

**YOU04191**

## **Building a Profile of the Young Web-Based Learner**

Kirsty A. Young  
University of Technology, Sydney  
Kirsty.young@uts.edu.au

**Abstract:** The Web is a culturally valued cognitive tool with the potential to transform the learner in ways not yet recognised. Whilst the Web has proved to have significant impact on forms of communication and methods of distributing and accessing information, less is understood of how its unique characteristics may impact upon individuals – their approach to learning and the skills and attributes required to successfully participate.

In order to gain such insight through structured research an integrated theoretical approach to examining Web-based learning is presented in this paper. This integrated approach underpins a qualitative research study aimed at understanding more about learners as they participate in Web-based environments. This integrated theoretical approach to Web-based learning also enables analysis of this unique and complex environment by examining multiple elements - society, tool, activity and individual – thus permitting an in-depth exploration of the phenomena.

The study presented in this paper is a case-study of five competent young Web-users. It relies on research methods of observation, think-aloud protocols and post-activity interviews, which have been used to gain an insight into the learning taking place in Web-based environments. Initial analysis of these data has resulted in the development of a profile of the Web-based learner in terms of the learner 'roles' which are required and/or promoted in this environment. This paper will explore the theoretical underpinnings guiding the study, the research methods employed and the subsequent Web-based learner profile.

### **Introduction**

With computer technologies becoming ubiquitous, we live in markedly different times from those prior to this age of technological advancements. Children of the current generation in much of the developed world have known no other world than one which is dominated by these technologies. Research strongly suggests that the number of children and young adults using the World Wide Web (Web) is continually increasing. Current reports indicate that in Australia 58.5% of 12-14 year olds use the Web at home, 39% of 15-18 year olds use the Internet daily and 75% of 18-24 year olds have access to the Web at home or work (Pitman, et al., 2003). Similar trends are evident throughout the world with growth of Web usage at home by Britain's youth increasing from 45% in 2001 to 56% in 2002 and increased usage at school from 56% in 2001 to 71% in 2002 (Hayward, et al., 2002). The trend continues in the United States where 9 – 12 year olds have a recorded growth in their Web-based 'exploring' activities to 58% - up from 22% in 2000 (enGauge, 2003).

We have seen throughout history the development of technologies which then become culturally valuable to the societies in which they evolved. As each has come to prominence they have been researched to determine their impact on learners and learning and thus to determine their role in education. At present the Web is the latest technology being heralded to have the potential to significantly impact upon learning. Indeed, the NESTA Futurelab review of the literature related to informal learning with technology outside school, highlights the extent to which research in the area is moving to consider how technologies have “changed both the scope and the nature of this learning ... new kinds of skills, as well as offering different ways of learning traditional knowledge” (Sefton-Green, 2003, p. 4).

It is my belief that the characteristics of the Web-based learning environment are such that they will profoundly affect those who grow and develop as competent Web-users. This paper presents an overview of my current research study which is aimed at establishing a profile of the young Web-based learner. Analysis of the data collected in this research is currently being undertaken and it is providing some detailed insight into the learner and the learning which occurs during engagement with the Web.

In the first instance I will identify the role of the Web in education and society generally. I then move to outline the conceptual framework under which I am currently working. This includes an overview of the Web as a cognitive tool and the integrated theoretical position I have taken which incorporates Situated Cognition, Distributed Cognition and Activity Theory. The paper then concludes with a discussion of my findings.

### **The Web and Learning in the 21<sup>st</sup> Century**

As we have naturally progressed from the Industrial Age to the Information Age, learning outcomes have evolved to reflect changes in society. For instance, in the field of education we have come to appreciate that learning does not just occur during periods of formal education, but throughout one’s lifetime (Alheit & Dausien, 2002; MacKeaogh, 2002; Griffin & Brownhill, 2000; Field, 1998). Across much of the developed world

literature has also continued to emerge, detailing the competencies necessary for the lifelong learner in the 21<sup>st</sup> century. A clear example of such competencies is presented in the report of EnGauge (2003) 21<sup>st</sup> Century Skills for 21<sup>st</sup> Century Learners as shown in Figure 1 below.

<p><b>Digital-Age Literacy</b></p> <p>Basic, Scientific, Economic and Technological Literacies</p> <p>Visual and Information Literacies</p> <p>Multicultural Literacy and Global Awareness</p>	<p><b>Inventive Thinking</b></p> <p>Adaptability, Managing, Complexity and Self-Direction</p> <p>Curiosity, Creativity and Risk-Taking</p> <p>Higher-Order Thinking and Sound Reasoning</p>
<p><b>21<sup>st</sup> Century Learning</b></p>	
<p><b>Effective Communication</b></p> <p>Teaming, Collaboration and Interpersonal Skills</p> <p>Personal, Social and Civic Responsibility</p> <p>Interactive Communication</p>	<p><b>High Productivity</b></p> <p>Prioritising, Planning and Managing for Results</p> <p>Effective Use of Real-World Tools</p> <p>Ability to Produce Relevant, High-Quality Products</p>

*Figure 1: EnGauge (2003) 21<sup>st</sup> Century Skills for 21<sup>st</sup> Century Learners*

Many other such profiles are available, including those presented in the works of Oliva & Treelle (2002), Ouane (2002), Rychen (2002) and Trier (2002).

What is known, at this point in time, is that the Information Age is markedly different from eras gone by. This makes it unlikely that past understandings of learning will be sufficient to capture all facets of learning in the 21<sup>st</sup> century. What we do not have, at this point in time, is a sufficient understanding of what changes may be experienced by learners as a result of new technologies, particularly the Web-based learning environment. Indeed, until we have established, to some degree, a clear and socially shared idea of what changes may have occurred in the learning process and what new capabilities are required, we are limited in our attempts to provide learning experiences which aim to develop them (Lesgold, 2000).

Our changing conceptions of the desirable learning competencies for today's citizens can be considered to have occurred, to some extent, through advancements in technologies such as the Web. There are many facets of the Web which make it a unique environment, unlike any previously available. The Web has allowed an explosion of information to be

both distributed to, and readily accessed by, a wide audience. It has allowed global connections and given a voice to amateur and expert alike. Further, it comprises a range of design features which engage learners in markedly different ways from traditional sources and environments. Whilst discussion abounds on the likely effects of specific elements of Web-based technology on learning, there is little in terms of empirical research devoted to understanding the unique ways in which the Web might promote, impede, or fundamentally affect the way in which we learn and the development of related skills. I believe that without a research base which enables some insight into the Web-based environment we will be limited in understanding the abilities of, and difficulties faced by, learners who confidently engage in this environment during times of both formal education and leisure. Indeed, if one views the Web as a cognitive tool then, similar to cognitive tools which have gone before, such as writing implements, printed text and calculators, its impact on current and future generations of learners will be profound.

### **The Web as a Cognitive Tool**

Cognitive tools support one's cognitive powers during thinking and learning and these tools evolve as a result of the development of a society. Over time these tools become increasingly valuable within the cultures in which they are utilised (Reeves, et al., 1997). This process of both developing and valuing a cognitive tool is considered two-fold – as one masters the tool, the user or the collective group using the tool, subsequently affect the way it is utilised and further developed (McLellan, 2001; Brown, et al., 1989).

Further, it is held that effective use of a cognitive tool is not limited to mastery of its technicalities, but rather, involves engaging the tool to develop one's cognitive skills in conjunction with developing some awareness of the tool's impact on society (Rychen, 2002). Thus, a tool such as the Web is not just 'used' by the learner, but rather, influences and is influenced by the individual's actions – similar to other culturally developed tools of the past, it both reflects and affects human development (Glassman, 2001; Salomon & Perkins, 1998).

Although not the focus of this paper, I highlight the numerous aspects of the web which promote it as a unique tool which has the potential to significantly impact upon our current and future generations. These could broadly be categorised into six areas: (1) demands on human senses; (2) changes to communicative processes; (3) issues of information distribution, access and retrieval; (4) quality and quantity of available information; (5) changes to the research process, and (6) levels of interactivity and learner control.

I have positioned the Web as a culturally valued cognitive tool with, I believe, real potential to transform learning and, indeed, the learner who is a competent and regular user. In order to study this potential impact I was desirous to establish a strong theoretical position which would enable exploration and analysis of this complex and unique learning situation from many angles. During this process I was subsequently drawn to three theories and the integration of these theories underpins my work in this area. The three theories in question are Situated Cognition, Distributed Cognition and Activity Theory. In what follows I provide a brief overview of each of these theories, particularly highlighting their relevance to my current research study.

### **Conceptual Theoretical Framework**

This integrated framework evolved as a direct result of my desire to capture the complex nature of learning through several fundamental components – society, environment, tool, activity and individual, and more specifically to:

- (a) investigate the learning which occurs both intentionally and inadvertently as a result of Web-based activity;
- (b) identify whether young Web-based learners were acquiring or exhibiting skills which may or may not be recognised in the current literature on lifelong learner competencies.

While studies examining isolated components of the Web's design features are particularly prevalent in the growing body of literature, I consider it important that some of us shift our focus to examine the Web as it is currently utilised and valued by members of society. Similar to Fetherston (1998) I contend that a theoretical framework for studying learning within the context of the Web must have the power to examine both the social and cognitive components of learning and, I believe, the three theories presented here allow Web-based learning to be examined in sufficient detail. I hold that the theories of Situated Cognition and Distributed Cognition both provide vehicles for examining specific components of the Web-based environment, while Activity Theory allows the examination of Web-based learning in the broader context. Whilst there is obvious overlap between components of these three theories, each brings with it unique principles which, when integrated, provide a strong theoretical approach to examining Web-based learning. Additionally, I maintain that each theory, when considered in isolation, is insufficient to fully explain what happens in Web-based learning. This is discussed in what follows.

### *Situated Cognition*

Situated Cognition is discussed in the first instance because of its significant impact on my development of a research design which allows examination of the Web in its authentic and culturally valued state.

Under this theory, cognition is explained through the relationship between the individual and the situation in which he/she is performing (Barab & Plucker, 2002). It is held that the construction of one's knowledge is fundamentally influenced by the activities and context of the given communities, organisation and structure of one's society and that knowledge is thus bound by the materials and environments (ie. tools, rituals, physical spaces) that make up a culture (Griffin & Brownhill, 2001; St Julien, 2000; McLellan, 1996; Brown, et al., 1989).

The main attraction of this theory for me is its suggestion that effective learning occurs when it is situated in authentic activity. Authentic activity is defined under this theory as

ordinary practices of a culture – activities which promote the kind of cognitive processes engaged during the normal course of interaction, that is, ordinary people doing ordinary things (Grabe & Grabe, 2001; Brown, et al., 1989).

Taking account of this I designed a research study which specifically allowed each participant to identify a personally relevant use for the Web and determine their own Web-based activity goal/s. It is my strong belief that research studies today should avoid investigating participants' use of the Web in a prescribed manner, or limit their access to Websites and Web-features identified by a researcher. Instead, I believe we should encourage research participants to engage with the Web in ways similar to those which they engage during the ordinary course of their lives. This approach, I believe, is necessary if we are to understand how the use of a tool like the Web may fundamentally impact upon those who engage with it.

#### *Distributed Cognition Theory*

In addition to examining Web-based learning through the activity and goals under the situative approach it was also deemed necessary to specifically examine the relationship between learner and tool and Distributed Cognition is considered an appropriate theory to capture this aspect of learning.

Distributed Cognition presents a view of learning which posits that one does not possess knowledge as such, rather, knowledge evolves from a complex relationship between the tools, rules, values, artefacts and individuals making up a particular environment (Barab & Plucker, 2002; Looi, 2000).

An integral principle of the Distributed Cognition perspective is the belief that tools and artefacts play a fundamental role in changing the nature and the function of activity through which competent action emerges and, as a result, these changes affect conceptions of what, how and why one needs to know (Barab & Plucker, 2002). From this, I hold that culturally developed tools (such as the Web) can be viewed as forming part of the learner, rather than being viewed as an external aid.

This theoretical position has proved invaluable in providing me with a vehicle to examine the co-existent relationship between tool (Web) and learner. In the study currently being undertaken preliminary analysis of data under the Distributed Cognition perspective has enabled me to identify unique processes which exist between the learner and the tool. The incorporation of a distributive approach to learning has thus enabled fundamental elements of the learning environment to be explored with sufficient depth to capture the complexity of this relationship between learner and tool.

Elements from both Situated Cognition and Distributed Cognition are extremely useful in providing a foundation for examining specific components of the Web-based learning experience. However, I felt that the specific nature of these two theories is somewhat limiting in capturing the truly multifaceted nature of learning. Consequently Activity Theory was identified as a sufficiently holistic theory with an appropriately naturalistic emphasis to provide a framework for analysing the complex process of learning in a Web-based environment (Barab & Plucker, 2002; Ravenscroft, 2000; Engestrom & Miettinen, 1999).

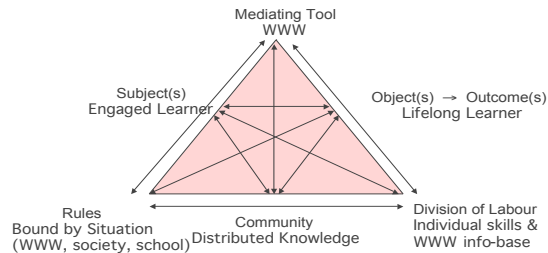
### *Activity Theory*

Modern Activity Theory originates from Soviet cultural-historical psychology heralded by Vygotsky, Leont'ev and Luria (Lim, 2002; Blanton, et al., 1997; Engestrom, 1989). Similar to the principles underpinning Distributed Cognition, cognition under Activity Theory is not studied as individuals' learning in isolation, with only their minds to guide them; instead, the emphasis is on individuals' learning with a wide variety of tools to assist them carry out goal-oriented activities (Blanton, et al., 1997; Kaptelinin, 1996). Further, and aligned with Situated Cognition, Activity Theory holds that learning emerges out of socially organised practical activity and tool-mediated activity that unites the mind with the real-world objects and events (Blanton, et al., 1997; Kaptelinin, 1996).

Activity Theory is most simply captured through the triangular figure which has been presented and adapted by numerous authors (Barab & Plucker, 2002; Blanton, et. al.,



1998; Engestrom, 1989). The application of Activity Theory to Web-based learning can be understood to some degree if one applies the traditional Activity Theory triangle to this situation, as shown in Figure 1.



*Figure 2: Application of Activity Theory to Web-Based Learning*

Here we see the interactive nature of learning captured through the relationships between the individual learner and the tool related outcomes, which are necessarily bound by societal rules, community and divisions of labour in which they exist.

In terms of Web-based learning, Activity Theory is considered to be an appropriate vehicle through which we are able to acknowledge that the relationship between human activity and cognitive tools can trigger changes in activities, curriculum and interpersonal relationships in the environment. Further, these elements are reciprocally affected by the very changes the technology causes (Lim, 2002).

It is certainly not claimed that a complete overview of the theories of Distributed Cognition, Situated Cognition or Activity Theory is presented in this paper. The intent has been to merely provide an overview of those components of these theories which have been invaluable in achieving my research goals and which I believe are appropriate to guide and structure further research in this area.

### *Implications for Research*

Given that interest in technology lies in numerous fields (for example, cognitive science, cognitive psychology, education, computer science and communication) no single research approach has to-date been universally accepted for examining the impact of various technologies (Fetherston, 1998). I have found, however, that application of the integrated theoretical approach presented herewith led to the development of a research design which enabled me to capture the Web-based learning experience in much of its complexity. I believe this design provides a useful framework for other researchers in this field and my research design and data analysis is presented in what follows.

### **The Study**

#### *Participants*

Five Grade 5 students from the Newcastle region of New South Wales participated in this study. Each child was selected to participate after completion of a questionnaire designed to ascertain their competence using the Web. This competence was demonstrated through questions related to Web-usage rates and a brief practical activity.

#### *Research Design and Methods*

As it was my intention to gain insight into learners in terms of both their thinking processes and the societal influences which bound their engagement in the Web-based environment, I was desirous of employing research methods that would capture evidence of both their overt behaviours and usually covert cognitive processes.

Further, as this is a relatively new area for research I also wanted to achieve an in-depth and descriptive account of the situation being studied. A qualitative approach was thus deemed appropriate to capture the depth required and I subsequently established a bound case in which to position the study.

Under the qualitative paradigm I determined the following research design and supporting methods as most appropriate to achieve my stated goals:

#### Phase 1

1. Questionnaire completed by potential participants to determine Web competency
2. Participants identify their own Web-based activity and goal
3. Video-observations of overt behaviours whilst participants undertake their chosen Web-based activity
4. Audio-taped think-aloud protocols collected whilst participants undertake their chosen Web-based activity

#### Phase 2

After analysis of data collected in Phase 1:

1. Follow-up interview questions to clarify issues and test emerging theories
2. Follow-up Web-based activities to gain further insight into issues and test emerging theories

#### *Data Analysis Procedure*

At the conclusion of individual sessions with each of the participants the audio-taped think-aloud data were transcribed. Following this, the associated video-taped observations were transcribed and integrated with the transcribed audio-data.

During this process of analysing the data collected in Phase 1 early themes began to emerge directly from the data. These themes roughly related to the elements of interest raised through the integrated theoretical underpinnings guiding the study. That is, data were broadly organised in terms of the relationship between learner, tool and the societal and cultural influences under which Web-based activities are bound.

The themes to emerge from the initial analysis of Phase 1 data were then set in place to be challenged and tested through analysis of data collected during Phase 2. Indeed, the data from Phase 2 of the study were subsequently found to enhance, modify or reduce the initial thematic codes.

The data produced through this process indicates that the methods described here have been useful in gaining insight into learners while they are engaged in Web-based environments. To demonstrate the value of this theoretical approach and research design for research into Web-based learning I present in what follows a brief overview of my findings.

### **Preliminary Findings**

As suggested above the integrated theoretical approach underpinning the study's design subsequently encouraged initial broad categories to emerge from the data which related to the following aspects of Web-based learning:

- societal and cultural influences
- the situation in which learning was bound
- goals and outcomes related to the situation
- activity undertaken by the individual participants
- the Web as a cognitive tool
- individual attributes of learners

From each of these broad categories themes began to emerge and in order to organise these themes it became apparent that a specific unit of analysis, from which to view the data, needed to be established. After trailing several approaches, it became evident to me that 'the learner' as primary unit of analysis would enable clear and logical presentation of the data. This approach resulted in three primary categories being established:

Participant Citizen  
 Tool-Mediated Citizen  
 Adaptive Citizen

These three categories reflect the principles captured through the theories underpinning the study and allowed me to examine the interrelated aspects of society, tool and individual making up this complex learning environment.

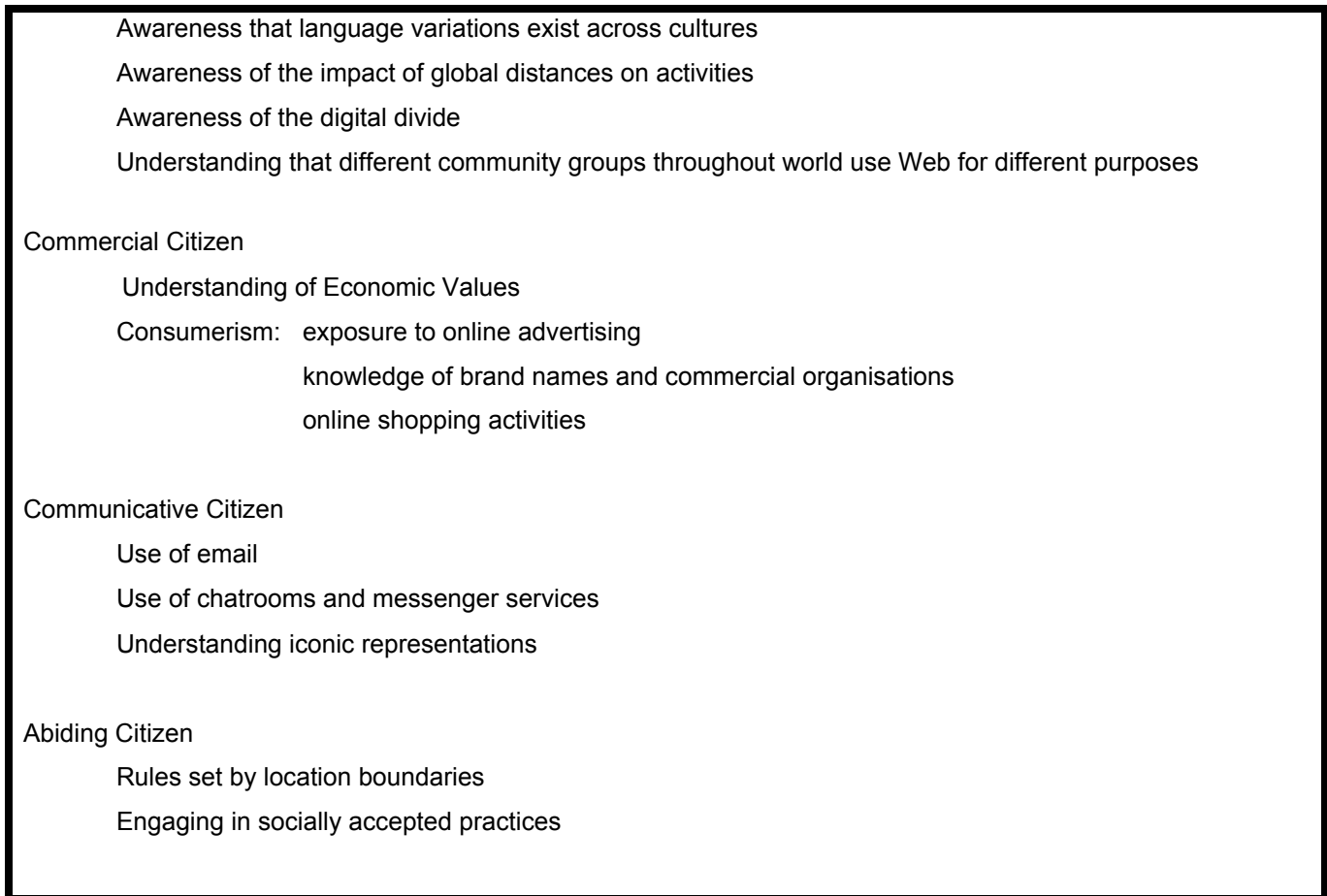
Each of these three primary categories has defining characteristics which were set in place through the secondary categories which subsequently evolved during data analysis. The primary categories and their associated secondary categories are shown below in Figure 3.

<b>Participant Citizen</b>	<b>Tool-Mediated Citizen</b>	<b>Adaptive Citizen</b>
Global Citizen	Technician	Efficient Worker
Commercial Citizen	Security Guard	Researcher
Communicative Citizen	Integrator	Director
Abiding Citizen	Design Analyst	

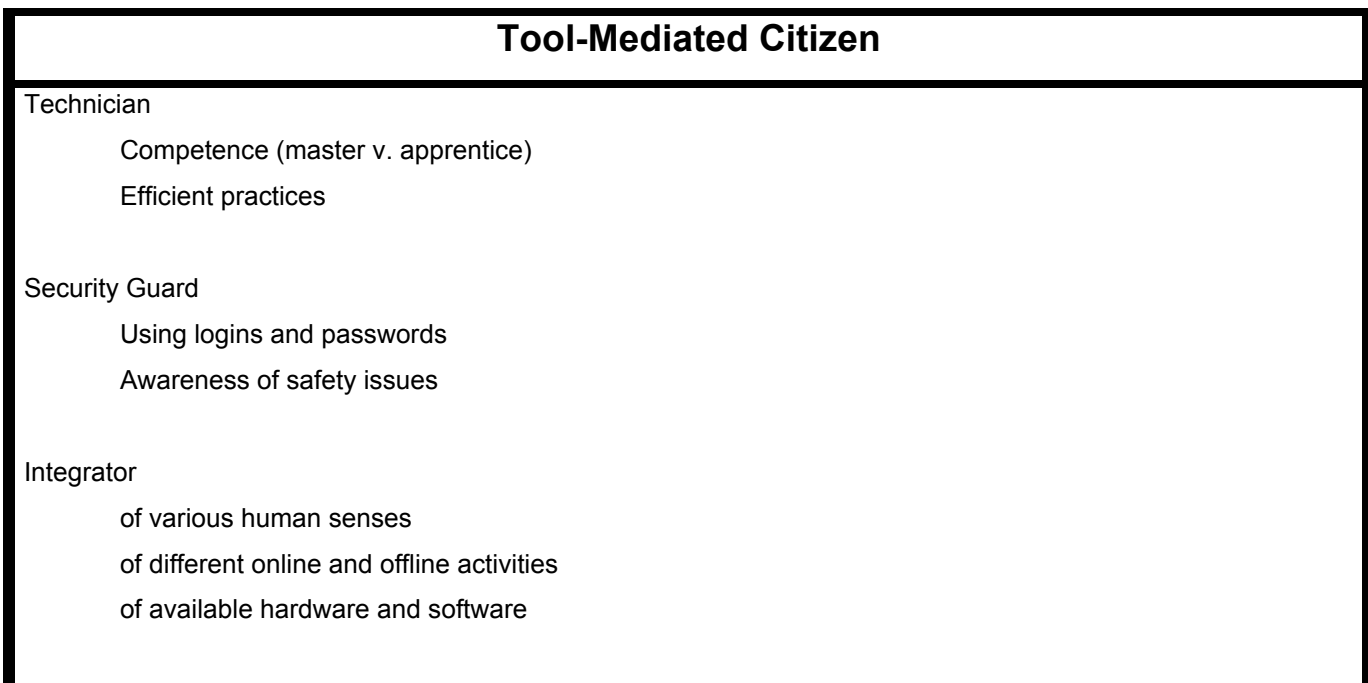
*Figure 3: Profile of the Young Web-based Learner*

From each of the secondary categories a more descriptive set of categories is used to present the findings. These descriptive categories are shown below in Figures 4 to 6.

<b>Participant Citizen</b>
Global Citizen Understanding of their community as part of Australia and Australia as part of the World



*Figure 4: Profile of the Young Web-based Learner: Participant Citizen*



**Design Analyst**

- Analysis of various Web site layout
- Interpreting displays and graphical representations
- Understanding of use and limitation of Web
- Understanding of skills and knowledge required or facilitated through Web usage

**Figure 5: Profile of the Young Web-based Learner: Tool-Mediated Citizen**

**Adaptive Citizen**

**Efficient Worker**

- Scanning for Key Words
- Skimming Texts
- Evaluating Material
- Automaticity in Responses

**Researcher**

- Search for information
- Navigate through sites
- Comparison of tools for purposes

**Director**

- Flexibility
- Persistence
- Focus
- Personal Preferences
- Self-regulation/Self-monitoring

**Figure 6: Profile of the Young Web-based Learner: Adaptive Citizen**

One of the most interesting aspects to initially emerge from my identification of these characteristics and roles has been the integration of these various learner characteristics and roles in different forms and to different degrees throughout the course of each participant's Web-based activities.

These emergent characteristics and roles are complex and many can be seen to represent multiple levels of learning if we consider learning in traditional forms. Over time we have built expectations of learner behaviour and experiences that facilitate learning. It is naturally difficult to depart from these notions of learning which are well established in the literature and in practice. However, the aim of this study was to examine the learner without placing labels on the perceived 'success' or 'appropriateness' of each learner's experiences. Given this, what is being analysed through the data is that which is actually occurring, rather than passing judgments or making comparisons.

Such example is evident if we look at the issue of Adaptive Citizen: Efficient Worker (see Figure 6 above). In the past, competence of action was generally claimed when a learner demonstrated both accuracy and fluency with a given task or situation. However, the concept of speed is somewhat different in the Web-based context. The speed with which the participants of this study performed was evident in numerous forms:

- scanning for keywords
- skimming text content
- interpreting displays and graphical representations
- evaluating material towards goals
- automaticity in responding to tool-related functions

It was ascertained by watching and listening to the participants that the speed with which they performed has evolved from their personal engagement in the Web-based environment. None of the participants has been formally instructed in how to work quickly on the Web – it has been a natural evolution. We must examine this issue, therefore, not from the perspective of our prior understandings of speed in learning, but rather trying to gain an understanding of how this speed affects learning in the Web-based environment and what impact it may have on learning outside this environment. If children are automatically responding rapidly in the environment it is not enough for us to merely evaluate how effective this skill is in their learning. Instead we must try to



understand how this technique has changed learning and what we, as educators need to do to facilitate growth and maximise experiences.

It has become apparent to me, as a result of this study, that if we are to truly understand and meet the needs of future generations we must broaden our pre-technological ideals of effective learner characteristics and situations and instead look at what students are doing in specific environments (such as the Web) to identify the potential and powerful differences. This, I believe, will aid us in our developing notions of how and why the future generation of learners build understanding and knowledge – without which we will struggle to facilitate their growth and development.

## **Conclusion**

My position throughout this paper presents the Web as a culturally valued cognitive tool. With the introduction of such technologies the nature of society in much of the developed world has necessitated changes in our views of learning and the learning competencies necessary to succeed.

To date, much has been predicted in the literature on learning in the 21<sup>st</sup> century. However, much of what is claimed evolves from our pre-technological notions of learning. It is therefore necessary for us to identify the learning characteristics of the new generation - rather than trying to fit them into a pre-existing mould. We must develop some understanding of differences which exist between past and future generations of learners and their learning environments. One small area in which we can begin to develop such understanding is, I believe, by investigating the learning behaviours of young students who are competently using technologies (such as the Web) in both their school and their leisure activities. This type of research will give us some insight into those whom we, in many research fields (such as student learning, societal change or technology), aim to understand.

This area of research is wide in its scope and fields of interest so I go further to say, we must not only examine authentic Web-based learning but we must do this in a structured and theoretically sound manner which is readily interpretable by a broad range of interested parties. What is needed, and what I hope is presented here, is an approach to examining learning in this situation – one which can be utilised in future studies to build strong and supported theory on Web-based learning and the learners who develop as confident, competent and regular Web-users.

### Reference List

- Alheit, P., & Dausien, B. (2002). The 'double face' of lifelong learning: Two analytical perspectives on a 'silent revolution'. *Studies in the Education of Adults*, 34(1), 3-23.
- Barab, S., & Plucker, J. A. (2002). Smart People or Smart Contexts? Cognition, Ability, and Talent Development in an Age of Situated Approaches to Knowing and Learning. *Educational Psychologist*, 37(3), 165-182.
- Blanton, W. E., Moorman, G., & Woodrow, T. (1997). Telecommunications and Teacher Education: A Social Constructivist Review. In P. D. Pearson & A. Iran-Nejad (Eds.), *Review of Research in Education* (Vol. 23, pp. 235-275): American Educational Research Association.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated Cognition and the Culture of Learning. *Educational Researcher*, 18(1), pp.32-42.
- EnGauge, (2003). *21<sup>st</sup> Century Skills for 21<sup>st</sup> Century Learners: Literacy in the Digital Age*. North Central Regional Educational Laboratory and the Metiri Group. [www.ncrel.org/engage](http://www.ncrel.org/engage)
- Engestrom, Y. (1989). The Cultural-Historical Theory of Activity and the Study of Political Repression. *International Journal of Mental Health*, 17(4), 29-41.
- Engestrom, Y. (1999). Activity theory and individual and social transformation. In Y. Engestrom & R. Miettinen & R. Punamaki (Eds.), *Perspectives on activity theory*. Cambridge: Cambridge University Press.
- Fetherston, T. (1998). A socio-cognitive framework for researching learning with IMM. *Australian Journal of Educational Technology*, 14(2), 98-102.
- Field, J. (1998). The Silent Explosion - Living in the Learning Society. *Adults Learning*, 10(4).
- Glassman, M. (2001). Dewey and Vygotsky: Society, Experience, and Inquiry in Educational Practice. *Educational Researcher*, 30(4), 3-14.
- Grabe, M., & Grabe, C. (2001). *Integrating Technology for Meaningful Learning* (3rd ed.).
- Griffin, C., & Brownhill, B. (2001). The learning society. In P. Jarvis (Ed.), *The age of learning: education and the knowledge society*. London: Kogan Page Limited.

- Haywood, B., Alty, C., Pearson, S. & Martin, C. (2002). *Young People and ICT 2002: Findings from a survey conducted in Autumn 2002*. Report to the DfES. NFO System Three Social Research.
- Kaptelinin, V. (1996). Activity Theory: Implications for human-computer interaction. In B. A. Nardi (Ed.), *Context and Consciousness: Activity theory and human-computer interaction*. Cambridge: MIT Press.
- Lajoie, S. P., & Derry, S. J. (Eds.). (1993). *Computers as Cognitive Tools*. New Jersey: Lawrence Erlbaum Associates.
- Lim, C. P. (2002). A theoretical framework for the study of ICT in schools: a proposal. *British Journal of Educational Technology*, 33(4), 411-421.
- Looi, C. K. (1999). A Learning Ecology Perspective for the Internet. *Educational Technology*, 36(6), 56-60.
- MacKeogh, K. (2002). National Policies on Cost-Effective use of New Technologies in Lifelong Learning. *European Education*, 33(4), 41-55.
- McLellan, H. (1996). 'Being Digital': Implications for Education. *Educational Technology*, 36(6), 5-20.
- Oliva, A. & Treelle, A. (2002). *Key Competencies in and Across Social Fields: The Employer's Perspective*. A paper presented at the Second DeSeCo Symposium, Geneva, Switzerland.
- Ouane, A. (2002). *Defining and Selecting Key Competencies in Lifelong Learning*. Paper presented at the Second DeSeCo Symposium, Geneva, Switzerland.
- Pitman, S., Herbert, T., Land, C., & O'Neill, C. (2003) *Profile of Young Australians 2003: Facts, Figures and Issues*. Melbourne: The Foundation for Young Australians.
- Ravenscroft, A. (2001). Designing E-learning Interactions in the 21st Century: revisiting and rethinking the role of theory. *European Journal of Education*, 36(2), 133-157.
- Rychen, D. S. (2002). *A Frame of Reference for Defining and Selecting Key Competencies in an International Context*. Paper presented at the Second DeSeCo Symposium, Geneva, Switzerland.
- Reeves, T. C., Laffey, J. M., & Marlino, M. R. (1997). *Using Technology as Cognitive Tools: Research and Praxis*, ASCILITE '97. Available: [www.ascilite.org.au/conferences/perth97/papers/Reeves/Reeves.html](http://www.ascilite.org.au/conferences/perth97/papers/Reeves/Reeves.html) [2002, 17 September 2002].
- Salomon, G. & Perkins, D. N. (1998). Individual and Social Aspects of Learning. In P. Pearson & A. Iran-Nejad (Ed.s), *Review of Research in Education*, Vol. 23.
- Sefton-Green, J. (2003). *Report 7: Literature Review in Informal Learning with Technology Outside School*. A Report for NESTA Futurelab.
- St.Juilen, J. (2000). Changing conceptions of human intelligence and reasoning: Implications for the classroom. *Australian Journal of Education*, 44(3).
- Trier, P. (2002). *Twelve Countries Contributing to DeSeCo: A Summary Report*. Paper presented at the Second DeSeCo Symposium, Geneva, Switzerland.