Learning environments for the Net-generation learners

Working paper

J. (Joost) Robben *
A.A.M. (Ida) Wognum **
M.R.M. (Martina) Meelissen **

* Stoas Learning, Wageningen, The Netherlands
** University of Twente, Enschede, The Netherlands

E-mail: jrn@stoas.nl
E-mail: a.a.m.wognum@utwente.nl
E-mail: m.r.m.meelissen@utwente.nl

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Abstract

Based on a survey among 224 students of preliminary vocational education in The Netherlands, the present paper explores the use of digital media and webtechnology and the characteristics of Net-generation learners. Two developments in digital media and webtechnology have been taken into account: 1) virtual social networks and 2) multi-user virtual environments. These incorporate the general use of the internet, instant messaging, weblogs and gaming. Further data analysis provides insights into possible differences caused by e.g. Social Economic Status, gender, and educational track. Evolving on the findings, which have shown a high use of digital media and webtechnology, insights are given on the characteristics of Net-generation learners. Furthermore, this paper explores the design of learning environments based on concepts of networks of practice and communities of practice that make the most profound use of the digital media and webtechnology most used by Net-generation learners.

Key-words: Net-generation, learning environments, digital media, web technology, internet

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Introduction

Due to emerging developments in digital media and web technology, people are changing the way they communicate and access information. Unlike older generations, the currently youngsters are now growing up with these new media technology. This generation, often referred to as “the net-generation” (Tapscott, 1998), is therefore more profoundly changing than older generations. In addition, there is a fast growing disconnect with the use of digital media and web technology by the Net-generation in education and in informal learning and communication processes at home (Levin & Arafeh, 2002; Selwyn, 2006). Changes in communication and information seeking processes are therefore primarily caused by out-of school use of digital media and web technology (Levin & Arafeh, 2002).

The impact of these changes and the aforementioned disconnect is currently heavily debated in the field of education, but the research on this topic is still in its infant state. Publications on research of the use digital media and web technology by young people (Levin & Arafeh, 2002; Selwyn, 2006) describe students who perceive technology as having changed their ways of communicating and accessing information, but do not describe these changes in detail or go into the possible impact on learning environments. Another group of authors (e.g. Jones, 2002; Tapscott, 1998; Prensky, 2001) describe changes in communicating, accessing information and learning processes caused by the use of digital media and web technology. Although they argue for major changes in educational as well as corporate learning, they do not show empirical evidence to prove this argument.

This paper goes into a study on exploring the use of digital media and web technology by a specific target group of students. As described previously, the net-generation is changing because of the use of and reliance on digital media and web technology. The youngsters of this generation – so-called Net-geners - have different expectations, resources and skills primarily because of home use of these digital media and web technology. This study primarily focuses on this home use of digital media and web-technology and its implications for the design of corporate learning programs by the Netherlands Tax and customs Administration (NTA). This organization is currently experiencing an aging workforce because a relatively large number of employees are expected to retire within the next 10 years. Also, there is an expected shortage on the labour market on qualified workers for the upcoming years (CWI, 2005). Combined with an aging workforce this could lead to a strong competition for the next generation of workers, the Net-generation, on the labour market (Burke and Ng, 2006). Organizations, such as the NTA, are now facing the challenge to create a work and learning environment that is attractive to this new generation of workers.

Net-Generation

Due to emerging developments in digital media and web technology, people are changing the way they communicate and access information. In contrary to older generations, the currently youngsters are actually using these new media technology during their formative years and are therefore expected to be more profoundly changing their ways of communicating and accessing information (eg. Tapscott, 1998; Jones, 2002; McMillan & Morrison, 2006; De Haan, Van ‘t Hof & Van Est, 2006). Several authors have yet described this argument and provide us with a mix of terms for this “new” generation: Millenials (Howe & Strauss, 2000), Homo Zappiens (Veen, 2000), Digital Natives en Digital immigrants (Prensky, 2001) and the Net-generation (Tapscott, 1998; Oblinger & Oblinger, 2005). In the current debate on this topic in Dutch education, there seems to be a preference for using the term Net-generation (SURF conference 2005; ALT-C conference 2006; CVI conference 2006) as a description for this phenomenon. Therefore, the term Net-generation will be used in this paper.

By means of similar formative experiences and characteristics a distinction can be made between generations (Becker, 1993; De Haan et al., 2006; Van den Broek, 1999). This implies that if we can perceive a Net-generation, the emerging developments in digital media and web technology is a life-forming development for its members (De Haan, et al., 2006) as well as they share similar characteristics that differ from those of previous generations. Using these two concepts that distinguish a generation from another, the Net-generation can be defined as a generation which holds the following two aspects:

- shared formative experiences: the emerging digital media & web technology
- shared set of characteristics: new ways of communication and accessing information

An often heard critique to the argument of the Net-generation is that changing communication and accessing information processes caused by emerging developments in digital media and web technology could not necessarily be ascribed to one generation because also other generations get in touch with these new technologies. According to Oblinger and Oblinger (2005), the key difference, is that the youngsters of the Net-generation are actually surrounded by digital media and web technology and they are already using it at a very young age. Developments and experiences during the formative period in the life cycle, make these experiences having a greater impact than in other stages of life (De Haan et al., 2006). According to De Haan et al. (2006), the difference in use of digital media and web technology lies in what Net-geners are doing online and how long they are doing it.

Another aspect is that differences within the population of the Net-generation might exist. A study by Levin & Arafeh (2002) shows, that not all children have the right skills and knowledge to navigate the web effectively. This is partly because some do not have access to new media and web technology at home. 'Younger' members of the Net-generation also seem to have developed different skills than 'older' members of this generation (Livingstone & Bober, 2005).

In order to get an understanding of the concepts that distinguish between the Net-generation and other generations, an overview of the emerging digital media and web technology as a major formative experience is presented in the next paragraph. Later on, an overview of the literature on the characteristics of the Net-generation is given.

Emerging digital media and web technology

Various explorative studies for educational policy report on emerging digital media and web technology that are likely to have an impact on how people communicate and access information and will be off value for learning processes (Dede, 2005; Horizon, 2006; Owen, Grant, Sayers & Facer, 2006). These publications are more developed as explorative studies for educational policy. Emerging technologies and their value for the facilitation of learning processes are also discussed on various conferences (Educause, 2005; Alt-C, 2006; CVI, 2006; SURF, 2005). In conclusion to these explorations, a growing body of knowledge provides empirical findings on the application of the emerging digital media and web technologies in learning environments (e.g. Oravec, 2003; Steinkuehler, 2006). For the study presented in this paper, two developments have been taken into account that characterize the changing nature and use of digital media and web technology: 1) virtual social networks and 2) multi-user virtual environments.

Virtual social networks

The use of the World Wide Web is currently evolving from being a medium in which information was transmitted and consumed (Downes, 2005) towards a platform in which services are offered to the user (O'Reily, 2005). A desire to visualize, design and search through global social networks underlies these services (Boyd, 2005). Web services such as 'Hyves' (www.hyves.nl) and 'My Space' (http://myspace.com) are social network sites that provide people access to experts online and virtual communities of practice. These web services also often facilitate personal broadcasting, for example through tools for weblogging by means of which people can create weblogs. People are using weblogs to express their thoughts and ideas on particular subjects. These personal reflections are seen as a vital part of weblogs (Oravec, 2003). Weblogs provide the ability to not only express thoughts and ideas but also to discuss them through networks of using "RSS", a web feed technology which connects weblogs. Through this technology people can subscribe to a weblog and receive its content in a web feed format.

Virtual networks are also build and maintained trough the use of services for online communication. Instant messaging is the most used form of online communication, even more used than e-mail (De Haan & Van 't Hof, 2006). Chatting trough the use of instant messaging services can be characterized as synchronous communication, unlike weblogging which is a form of asynchronous communication. Instant messaging is a form of real time communication through which you can also see if contacts from your network, or friends list, are online. The use of the web as a platform for services is often referred to as Internet 2.0 or Web 2.0. There currently is a lot of debate on the use of the term "Web 2.0" (e.g. Boyd, 2005). Some even argue that it is just another buzzword or marketing trick (e.g. Siemens, 2006). The media regularly report on the extreme popularity of Web 2.0 services, especially among the youngsters of the Net-generation. Numbers and figures are, however, often collected for

commercial uses. It is therefore of concern to question the real use of these services by the Net-generation and their impact on students' learning processes.

Multi-user virtual environments
According to Kirriemuir and McFarlane (2004, p. 1) "Computer and video games are today an important part of most children's leisure lives and increasingly an important part of our culture as a whole". There has, however, been very little disciplined study on the use of gaming as a learning tool (Squire, 2002; Steinkuehler, 2006). Computer and video games are increasingly recommended for use in learning environments. Simulation games in particular are good for learning, as was argued by Gee (2005). These games are digital simulations of worlds that are 'played' in the sense that a player has a surrogate or surrogates through which the player can act within and on and that have 'win states'" (Gee, 2005).

A more enhanced version of the simulation games are the Massively Multiplayer Online Games (MMOG's). In these games, players connect trough the internet and start playing, communicating and learning with each other. Squire and Steinkuehler (2006) describe a MMOG as follows: MMOGs are highly graphical 3-D videogames played online, allowing individuals, through their self-created digital characters or 'avatars', to interact not only with the gaming software (the designed environment of the game and the computer-controlled characters within it) but with other players' avatars as well. The virtual worlds of a MMOG are persistent social and material worlds, loosely structured by open-ended (fantasy) narratives, where players are largely free to do as they please (Steinkuehler, 2005).

Many commercial games also have large fan sites. These are virtual communities in which game players organize themselves around their shared goal to develop expertise in the game (Shaffer, Halverson, Squire & Gee, 2005). Players interact with each other outside the game, using web 2.0 services to communicate and learn about a particular game. Not extraordinary, they even extend their online relationships to the real life and meet with each other face to face (Galarneau, 2005). Gamers also use web 2.0 services like MSN Messenger, an Instant Messenger (IM) service by which text messages can be exchanged to communicate and learn from other players. These fan sites form meaningful learning experiences (Shaffer et al., 2005) and are interesting objects for research as they emerge in out-of school contexts without a formalized curriculum or assignment from a central authority. Studying the learning processes that develop in this spontaneous way - coming from the intrinsic motivation of the learners, will provide us with arguments on how to design learning processes in educational or more formalized settings.

In Table 1 the two emerging digital media and web technology that are subject to the study presented in this paper are summarized, with their tools and applications.

Table 1. *Emerging digital media & web technology and their tools and applications*

Digital Media / web technology	Tools/ application
Virtual social networks	- Online networking services (hyves; myspace) - Online communication: MSN - Weblogging
Multi-user virtual environments	- Interaction in Massively multiplayer online games - Gaming communities/ fan sites - Online communication: MSN

The above described two forms of digital media and web technologies are considered to either already have changed or will change the way the Net-geners communicate and access information in the next two years (Dede, 2005; Horizon, 2006). For the years ahead also other technologies will have an impact. By time mobile phone connections can compete with the speed of wireless networks, they become an interesting device for access to information at any place and any time.

Net-generation characteristics

In the previous section, the emerging developments in digital media and web technology were described as they are seen as a major life forming experience that is of strong influence on the characteristics of the members of the Net-generation. However, the body of research on the characteristics of the Net-generation is still in its infant state. Many scholars (e.g. Brown, 2000; Oblinger & Oblinger, 2005; Tapscott, 1998) provide us with arguments about changing characteristics, but do not support their arguments with empirical evidence. Most empirical evidence that does exist, provides information about the use of digital media and web technology in terms of when, where and how (e.g. Levin & Arafeh, 2002; Selwyn, 2006). A few publications provide insight into empirical

evidence and their methods of research (De Haan et al., 2006; Eshet, 2004). In this section the dominant arguments from various scholars about the characteristics of the Net-geners are described. Also a reflection on these arguments through the use of the empirical studies is given.

Brown (2000) describes a set of four dimensions or shifts that describe the Net-generation characteristics developed through the use of digital media and web technology:

The first dimension is in *literacy*. According to Brown (2000), the Net-generation's exposure and familiarity with digital media has resulted in a new and digital kind of literacy. These youngsters are not only textual literate, but are also image and screen literate. The Net-generation is able to intuitively use a variety of digital media (Oblinger & Oblinger, 2005). Also, they are proliferated multitaskers because they often use diverse media at the same time and are able to quickly switch their attention from one to another. Also when Net-geners are surfing the web, they are working with multiple screens, communicating with different people at the same time using MSN and navigate the internet searching information. According to Brown (2000), navigation may well be the main form of literacy, which is a form of literacy beyond text and image.

The second dimension concerns *learning*. A preference for discovery or experiential based learning is emerging through the incredible amounts of information available through the web, (Brown, 2000; Tapscot, 1998). Most Net-generation learners prefer learning by doing rather than by being told (Oblinger & Oblinger, 2005). Tapscot argues that the new media helped to create a learning culture where learners enjoy an enhanced interactivity and connection with others. He calls this the shift from broadcast to interactive or experiential learning which shows up when e.g. gamers learn how to play a new video game. They learn by playing the game and communicate with others through fan sites and use of instant messaging services.

With the two shifts mentioned above, literacy and learning, a third dimension comes into sight, one that concerns *reasoning*. This is a shift toward a more constructive form of learning. Brown calls this 'bricolage'; the ability to find something and use it to build something you deem important. Being able to judge whatever you find on the web becomes critically important (Brown, 2000). Recent publications in Dutch media indicates that this ability or skill might not have been well developed by all youngsters as it is argued that youngsters rarely check whether the information they find on the web is actually accurate (Duimel & De Haan, 2007).

The final dimension as described by Brown (2000) has to do with a bias toward *action*. The Net-geners first try to do things themselves. If they experience any problems they contact a peer from their (virtual) social network and finally they consult a tutorial. Net-geners are used to do things at high speed (Prensky, 1998). When they receive an e-mail, they will reply almost instantly. According to Oblinger & Oblinger (2005) immediate reply is often more important than accuracy of the content of the message. Being action oriented and living at high speed brings an implication for the learning process of the Net-gener. It has affected the time taken for critical reflection (Prensky, 1998). This seems to be in high contrast with the Net-gener's preference for experiential learning, in which the process of reflection is so important.

Next to the mentioned four dimensions, Brown also describes a shift in the use of the technology which is "a shift from the use of technology to support an individual, towards the use of technology to support the relationships between individuals" (p. 20). Along with this shift, Brown argues, new social protocols will be discovered. Also Oblinger & Oblinger (2005) refer to the social aspects of the Net-generation. They argue that their *social nature* results in a preference to work in teams and use ICT to communicate peer to peer, for example via MSN or weblogs. The communities and social networks of Net-geners are physical, virtual and hybrid, which means that they find virtual interactions as valuable as physical interactions. Net-geners are emotionally open and use the web as a "social technology to reveal their feelings, to express their views, to meet new people, and to experience different cultures (Oblinger & Oblinger, 2005; p. 2.12)". Through the use of the web as a social technology, the term "social" gets into a different perspective. Some web services like "Friendster" or "Hyves" are calling a person in your contact list a "friend". The meaning of being friend in the real and virtual world gets mixed. Being a friend of a friend has also become acceptable (Oblinger & Oblinger, 2005). In Table 2 the digital age shifts that refer to the changing nature of the Net-generation, and describing Net-generation characteristics are summarized.

Eshet (2004) described 5 major digital skills which are required in order to become digitally literate, which show a high similarity with the digital age shifts as described by Brown (2000). It is however important not to assume that all youngsters have developed the above described characteristics and skills. Some youngsters might not have developed these characteristics and skills because of a lack of access to digital media and web technology, others because of a lack of interest or because they are just not able to. A study by Eshet and Hamburger (2004) on the presence of digital literacy skills amongst three different age groups revealed that digital literacy skills are not equally present amongst

all age groups. More importantly, the researchers warn that the notion of Net-geners all being more digitally literate than older age groups should be treated with care.

Table 2. *Net-generation characteristics (Based on Brown, 2000, and Oblinger & Oblinger, 2005)*

1. Literacy	Ability to 'read' rich media
	Navigation as new form of literacy
2. Learning	Discovery, experiential learning
3. Reasoning	Lateral stuctured reasoning.
	Bricolage and judgement.
4. Action	Immediacy is seen as important; action oriented
5. Social nature	Web is being used to maintain relationships between people

As the Eshet and Hamburger (2004) study show, youngsters (with an average age of 17) seem to excel in photo visual skills and branching literacy skills. These skills can be compared with what Brown (2000) described as the new digital kind of literacy i.e. being able to intuitively use a variety of digital media and being able to navigate through the non-linear, lateral structures of the web. These comprise primarily the first digital age shift as described previously. On the contrary, the Eshet and Hamburger (2004) study showed that the older aged participants performed better in reproduction and information literacy tasks. Reproduction skills comprise the ability to construct new meaningful knowledge from preexisting data. Information literacy entails the skills to judge the quality and validity of information. This is very similar to what Brown has described with the third digital age shift holding the concepts bricolage and judgment.

In his 2004 publication, Eshet added a new kind of literacy to his conceptual framework for digital literacy. This is a social-emotional literacy which is a compound of the other four literacy skills. In short, it entails the ability to 'survive' in – online - virtual social networks and multi-user environments such as described before in the section on emerging digital media and web technology. Next to this, it entails aspects as a willingness to share data and knowledge with others, the capability to judge information, abstract thinking and to collaboratively construct knowledge in virtual environments. The Eshet & Hamburger (2004) study did not reveal significant differences between the various age groups regarding the degree of social-emotional literacy, but the authors relate this to their lack of understanding in this concept. Eshet (2004) argues that in order to be social-emotional literate, one needs to have a high degree of information literacy and branching literacy. As youngsters perform to a lower degree on literacy skills, educators should emphasize on the development of these skills in order to help young learner to be socio-emotional literate. This argument corresponds to the conclusions of Ten Brummelhuis (2006) and Janssen and Hermes (2006) who argue for a major role for education to develop these skills with their students. However, studies among middle- and high school students in the USA (Levin & Arafeh, 2002) and secondary school students in the UK (Selwyn, 2006) have revealed a fast growing disconnect between the use web technology in formal learning (education) as compared to the informal learning and communication occurring during home use of these tools. In particular the UK study found that the primary reason for this disconnect does not lie in a lack of physical access on educational institutions, but in restrictions through regulations and content filters. The shared set of characteristics by the Net-generation, as argued before, is therefore primarily developed by out-of school use of digital media and web technology (Levin & Arafeh, 2002). This implies that research in this area should focus on out-of school use of digital media and web-technology.

Social aspects of learning

People increasingly communicate and access information through the use of digital media and web technology. In this process of harvesting, sharing and discussing information, people personalize information by adding meaning to it. Information becomes active knowledge by means of situating it in practice through the use of web-communities. This social -or relational view on knowledge has an impact on one's learning perspective. Studying the Net-generation's use of digital media and web technology for learning purposes is important to gain better insight into learning processes that are facilitated through the use of these technologies. This section reviews a small spectrum of the available literature on epistemology, notions of knowledge and connections with the social nature of learning. This is clarified by means of an elaboration on two world views, the positivist and constructivist view. Within these views, several cognition theories are explained. Furthermore, a connection is made between the constructivist view of the world and the Net-generations' use of digital media and web-technology.

Positivist view
From the positivist point of view, the world is seen as an objective reality, a pre-given state in which "the aim of the cognitive process is to create the most accurate presentation of this reality" (Harrison & Kessels, 2005; p. 142). The cognitivist view of knowledge is rooted in this positivist view of the world. It views knowledge as abstract, task specific and oriented towards problem solving (Von Krogh, Roos & Slocum, 1994). Learning is seen as acquiring knowledge by reshaping your personal view of the world through the assimilation of new experience (Von Krogh et al., 1994; Akkerman, 2006). Within the cognitivist view, knowledge, as the managers representation of the world, can be stored and retrieved in organization wide repositories or content systems that give organizational members a shared perception of the world (Von Krogh et al., 1994).

Constructivist view
The constructivist point of view perceives the world as an objective external reality; a not pre-given state (Harrison & Kessels, 2005). A powerful cognitive theory rooted in the constructivist view of the world is the autopoiesis theory. Originated in the field of neurobiology, autopoiesis theory was later on developed in the field of social science as a theory of knowledge of a social system. Autopoiesis theory views cognition as a creative act of bringing a world into being (Von Krogh et al., 1994). It views knowledge not as abstract, but as embodied in the individual. Or, as Brown and Duguid (2002) say: "knowledge entails a knower" (pg. 119). The autopoiesis theory makes also a clear distinction between data, information and knowledge. In this view, the mere storage and availability of knowledge in organization wide repositories as within the cognitivist view is not sufficient. (Digital) materials stored in repositories are viewed of as data. People create information of these data by not only retrieving it, but also discuss it and file it for later use (Von Krogh et al., 1994). Pieces of information are used to actively construct knowledge through a process of personalization and adding meaning to it.

Under the influence of Vygotsky's ideas, the social-constructivist and the socio-culture perspectives emphasize the social nature in which the construction of knowledge takes place. The two perspectives differ in their notion on where information processes are situated. The social-constructivist perspective makes a distinction between the learner and the environment, but the socio-cultural perspective sees the individual as part of that environment (De Laat, 2006). Also Akkerman (2006) outlines this specific situation of the socio-cultural perspective in a comparison with the cognitive theory, and notes that information processes are located in social interaction. The construction of knowledge is situated in social interaction, and might be found in work related learning networks as well as networks of practice and communities of practice. Networks of practice are networks of people who have a shared practice and knowledge in common. In most cases however, these people do not know each other (Brown & Duguid, 2002). Web-technologies have extended the reach of such networks, in which information can know be transmitted with higher speed to a larger audience of people. An example is a network of people established through the website "Wikipedia", an online –free of charge- encyclopedia. The content of this encyclopedia is produced by the members of the network; everyone who surfs on the web and wants to make a contribution. Communities of practice are smaller units within the networks of practice. These are small groups of people who work together and mostly know each other also in the real world. Communities of practice are emergent and evolve around a shared topic of interest. Within these communities, some members are core participants, while others act more peripherally (Brown & Duguid, 2002; Lave & Wenger, 1991). Whereas the learning that resides in networks of practice remains more static, communities of practice allow for rich creation of knowledge through collaborative learning activities between members. Social software or web 2.0 technologies make these rich collaborative learning activities also possible trough the web, thereby enhancing the range of such communities and the ability for people to form communities that don't know each other in the real world. Especially weblogs or blogs might be a great opportunity to create such networks and thereby facilitate the social construct of knowledge (Oravec, 2003; Du & Wagner, 2005).

Research questions

As was mentioned before, the emerging digital media and web technology can be perceived as a major formative event that shapes the characteristics of the members of the Net-generation. In the study presented in this paper, two major developments in digital media and web technology were emphasized: (1) the emerging virtual social networks and (2) multi-user virtual environments. Within both developments, special attention is paid to the rise of "web 2.0" services that are likely to have a great impact on ways of accessing and communication of information. This study does not focus on

learning processes that could reside within multi-user virtual environments, and more explicitly the multi player online games. Instead the study focuses on the use of web-communities that facilitate learning *about* games. In studying the actual use of digital media and web technology, the focus is on the home use of these tools. The underlying assumption is the perceived disconnect between the use of digital media and web technology at home, as compared to the use of these tools in an educational setting at school. This study also focuses on characteristics that are attached to the Net-generation as a result of their use of digital media and web technology. The social nature of the Net-generation seems to be a major factor in the use of digital media and web technology for learning processes. For this reason, this study focuses on social aspects of learning for which guidelines will be provided for the design of (work-place) learning environments that make the most profound use of digital media and web technology in order to fit with the characteristics of the Net-generation. In order to provide these guidelines, and based on the aforementioned information, two research questions are important.

The first research question is of a descriptive nature and runs as follows: What is the use of digital media and web technology by students of preliminary vocational education that are subject to the dual work and learning program? The aim is to describe what kind of digital media and web technology is actually used and where these media are used. A distinction is made between home and school use of digital media and web technology. Furthermore, this question focuses on how these digital media and web technology are used for the access and communication of information.

The *second research question* evolves on the findings of the first research question and goes into characteristics of the Net-generation. This question runs as follows: *Do students show net-generation characteristics as a result of their use of digital media and web technology?* The aim is to find a relationship between the use of digital media and web technology and the development of certain characteristics that are typical for the Net-generation and are supposed to influence learning processes.

Based on the findings of the two research questions and supported by the described theoretical exploration on the social aspects of learning guidelines can be developed that could be of value for the designers of learning environments for Net-generation learners in organizations such as the NTA as well as other organizations.

Method

Instrument

Data was collected through the use of a survey. The survey was presented to four institutions by means of two different delivery methods. To three institutions, an e-mail invitation was send to complete an online version of the survey. At one institution, the survey was presented on paper. All students in class were asked to participate in the study as part of their normal schedule.

The survey covered the main themes of the study and questions were also presented in the categorized order. The first two categories were presented to all participants within the sample. First, general questions were presented like ‘gender’ or ‘educational track’. The second category covered the access students have to ICT and also the general use of digital media and web technology. Students were, for instance, asked for their three most favourite websites. Of the categories instant messaging, weblogs and gaming, only the first questions were presented to all participants. These questioned the frequency of which the category is used, e.g. "How many times do you read weblogs or internet diaries from other people? A five point scale was used running from "never" to "multiple times a day". When participants responded "never", they were directed to the next category. Others, who responded to use the tool or activity of the specific category, were presented more in depth questions. These include e.g. "How many names do you have in your MSN contact list?" or "Do you read weblogs from people you know personally?" and "Do you ever visit fan sites or communities about games?" The last category of the survey was again presented to all participants and covered questions about participant’s life outside the use of digital media and web technology and participant’s position on different propositions, such as "Through playing online games, you make new friends".

The design of the survey was tested in a pilot session with 100 respondents at an institute other than the current four institutes. Comments or feedback derived from the pilot session were processed in the final design of the survey.

Sample

In the Dutch preliminary vocational education system (VMBO) there are four advanced vocational tracks students can choose in the last two years of their vocational study. The tracks differ from being more practice oriented to more theory based. The NTA was intended to start a work-learning program

with VMBO students from economic preliminary vocational educational programs in various tracks. Because the NTA is a national operating organization and their target group is thus spread over the entire country, three tracks of demographically dispersed VMBO-institutes were selected to participate in the study, based on their willingness to co-operate. The selected institutes and tracks are described in Table 3. The tracks differ from each other as track A being most practice oriented, track B combines practice and theory, and track C is most theoretical based. From each track various all third grade students with an emphasis on economic subjects were selected. Students within the sample (N=224) were all born between 1990 and 1992. Within the sample, 55% were boys (N=122) and 45% were girls (N=102), 32% (N=70) attends educational track A, 40% (N=88) track B and 29% (N=63) attends track C. Most students were classified to Social Economic Status (SES) 2 and 3, meaning that SES 1 is the lowest with 41 students (18 %), SES 2 is higher with 62 students (28%), SES 3 is middle status, with 76 students (32%), SES 4 with 34 students (15%) and SES 5 is the highest social economic status with 16 students (7%).

Data analysis
The data analysis is partly descriptive, partly explorative. For the part of the actual use of media and web technology, descriptive methods are used to find answers to these questions. In order to relate the found use of media and web technology to characteristics of the Net-generation, explorative methods are used. A literature review and the survey results are used to propose design principles for learning environments that make the most profound use of digital media and web technology and fit wit the Net-generation's characteristics.

Table 3 *Characteristics of Respondents in percentages of total sample (N=224)*

	%	N
Gender		
Boys	55	122
Girls	45	102
Educational Institute		
1	24	54
2	13	30
3	26	58
4	37	82
Educational track		
A	32	70
B	40	88
C	29	63
Social Economic Status*		
SES 1	18	41
SES 2	28	62
SES 3	32	70
SES 4	15	34
SES 5	7	16

*Average score on proxy for Social Economic Status (SES) "Number of books at home" from 1 = low SES to 5 = high SES.

Findings

The next section goes into the first research question on the use of digital media and web technology by students of preliminary vocational education that are subject to the dual work and learning programs. A summary is presented on the digital media and web technology used as well as a more in depth description is given on how these media and technology are used and how the web is being used to access information. Possible differences between variables such as gender, educational track and social economic status are also searched for, as well as the scores on home and school use of digital media and web technology are presented. The last section goes into the perceptions of the students regarding digital media and web technology. By means of these perceptions some insights will be given in respondents' so-called Net-generation characteristics.

Access to digital media and web technology
The responding students (N=224) appear to have access to digital media and web technology to a high degree; 96% reports to have access to a desktop PC and 40% has access to a laptop. Other mobile devices to which students have access to are mobile phones (87%) and to a smaller degree

the I-pods (33%). A little 9 % of the students have access to portable computers such a PDA's or Blackberries. The research only holds questions concerning the availability of these devices, so that they not need to be necessarily owned by the students themselves.

A majority of the students reports to have access to internet at home through a wired broadband connection, 34% has cable, 30% a ADSL connection (N=234). Wireless connections are much less integrated, 10% reports to have a wireless cable or ADSL connection. Also 18% of the students are not aware of what connection they have at their home pc.

Use of digital media and web technology

Table 4 provides an overview on the extent to which digital media and web technology are used by the students. The data show that the responding students are extensive users of the internet; they use the internet, on average, one to several times a day. Students make the most use of MSN messenger as a chatting tool. The extent to which students use MSN almost equals the frequency they report on making use of the internet. Games are played several times a week. There is significant difference ($p < 0.01$) between boys and girls. Boys play games at least once a week, while girls play game once or twice a month. A 47% of the students report that they read weblogs from other people. Girls appear to read weblogs significantly more often than boys ($p<0.01$). On average, boys read weblogs a few times a year, girls do this once a month.

Table 4. *Means (and standard deviation) for the use of digital media and web-technology, with means divided to boys and girls (on a scale running from 0=never to 5=several times a day).*

	Means *)		
	Total (sd)	Boys	Girls
Use of the internet	4,38 (.64)	4.36	4.39
Use of MSN to send IM	4,23 (1.03)	4.21	4.25
Playing games	**2,66 (1.70)**	**3.45**	**1.71**
Reading weblogs	**1,21 (1.51)**	**.93**	**1.55**

*) Bold values: difference between groups is significant ($p < 0.01$). Based on t-test for equality of means.

There are no substantial differences found among students of the four different educational tracks, in the extent to which digital media and web-technology are used. In terms of socio-economic status (SES), the use of digital media and web technology is equally divided, with the exception of the reading of weblogs for which a difference between groups of SES was found.

Favourite website

Students were asked for their most favourite websites. Figure 1 below represents the websites which were ranked as most favourite. Websites of which its main purpose is to provide services for social networking were categorized as such. These are regularly characterized by the ability for visitors to create their own profile on which personal information is expressed in forms of text, images or video. Through these profiles, visitors are able to connect with others. Most commonly social networking sites are http://www.PP2G.com, http://www.hyves.nl or http://www.fiestainfo.nl. The results show that 28% of these websites are categorized as ‘social networking sites’, and 24% as ‘information’ websites. These second most popular websites provide access to information. There is no subdivision between types of information in this category. Google is mentioned several times as most favourite website, but there are also several portal sites that could be used as a homepage in the browser from which use have access to all different types of information. The website http://www.msn.com is an example, but several students also mentioned their school institution's portal as their most favourite website.

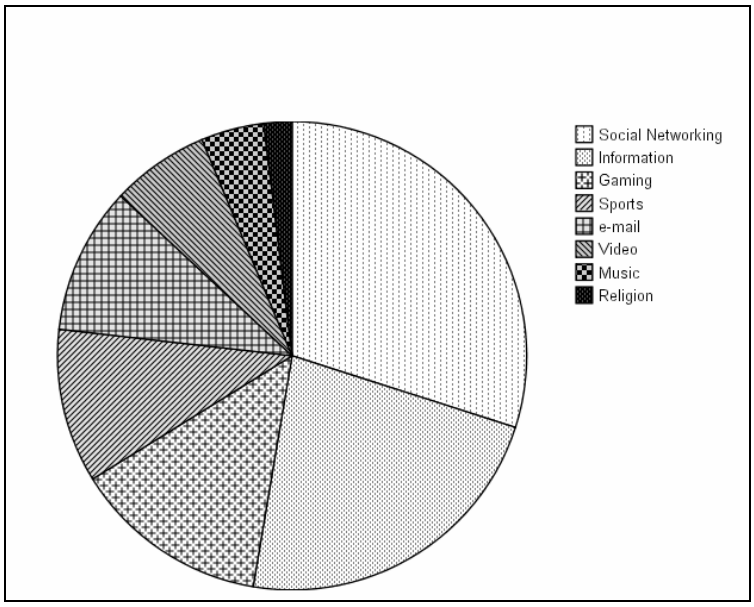

Figure 1. *Most favourite websites divided into categories*

Substantial differences are found in preference for certain categories between boys and girls (see Table 5). At first, girls are more likely to favour social network sites (57%). Also video sites and e-mail sites are more likely to be favoured by girls. Boys, on the other hand, also like social networking sites but there is a large difference when it comes to sport sites. 96% of the students who reported a sport site as their most favourite are boys. There is also a large difference for gaming sites; 90% boys. This difference with gaming is not the most remarkable as there is also a significant difference between boys and girls who are playing games.

Table 5. *Percentage of respondents' score for most favourite type of websites, divided by gender*

Type of website	**Gender**		**N**
	Boys (%)	Girls (%)	
Social Networking	43	57	62
Information	46	54	47
Gaming	90	10	28
Sports	96	4	22
E-mail	24	76	21
Video	29	71	14
Music	44	56	9
Religion	25	75	4

n= 207

Access to information

All students in the sample were asked how they use internet to access information. Although 99% of the responding 224 students report using the internet to search for information regarding essays or other school related topics, only 53% of the students use the internet on a weekly basis for this purpose. A minority of 17% reports using the internet to look for updates on the latest news on a weekly basis and an additional 15% on a daily basis; 42% report to never use the internet for this purpose. From this survey it is not clear whether other sources like newspapers or television are used to gather information on the latest news.

Almost all students (98%) perceive that they know how to use a search engine like Google to find information on the internet. A 71% of the students use the internet to find information about (continuing) education. A majority of 57% of the students reported that they never use Wikipedia to search for information. It is not sure if all respondents are aware of what Wikipedia is and if they really do not use it. When asked if students know how to write texts in a wiki, 83% reports to have never heard of it. The large amount of missing scores is also remarkable, 3% did not fill in this question. A wiki is the technology used within the internet encyclopaedia Wikipedia. When one wants to edit a

page in Wipedia this is referred to as "edit wiki". The suspected correlation between the (non) use of Wikipedia and the editing of wiki's could not be found.

Use of MSN

The responding students appear to be heavy users of MSN messenger for the purpose of sending text messages (98%). On average they report using MSN every day, even 50% report using MSN multiple times a day. There are no significant differences in the extent to which MSN is used by boys and girls. Most of the students who use MSN (90%) report that they use the messenger program to keep connected with friends and 67% also reports that they use it to plan their social activities. Students differ on using MSN to chat about school related topics, 42% reports to chat about homework. The MSN messenger also might be a good example of "multitasking". On average, the students report they are "mostly" chatting with several persons at the same time. A 44% of the students report to chat with more than 10 persons at the same time. It is not clear what the intensity or content of these conversations is. It also appears that students maintain a large network of (digital) contacts. On average students have around 200 contacts in their contact list.

Table 6. *Means (and standard deviations) of respondents' scores on the content of activities with the use of MSN on a scale running from 0=never to 3=always.*

	Mean (sd)	**N**
Block someone	.94 (.52)	219
Conversations with several people at the same time	1.91 (.92)	219
Send a link to a website	1.05 (.81)	219
Send pictures or documents	1.59 (.74)	218
Send music or video files	1.48 (.80)	216
Telephone or video conversation	.95 (.82)	216
Send a message to someone in the same room	.74 (.80)	217

Respondents' behaviour in using MSN also appears to be of a relatively social nature. MSN provides a functionality to block a certain contact. When doing this, the blocked contact is prevented to chat and see one's online status. On average, students report to "sometimes" use this functionality (SD =.51). There also seems to be a high degree of integrity while using MSN; 92% report to never make a fool of someone by pretending they are someone else. Also only 13% report using MSN to tell something they would not tell face to face. The latter does not indefinitely imply that students' behaviour could be characterized as 'social', but it does tell that digital environments seem not to be used as a façade in addition to communication in 'real-life' experiences. MSN is mainly used to chat with others through the use of text messages. The more advanced communication possibilities are being used at a minimum. On average, students report they sometimes use the telephone or video call functionalities (m=.95; sd=.8). This could be explained by the preference to chat with more persons at the same time and the fact that video or phone calls can only be made with one connection at the time. But no significant correlations between those variables could be found. Also the exchange of digital object through the use of MSN happens at a minimum size. Links to websites are transferred sometimes (mean = 1.1; SD = .8), while music and video files (mean = 1.5; SD = .8) and pictures and document files (mean = 1.6; SD = .7) are transferred a little more often. The students are almost never chatting with persons that are in de same physical room (mean = .7; SD = .8).

Playing games

A majority of the students who completed the survey appear to be regular gamers; 79% (N=224) reported that they play (video) games;59% of this group of gamers reports that they are playing games at least once a week. On average, students report that they unbrokenly play games for one hour a time. This research does not provide insights into the time spent by students on other media use such as watching TV.

Fan sites or communities about games on the internet are visited by 50% of the group of gamers. Girls are more likely to visit fan sites or communities than boys. Within the population of students who have reported that they play (video) games, 41% of the boys and 67% of the girls report that they visit fans sites or communities about games. Also a relationship can be seen between frequency of playing games and favourite websites. The more frequent students are playing games, the more likely they have ranked a website about gaming as their most favourite website.

Students were asked to report their top three of most liked games. These games were categorized into nine categories (see

Figure **2**). It appears that sport games are the most favourite for respondents (40%). Examples of these games are "FIFA 2007[1]" and "Pro evolution soccer[2]". Second are the action games (22%). Examples of these games are "Counter strike[3]" and "Call of duty[4]". All these four games have online multiplayer modes.

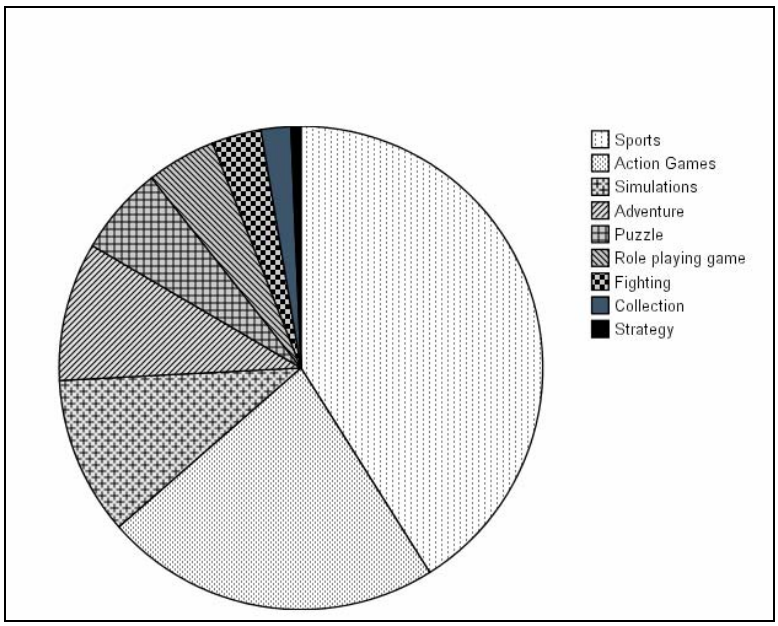

Figure 2. Most preferred websites, categorized

Weblogs

Weblogging appears to be an activity which is not as popular as the other activities questioned in the survey, 47% of the students (N=224) report that they read weblogs and only 15% of the students actually writes his or her own weblog. Girls are significantly more frequent readers of weblogs than boys. On average, girls read once or twice a month and boys a few times a year. The 15% of the students who reported that they write their own weblog were presented a few more in depth questions to reveal how this medium is actually used. In light of the size of this group (N=34), conclusions based on these results should be addressed carefully.

The students who are writing their own weblogs appear to do this on average a few times a month. Mostly they read weblogs from people they don't know in real life (91%). The content they add to their weblogs is mostly focused on topics the students like such as hobbies, music and movies. On average, the students write about this once or twice a month. Students write less often about personal experiences, they do this on average a few times a year. They hardly write about things they learn at school.

Environment of making use of digital media and web technology?

As table 7 reveals, digital media and web technology are used at home. Almost all students (94%, N= 224) report that they "often" use the internet at home. This is in large contrast with the use of internet at school of which 36% report to use the internet "often". Students ‘sometimes’ make use of the internet at someone else's home (mean = 1.1; SD = .5). Internet is almost never used at the library (mean = .2; SD = .4).

Table 7 *Means (and standard deviation) of students' perceptions on the use of digital media and web technology, on a scale running from 0=never to 2=often.*

	Mean (SD)	**N**
At home	1.93 (.29)	219

[1] FIFA 2007 is a soccer game which can be played at several game consoles as well as the PC. Online play of soccer competition is possible. See: http://en.wikipedia.org/wiki/FIFA_2007 or http://www.fifa07.ea.com/

[2] Pro evolution soccer is a soccer game which can be played at several game consoles as well as the PC. Single player and online multiplayer is possible. See: http://en.wikipedia.org/wiki/Pro_Evolution_Soccer_6

[3] Counter strike is a first person shooter game which can be played at the PC or Xbox and is an online multi-player game. See: http://en.wikipedia.org/wiki/Counter_strike

[4] Call of duty is first person shooter game which can be played at the PC, Mac or Nokia N-Gage. This games has a single player and an online multiplayer mode. http://en.wikipedia.org/wiki/Call_of_duty

At school	1.35 (.49)	220
At someone else's place	1.11 (.51)	221
At the library?	.18 (.41)	219

It seems unclear for a group of students whether they are allowed to use MSN at school. In general - and measured at all four locations - 83% of the students report they are not allowed to use MSN at school. At a single location, number 3, 28% of the students reported there that they are not allowed to use MSN at school.
(Video) games are mostly played at students' home (94%). Games are also played at a friends' home (65%) and a small group of 18% report that they play (video) games at school.

Perceptions on the use of digital media and web technology
Students were asked for their opinions regarding various statements. Table 8 summarizes the results for each statement. It appears that students' perceptions are not always very distinct among the sample.

Table 8 *Students' position on use of digital media and webtechnology, in percentages "agree" or "disagree"*

Statement	Disagree	Agree
By playing online games you make new friends	44%	56%
Youngsters who use the Internet to keep in touch with friends are having a better social life than the ones who don't do that via the Internet.	70%	30%
Most youngsters are careless with their personal information on the Web.	34%	66%
Youngsters waste a lot of time on the web, they should better do other things.	62%	38%
Gaming is addictive, youngsters should not play more than two hours a day.	51%	49%
It's OK to copy pieces of text from the internet for your own work.	27%	73%
If you don't learn how to work with a computer at a young age, you run behind to your classmates when you enter school.	41%	59%
The internet helps youngsters to perform better in school.	36%	64%

N=207

A small majority of 56% of respondents believes that through playing online games, you will be able to meet new friends. A minority of 30% agrees that when you maintain your social network online, you are to have a better social life than people who don't do that. This image on the role that digital media and web-technology could have to build and maintain your social network is a bit diffuse. It appears that students who are more frequent players of (video) games are more likely to agree that you are able to meet new friends through playing online games.

Regarding one's own privacy on the Web, 66% agrees with the statement that most youngsters are careless with their personal information. This is seen as an indicator of awareness of the dangers that come with an "online life". On the other hand, there is not a very large distinction regarding the perception on the time spent online, 38% agrees that youngsters waste a lot of time online and half of the response group agrees that gaming is addictive and should be limited to two hours a day. With the latter, there is a relation with the frequency of which games are played. Respondents, who reported to play games often, are more likely to disagree with the statement that games are addictive. It is also striking that a relatively large majority of 73% of the students believe it is allowed to copy pieces of texts from others for their own work. This could be explained in two ways. Youngsters on the one hand may believe it as normal to "steal" intellectual work from others, on the other hand this could also be seen as an indicator that students are willing to share their own information with others and therefore think it normal to take information from others as well.

Students are a little more distinct regarding their perceptions on the value of the internet for learning purposes. Whereas a majority of 59% agrees that if you don't learn how to work with a computer at home, you will lag behind classmates when entering the school period; 64% agrees that the internet will help students to do better at school.

(information will be added on Net-generation characteristics)

Conclusion and discussion

Based on an extensive exploration of literature, the emerging digital media and web technology are seen as a major formative event that has shaped or has been shaping the characteristics of the so called "Net-generation". The aim of this study was to investigate at first the actual use of digital media and web technology of students of preliminary vocational education as they are seen as members of the Net-generation and subject to a dual work and learning program of the NTA. Two developments in digital media and web technology were taken into account in this study as described in the literature part of this paper, i.e. virtual social networks, and multi-user virtual environments.

Use of digital media and web technology

The extent to which responding students of preliminary vocational education make use of digital media and web technology can generally be seen as very high or intensive. Data shows a wide adoption of digital media and web technology, and students were found to be adepts of the use of MSN to send instant messages and thus keep connected with others from their (personal) network. Students also make use of other ways to create and maintain there (virtual) social networks. A majority of them reported ‘social network sites’ as their most favourite websites. This confirms the image of these web services as being very popular. The results, however, do not provide insights into the use of these social network sites. It could be questioned if Net-geners are actively involved in online communities, as core participants, or act more peripherally. A recently published large scale study by Duimel and De Haan (2007) amongst students from all levels of secondary education in The Netherlands also confirms this image from the use of MSN as well as the use of social network sites. Duimel and De Haan report 95% of their sample using MSN and they found that students of preliminary vocational education are using MSN more frequently, and over a longer period of time, than students from other education levels. Duimel and De Haan also found a high adoption of social network sites. They report 42% of students of preliminary vocational education to actually have a personal profile at a social network site which also is a higher percentage as compared to other educational levels.

Remarkably low is the use and reading of weblogs as this tool is also frequently included in social network sites like "pp2g" or "hyves". This could be explained by the fact that communication with others through weblogs is asynchronous as apposed to the synchronous communication in tools like MSN and online gaming. Duimel & De Haan (2007) also reported a low use of weblogs and they relate this to a high degree of texts to be used in this medium. As opposed to Duimel & De Haan, differences between boys and girls in their use of weblogs were found in the study presented in this paper. Girls appeared to be more frequent users of weblogs. Maybe, this could be ascribed to the similarity weblogs have with ‘old-fashioned diary’s girls often use, although support ‘for this is lacking from the data

Computer and (video) games are also popular among the responding students, especially for boys. Boys appeared to be more extensive players of games then girls. This gender difference is also found by Duimel and De Haan (2007). These authors report a difference in gaming for students of preliminary vocational education as being more extensive players than students from other levels of vocational education. Data also showed that the responding students perceive games as most favourite games, and they like to play these online. This could indicate that they prefer to play with others instead of playing against a computer. This corresponds with respondents’ preference of using social tools like MSN messenger and visit social network sites. Respondents like to play sport games. This also is consistent with a high preference found for websites about sports. In contrast, role playing games appeared to not be very popular. This is surprising as these games are strongly built around elements of social game play. Fan sites or communities about games are visited by half of the group of gamers. From this research we do not know how many times these communities are visited and for what purpose. It would be interesting to gather more information on how students of preliminary education are using these sites as it could tell us more on how they learn to play a particular game. Overall, the results support the arguments of e.g. Oblinger & Oblinger (2005) concerning a high use of digital media and web technology by youngsters from the Net-generation. But ascribing this high use rate to all youngsters should be treated with care. Differences, for instance, were found between boys and girls. More research is needed into the use of digital media and web technology by VMBO students, and more specifically into how they integrate digital media and web technology in their daily lives. Publications of e.g. Duimel & De Haan (2007) also point to differences between various levels of secondary education. These authors describe students of lower levels as having a preference for entertainment related use of digital media and web technology. This high use of digital media and web technology could be interpreted as strongly socially related; entertainment could be part of it but the crux lies in building and maintaining relationships through the use of digital media and web technology.

Characteristics of Net-generation

As a high use of digital media and web technology was confirmed by the data, the second aim of this research was to investigate the impact of this on characteristics ascribed to members of the Net-generation. An indication of certain characteristics can be derived from the data.

The data confirmed the use of a variety of digital media and web technology by the members of the Net-generation as argued by Oblinger & Oblinger (2005). Also, there is some evidence that members of the Net-generation are multitaskers as they report to chat with several persons at the same time. Almost all respondents reported that they know how to use a search engine like Google for searching information. Herewith, we could say that navigation, as a main form of literacy is well mastered. We need to take in consideration that the current survey data does not give us in depth information on the use of digital media and web technology to discover any shared characteristics among the members of the Net-generation. We now know that a variety of digital media and web technology is used, but we don't know if this is used intuitively. We also know students' perception on the use of search tools like Google, but we can not say to what extent they really are effective in their search efforts. In order to provide a valid conclusion on the shift in literacy and an answer to the question if all Net-geners are really digitally literate, we need to conduct more in depth research.

The shift towards the use of technology to support relationships between individuals as argued by Brown (2000) can be confirmed based on the data. Throughout all reported use of digital media and web technology there is a clear preference for applications that can support the relationship between individuals. MSN messenger enables people to communicate with others; the most popular games within the sample are build on aspects of online gameplay with other gamers and rely heavily on the cooperation of gamers to succeed in a certain task. Students have reported a strong preference for social network sites in which they are able to create a distinct profile and connect and communicate with others.

The survey data has shown that members of the Net-generation expose a social nature through the use of digital media and web technology. Currently youngsters are intensive users of these technologies that enable them to build and maintain relationships or social networks. This does not imply that the new generation is more social then others. It shows that there is a generation which uses these technology very intensively and thereby creating new possibilities to build and maintain relationships. These findings are supportive to exploring new possibilities and their implications for the field of HRD or more specifically for the design of (virtual) learning environments for Net-generation learners. *(next to the following section, more conclusions and concrete suggestions based on these conclusions will be soon added).*

Within the constructivist view of the world, the difference between two perspectives were clarified; the social constructivist and the socio-cultural perspective. The main difference between these two perspectives concerns the origin of the construction of knowledge. The socio-cultural perspective argues that this originates from social interaction between learners in networks or communities of practice. It is interesting to investigate if this kind of processing also emerges within the social interactions that occur as people interact in virtual social networks. If this is the case, principles for the design of social networks could be used to build these kinds of virtual environments for the purpose of learning.

The social environments and tools investigated in this study are able to facilitate the kind of learning that resides in networks of practice, in several ways. A distinguishing feature of networks of practice is its loosely coupled character. Participants in such networks decide when and how they share their knowledge. whereas networks of practice are large and loosely coupled networks of people, communities of practice are smaller units within those networks of practice. Communities of practice can be situated in that (part of the) organization where the learner is active or employed, and networks of practice to extend beyond the borders of that (part of the) organization.

Environments or tools like social network sites, wiki's or blogs seem to have great potential to facilitate the participation in such networks or communities of practice. As the networks of practice it seems that learners should be free to choose their own ways to connect with others. As with communities of practice, there are more opportunities to design specific elements that facilitate learning at the workplace. It would then be tempting to argue just to use the environments or tools found in this study, or one of the many others that are used by youngsters world wide. However, these environments are used primarily in out of school settings and just implementing these environments in designed learning environments would be a mere technology based implementation. Therefore, a design for a powerful learning environment could be argued which facilitates learners to participate in communities of practice.

The low level of the use of weblogging tools and tools for the social creation of content like Wikipedia (wiki's) found in this study are a challenge for the design of learning environments, as they

seem to have great potential. Characteristic of these tools are that these are both primarily text based. Duimel and De Haan (2007) argue that students of preliminary vocational education are barely using these tools because of their text based design. But as technology emerges, opportunities for all users to create rich and interactive content increases. This can be seen at sites like e.g. YouTube, where users create short movies on topics of their interest. With a target group like the students of preliminary vocational education, designers could combine the strength of the design of these tools. This could result in reflectional weblogs build around (video) content placed at websites like e.g. YouTube. Next, the design could be made more powerful by adding possibilities for people to interact with each other by giving feedback to personal reflections from others. It is important to realize that the power of social environments on the web lies within its reach and thus giving people a chance to connect with others from all over the world. Designing virtual social networks for learning purposes and keep its reach limited to the borders of the physical (formal) learning environment would not give it the power to reach its fullest potential. When providing the ability for learners to connect with other learners or experts from all over the world, you enable them to build and participate from their communities of practice into global networks of practice. This open access to the web requires a view on learning where learners experience a lot of freedom, or as according to Harrison and Kessels (2004) "it may seem anarchic and threatening to those holding conservative notions of learning".

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