, but the learner (both trainees and trainers) need to establish a mental space and a conceptual understanding of this particular context.

1. Accessibility

There is a range of others problems related to the accessibility:

- Systems access: how to register and handle the single users access to the system requiring database structures and feeding systems identifying the various roles and activities
- The users role in the educational system: identifying the student, educator, administrator
- The learning outcome in terms of credits: how to import and export data from one system to another in case of students from other educational institutions, support for evaluations, exams, etc.
- The users ability and skills when it comes to using the system functionalities:
- The administration of courses, credits, exams

All of these interrelated problems are possible to address by applying the proper technology and by delegation of relevant tasks to the relevant administrative stakeholders in the educational institution. The necessary conditions need to be in place first though, and usually some of the problems when implementing or utilising the e-learning environment have their origin here. The decisions of using such a system and the delegation of responsibilities need to be taken on a political basis, within the institution, be it large or small.

2. Choosing and implementing e-learning

If we attempt to examine the problems closer when choosing to use and implement an e-learning environment in an educational institution – asking the question: why is it so difficult, and disregarding the basic analyses of the needs - we face even further problems:

- Too many standards, and which standards do the system need to support?
- How do we secure the future of the system, which standards will be the future technology?
- What are the conditions of the future standards, which company will win the race?

Discussing the dependence of standards that educational institutions face when interacting with the industry that develop and establish standards, we need to acknowledge that the educational system will never be able to establish its own standards, but will need to interact with the industry. The establishment of standards – one could even say; the evolution of standards - depends of how the markets react. The investments in developing standards depend to a large degree in the economical potential in the standard, ie. how many costumers will buy the product. This factor decides what standard will win the race. It does not have to be the best product, just the product that has the best market potential.

3. The technological acceleration

This takes us to the next problem which is the acceleration of new technologies and new tools and products. This affects the decisions we make about using new technology taking the considerations in the previous, but more than that it affects the time to implement and learn the new technology. That is; internalise the use of the tool.

A common example used in a lot of presentations of studies where youth use new technologies and evaluating their learning potential, is that young people are able of learning a new tool very fast. But often the studies disregard the fact that new technologies often are produced to younger people to be used in their social life thus take place in a context they are familiar to, and it takes time to forget about older user interfaces and procedures, that is; to disregard experiences with out dated technology, which often is the case with older users (Naur, 1988).

The Context

The study takes place in a Danish tertiary educational institution of approximately 15.000 users divided into students, administrative personnel and teachers. The institution offers studies in a wide variety of subjects, all with very different needs and traditions of teaching, didactics and research.

The institution has through the four years the study has been conducted been through a major organisational change, and many small institutes has been merged into fewer and larger institutes.

The traditional educational structure has not been challenged by the implementation of e-learning as the e-learning system have been implemented in order to create a supplement to the educational activities in the physical learning environment.

During the first year of the study a tentative test environment involving three of the smaller institutes where initiated. The test environment or pilot included some 100 teachers and approximately 500 students and approximately 12 persons in the institute administration. The pilot was based upon the implementation of a commercial conferencing system with a wide variety of support for collaborative work. The system included online chat, discussions, messaging, file repository, e-mail notifications and groups.

The system was supported by a local administrator whose primary task it was to perform the manual registration of users and of the access rights on user level in the system. There was also a super user situated at the IT-facilities centre whose primary task it was to produce user manuals, create course material for courses in the use of the system for teachers and the administrative personnel, and last but not least to answer questions from the users when they experienced problems.

Finally the system was supported by IT-personnel handling the systems servers and implementations of patches, new versions, etc.

During the first year of the study a lot of problems arose. Some of the problems were related to the organisation of the supporting structure, some of the problems were related to the system it self, and some problems were related to the way the institutes had chosen to organise the structure of the various zones, discussion forums and groups.

The major problem of the system was scalability. If the pilot should expand to the 30+ institutes at the time being, it would create a demand for numerous local administrators whose only occupation would be to register and administer users manually.

During this year a plan for developing and implementing a portal hosting the conferencing system was made. The plan was based upon the experience and knowledge of the infrastructure on the institution from two former directors of study. The new portal should also consist of a database containing an identity management system in order to place the users in three major groups:

- Common users = students with predefined access rights
- Teachers= with predefined access rights and some administrative rights
- Administrators= with predefined access rights and more broad administrative rights

A template of a standard course room was also developed in order to support the automatic creation of course rooms, and an organisational administrative structure was formed based upon the existing administrative structure.

Struggling with sparse resources on crew to support and administer the system and without the sufficient local knowledge of the different studies, their subjects and the relations between these, it seemed more fruitful to place the administration of courses and teachers locally.

Courses in the new portal system containing the commercial conferencing system were developed and the administrative personnel on a third of the 30+ institutes at the time being were offered courses in the system.

The following year, the second year of the study, organisational changes of the institution and of the IT-facilities centre were taking place. These re-organisations had some effect on the supporting organisation offered by the IT-facilities centre, but the re-organisation of the institution resulting in decreasing the number of institutes from 30+ to 7 of course had effect on the spread and further implementation of the e-learning system.

At the IT-facilities centre a help desk call centre had been established. This call centre needed to be updated in the process of developing the e-learning environment. The responsibilities of the IT-facilities centre had up until then, been the support of single user computers connected to a NT based environment, and the support of servers providing e-mail, web and numerous list servers. A very traditional IT-facilities organisation indeed, but this was to change.

For a long period of time the attitude to the e-learning environment was somewhat ironic. It did not seem as though the supporters thought that the e-learning environment would have any affect on their daily work, thus the courses for the IT-support personnel was sparsely visited until decisions from the management were taken that all supporters should attend to the courses. The learning outcome of the courses though, should prove to be somewhat sparse.

The following two years the re-organisation of the institution had been carried through, and some of the newly elected leaders of the new institutes took the challenge of bringing their institute up to date on the digital era. Two of the institutes choose to implement and use the e-learning environment for all studies and subjects, and to offer courses to all teachers and administrative personnel. This lead to an increased course activity, so when the implementation of the e-learning environment started the following term, also to busy days of managing the pressure of suddenly coping with five times the usual amount of users. But it also created a snow-ball effect; several institutes initiated their own pursuit of courses for their teachers, and administrative personnel.

The two institutes also chose to hire tutors and assistant teachers to work as administrative personnel on the e-learning environment. This was due to the fact that assistant teachers and tutors were cheap and could be dedicated to the support of the administrative procedures in the e-learning environment. However it is nearly impossible for tutors or assistant teachers to be knowledgeable of the myriads of administrative and institutional issues that are often a great concern to students (Phillips et al., 2003). Moreover temporary hired assistance builds a knowledge that disappears from the organisation unless there is a plan for handing over this knowledge.

During the last two years a final decision from the management of the institution was sent to the employees stating that from the autumn term there should be a virtual class room for each and every course. Minimum requirements of using the virtual class rooms were also made, and this led to a further increase of users in the e-learning environment. During these last two years it also was clear that assistant teachers or tutors could not manage the administration of the courses in each subject. What was needed was the tacit knowledge of a skilled and professional secretary that knew about all the institutional and administrative procedures, etc.

During all four years the e-learning environment was competing / collaborating with an informational system for the students, which later developed into an e-learning environment.

Data gathering and procedure

When planning a research project one needs to broaden the perspective from a solid platform, which usually are old methods proven to work. The extension to which one utilises variations of methods often also provides other researchers with the ability to place one's work and research perspective in an already defined casus, or from a well known paradigmatic perspective to understand the essence of the research being performed. The extent to which the established community of researchers manages and perceives research projects is often based on traditional prejudices.

The fact that the area of social sciences is rather new compared to natural sciences has of course had significant influence onto the tradition of research. In order to obtain respectability the emerging social sciences adopted the methods of natural sciences although the fact remained that the areas of research is radically different. In natural science forming a theory of the solar system or gravity had no effect on these systems, as later the theories of capitalism proved to have (Vickers, 1965).

The intriguing problem of social science researchers is that the traditions of 200 years natural science often heavily affect our attempts to form and develop new approaches and methods of defining, collecting and analysing data material in a research perspective. The desire of on one hand obtaining the respect from the established scientific world using old proven methods, while on the other hand the desire of contributing with new knowledge demanding the development of new methods often place researchers in social sciences in a conflict, which could be described as existential relativism.

Many philosophers have described the human perspective in ratio and logic's versus the complicated reality (Locke 1690, Berkeley 1733, Hume 1739, 1748¹)

A disciple of Parmenides, Zenon of Elea, created a series of thought experiments to support the metaphysics of Parmenides. As Parmenides meant that reality is an unchangeable plenum, the thought experiments of Zenon aimed at showing the impossibility of empty space and motion².

The thought experiment aims at showing the lack of correspondence between our ways of describing our perceived world using concepts based upon our language, ratio and logic's as they clash with the extension of space and the aspect of time³.

From discussing the nature of motion to discussing the concepts of how motion in a logic sense could be possible, the old Greeks showed an example of the complicated reality later analogue to nuclear physics: the fact that a nuclear atom consist of mainly nothing.

In quant physics light moves in both waves and particles capable of penetrating a filter in two places on the same time – analogue to shooting a billiard ball into two holes on the same time!

These facts are not transferable to our way of conceptualising the world. As the avant-garde of natural science moves toward new paradigms, social and educational sciences still struggle with the old paradigm of natural science. Reality is more complicated than a machine consisting of wheels we can pick out from their common context to be described as general laws applicable to the real world.

¹David Hume (1711-1776) *Treatise of Human Nature* (1739-40), *Enquiry Concerning Human Understanding* (1748), George Berkeley (1685-1753) *Essay toward a New Theory of Vision* (1709), *Treatise concerning the Principles of Human Knowledge* (1710), *Theory of Vision, or Visual Language Vindicated and Explained* (1733), John Locke (1632-1704) *Essay concerning Human Understanding* (1690)

² Achilles and the turtle, H. F. J. Muller, <<http://cogprints.ecs.soton.ac.uk/archive/00000361/00/1-TA12.HTM>> accessed 28.05.06 from Cognitive Sciences Eprint Archive

³ As later Einstein would show in his theory of relativity

Do we need to develop a whole new paradigm? Do we need to throw out all the experiences and start all over or can we bend the existing and create a whole new perspective? Design based research is an emerging research area. It is characterised by design flexibility and emergent goals as it is driven by a vision for yet unrealised possibilities (Berietter, 2002) and inherently pragmatic approach to research.⁴

Considering the context and the starting point being action research, it was of importance to choose a research method suitable for defining and clarifying the research problem. In this case the group interview combined with individual interviews seemed to be the best choice.

The group interviews can be implemented into both the structured, semi-structured and unstructured format. This approach derives from the marketing research, where the customers or focus group (Denzin et al, 1994: Fontana & Frey; Merton, Fiske & Kendall, 1956) through research contributes with valuable data concerning products, price etc. Also in politics this approach has been given a great deal of attention.

Within sociology the group interview has been used quite early (Denzin et al, 1994: Fontana & Frey; Bogardus, 1926, Zuckerman, 1972, Thomson & Demerath, 1952, Morgan & Spanish, 1984).

Group interviews are sometimes considered more valuable than individual samples (Denzin et al, 1994: Fontana & Frey; Blumer, 1969). The interviewer directs the interaction during the inquiry, which can be both very structured and much unstructured. The approaches depend of the purpose with the interview, which in this particular case, was to examine if there were a common understanding of the concept of e-learning, thus clarifying the research problem (Denzin et al, 1994; Fontana & Frey).

The group interview requires some other skills than the individual interview: flexibility, objectivity, empathic, persuasive, a good listener, etc. Some of the keywords are applicable to the skills required by the interviewer of individuals, but far from all. Especially three skills are important: first of all the interviewer must keep an individual or a small group coalition from dominating the rest of the group, secondly the interviewer must encourage recalcitrant respondents to participate, and thirdly the interviewer must obtain responses from the entire group. The last is of course important in order to establish the best possible image of the topic in question.

Group interviews are inexpensive, data rich, flexible, stimulating, recall aiding, cumulative and elaborative. They reach beyond the possibilities of individual responses.

Problems are the group domination over the individual or on the other hand that one individual may be dominant to the group. It is also problematic to enter sensitive topics and the group interviewer has a far more difficult job.

Five types of group interviews can be identified (Denzin et al, 1994: Fontana & Frey): Focus group, Brainstorming, Normal/Delphi, Field/Natural, Field/Formal.

The call for the interviews was published on the message board in the e-learning environment, but also distributed to the various directors of study. A series of group interviews were conducted. The interviewed were teachers and administrative personnel at the tertiary academic institution. The Focus group interviews were chosen as the most appropriate interview form in the present context.

⁴ See recent research issues in *The Journal of the Instructional Sciences*, (13, 1, 2004), *Educational Researcher* (32, 1, 2003) and *Educational Psychologist* (39, 4, 2004) that have highlighted the emerging research methodology.

Applying language as tool of interpretation

The problem of applying language as a tool onto a constructed reality is that we cannot speak with each other using the language if we do not implicitly assume that reality exist independent of us and our language. Every statement in language is meaningless if we claim there is no reality independent of our existence. Like in formal logic a condition of using the language communicating verbally, is that we presume reality exist independent of our presence, perception and words (Zinkernagel, 1988).

The language is not a constant but a dynamic entity. The language has developed with our perception of the world. Therefore we cannot expect that our ideas and words developed from the experiences of everyday life necessarily are capable of containing and describing those parts of reality that has only been accessible to us through the discoveries of natural science. We see this aspect illustrated in the microscopic reality – the world of quants. Without concepts and ideas the reality comes to an end. An electron is neither a wave nor a particle, but something that has not yet found its place in the words image of the reality. This does not mean that what we call an electron does not exist.

Natural science as well as social science is not only a cultural activity. If it were it would only be useless attempts of observing our own prejudices (Naur 1988).

Analysis

Common to the interviewed after the individual interviews had been conducted, was that there were no common understanding of what e-learning really was. Most of the interviewed persons had some vague definitions like

“E-learning is... ahm ... the use of digital media to learn for instance...using video in language education!...”

In this short statement we see the common understanding of e-learning as the technology enhancing something already existing. By using a technological artefact we become better learners of for instance language. The focus is still onto technology, the tool, not the way the tool is used. The mere presence of the tool seems to have some magical effect on your learning.

“E-learning, well – that’s easy; e-learning is when you in your teaching use a message board or e-mail... the advantages are that you can save a lot of time when the students for instance have forgotten their compendia at home. You don’t need to spend time printing or copying. You can just ask them to download the document from the e-learning platform and print it. So you save a lot of time!”

In the above statement focus lies on the effective distribution of information to the students and the fact that the teacher can forget about the practical problems of students forgetting the material handed out. In this view e-learning is seen, again as a technological solution to some practical aspects of the educational infrastructure, rather than a medium for establishing new forms of didactics and learning.

The group interviews revealed the same type of discrepancy when it came to a common understanding of the concept of e-learning, and the general impression when doing the data analysis was that e-learning indeed is an empty term or concept. Also the group interviews stated that one of the problems of implementing e-learning in the normal educational infrastructure was the costs combined with the time and efforts that was necessary to learn the new tools, and – that the tools kept changing so it was a Sisyphus' myth in modern interpretation. When one had learned one tool, it was replaced by a new one, or the standards changed making further use of the tool more or less impossible. These statements came from the teachers who had worked with own implementations of e-learning, like homepages and file repositories, etc. They seemed very pessimistic about the future of e-learning.

Also the issue of copy-right came up. It was stressed that as long as there had not been found a solution for the copy-right issue, e-learning full-scale would be too difficult to cope with. As many of the teachers were teaching subjects where copy-right would be an issue (visual culture, arts, film, etc.) this problem was of great relevance. This problem, though need to be dealt with either by the politicians or by agreements between the different copy-right holders' organisations. This has been tried before, but with little or no luck at all. Eventually the problem will be solved.

Common to both individual and group interviews were that focus was onto the tool, the technology, rather than the context it should be part of. There was a technological fascination (or repulsion against technology) and a wide gap between the technology and the traditionalistic view upon the educational praxis, the didactics of the subjects taught.

This focus of the tool and what it can do is quite typical for the utilisation of new tools on which one is not quite certain how to use. They need to be contextualised and their use needs to be internalised in order to make the tools invisible. The carpenter does not see the hammer, but the nail when he is building a house (Heidegger, 1996).

Some teachers saw the potential, also guided by organisational changes and the recent changes deployed in Danish educational politics.

...Cuts in budget made it necessary that teachers during the first term more than before had to take on the role as facilitators providing the learning materials and guiding the students through the learning process...

This was by some seen as a loss of the valuable communication and the meetings between teacher and students in the physical learning environment, which is considered to be very important during the first two terms of study. But it also brought the possibilities of altering and developing the communication into a context of a knowledge building community. A knowledge building community creates the need of changing the traditional teacher's role - being very much defined by the physical context the activities and communication takes place in – into another implying that the teachers to a higher degree needs to be “practical intellectuals, curriculum developers, and generators of knowledge in practise” (Feiman-Nemser, 2001, p. 1015). So starting to use the e-learning environment, was part of redefining the teacher's traditional role *not only* in the virtual learning environment, but also in the known physical learning environment.

Discussion and proposal of a new conceptual framework

In the previous I have described some of the problems concerning the concept of e-learning, and tried to condense the problem area to the problem of access - be it virtually, physically or mentally - to the tools embedded within the traditional concept of e-learning.

Also the contexts of seeing e-learning in are part of defining the concept of e-learning. Where e-learning in Norway and Sweden have emerged as a practical and technological solution to enhancing the letter courses in distance education for various political reasons like the wish of keeping the countryside populated, in Denmark the concept seems to have no common meaning, more than it is some kind of technological platform of many various kinds that can be applied in the learning context to solve practical problems related to the educational infrastructure and enhancing the speed of learning.

But what if the tools are really not the problem, as well as learning the tools is not the problem? What if the problem is the question asked and the tools and methods for examining the problems?

In “Programming as Theory Building” (Naur, 1988), the mental activities of creating software is connected to metaphor building and how metaphor building can be applied to problem solving. The quality of the programmers’ work is related to the match between his theory of the problem and his theory of the solution, and the quality of the later programmers’ work is related to the match between his theories and the previous programmers’ theories.

Using Naur’s ideas in the present context of e-learning with the vast variations and fast changing electronical/digital tools, the teachers’ job is not to pass along the design of e-learning; being the structure, methodology, didactics, but to pass along the theories driving the design; being the curriculum. It highlights that knowledge of the theory is tacit in the owning, and so passing along the theory requires passing along both explicit and tacit knowledge.

This discussion, although it stems from courses in programming, is generalisable in two aspects that can be applied to the distinction between traditional distance education and e-learning in blended mode;

Distance learning and intelligent behaviour:

The intelligent behaviour is not restrained to the ability of following rules, prescriptions or methods. That would imply that there would have to be rules about following rules, and so forth in an infinite regress. Nor is it only defined by the display of or knowledge of particular facts, or to the ability of intelligently doing things and doing them well, but also certainly of the ability of applying the criteria of doing things in such a manner that it is possible to detect and correct lapses and to learn from examples of others.

The structure of traditional distance education and the definition of intelligent behaviour support a certain learning paradigm that has been formed by the theory of industrialisation mentioned earlier.

- The development of distance study courses is just as important as the preparatory work taking place prior to the production process.
- The effectiveness of the teaching process is particularly dependent on planning and organisation.
- Courses must be formalised and expectations from students standardised.
- The teaching process is largely objectified.
- The functions of academics teaching at a distance have changed considerably vis-à-vis university teachers in conventional teaching.
- Distance study can only be economical with a concentration of the available resources and a centralised administration. (Peters 1988, p. 110)

Blended learning and intellectual activity

The participants in a learning context not only needs to build knowledge, but also needs to take part in theory building if the learning process should be successful and lasting, and it should be possible to hand over knowledge to peers. This implies the notion of intellectual activity. When building a theory one start to build knowledge how to do certain things and additionally is able of providing explanations, justifications and answers to queries about the activity of the actual doing (Ryle, 1949). Theory in a philosophical understanding thus can be defined as un-embodied world 3 objects (Popper & Eccles, 1977).

The notion of theory in the present sense is not confined to the most general or abstract parts of the insight. The person having the theory must understand how central laws apply to certain aspects of reality in order to be able to recognise and apply the theory to similar aspects or domains of knowledge.

The dependence on a theory on a grasp of certain kinds of similarity between situations and events of the real world gives the reason why the knowledge held by someone who has the theory could not, in principle, be expressed in terms of rules. In fact the similarities in question are not, and cannot be, expressed in terms of criteria, no more than the similarities of many other kinds of objects, such as human faces, tunes, or tastes of wine, can be thus expressed.”, Naur, 1988

The above can be interpreted as an expansion of the view upon what a learning process in an educational environment is constituted and supported by, and therefore challenges the traditional categorisation of levels of abstraction when considering test situations and learning strategies as described by Bloom (1984).

In Bannan-Ritland (2003) four stages of design-based research is described, and these steps are mapped to more traditional forms of educational research and publication. The properties of each of these four stages are discussed below.

Stage one: *informed exploration*

This is the stage within which a variety of literature review, theoretical extrapolation and expert and participant input is used to design the intervention. This first stage also focuses on the search for an ideal (Dewey, 1894 in Boydston, 1971). This ideal is not a complete formalism from which actions can be induced, but rather an incomplete motivator that generates working hypotheses to be tested in real contexts. Thus the ideal provides a vision and a guide as well as significant component of the measuring stick by which the ideal, as instantiated in actions within a real context, is measured.

The ideal of the informed exploration is used to function as a lever to secure the basis of preparing the next stages in the design experiment. In this sense the ideal is conditioned by the social status and class of the researchers themselves and the various political or ‘value orientations’ to which they adhere (Diesing, 1991).

Data collection in this phase focuses on literature reviews, expert interviews, assessment of interventions in comparable educational contexts.

Stage two: *enactment*

Here the intervention is constructed with attention paid to documenting design and production decisions. In this stage the research becomes highly visible. The costs of developing are often placed in this stage and there is attention to the cost and length of time needed to design and build the intervention. The expenses and the complexity of the intervention can vary from large scale development processes involving whole teams of technicians and programmers/GUI-designers to smaller purely pedagogical interventions involving little to none technical development.

Data collection in this second phase seeks to document production decisions, processes, barriers and costs.

Stage three: *evaluation within a local context*

Here a variety of qualitative and quantitative measures are used to assess the multiple impacts of the intervention in the original context for which it was designed. Evaluative instruments are created to describe, monitor and assess both the intended and the unintended consequences of the intervention.

Data collection in this stage usually consists of a combination of qualitative and quantitative methods.

Stage four: *broader impact evaluation*

In this stage the intervention is studied in multiple contexts and efforts are made to theorise its impact and improve the design across ever larger and more generalisable contexts (Collins, Joseph, & Bielaczyc, 2004). Larger generalisations of the effect of the intervention and the knowledge about the ways and means by which specific characteristics of each unique educational context effect upon the efficacy of the intervention are developed during this stage. The search in this final stage is that design results reflect the conditions in which they operate. The results of the fourth stage are an emergence of the tools and conceptual models to understand and adjust the context and the intervention so as to enable effective learning to occur.

New meanings, values and attitudes become encultured in schools only when they have become embodied and are sustained within real life contexts (Dewey, 1932 in Boydston, 1971). The type of research that unilaterally descends for testing in a classroom and then disappears with the researcher once the experiment has been concluded is thus disadvantaged by this approach. In this sense design-based research does not seek for universal solutions but rather for deep understanding of innovation and the factors that effect improvement in local contexts

Design-based methods leave room for multiple iterations through all four of the phases resulting in the intervention's continuous development. The ideals that emerge across contexts in the fourth stage will become guiding for further studies in the first stage after completing the iteration. After each phase we should be more knowledgeable than at the starting point for the previous stage. In this context knowledge is argued to grow in a circular way through iterations through the stages of the design-based research project.

Maybe design based research would provide some useful tools for supporting the e-learning (and learning) efforts in higher education?

Implementing virtual learning environments in traditional higher education in Denmark with the country's geography and tradition of educational activities take place in a physical context with the learners and the teachers together, has challenged the traditional teacher's role and provided an opportunity to use the impact from the virtual learning environment to change the communication and activities that take place also in the physical learning environment.

The developmental introduction to the e-learning environment at the institution can be criticised due to the difficulties it has brought the students and staff into in some shorter periods, but the potential of changing the traditional role of communication and learning activities of both teachers and students should be considered as a gaining – the further perspectives in bringing the virtual learning environment into the traditional physical learning environment in order to establish real blended mode will require the collaboration of teachers, staff and academic support with researchers that can design interventions giving meaning to the term ArchiMedia.

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