Module 5: Costing educational technologies II: E-learning

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Module title: The costs and costing of e-learning

This module is a continuation of the last one now including the more recent Internet based technologies. The theoretical background is the following: While traditional distance education had to shift the focus of instruction to material development (and student content interaction) simply because of the lack of 'responsive interaction at a distance at the time (the sixties and seventies), the digital technologies brought new afforances which allowed responsive interaction at a distance between student and teacher as well as between peers.

The focus in this module is looking at the implication of these new affordances on the traditional cost structure of distance education.

We will have the following main topics:

- **Introduction**
  which is where you are and which tells you what this module is about
- **Different types of e-learning**
  Classifies the new digital technologies in two categories (called type-i or type-c, dependent if they rely on information processing or sustaining communication)
- **CBTs and WBTs**
  One of them (type-i) can be linked to what Holmberg referred to as 'simulated interaction'; but the digitization allows new levels of 'simulated interaction' Holmberg wouldn't have dreamed of when he coined the term; though it tend to drive up fixed costs of development it is, in terms of cost-structure similar to the resource media of 1st and 2nd generation DE.
- **Virtual seminars**
  The other class (type-c) is where the real innovation lies; for the first time in the history of distance education we have 'responsive interaction at a distance' (both of asynchronous and synchronous type); while this arguably repairs an old deficit of DE it also drives horses through the traditional cost-structure of DE.
- **Videoconferencing**
  Video-conferencing is discussed as synchronous type-c application; it allows to mimic the f2f teaching style but trades not only scale economies (as it is also the case for the virtual seminar type application) but also flexibility so imortant to the distance learner.

- **Comparing technologies**
  This main topic summaries the cost structure of all technologies including the old ones based on Bates (2005); it makes visually clear that type-c technologies sacrifice scale economies and therefore DE claims for cost-effectiveness.
- **Digital convergence and the importance of scenarios**
  While media were traditionally separated in different formats with different distribution channels digital convergence allows to integrate all media; as a consequence the question of media selection is transformed in a question of determination of educational scenarios. Th emain topic discusses media intergration with respect to LMS (Learning management systems) and emphasiszes the importance of determining learning scenarios as a basis for costing.
- **Learning objects**
  Given that digital media, especially of type-c, lead to trade-offs with scale economies and hence efficiencies, distance education need to look for ways of recovering at least parts of the lost efficiencies; one of the options is the use of learning objects and the creation of shareable oppen content (OER Open educational resources).
- **Business models of cooperation**
  Cooperation is a second way to capture synergies in order to recover lost efficiencies. The most recent identification of distance education as network system allows to link back to where the discussion started: Peters' industrialization formula.
- **Laurillard**
  Diana Laurillard is a researcher with a focus on educational technology with a keen interest on its cost implication. The main cost driver, according to Laurillard is academic time. She developed models to relate costs to academic time.

12.5 %1 of 8 topics complete
Show data table for This chart displays the number of completed topics versus the total number of topics within module Module 5: Costing educational technologies II: E-learning..

List of Topics and Sub-Modules for Module 5: Costing educational technologies II: E-learning

- Module 5 - Readings

  Adobe Acrobat Document

  Actions for 'Module 5 - Readings'

- Module 5 Unit 1: Different types of e-learning

Discussion Topic

The last few activities related to 'pre-computer media'. Print still plays an important role in distance education and for some (especially big institutions, which can count on economies of scale) broadcasting remains an important option. However, computers and digital technologies offer new choices.

In particular, we have to decide whether to use computers mainly for information exchange, retrieval, processing and management, or also as a means of communication. This has implication for cost-analysis. The first option follows the traditional cost structure of distance education, while networked computing may mean a considerable break with the established cost-structure of distance learning.

By (distributed) e-learning we mean using ICT within ODL courses. ICT refers to digital technologies, both for information processing as well as for communication. E-learning in general includes the use of ICT for on-campus teaching or other sorts of contiguous training.

The core components of ICT are computers linked via the Internet. They can be used for exchanging information, information processing and retrieval, applications ranging from multiple choice questions to simulated dialogue. We call this the **type-i** variant since it emphasizes the information processing aspect of ICT use. This variant raises **learner-content interactivity** (Moore & Kearsley, 1996 pp. 128-9), or **internal interactivity** (Hülsmann, 2000, p.26) to a new level of sophistication. Even in the case of print you can design a certain level of learner-content interactivity by using activities, in-text questions, multiple choice questions, and so on. Digital technology allows us to go further by using computer marked assignments (CMA), computer assisted learning (CAL), and computer based training (CBT).

All these applications enhance **learner-content interactivity** without involving the teacher or tutor. The **type-c** variant emphasizes the communication aspect of using ICT (type-c) in distributed e-learning. Here ICT is used to facilitate communication between people, most importantly between students and the teacher. This variant facilitates the other forms of interactivity (teacher-learner and learner-learner; cf. Moore & Kearsley, 1996 pp. 129-32), which sometimes is referred to as **external interactivity** (Hülsmann, ibid.). The type-c variant includes synchronous and asynchronous sub-variants. Videoconferencing teachware is a synchronous format and CMC (computer mediated communication) is an important asynchronous format.

The distinction is based on the following observation made by Rumble (2001, p.74-75):

'A number of case studies comparing the costs of online learning are beginning to emerge. This section attempts to summarize the information we now have. In approaching the issue it is worth bearing in mind that what constitutes an 'online' system

varies enormously. Typologies have their dangers, but they can also be useful in sorting out one's thinking - and the following typology is offered with this in mind:

1. Type A online systems offer Computer-Based Learning (CBL) involving textual, audio, and video course materials in electronic format. No student support is involved.
2. Type B online systems offer Computer Mediated Communications (CMC) supporting tutor-student and student-student interaction. This support may be offered in synchronous mode (Type B1) or asynchronous mode (Type B2).
3. Type A/B systems combining both CBT and CMC.'

The following table classifies some computer applications in terms of type-i or type-c.

Classification of computer applications

Acronym	Medium	Comment	Type
CMA	Computer marked assignment	incl. multiple choice	type-i
ICMA	Interactive computer marked assignments	using generative questions with hints, feedback and scoring	type-i
CRes	Computer based resources	indexed and searchable databases, e.g. articles, picture library, databases	type-i
CAL /CBT	Computer assisted learning or computer based training	Interactive, adaptive, simulation/tutorial teaching program	type-i
MM	Multimedia	Multimedia CAL , with AV media incorporated	type-i
CTools	Computer-based tools	e.g. spreadsheet, data analysis	type-i
CMC	Computer mediated communication	Asynchronous computer conferencing for tutorials, discussion, and self-help groups	type-c (asynchronous)
VCS	videoconference system	Voice + shared screen for tutorials and group discussion	type-c (synchronous)

Most of these elements are integrated into learning management systems (LMS) such as Blackboard, Lotus Notes or First Class. However, in CD-ROM courses many of these elements can still be provided.

It is easy to see that, broadly speaking, the classification of new technologies in those focusing on the information processing aspects (type-i) and those focusing on sustaining communication (type-c) can be linked to the Holmberg's "constituent elements of distance education" (Holmberg, 1995, p.2)

1. *One-way traffic* in the form of pre-produced course materials sent from the supporting organization and involving students in interaction with texts; this can be described as simulated communication

2. *Two-way traffic*, i.e. real communication between student and the supporting organization

		Old	New (digital technologies)		
One-way	*Synchronous*	Radio, television	Digital radio (e.g. WorldSpace)		*Type-i*
	Asynchronous	Print, cassette media	CD-ROM, DVD, Breeze		
Two-way	*Synchronous*	F2f, telephone	*Individual*	Mobile phones	*Type-c*
			Group	Telephone-, videoconferencing	
	Asynchronous	correspondence	*Individual*	Email, SMS	
			Group	Computerconferencing (CMC)	

Broadly speaking the *one-way traffic* corresponds to *type-i application* only that the new digital format allows much more sophisticated simulated interaction than Holmberg could have dreamed of earlier on. *Two-way traffic* is about sustaining real communication and corresponds to *type-c applications*. Again in the early days of distance education the main two-way communication format was correspondence which could hardly regarded as 'responsive communication'. Holmberg's two 'constituent elements of distance education', classifying media/technologies according to interactivity, remains therefore an important classification criterion. The other is *time*: *synchronous* or *asynchronous* media/technologies. In fact, the new technologies have introduced a new social dimension, largely absent in traditional distance education, i.e. teaching groups at a distance.

Next we will examine the cost structure of CBTs/WB.

Questions:

- How do you rate the importance of the distinction between type-i and type-c applications of digital technologies Rumble and Hülsmann have proposed? How is it related to the concept of cost structure which distinguishes the different forms of e-learning?
- Hülsmann argues that fully exploiting the interactive capabilities of digital technologies drives horses through the traditional claim of DE to be more cost-effective than traditional (mass-media based) distance education. Do you agree?
- Can you imagine that a distance teaching institution introduces digital technologies while clinging to a cost-structure of correspondence teaching?

- Module 5 Unit 2: CBTs and WBTs

Discussion Topic

One of new application types (type-i) can be linked to what Holmberg referred to as 'simulated interaction'; but the digitization allows new levels of 'simulated interaction' Holmberg wouldn't have dreamed of when he coined the term; though it tend to drive up fixed costs of development it is, in terms of cost-structure similar to the resource media of 1st and 2nd generation DE.

The type-i format: Computer applications
Most texts, even if they are destined to become printed material are nowadays created on a computer, i.e. in a digital format. Such documents can be distributed by email or put onto a server for users to access. Changing from a Word format to .pdf or a .html is just a matter of saving the document.

Older documents can de made available by scanning them, although that is a time-consuming process. If scanned documents are also to be edited or styled, then, text recognition software is also needed. These process need hardware and software, but no specialist labor.

Changing text
The need for specialist labor increases when it comes to changing standard text into hypertext. Hypertext is a text, which includes links. Such links may be internal, leading to other places within the document, or external, leading to other web sites. Standard software has made it quite easy to edit web pages and include links. The process becomes expensive only when a high design standard is required. In this case, specialist skills and software (e.g. Photoshop) are needed.

To edit study guides for use on the web is simple, requiring little more than the original skills of designing the study guides. But the digital format allows more effective content-learner interactivity. Multiple choice questions, computer marked assignments (CMAs) or spreadsheet simulations (such as you find in this booklet) are standard methods of learner-content interactivity. Such elements are often integrated into CBT packages. They often require sophisticated design and can be very costly, especially if audio or video clips are integrated into them. In many such cases academic time inputs are lower than those of the technicians involved, which means that production costs can be extremely high (e.g. in the case of CAL/CBT and multi-media (MM)).

The following section describes how computers can be used to enhance self-study by adding interactivity into course material. The definitions of the different categories are neither strict, nor mutually exclusive or exhaustive. They merely serve to indicate different levels of sophistication.

The following figures are again to be read with caution - the costs may not apply in your contexts. However, the figures used in our spreadsheet activities are 'real world' figures. Note that all figures below are related to one notional student learning hour.

Computer-based resources

The simplest way to use a computer is to use it to provide access to resources by creating indexed and searchable databases for articles, pictures, etc. This requires considerable academic time as well as programming and general support input. According to one source academic input to create such resources to support one student learning hour has been rated at 19 hours or 2.37 academic person/days which amounts to US$ 711. Other production-related inputs are rated at 42 hours. Based on our benchmark rate for production-related inputs at US$ 180/day we get US$ 943. Taken all together this would amount to US$ 1 654. For the purpose of the spreadsheet activity we assume:

cost/SLH(computer resources) = US$ 1 600.

Computer- marked assignment (CMA)

There is a variety of options for using interactivity digital media. Automated marking of multiple choice questions is one of these options. To design assignments which can be graded automatically was reported by our source to have required 18 hours of academic and 23 hours of programming input. This amounts to US$ 675 (2.25 person/days x US$ 300) of academic costs and US$ 532 (2.9 x US$ 180) of programming costs. Taken all together this would amount to US$ 1 207. For the purpose of the spreadsheet activity we assume:

cost/SLH(CMA) = US$ 1 200.

Interactive computer-marked assignment (ICMA)

If programming is more sophisticated and includes generic questions with hints, feedback and scoring one often speaks of interactive computer-marked assignment (ICMA). Our source indicates 30 hours of academic and 37 hours of programming input. This amounts to academic costs of US$ 1 095 (3.65 person days) and production-related costs of US$ 832 (4.6 person days). Taken all together this would amount to US$ 1 926 For the purpose of the spreadsheet activity we assume:

cost/SLH(ICMA) = US$ 1 900.

Computer-assisted learning or computer-based training (CAL/ CBT)

Raising programming sophistication a further level we speak of computer-assisted learning or computer-based training. We refer to such interactive, adaptive, simulation/tutorials or teaching programs as CAL/CBT. As a benchmark value we found 73 hours of academic and 733 hours of programming and production-related inputs. Hence we have costs attributed to input of academic staff of 9.13 person/days or US$ 2 737 and costs attributed to production-related activities of slightly more than 90 staff days or US$ 1 6245. Taken all together this would amount to US$ 18 982. For the purpose of the spreadsheet activity we assume:

cost/SLH(CAL/CBT) = US$ 19 000.

Multi-media applications
The multi-media formats are the highest in the league table of computer applications. These combine the various interactive media, e.g. multi-media CAL and audio visual media. This leads to high inputs both in academic time and in production related work. We find benchmark figures of 230 hours of academic input and 807 hours of production related inputs. This means 28.75 staff days or US$ 8 625 of academic costs and 101 production related person/days costing US$ 18 202 in production related costs (programming and media design). Taken all together this would amount to US$ 18 982. For the purpose of the spreadsheet activity we assume:

cost/SLH(MM) = US$ 19 000.

Computer tools
To end with we will finally consider the use of simple computer tools like spreadsheets for calculation or statistical tools for data analysis. Given a benchmark figure of 17 hours academic time and 46 hours of production related time (including configuring the software for the task at hand) we estimate the respective costs as US$ 637 (2.13 academic days) and US$ 1 035 (5.75 production related days). Taken all together this would amount to US$ 1 673. For the purpose of the spreadsheet activity we assume:

cost/SLH(computer tools) = US$ 1 600.

All these different applications use computers as information processing devices and can be classified as i-type., i.e. they can be saved to a CD-ROM and sent to students for self-study. The replication and mailing costs are low. We assume US$ 2 per CD-ROM.

Important it is to note that i-type uses of the computer have the same cost-structure as traditional 'one way traffic' media (Holmberg, 1995, p.2). They allow economies of scale.

Activity A23:
Computer applications

Use the spreadsheet Activity A23 for this.	
This spreadsheet starts with print plus some measures of student support as the default option.	
1.	*Now, try to substitute the student support measures by content learner interaction using computer applications.*
2.	*What do you observe?*
3.	*Vary the student numbers. Which option is most sensitive to increased enrollment?*
Notes	
1.	*If you want to run a macro you need to have the spreadsheet page for that macro open. Running a macro for another page is*

	likely to cause errors. However, if this happens, close the activity without saving and start afresh.
2.	*The spreadsheet adjusts fees to reflect costs. The fee is based on average cost per student plus a margin for profit and a margin for risk. Our assumption that enrollment levels will not be affected by higher fees may not be realistic.*
3.	*The V lines may not be visible on your economies of scale worksheet. This happens when the value of V is very low, making the V line contiguous with the bottom axis of the graph.*

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Type-i advantages and disadvantages
The advantage of the type-i variant of e-learning is that, though possibly costly to develop, it is in line with the *traditional cost-structure of ODL* which allows considerable *economies of scale*. Burning and distributing CD-ROMs is comparable in cost with copying and mailing audio or video cassettes.

It should be noted that requesting computers and maintaining an online ifrastructure is in some parts of the world still quite costly and a considerable access barrier since it devolves a *cost to students*.

Question: The terminology (CBTs and WBTs) seems in the age of social media already out of date. However, whatever the specific technologies and media you use with respect to costing the essential cost driver is academic time.
When you relate this to the cost-structure (the composition of TC with respect to V and F) in which way does student teacher interaction change the cost-structure of DE?

- Module 5 Unit 3: Virtual seminars

Discussion Topic

There are basically two ways of using computers as means of communication:

-- In a *synchronous* manner (e.g. for videoconferencing)
-- In an *asynchronous* manner (e.g. virtual seminars or threaded text-based conferences).

We will start with the latter case.

CMC and the Virtual Seminar model

Communication often has been seen as the Achilles' heel of distance education. Effective learner support used to prove difficult and costly to organize. distance education therefore has traditionally emphasized the individual study of course material that was (hopefully) so well designed that it pre-empted any further questions. If they were, the remaining questions were dealt with by correspondence (now often by email), telephone counseling and (face-to-face) weekend seminars or summer schools.

Asynchronous text-based communication (or computer mediated communication (CMC)) has fundamentally changed this. It not only allows effective student support but also blurs the separation of content presentation (one-way communication) and dialogue (two-way communication). A major form of online teaching has emerged which we call here 'the virtual seminar'.

Activity 24:
Virtual seminars

Use the spreadsheet Activity A24 for this.	
This spreadsheet starts with a basic print course with some amount of student support.	
1.	*Use the spreadsheets to find out if a virtual seminar (VS) is more cost-efficient.*
2.	*First set the print elements to zero and then opt for the VS option.*
3.	*Check on page three of the spreadsheet what happens.*
4.	*You will have found the VS slightly more costly. In particular, the costs rise more quickly with the number of students in the system.*
5.	*You can explore how scale affects the system.*
6.	*If you have only small cohorts, say 90 per year, what happens?*
7.	*What happens when you have 400 per year?*
8.	*Look at the slope of the TC function and the Variable cost per student. What do you observe? Can you conclude something about the scale economics of the VS option?*
Notes	
1.	*If you want to run a macro you need to have the spreadsheet page for that macro open. Running a macro for another page is likely to cause errors. However, if this happens, close the activity without saving and start afresh.*
2.	*The spreadsheet adjusts fees to reflect costs. The fee is based on average cost per student plus a margin for profit and a margin for risk. Our assumption that enrollment levels will*

	not be affected by higher fees may not be realistic.
3.	*The V lines may not be visible on your economies of scale worksheet. This happens when the value of V is very low, making the V line contiguous with the bottom axis of the graph*

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Characteristics of virtual seminars include:

- A shift away from exclusive individual study to group communication and collaboration
- The software feature of 'threading' as a structuring tool

A virtual seminar has a cost structure quite different from that of traditional distance education we discussed earlier in this course. The development costs are lower and the commitment of teachers' time is higher. Recall that instructional costs of teaching classes (cohorts) are semi-variable costs depending on class size and number of classes (sections) to be conducted. There is not much space for economies of scale. Virtual seminars are easily updated, which makes course shelf-life less of a problem. Courses can more easily be customized as can whole programs, especially if they are designed in a modular manner.

However, if CMC is used just to provide more flexible student support, it becomes an add-on cost. This means it is about quality rather than cost-efficiency. In some cases the weekend seminars and face-to-face parts of student support are partially reduced to pay for the more flexible online tutorial support. There is, though, a pedagogical difference between virtual seminars, and the use of CMC as a sort of help desk function. In the virtual seminar, it is the discussion which drives the course (albeit along the lines of the pre-constructed plan) while, when using CMC as an optional help desk function, students may make use of it only intermittently. This explains the contradicting reports about online communication. While teachers in virtual seminars often report high volumes of communication, the use of CMC as alternatives of student support often leads to frustrating low volumes of communication. This suggests that the added value of CMC depends on the instructional design and the way it integrates CMC in the overall course set up.

Virtual seminars depend on a certain level of available infrastructure and software. They are not characterized by a **capital-for-labor substitution** (typical for distance education as an industrial approach to teaching and learning), but they may improve cost-efficiency through **labor-for-labor** substitution (cheaper labor for expensive labor.).

It is possible to introduce a division of labor by employing teaching assistants for doing the more routine part of the work (loading the predetermined elements of an online course, organizing study groups, updating the schedule, assuring copy right, etc.). Meanwhile the lead faculty can focus on quality dialogue with the students. There are

further strategies to reduce the involvement of the teacher by emphasizing peer discussion. In such a model the tutor would encourage students to answer each others questions. Strategies like these, however, risk sacrificing the quality advantages to economic pressures. Students may not accept that a level of interactivity facilitated by advances in technology is reduced for cost-efficiency reasons.

Parameters determining the costs here are class size and time factors, i.e., student work load per week. Low class sizes can be difficult to manage and high class sizes may produce too high a volume of interactivity. Experience suggests that about a third of the students are active so that between 20 and 35 would seem to be quite manageable in a class. Given a workload of 10 hours per week, such seminars would require about 10 to 15 hours of teaching time. If a division of labor is to be introduced about 5 hours may be seen as routine work and can be done by a teaching assistant.

The above activity illustrates that asynchronous text-based communication does not yield the same economies of scale. (Note: it does not mean that asynchronous seminars are not scalable. *Scalability* and *economies of scale* are not the same thing.)

Question: What is the difference between *scalability* and *scale economies*? Why virtual seminars promise no scale economies? What are the implications of the loss of economies of scale for the claim of DE to be more cost-effective than conventional education?
Can one imagine scaling-up the model of virtual seminars?

- Module 5 Unit 4: Videoconferencing

  Discussion Topic

  Videoconferencing is discussed as synchronous type-c application; it allows to mimic the f2f teaching style but trades not only scale economoies (as it is also the case for the virtual seminar type application) but also flexibility so important to the distance learner.Hence some distance educators are reluctant to call *videoconferencing* (below referred to as video-network teaching) a mode of distance teaching.

  "Let us try to analyze the video-network teaching you have described:

  - Is it carefully planned and carefully developed with the support of considerable financial means - which are used for instructional purposes - not for technical media? No.
  - Are the best scholars in the given discipline engaged in order to produce an really authentic teaching? No.
  - Has there been a cooperation of educational and subject matter specialists? No.
  - Has the product - the teaching- been 'objectified'? No.
  - Has the product been mass-produced? No

- Do the institutions use these networks in order to target at the greatest possible number of students? No
- Do these models try to achieve what Henry Ford had in mind when he produced high quality products at low prices for everybody? No
- Is this instruction developed in order to reach and help students who were born into socially disadvantaged families and neighborhoods and also to those who can never attend classes on campus for other reasons? May be."

*(*Peters in Bernath et al. (eds.), 1999, p. 162*)*

This emphatic diatribe against videoconferencing is based on the conception of ODL as 'most industrialized form of teaching and learning' (cf. the reference to Henry Ford in the second last point). Note, however, that much of these challenges can also be made against virtual seminars. The main difference to traditional distance education lies in the level of interactivity, the role of the learning group (class), and the use of available material instead of costly new course developments. Hence, in spite of the criticism, videoconferencing remains an option for the distance educator.

Videoconferencing is designed to allow lecturing at a distance, even at different sites simultaneously. There are two types of set-up of videoconferencing: the symmetrical (or peer) case and the asymmetrical (or master/slave) case. In the symmetrical case the sending and receiving stations are all identically equipped for sending as well as receiving.

Videoconferencing equipment

Display Equipment	Costs	Network/Connections	Costs
Overhead camera	2 508	Videodec (compression lab)	80 268
Teacher Tracking Camera	1 504.5	Videodec (Aethra)	10 033.5
Monitor 11"	1 504.5	Inverse Multiplexer(Teleos)	5 016
Backprojectors (2)	22 074		
Video Matrix (16:4)	702		
Presentation manager	1 254		
PC+VGA/PAL	2 007		
Audio Mixer	702		
Wireless Microphone	501		
Sliding Blackboard	1 504.5		
Subtotal	*34 261.5*	*Subtotal*	*95 317.5*
Total			129 579

Note: Based on Hülsmann, 2000*; converted in US$ and rounded to nearest dollar.*

The above example illustrates that professionally equipped videoconferencing stations can be quite expensive. However, when equipment costs are depreciated over a five years life time and assuming that the available capacity is well used, cost per hour of videoconferencing is not too high.

Before we look into the actual cost figures we look at the cost equation for videoconferencing. In the symmetrical case with two sites (S = 2) the cost per hour of teaching using a videoconference system (VCS) can be calculated as:

$$\text{Cost / SLH (VCS)} = (\text{DEC} + \text{TSC}) \times 2 + \text{LIC} + \text{LEC}$$

Where DEC = Depreciated Costs; TSC = Technical Support Costs; LIC = Line Costs; LEC = Lecturer Costs

This means that we have at each site equipment costs and costs of technical staff. We have one line to pay for and one lecturer.

To find the average cost per learning hour per student we only have to divide the cost per student by the number of students N:

$$AC / SLH (VCS) = \frac{C / SLH (VCS)}{N} = \frac{[(DEC + TSC) \times 2 + LIC + LEC]}{N}$$

Since N, the number of students, can be considered as a product of the number of sites S and the average number of students per site G, we have for S = 2, N = 2 x G:

$$AC / SLH (VCS) = \frac{[(DEC + TSC) \times 2 + LIC + LEC]}{2 \times G}$$

$$= \frac{[(DEC + TSC) + \frac{LIC + LEC}{2}]}{G}$$

For the general case S > = 2 we have:

$$C / SLH (VCS) = (DEC + TSC) \times S + LIC \times (S - 1) + LEC$$

$$AC / SLH (VCS) = \frac{[(DEC + TSC) \times S + LIC \times (S - 1) + LEC]}{S \times G}$$

$$= \frac{[(DEC + TSC) + \frac{LIC \times (S - 1)}{S} + \frac{LEC}{S}]}{G}$$

In fact, since (S-1)/S = 1-(1/S) approaches 1 when S gets larger, we may simplify the above formula and write:

$$AC / SLH (VCS) = \frac{[(DEC + TSC) + LIC + \frac{LEC}{S}]}{G}$$

This formula reflects the fact that the average cost per student declines if the number of sites increases.

The benchmark figures we use for the activity are based on Hülsmann (2000, pp. 132-138). Equipment costs fall broadly into two categories: costs of display equipment and network related equipment. The display equipment includes the equipment of the teacher station. A summary of equipment costs is presented in the above table. It was suggested that the equipment costs should be depreciated over five years at a usage rate of 1 300 hours per year (5 years × 26 weeks per year × 5 days per week × 10 hours per day = 6 500 hours). This however is using the equipment at full capacity, which would be difficult to do. More realistic it is to assume that for one hour of operating the equipment there is at least another hour of preparation and putting back the equipment. This is why we depreciate the equipment on the basis of 3 000 hours of use over its lifetime. This leads to US$ 43 per hour of depreciated equipment costs (DEC = US$ 43).

Line costs: In the cited case ISDN lines were used for intercampus connection. The line costs depend on bandwidth: We assume 384 Kbps rated as US$ 78 per hour (LIC = US$ 78).

Personnel costs: The personnel costs consist of costs for technical support and the cost of the lecturer. Here we use the standard figures we have used throughout the activities. This leads to cost of technical support per hour of US$ 25 (TSC = US$ 25) and instructor costs per hour of US$ 43 (LEC = US$ 43).

Other parameters included in the above equation are group size and number of sites. In the activity you can explore how group size and number of size influences the average cost per SLH. Here we assume as a benchmark figure five sites with 15 students per site. This leads to cost/SLH (videoconferencing) per student = US$ 15.5. (Note that this is a variable cost rather than a fixed cost of development!)

Activity A25: Videoconferencing

Use the spreadsheet Activity A25 for this.	
Here you might like to compare the default option (i.e. print + student support) with an option where the tutorials are substituted by videoconferences.	
1.	*Which seems to be more cost-efficient?*
2.	Check page three of the spreadsheet to see the effect in each case.
3.	How scale sensitive is videoconferencing as compared to tutorials?
Notes	
1.	*If you want to run a macro you need to have the spreadsheet page for that macro open. Running a macro for another page is likely to cause errors. However, if this happens, close the activity without saving and start afresh.*
2.	*The spreadsheet adjusts fees to reflect costs. The fee is based on average cost per student plus a margin for profit and a margin for risk. Our assumption that enrollment levels will not be affected by higher fees may not be realistic.*
3.	The V lines may not be visible on your economies of scale worksheet. This happens when the value of V is very low, making the V line contiguous with the bottom axis of the graph

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Advantages and disadvantages of videoconferencing

Videoconferencing has cost-advantages, essentially if savings can be made in terms of raveling costs.

The limitations of videoconferencing include the lack of time flexibility and the inverse relation between teacher student interactivity and audience size.

Protagonists of videoconferencing point out that it can bring the best teacher available to the remotest place. This, however, is a rather simplistic understanding of the teacher's role and the relation between teaching and learning. However, it is true that videoconferencing can be the most cost-efficient way to present an internationally renowned expert, albeit with limited interactivity options.

Question: Some technology (e.g. Wimba. Lecturnity) allow synchronous interaction but also recording. Do you still see advantages in asynchronous text based interaction?

- Module 5 Unit 5: Digital convergence and the importance of scenarios

  Discussion Topic

  While media were traditionally separated in different formats with different distribution channels *digital convergence* allows to integrate all media on one platform; as a consequence the question of media selection is transformed in a question of determining the appropriate educational scenarios. This discussion unit proposes to look at media integration with respect to LMS (Learning Management Systems) and emphasizes the importance of determining learning scenarios as a basis for costing.

  We begin with looking at Learning Management Systems.

  The advances in using computers for administrative purposes have already made considerable progress in all educational institutions. **Learning management systems** integrate pedagogical and administrative systems. They provide mechanisms for student registration, administration, assessment and teaching. They also track learning, courses and credits.

  It is difficult to say something about costs of LMSs since prices are generally negotiated with the provider. There are more than a hundred such systems on the market and there is fierce competition. Experts believe that there is a shake-out going on, which will leave not more than five major contenders. This explains why cost data are not easily available. Where figures are included they are referred to as 'pricing models', which signals that there is room for negotiation. Some typical systems are set out in Table 16.

  Some virtual learning systems

Names	Pricing models	Comment
Blackboard 5 *www.blackboard.com*	US$ 20 000 p.a. for ca. 2 000 user	Blackboard uses licensing as pricing model; temporary licenses for testing for US$ 7 000 for a month
Clix *www.im-c.de*	Business price: From US$ 75 000 onwardsa	IMC prefers selling to licensing; service gets expensive; telephone hotline costs per minute
Distance Learning System (DLS) *www.ets-online.de*	US$ 230 000 from 10 000 users onwardsa	Excluding support, maintenance and hosting
IBT SERVER elearning suite v6	Single server license, scalable to 100 users € 8 000a Web authoring (5 authors): € 7 500a Assessment (100 user): € 7 500 Curriculum design (5 authors): € 5 000a Skill management (100 user): € 7 500a Resource management (100 users): € 3 200a	
iLearning*www.oracle.com*	License pro named user p.a. € 60a List price pro user € 34 plus 22% support p.a.a	
ILIAS *www.ilias.uni-koeln.de*	Open source	
Lotus Learning Space(LLS) *www.lotus.com*		proprietary software; special feature: replication, which reduces cost to be online.
Top Class *www.topclass.com*		
WebCT *www.webct.com*		
H.U.T.GmbH H.U.T.VERDI	Business price: from € 80 000 onwardsa License per user: €2	
Integrity Learning WBT Manager 1.51	Business price: € 42500; license per user from € 5 300 according to no. Of users.a	
TLM Corp. The Learning Manager 3.2	€ 50 000 p.a.; per user € 2.5a	

Notes: ***a:*** Hettrich & Koroleva (2003).

Institutions need to be aware that initial terms may appear to be advantageous but once institutions are hooked onto a system, it is difficult to shift to alternative platforms. By then much material will be held in the system-specific format and staff will have been trained to feel comfortable with it and usually will be reluctant to change. Once the institution is hooked and many courses are running in the particular learning environment, the price may begin to rise. For example, a South African university wanted licensed a LMS for US$ 5 000/year for their 50 000 students for the five years; at the end of the license period the price for a similar product and accompanying services was

US$ 110 000. The university had to decline a continuation of the contract. Eventually negotiations led to a compromise about which no public information is available. The example illustrates why open source platforms should always be considered.

The next point is arguing that the digital integration renders some of the discussion of 'selecting media' (such as the ACTIONS model) obsolete.
The main point here is the question if - beyond a certain level of technology (or 'in the present generation of technologies in DE') - the issue of selecting technologies still makes much sense. Obviously it is important for a distance educator and planner to recognize the different cost structure of *resource media* and *communication media* and in fact, the different potential for *scale economies* within the resource media. However, once we have arrived at the present generation of technologies (networked computers with packets of software including off the shelf LMS) the technology does not anymore give a clue with respect to costs. It is still informative to report cost-figures of best-practice examples, as it is done in the added book chapters (e.g. UBC/Tec de Monterrey co-operation). However, it could be argued that such a technology environment allows you to run an extremely different form of learning scenarios.

Let me go back to the *distinction between technologies and media*. The distinction is not made clearly. There is a tendency to refer to radio and television as media, anything related to a computer is often labeled as technology. Other authors tend to relate media to the senses (visual media, audio media; but to which sense textual media refer to?). Let me quote two statements by Kozma which relate to the distinction between media and technologies: "Media can be defined by its *technology*, symbol systems, and processing capabilities. The most obvious characteristic of a medium is its technology: the mechanical and electronic aspects that determine its function and, to some extent, its shape and other physical features."(Kozma, 1991, p. 180; emphasis added) He continues: "However, the primary effect of a medium's technology is to enable and constrain its other two capabilities: the symbol system it can employ and the processes that can be performed with it." (ibid. p. 181)

If we now take a networked computer, well equipped with relevant software, there is little what restrains. Text, graphics, videos, sound, all the symbol systems are enabled and processing goes much beyond what is available in a typical face to face situation.

Isn't the real issue in the present situation (of 3rd, 4th generation technology) the determination of appropriate, affordable and accessible learning scenarios rather than the selection of a specific technology? Earlier on choice of technology, as Kozma put it, enables and restrains the symbol systems and symbol processing capabilities. In this sense the choice of technology implied constrains: print implies no sound, radio implies no pictures. There are (almost) no constrains with the networked computer: you can do everything, from video, to sound, to simulations. But this is exactly the reason why this technology as such has no clear cost-implications anymore. The educational scenarios you can implement on this basis are so different that it makes little sense to apply ACTIONS without more specific specification of the scenario intended to implement.

In fact web-conferencing (i.e. asynchronous text-based CMC) is more a scenario than a technology. However, it allows a large span of realizations: you could equip the media center of the *LMS LearningSpace* with lots of complicated learning objects and run it as a self-learn package. You can however, prepare little content beyond a curriculum and let the course be driven by the communication process.

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References:

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- Module 5 Unit 6: Business models of cooperation

Discussion Topic

Given that the captive markets for distance learners is a thing of the past and given the typical context of conventional institutions 'going dual mode', planners cannot base their planning on large enrollments (i.e. large N). But high course development investments (implying high fixed costs F) can only legitimized on the basis of large N. Hence the planner sails between *Scylla* and *Charybdis*: not investing in course development leaves him/her open to the charge of 'chained media'; on the other hand, fully exploiting media capabilities is expensive and may, in the words of Rumble, 'price the product out of the market'. The question is 'how can we, in in spite of limited markets and demands for customized products, get a large N, which is the precondition to operate scale economies?' The answer is: 'by cooperation'.

Remember that distance education as a system is characterized by a division of labor which is reflected in different system components, such as course development and student support (to name but the two most important). While all these components are required it is by no means a logical necessity that they are to be hosted in the same institution. Especially, the e-learning environment facilitates such cooperation.

"Technology and e-business approaches make it possible for integrated processes of open and distance education to be disintegrated into their constituent parts: curriculum development; content development; learner acquisition and support; learning delivery; assessment and advising; articulation; and credentialing. These processes can then be managed by different organizations." (Rumble & Latchem, 2004, p.134)

The Table below is a selection of good reasons for cooperation. The first one of them indicates that cooperation may contribute to the above mentioned problem: How to bring back scale into a system characterized by limited local markets and specialized demand?

Reasons for cooperation

Consortia, partnerships, strategic alliances etc. are formed by educational, training and corporate providers for a variety of reasons, but principally to:

- share costs or spread these over a larger number of students;
- share courses, resources and academic and commercial experience and expertise;
- attract funding opportunities (particularly in the European Union which makes inter-institutional collaboration a condition of funding);
- be fast to market or cope with major market demand by joint course development and optimising complementary strengths, as shown by Open Learning Australia in its earlier years of operation
- capitalise on partners' knowledge of, and reputations in, local markets;
- accommodate other countries' governmental requirements for local institution involvement as a condition of entry;
- ensure adequate provision of local services such as marketing, counselling, admissions, registration, and examination invigilation;
- de-bundle learning materials, tutorial support and course assessment to provide expanded market opportunities;
- achieve a franchise arrangement.

Source: Selected from Rumble & Latchem (2004, p.128)

Bernath & Hülsmann (2004) have demonstrated how a small institution like the Center for Distance Education at the Carl von Ossietzky University can exploit the synergies of alliances and partnerships. They described a number of such models of co-operation in which ZEF supplied different system components at mutual benefits.

9. "The *Branch Model*: ZEF co-operates with the FernUniversität in Hagen (the main distance teaching university in Germany) to provide educational counseling and tutorial services to their students in the North Western regions of Germany. For the state of Lower Saxonythis is a low cost option since local students are qualified at marginal costs. At the same time this arrangement contributes to the efficiency of the FernUniversität Hagen.
10. The *Subcontractor Model*: ZEF co-operates with the University of Maryland University College (UMUC) to develop and teach online courses within the Master of Distance Education (MDE) jointly offered by UMUC and Oldenburg University
11. The *Shared Ownership Model*: ZEF co-operates with three centers for distance education at other universities in Lower Saxony to operate a technical infrastructure for online distance education (Via Online). This again is an efficient

way of capacity building, which allows the participating centers to offer services to their own universities as well as selling services to outside clients.

12. The *Franchise Model*: ZEF has developed course material for professional development in nursing which has been franchised to other universities. In this case ZEF operates as a curriculum developer and content provider. The cost-efficiency depends on scale economies which can only be achieved in such broad alliances." (Selected from Bernath & Hülsmann, 2004, p.)

We started beginning the course with going back to the early theories of distance education, especially of Peters' theory of *distance education as most industrialized form of teaching and learning.* This theory conceptualized distance education in analogy to industrial production processes. The analogy can be seen as a rich source guiding principles on how the newly forming sub-discipline of distance education should shape itself as autonomous educational subsystem (in Peters words, as educational format 'sui generis'). It tells us to look at industrial processes for inspiration. In this sense it can be seen as a *contingency formula* (cf. Note* below) since by reference to the analogy between education and industrial processes it allows to deal with open, contingent situations thus reducing uncertainty. Peters' industrialization theory has been discarded at various points in history by critics pointing out that industrialization has undergone various substantial changes (e.g. from Fordism to Post-Fordism). Peters himself has responded to his critics in a way we can read as a *re-specifion of his industrialization formula*: when Fordism is discarded in industry it should also be discarded in distance education; when mass-customization is introduced in industry it should be introduced in distance education. Keywords figuring larges in the management of industry discourse (e.g. time-to-market, total quality management) should be considered/discussed in education also. This gives the theory a somewhat *chameleon like* appearance since the theoretical/descriptive content has changed considerably over time. What remained is the formula (with changing normative heuristics) linking distance education and industrial processes.

The latest re-specification of Peters' industrialization theory can be attributed to Michael Moore who sees 'network systems' as 'the emerging organizational paradigm' (which brings us back to the topic of cooperation) and writes:

"In the *strategic alliance*, participants in a network contribute technological and managerial expertise and capital and share the costs of developing new technologies, spreading the financial risks of entering new markets. Although quite common in the manufacturing industry, in distance education so far, strategic alliances have not made much headway in collaborative design and delivery of the products, that is, courses and programs. Rather, they have been directed towards cooperative marketing of their existing courses.

However, in the distance education field, it is not only the strategic alliance but also the *vertical disaggregation* form of network that is likely to be of greater interest in the future. Vertical disaggregation is the process developed in the manufacturing industry to deal with shortening product life cycles, by which large firms outsource the production of

various components of the product to smaller suppliers. As in manufacturing, in the knowledge industries too it looks as if vertical disaggregation will become the means of reducing product life cycles and improving efficiency and quality. What that means in distance education is outsourcing some of design and a lot of the product development of course materials. It means devolving learner support services to local points of contact and specialized services. It means drawing in instructor resources from wherever they may be located rather than solely on the faculty on campus."
(Moore, 2003, p. 4; emphasis added)

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Notes:

*According to Luhmann *contingency formulae* appear when a subsystem in a process of *functional differentiation* claims a certain *autonomy*. This applies for Peters claim that distance education is '*sui generis*', a sharply distinct subsystem of education in its own rights. Successful contingency formulae help to deal with open situations by reducing contingencies. (cf. Luhmann & Schoor, 1988, S. 59)

- Module 5 Unit 7: Laurillard

Discussion Topic

I want to alert you to the work of Diane Laurillard's work who is one of the few persons relating the aspects of costs, technology and learning in a rather balanced way. You may start by listening to her recent presentation at the Wiley-BJET seminar at the BERA Conference at the University of Manchester.

Wiley-BJET seminar: Prof. Diana Laurillard http://www.youtube.com/watch?v=N4t8IJGbZiY

Learning Technology: Redefining the Field.

This Wiley-BJET seminar was recorded at the BERA Conference at the University of Manchester, September 2012. Prof. Diana Laurillard made one of four contributions to the seminar and to the discussion. Produced by Mike O'Donoghue, School of Education, University of Manchester.

You find her stressing the role of the teacher. The following youtube presentation introduces you to the model. (http://www.youtube.com/watch?v=6eOPWy75Aog).

Laurillard sees the teacher as a sort of an engineer who needs to approach teaching as an engineer would do: by designing, testing and improving her approach. Her approach to technology was not to take the teacher out of the loop but to recognize his/her central position and increase teacher productivity by creating the proper technological environment allowing teachers to optimally make use of technology.

However, Diane also looked at the efficiency potential of educational technology: She got quite interested in re-usable learning object (RLO) and was very interested in their cost-reduction potential. She wrote: "A cost-effectiveness analysis identified the potential to reduce the additional cost of introducing software by factors of ten to over 100. A software application originally costing GBP 100 000 could be reused at a cost as low as GBP 100 (Twinnings et al, 1998)" (Laurillard & McAndrew, 2003, p. 89)

Her approach was emphasized time as the driving cost parameter. I attached an Illuminate seminar where she explained her approach and an interactive spreadsheet she used for modeling costs.

References:

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Task: Discuss the difference of the costing approach of module 2 (e.g. used in the mock assignment) and Laurillard's approach. What is the purpose of the costing approach Laurillard uses?