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New media and their role in education

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Abstract

Virtual learning as a supplement to - or a substitute for - traditional learning is much heralded. Governments, universities and businesses are spending an increasing amount of money on projects that are aimed at integrating new media into existing courses to transform them into on-line courses.

However, contributions that stress the functionalities of new media can cause wrong expectations, because new media imply disfunctionalities as well. To optimize the learning process these disfunctionalities should be taken as serious as the functionalities that improve the learning process.

It is essential to analyze how people learn with the help of computers and which learning activities they deploy during this process. Essential to distance learning is the way new media like internet and intranet can support the learner.

It is important to know what expectations learners have from computer assisted studying. If a medium has the potential to assist learning processes, people automatically expect the software to exploit this potential.

In this contribution we present a conceptual framework to guide the process of decision-making. It regards the development of effective learning environments, by focusing on two sides of the construction process. The first is the side of the media and their functionalities, both activated and potential, and their disfunctionalities.

The second is the exploration of three types of learning activities: cognitive, regulative and affective. Based on these two, we are in pursuit of an optimal mix of media, old and new. Our central research question is: 'What combination of media offers an optimal mix of learning functions to support the learner's activities, necessary to reach his or her desired learning outcomes?'

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1 Learning and instruction

The essential features of learning and instruction can be described in just a few words (Thomas Duffy, 2001). 'Learning is making sense of the world. Instruction is aiding to learn. To design a learning environment you must know the learner's goals and the resources that are available. Then you can create learning activities.'

From this perfect description three elements can be elaborated upon. The first is a pedagogical element: what are the *learner's goals*? How can a learner become aware of them? New developments in assessment of competencies (Parry, 1996) make it possible to get them clear. The second element is a technical one: which *resources* are required? Which media are available to present them?

New media offer new functionalities to open up resources. The third element is innovation: what *learning activities* are possible these days? How can they be supported through the media? As new functionalities are available, new ways of supporting the learning activities can be found and maybe even new learning goals can be attained.

Virtual learning as a supplement to - or a substitute for - traditional learning is much heralded (OECD, 1997). Governments, universities and businesses are spending an increasing amount of money on projects that are aimed at integrating new media into existing courses to transform them into on-line courses.

These projects – computer aided instruction (CAI), distance learning, digital learning, etcetera - can be described as the application of digital media to learning processes. Or, shortly, virtual learning is learning from the screen.

Literature about virtual learning is dominated by enthusiastic studies and accounts (Hara and Kling, 1999). However, contributions that stress the functionalities of new media can cause wrong expectations. New media not only offer functionalities, they imply disfunctionalities as well.

To optimize the learning process, these disfunctionalities should be taken serious. They should at the least be made part of the discourse in order to stimulate the search for other media to compensate them.

If distance learning by ICT is recommended because of the functionalities 'learning independent of time and space', then this holds true for a book or a syllabus as well. These media have the same functionalities. But a written text

offers extra functionalities like the possibility of making notes in the sidelines. And it is easier to handle and take on a holiday. So, the functionalities of independency of time and place are not valid arguments for the choice of ICT as medium for distance learning.

Several studies (Guwardena, 1992; Mc Isaac & Gunawardena, 1996; Mendels, 1999) point out that the emphasis in literature about virtual learning is on what software and hardware can do instead of what students and teachers expect from it.

The focus is on functionalities activated to replace existing media, without accounting for the disfunctionalities and potential functionalities that are at the same time introduced. This might lead to bad experiences and to the conclusion that the same learning outcomes could have been reached by using existing media (University of Illinois, 1999).

Commonly the focus is on the choice of media if attempts are made to bridge the gap between resources and learning activities. However the perception should be that a choice is made for a set of functionalities and disfunctionalities adequate to support the learning activities to perform (Vernooij, 2001). Moreover, to get a clear view of the learning activities involved, more consideration is required for the pedagogical characteristics of learning and instruction.

For example: if a series of lectures is supplemented by a web site, the teacher gets an extra instrument to support the learning process of the students. He or she can give detailed virtual information on the tasks and advise students how to plan their study. Or the teacher can support other learning activities such as self-assessment.

This way the web site supports regulative learning activities of the students. But at the same time the teacher runs the risk the server will go down and students looking for support are disappointed. Then a disfunctionality of the medium shows up.

This contribution offers a conceptual framework to support the design of learning environments. The focus of the framework is: 'What combination of media offers an optimal mix of learning functions to support the learner's activities, necessary to attain his or her desired learning outcomes?'

2 Innovation: an experiment with virtual education

Two years ago the Faculty of Economics and Econometrics of the University of Amsterdam decided to redesign the preliminary course on Information Management as a pilot for the innovation of the educational program. Points of

departure for this redesign were:

- a change in educational format,
- the integration of competencies
- and the *integration of new media*.

In the traditional situation learning outcomes strongly focused on the acquisition of knowledge and not on the development of skills. This traditional approach created a passive absorption process instead of an active, constructive, and self regulated process of the learner (Bednar et al. 1991). Therefore, an experiment was started to introduce 'New Learning' (Simons, Van der Linden & Duffy, 2000).

The course on Information Management was followed by 250 students and ran over a whole academic year. During a first plenary session the objectives and the structure of the course were explained to the students, followed by an introduction in the new economy.

During the next 5 sessions students were trained in using Internet and learned to build their own web site. The course then continued with an empirical research on the application of e-business. Students, teachers and professionals shared knowledge by doing research together (Thijssen, Maes & Vernooij, 2001).

When constructing the course a central web site was developed, which mainly served as information provider. Relevant links, schedules and assignments were processed, and publishing functions were built. Still, because of the time stretch of the project, it was impossible to plan everything in advance.

During the course this web site was to be complemented with consultancy functions, discussion groups, and additional information. Teachers believed that in this way information could be added later on in the course.

However, a survey pointed out that students wanted more frequent updates (which they never expect from a book or a reader) and expected more links to relevant web sites to support their cognitive learning process. As frequent users of internet, the students were aware of its potentials and they expected updates.

These expectations were not met and hampered their motivation to participate. Next to these expectations, students wanted the old information to be removed from the site. This means that potential functionalities were not used and that disfunctionalities were not taken care off.

Because most of the information was published on the central web site, teachers expected that they did not have to communicate organizational matters during the meetings. The main purpose of these meetings was to discuss new discoveries, to offer students opportunities to hold a presentation and to reflect

on assignments accomplished. Still, students kept their old expectations of the way teachers were using lectures.

However, another disfunctionality became clear. If important information was changed, students were not aware of these changes and they did not know which revisions were made. That way the learning activities, regulating their study were hampered.

The functionality of the medium (quick change in data) interfered with the activities of the students. They were no longer sure what they were supposed to do and when this had to be done. Information on changes in information is required to shape the expectations of the students.

A third purpose of the course was to handle all communication electronically. Students had to work out assignments related to the course content and the empirical research. They had to develop a web site of their own and publish their assignments on that site. This way of communication was not only chosen to develop web site skills but as well to avoid a potential email overload for the teachers.

However, students expected other ways of communication once the web site was introduced. They are used to homepages of all kinds of organizations and these homepages explore the potentials of Internet. They are used to sending e-mails as well, but they are not used to put a message on a site and wait until a teacher reacts.

3 Technology: the characteristics of media

At the University of Illinois (Illinois, 1999) a seminar was organized for 'outstanding and highly committed teachers' to discuss the potential use of new media. This seminar focused mainly on pedagogy and assumed no technical barriers from hardware and software nor from other technological constraints.

The seminar concluded that online teaching and learning could be done with high quality if new approaches are employed which compensate for the limitations of technology, and if professors make the effort to create and maintain the human touch of attentiveness to their students.

Some of these conclusions may be discussed, as new media imply new pedagogical approaches to activate the new functionalities of these media. Once the potential benefits of the new media are activated, the resulting programs are difficult to compare with existing programs (Clark, 1983).

Either two similar pedagogical systems are compared, neglecting the extra potentials of the new medium, or two different pedagogical systems are

compared, with the computer as interfering variable. A better way of doing research, is comparing different approaches with the same medium (Hagman, Mayer & Nenniger, 1998).

A lot can be learned yet from critical reports (i.e. National Center for education statistics, 1998). These reports point at the disfunctionalities of the new media and are an invitation to avoid them or compensate for them. Hara and Kling (1999) wrote an article on 'Students' frustrations with a web-based distance education course'.

They described the agonies students went through and how these frustrations inhibited their educational opportunities. They stated that '... past studies do not illustrate the details of student's perspective on distance education ...'. Their article described three main sources of frustration: technological frustrations, lack of timely and adequate feedback, and ambiguous instructions via both the web site and email.

Another source of information on functionalities and disfunctionalities are teachers who describe the incorporation of new media into their courses. Rotfield (2000), for instance, described in his article 'Lights!! Cameras!! PowerPoint!! Now, ...lecture' the use of new media, and pictured the encountered functionalities and disfunctionalities from a teachers point of view.

Once the lights switch on and the machine starts zooming, the attention of the students goes towards the screen in stead of the teacher. He puts forward the question whether digital media make a lecture easier to convey or that it creates its own new distraction. 'The purpose of a class is an intelligent focus between instructor and students, so when the technology shuts down thinking, it may be discarded.'

These cases all illustrate that educational media have their functionalities and disfunctionalities. Sometimes the focus is more on functionalities and disfunctionalities from an instruction point of view, sometimes from a student's perspective. To make a thoughtful decision about the mix of media in use, one has to go into the characteristics of these media.

In discussing the role of technological support in education, Sandberg (1994) identifies the components of a (technologically rich) learning environment and gives a description of its place in the learning process.

To elaborate this point, Schneider (1994) argues that each of those components has functionalities, which must be taken into account in order to optimize the learning process. He suggests setting up a table with functionalities when adding a new medium to a learning environment.

One entrance is the existing set of media in use, like teacher, learning material

and tools (like calculators). The other entrance is a new set of media. This double entry creates a matrix that describes the supporting functionality of the new media to each of the existing components of the learning environment.

However, when introducing a new medium in a learning environment one should add as well the disfunctionalities installed on the existing media. Only then a rational decision on a new configuration of media can be decided upon. Those disfunctionalities can either exist of handicaps of the new media, or a block on the functionalities of the media already in use.

Besides functionalities and disfunctionalities, a third variable is to be taken into account. Users build up their own expectations of the potential support by a new medium. If those potentials are not used within the learning environment, disappointment arises about missed opportunities. The gap between the expected use of functionalities and the absence of them in a concrete situation, questions the usefulness of that new medium in that particular situation.

A computer, for instance, has the functionality of withholding information until asked for. This is opposed to a book or a paper exam. If in a book an accounting problem, for instance, is outlined then all data required to solve that problem must be given at the very start.

If the same accounting problem is given in a computer-assisted environment, students could be invited to ask for the data they need. That simulates better the situation of an entrepreneur, who has to decide which data should be taken into account. Using this potential functionality of the computer, a deeper learning can be attained.

Considering the characteristics of the media, the design of a new instruction environment is not just the choice of a new mix of media, but the choice of functionalities and disfunctionalities of these media. The crucial point in innovation is exploring the potential functionalities a new medium has.

The most professional group to advise about that, are the students. They bring in their experiences with the new media and all their disappointments with the learning environments can be transformed in information about potential functionalities.

4 Pedagogy: the characteristics of the learning process

In traditional learning the assumption exists that education is essentially the transfer of knowledge from an external source to the learner. This opinion is increasingly under pressure. More recent theories, like the constructivist theory, state that learning is not a passive 'absorption' process of knowledge but an active, constructive and self-regulated process of the learner (Bednar et al.

1991) To bring about this construction of knowledge students need skills to guide this process or in other words: 'they need to learn how to learn' (Boekaerts and Simons, 1993; Boekaerts, 1997).

New learning must be introduced in stages: guided learning, experiential learning and action learning (Simons, Van der Linden and Duffy, 2000). Aims of new learning include the acquisition of learning, thinking and regulation skills (Ten Dam, Vernooij and Volman, 2000). This approach makes it possible to work on the development of competencies (Stoof, Martens & Merriënboer, 2001).

Vermunt (1992) argues that the quality of higher education hinges on the quality of the learning processes students deploy. This implies that not only instruction theories, but also learning theories have to be taken into account when designing effective education.

Thus, there are two sides to learning, namely learning theories (demand side) and instruction theories (supply side). Vermunt combines these into a coherent learning theory, in which the activities students deploy are central. Gradually the students must take over the activities of the instruction and start instructing themselves. He divides the activities that support the learning process into three domains:

- *Cognitive domain*: mental activities that lead to learning results such as knowledge, skills and competences.

- *Regulative domain*: mental activities focused on the coordination and control of learning processes.

- *Affective domain*: attribution of emotions that occur during learning activities. They influence the motivation and self-esteem of the students and enhance or constrain the cognitive and regulative functionalities.

According to Vermunt all activities can be undertaken by the student or by the teacher. For instance teachers can try to motivate their students, but students as well can try to motivate themselves, just like employers must do, once they are in a job.

In the same way, the learning processes can be guided internally or externally. Internally means that the students have an intrinsic motivation driven by personal interests. Externally means that the content of the course and the learning process is tightly controlled by an external source. This can be a teacher, but also a peer-group or a fellow student. As example of structuring the study of a book: the teacher can prepare summaries or can leave this to the student.

5 Technology, Pedagogy and Innovation

In paragraph three we introduced technology and pointed at the functionalities, either activated or potential, and the disfunctionalities of media. In paragraph four we introduced pedagogy and pointed at the different learning processes like cognitive, affective and regulative processes. In constructing an innovative learning environment these two must be bridged in an adequate way.

The *media characteristics* meet the *pedagogical characteristics* at a critical cutting edge, as depicted in Figure 1. The top half of the figure shows the (desired) learning outcomes, which have to be translated in learning and instruction activities to attain them. The bottom half depicts the media characteristics. In the next paragraph we will focus on the application of the framework by analyzing some examples.

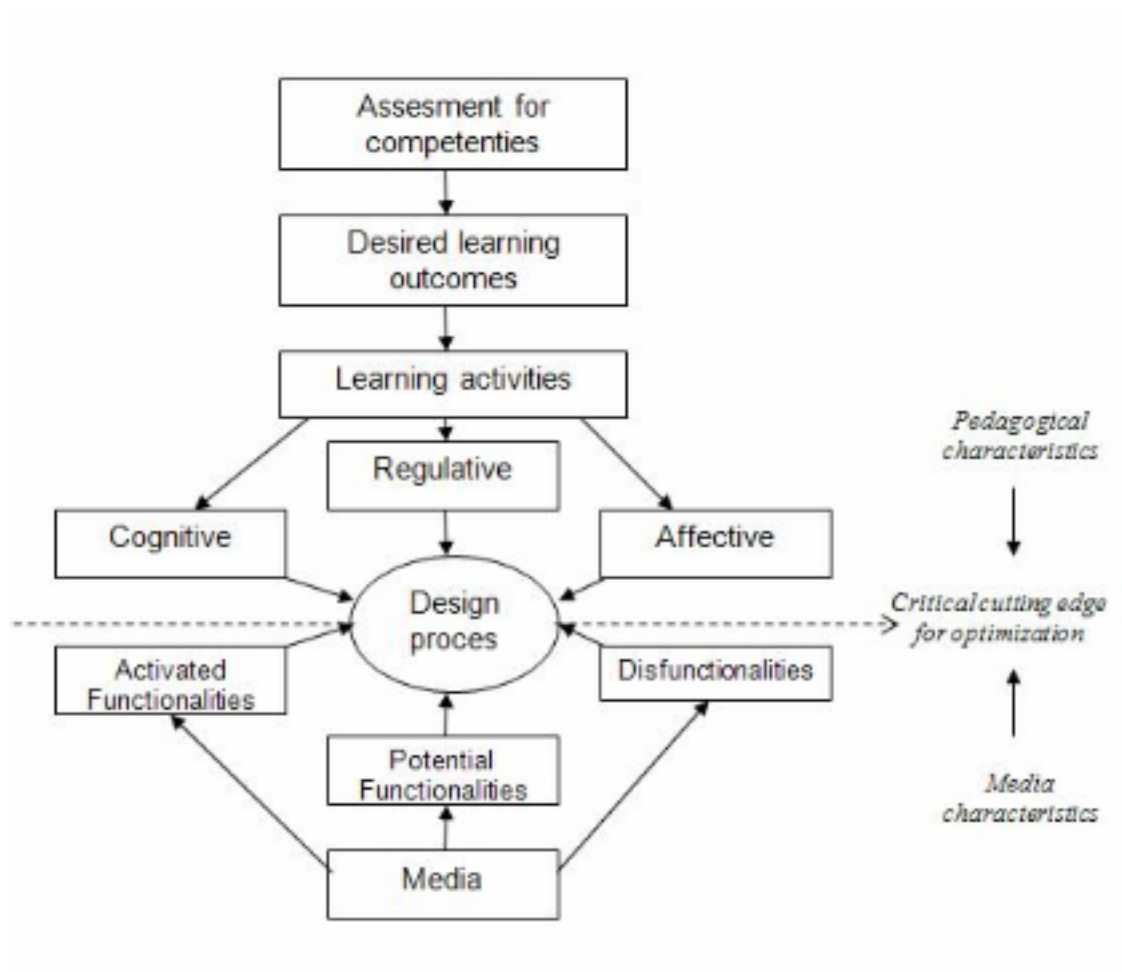


Figure 1: the functionality framework

6 Application of the functionality framework

The advantage of separating domains in learning activities, offers the opportunity of weighing contradictory effects in different domains. The Illinois example shows that the activated functionality of saving time via distance learning by introducing the web site (a *regulative functionality*) was overshadowed by the disappointment in technical problems (an *affective disfunctionality*).

Sometimes disfunctionalities of a medium influence different kinds of learning activities at the same time. As far as the technical problems of students with an on-line course are concerned (Hara and Kling, 1999) the disfunctionalities in the affective domain influenced regulative and cognitive activities. Of course everybody hopes technological problems don't occur in their course, but they must be taken into consideration, at least at the moment of the course design.

The same considerations hold true for email. Often, email is mentioned to facilitate a-synchronic learning. However, in essence email is not different from regular mail. Ordinary letters were also a-synchronic. Still email has distinctive functionalities. One distinctive functionality of email communication is that it makes ordinary mail more synchronic. Email can be sent and received at higher pace.

But email also has other distinctive functionalities. The messages can easily be changed and forwarded, stored, retrieved, and read from different locations. Besides, documents can be attached. E-mail makes communication more efficient (a *regulative functionality*).

The impact of the functionality of a-synchronic communication, however, is that students can approach teachers whenever they need them. But, if students do send an email-message, they generate expectations towards the medium email. They expect a reply within a shorter time than with regular mail (a *regulative functionality* that is potentially available).

Once teachers introduce the functionalities of email, they must take these expectations into account and make arrangements with their students. Otherwise they must face affective decline from their students.

Besides, lack of (timely-) feedback not only affects the affective domain, but also the regulative domain. If students don't get answers to questions on what they should do, they are unable to continue. Then the a-synchronic communication with email results in a *regulative disfunctionality*.

Sometimes disfunctionalities can be transformed into functionalities. Email can never replace the *regulative functionality* of questioning in a classroom situation. But it can be transformed in some other way. Instead of waiting for the

next lecture to come, students can form study groups, questioning each other with the help of a chatbox or discussion board.

This introduces a *regulative* and a *cognitive functionality* that is potentially available on the internet. The teacher, as a coach, can try to regulate the skill of teamwork, so as to change an affective disfunctionality into an affective functionality.

Another opportunity for the teacher is to combine the functionality of email with the functionality of Internet. A teacher, for instance, can build a list of frequently asked questions, for instance when students are playing a management game (Vernooij, 1999). If a student (or a group of students working together as a team) puts forward a question by email and the teacher expects more students to have the same question, he (or she) can build a list of questions received.

These questions can be answered in general terms aimed at stimulating the students to study further at the moment they need information. A-synchronic communication by email is thus transformed in synchronic communication by a web site. The list of 'frequently asked questions' can be placed on a web site (a *cognitive functionality* of Internet).

7 Suggestions for further research

The use of new media in education is a relatively new field of research. High expectations are set for an improvement of the efficiency and effectiveness of teaching and learning. Research is needed on the critical functionalities and disfunctionalities of new media in relation to the three main pedagogical characteristics of learning: cognitive, regulative and affective learning activities.

The main question in research on the impact of new media, however, is: "What can these new media do to the learning process, that other media cannot achieve?" .

The key to find an answer to this question is what students expect from these new media, as their expectations are the main entrance to the potential functionalities of the new media. Further research should focus on the expectations of the students, because they can indicate which potential functionalities are available and which solutions exist for the disfunctionalities of the new media.

8 References

- Bednar, A. K., Cunningham, D., Duffy, T. M., and Perry, J. D. (1991). 'Theory into practice: how do we link.' *Instructional Technology: past, present and future*. G. J. Anglin, (ed.), Englewood, Co: Libraries Unlimited, pp. 88-102.
- Boekaerts, M., and Simons, P. R.-J. (1993). *Leren en instructie: psychologie van de leerling en het leerproces*. Dekker & van de Vegt, Assen.
- Boekaerts, (M. 1997). 'Self-regulated learning: a new concept embraced by researchers, policy makers, educators, teachers and students', *Learning and Instruction*(7)-2, 161-186.
- Clark, R. E. (1983). Reconsidering Research on Learning from Media, *Review of Educational Research*, Winter (1983), Vol. 53, no 4, Pp 445-459.
- Duffy, T.M. (2001). 'Two examples of course design at Cardena University'.
Presentation at the 8th Edineb Conference in Nice, France.
- Gunawardena, C.N. (1992). 'Changing faculty roles for audio graphics and online teaching'. *The American Journal of Distance Education*, volume 6, number 3, pp. 58-71.
- Hagman, S., Mayer R.E., & Nenniger, P. (1998). Using structural theory to make a word-processing manual more understandable. *Learning and Instruction*, Volue 8(1), pp 19-35.
- Hara, N. and Kling, R. (1999). 'Students' Frustrations with a Web-Based Distance Education Course'. *First Monday*, volume 4, number 12, at http://firstmonday.org/issues/issue4_12/hara/index.html
- Mendels, P. (1999). 'Study Finds Problems With Web Class'. *New York Times*, September 22. at <http://www.nytimes.com/library/tech/99/09/cyber/education/22education.html>
- National Center for Education Statistics. (1998). *Issue brief: Distance education in higher education institutions: Incidence, audiences, and plans to expand*, at <http://nces.ed.gov/pubs98/98132.html>
- OECD. (1997). 'ICT as a Tool for Lifelong Learning'. *Information Technology Outlook*.
- Parry, S. B. (1996). The quest for competencies. *Training*. July, 48-56.
- Rotfield H.J. (2000). 'Lights!! cameras!! powerpoint!! now,....lecture'. *AMS Quarterly*, volume 3, February 2000 pp.6
- Sandberg, J.A. (1994). 'Educational paradigms: issues and trends'. In R. Lewis and P. Mendelsohn (eds.) *Lessons from Learning*, Amsterdam: North-Holland, (IFIP TC3/WG3.3 Working Conference 1993), pp. 13-22.
- Schneider, D. (1994). 'Teaching & Learning with Internet Tools'. A Position Paper presented at the Workshop on "Teaching & Learning with the Web" at the First International Conference on the World-Wide Web, 1994 at CERN, Geneva.
- Simons, Robert Jan. Van der Linden, Jos. & Duffy, Tom. (2000). New Learning: Three Ways to Learn in a New Balance. In: *New Learning*. (ed. Robert-Jan Simons, Jos van der Linden and Tom Duffy). ICO. Dordrecht / Boston / London: Kluwer Academic Publishers.

- Stoof, Angela, Martens, Rob L. & Merriënboer, Jeroen J.G. (2001). *What is competence? A constructivist approach as a way out of confusion*. Heerlen: Open University (in print).
- Ten Dam, Geert, Vernooij, Fons T.J. and Volman, Monique. (2000). New learning in Social Studies. In: *New Learning*. (ed. Robert-Jan Simons, Jos van der Linden and Tom Duffy). ICO. Dordrecht / Boston / London: Kluwer Academic Publishers.
- Thijssen, Thomas P. T., Maes, Rik. & Vernooij, Fons T.J. (2001). Learning by Sharing:
a Model for Life-Long Learning. In: *Educational Innovation in Economics and Business VI*: (in print: ed.). Dordrecht / Boston / London: Kluwer Academic Publishers.
- University of Illinois. (1999). 'Teaching at an Internet Distance: the Pedagogy of Online Teaching.' *The Report of a 1998-1999 University of Illinois Seminar*, www.vpaa.uillinois.edu/tid/report, 07-02-2000.
- Vermunt, J. D. H. M. (1992). *Leerstijlen en sturen van leerprocessen in het hoger onderwijs: Naar procesgerichte instructie in zelfstandig denken*, Swets & Zeitlinger, Lisse.
- Vernooij, A.T.J. (1999). *A swot-analysis of 'Trade Company'. The educational structure of a management game*. Paper for the 6th Annual EDINEB International Conference in Bergen, Norway.
- Vernooij, Fons T.J. & Thijssen, Thomas .P.J. (2001). *New media and the role of teachers, A report on new practices at the Johan Cruyff University*. Paper for the 8th Annual Edineb International Conference in Nice, France.