New Millennium Learners and Educational Performance

April 8, 2008

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I. Introduction

There is overwhelming evidence of the spread of digital technologies in OECD countries, but little is known about the effects of a digital lifestyle, or a life lived completely surrounded by digital technologies and services. Some researchers claim that digital technologies could be powerful transformational tools in classroom teaching and learning. Even commercial video games may have a positive impact on cognitive development and skills. These promising positions, however, must first be verified through data-based research and this is precisely the starting point for this two year project.

During the first year, available evidence from previous studies that focus on educational processes and results were synthesized and an alternative approach to the conceptualization of educational performance in a knowledge society was suggested. Research efforts were geared toward in-depth analysis of national as well as international research evidence and the convergence of various perspectives of multinational experts.

The following issues were clarified at multinational and national expert meetings:

- A wider definition of educational performance, including both traditional school-related competencies and other competencies linked to the emergence of a knowledge society.
- An updated synthesis of the effects of digital technologies on this wider concept of educational performance, addressing the relationships between:
    1. In-school use of digital technologies, and academic and non-academic results; and
    2. Out-of-school use of these technologies, and academic and non-academic results.
- Tentative tools to identify patterns of ICT use in school as well as out of school scales to measure a wider concept of educational performance by integrating future perspectives.

This paper presents briefly the conceptual framework of our research as well as the tools to

identify ICT use, and the scales to measure educational performance that have been developed and validated so far. These are our tentative measurement tools which will be further validated through expert meetings and field data. Feedback from international reviewers would be greatly appreciated.

II. Conceptual Framework

The framework indicates macro, meso and micro level factors that profoundly influence both ICT use and educational performance of New Millennium Learners (NMLs). This framework was generated as a result of the 2007 OECD expert meeting in Jeju, Korea and comprehensive literature reviews. ICT use and its impact on educational performance may be influenced by various factors such as personal attributes of teachers and students, and curriculum and teaching practices at the micro level. At the meso level, the school environment and its surrounding factors may affect the use of ICT in educational practices. At the macro level, ICT use and educational performance may be influenced by socio-cultural norms, economic forces and technological advances. This study will focus on understanding the effect of ICT use on educational performance at the micro level. With an awareness of complex phenomena in mind, the proposed research is planning to focus on a micro level and control meso and macro level variables as constant either by random selection or by setting research boundaries.

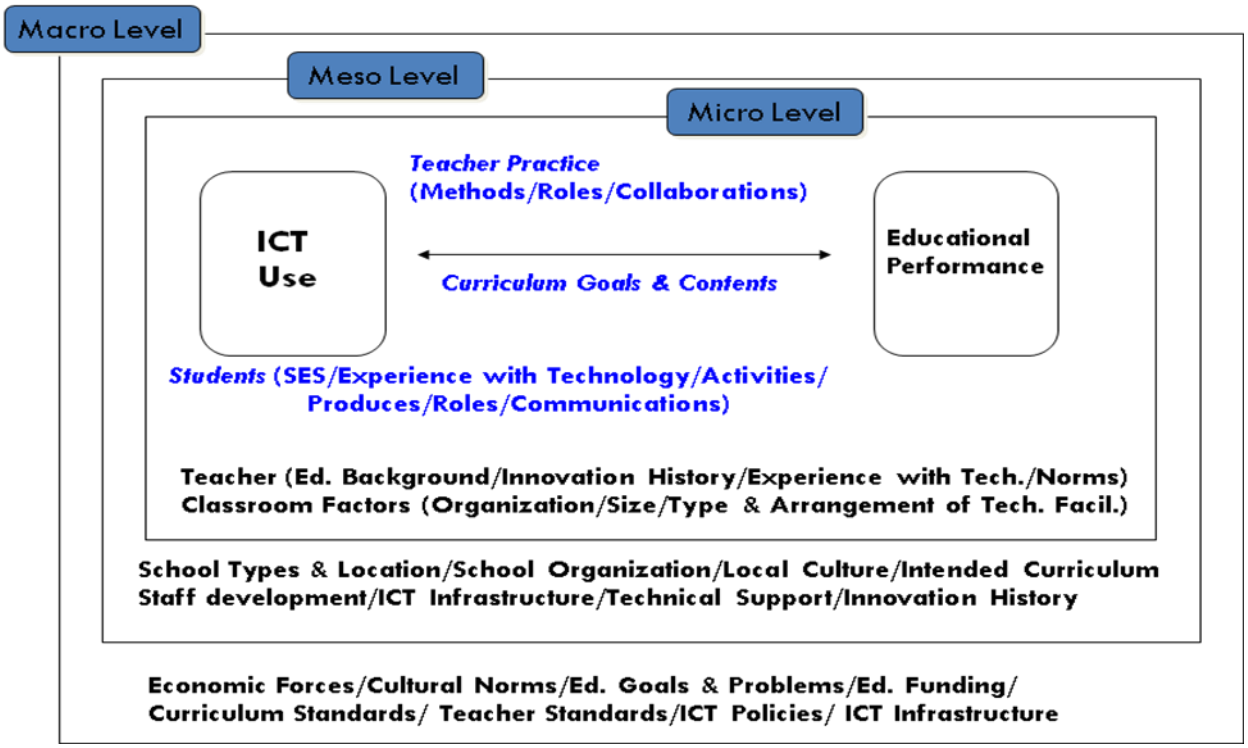

Figure 1 Conceptual Frameworks of ICT use and Educational Performance

III. ICT use

1. Taxonomy of ICT use

ICT is defined in this study as networked computer systems that can process and communicate information. However, stand-alone computers and portable devices, such as cellular phones, are included in ICT use as well. Individuals may use ICT in their daily lives, and their use may have a considerable influence on personal performance. The following three dimensions are employed to analyze the relationships between ICT use and educational performance.

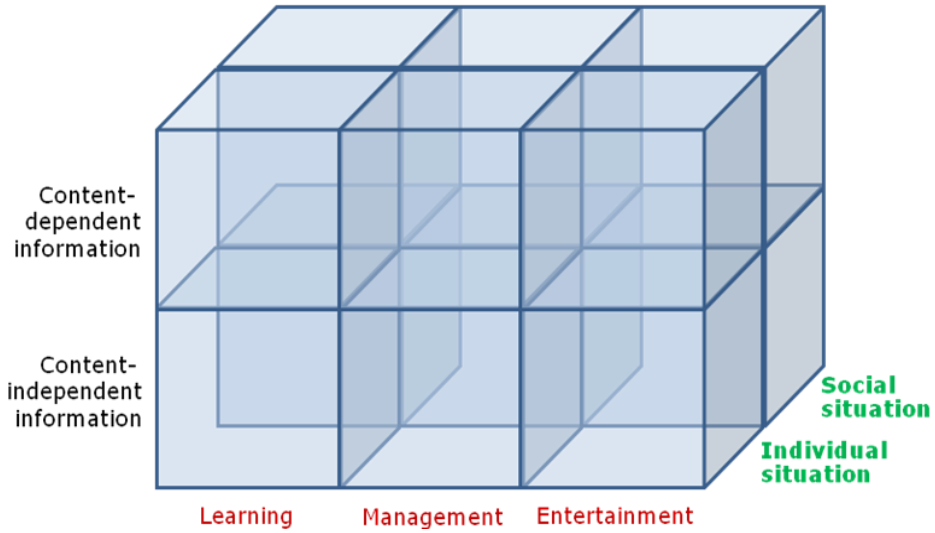

Figure 2 The dimensions of ICT use

The categories of the first dimension (x-axis) indicate a set of classifications for the purpose of ICT use and the intentionality of learning, which include learning, management and entertainment. Learners may use ICT for their learning processes, such as obtaining knowledge, solving complex problems and creating new knowledge. Experiences that learners have without any specific intention to learn may be categorized either as management or as entertainment. Management involves learners' use of ICT to classify and reorganize huge amounts of information. ICT also create new entertainment environments in which learners can socialize with friends and play games.

The second dimension (y-axis) includes two types of information that learners encounter through ICT, referring to school subjects. The processes of learning are inextricably related to the practice of education in formal educational systems in many cases, and more attention has been paid to using ICT for learning excellence in schools rather than outside of schools. Whether information is linked to school subjects is an important aspect of understanding the impact of ICT use in educational performance. Content-dependent information refers to the information that learners use for their schoolwork. For example, when a learner takes online lectures to prepare for a math exam, this can be classified as content-dependent information. Content-independent information, on the other hand, is defined as information which is less relevent to the content of school subjects, such as online information on a famous theme park for example.

The situations in which learners use ICT will be classified in terms of interaction among individuals in the third dimension (z axis). In an individual situation, learners use ICT in an

individual learning setting without collaborating with others. A social situation refers to a setting in which two or more learners use one computer together, or in which a learner works with friends to perform collaborative tasks online.

2. Development of a measurement scale

A measurement scale has been developed to investigate learners' ICT-based activities based upon this taxonomy of ICT use. A four-point scale with the response categories recorded as "Almost every day" (=4), "A few times a week" (=3), "Once or twice a month" (=2), and "Never" (=1) is used to assess the frequency of ICT use in different locations, including schools and other places.

Table 1 Measurement items for ICT use

Category			Items
Basic information			Learners' gender Personal experience with technology Average time spent using ICT Frequency of ICT use in classroom Available hardware, software and other devices
Taxonomy of ICT use			
Types of information	Types of experience	Features of environment	
Content-dependent information	*Learning*	*Individual*	Create documents
			Calculate numbers
			Plot graphs
			Search for information online
			Use multimedia data (e.g. graphics, video clips)
			Take on-line lectures for school learning
		Social	Engage in teamwork with peers
			Ask teachers questions via the Internet
			Ask experts questions via the Internet
	Management	*Individual*	Manage information and materials related to school learning
		Social	Share information and materials related to school learning with others

	Entertainment	*Individual*	Use educational games via CD-ROMs
		Social	Play online educational games
Content-independent information	*Learning*	*Individual*	Use CD-ROMs I am personally interested in
			Take online lectures according to my own interests
			Create new materials using on-line information
		Social	Use Internet search engines (for example, Google, Yahoo, Naver, etc.) or ask friends via the Internet when I have a question
	Management	*Individual*	Manage information on my favorite topics
		Social	Share information on my favorite topics with others
	Entertainment	*Individual*	Play games using CD-ROMs or other electronic devices
			Listen to music using an MP3 player
			Develop personal web pages
			Shop online
		Social	Play on-line games with others
			Participate in on-line communities (e.g. blogs, YouTube, Cyworld)
			Download audio and video clips via the Internet
			Meet friends on-line (e.g. chatting, email, SMS etc.)

IV. Educational Performance of the NMLs

1. The 2-Dimensional Taxonomy Model

A study on the educational performance of New Millennium Learners (NMLs) should consider future as well as established performance, which makes the level of complexity and vagueness of the study greater than that for traditional learner performance studies. We need a consistent and structured organizational framework that increases precision and, most importantly, promotes understanding of the complex phenomena of future-oriented educational performance. Taxonomy is a special kind of framework that seems to help us in this regard.

The study suggests a 2-Dimensional Taxonomy Model, which is composed of six cells in two dimensions: 1) Three Performance Domain Categories (cognitive, affective and socio-cultural) by 2) Two Behavior Levels (internal, external). This model utilizes the approaches of Bloom's Taxonomy of Educational Objectives and Krathwohl's Taxonomy of Affective Domain. It also puts more emphasis on socio-cultural aspects and less on psycho-motor aspects than other approaches.

The Performance Domain Dimension contains three categories: Cognitive, Affective, and Socio-cultural. These three categories are assumed to be mutually independent and, at the same time, to be critical to NMLs in the future. Traditional educational taxonomies emphasized cognitive categories with less, if any, emphasis on the affective and socio-cultural dimensions. As the world evolves into a more postmodern society, however, where multiple voices are heard, its citizens, the NMLs, should be experts in socio-cultural performance. The presence of ubiquitous computers connected by a global network will also accelerate socio-cultural dynamism.

These categories are assumed to lie along a continuum from internalized (or centripetal) behavior, to externalized (or centrifugal) behavior. The continuum underlying the Behavior Levels Dimension is assumed to be the orientation of performance; that is, Internal Competency is believed to be oriented more toward the learner themselves, while External Competency relates more to the world and others outside. In the new millennium, learners are expected to be more participatory and active practitioners who will contribute to the betterment of the community and the world. To live as active practitioners, learners should understand the cognitive, affective, and socio-cultural aspects of the world to make it a more livable place. Recent epistemological perspectives such as those of Leontev's Activity Theory and Lave & Wenger's Situated Cognition Theory also confirm this internal-to-external developmental orientation.

2. The Six Cells of the Model

A brief description of the Six Cells may help readers understand the Model.

① Cognitive-Internal Competency: Includes individual internal ability to select and gather information, and construct knowledge.

② Cognitive-External Competency: Cognitive-Internal Competency should be converted into useful tools to transform the individual's situated life-world. Problem solving in a relevant way can be exemplary C-P Performance.

③ Affective-Internal Competency: To live as an independent and mature member of many overlapping communities, a learner should have a set of internal values to recognize the importance of one's self as well as of others. Individuals should also be able to appreciate social norms such as the importance of honesty and integrity.

④ Affective-External Competency: Mature individuals are those who act in accordance with their own true values in both adverse as well as favorable situations. Self-efficacy, goal-setting and perseverance are a few examples.

⑤ Socio-cultural-Internal Competency: Future society will be more socially diverse so it's important that individuals tolerate and appreciate one another. This socio-cultural performance begins with open-mindedness toward uncertainty and that which is foreign. Also, members should be equipped with global communication skills such as foreign language proficiency and cross-cultural understanding.

⑥ Socio-cultural-External Competency: If one fully recognizes the presence of others and acquires communication skills, then one may be ready to collaborate with others to make the community a better one. Assuming pro-active roles, such as those of leadership, performing social services, and maintaining strong ties with others in a community can be some exemplary behaviors.

Table 2 Educational Performance 2-Dimensional Taxonomy

Type / Domain	Internal Competency (more toward the learner's internal construction of the domain)	External Competency (more toward the external application of the domain)
Cognitive	● Information managing ability (CI1): Collecting & selecting information (use of tools, use of resources, inquiry skills, the 3Rs) ● Knowledge construction ability (CI2): Constructing knowledge (information processing, reasoning skills, critical thinking)	● Knowledge utilization ability (CE1): Applying knowledge (analytic thinking skills, judgment & evaluation, solution generation) ● Problem-solving ability (CE2): Producing creative solutions (creative thinking skills, meta-cognition)

Affective	● Self-identity (AI1): Acknowledging the uniqueness of self (self-concept, self-esteem, self-image) ● Self-value (AI2): Setting up one's personal value system (mindfulness, credibility, honesty)	● Self-directedness (AE1): Having self-directed/active attitudes (self-efficacy, goal-setting, engagement, positive attitude toward errors) ● Self-accountability (AE2): Having proactive attitudes (initiative and perseverance, responsibility, tolerance for ambiguities)
Socio-cultural	● Social membership (SI1): Acknowledging the existence of community and his/her membership (social value system, sense of community, global citizenship) ● Social receptivity (SI2): Accepting others (multicultural understanding, respect and tolerance of differences)	● Socialization ability (SE1): Communicating with other members in a community (language fluency, ICT skills, communication skills) ● Social fulfillment (SE2): Assuming a proactive role in a community (leadership, performing social service, teamwork)

3. Preliminary Measurement Items on the 2-Dimensional Taxonomy

Below are the preliminary items that are assumed to measure each cell of the 2-Dimensional Model's components, the Six Cells. The subjects will provide the answers to each of the 4-Scale items.

Table 3 Preliminary Items Based on 2-Dimensional Taxonomy (Draft)

Code	Name of Construct	Preliminary Items
CI 1	Managing Information	1. When I study, I usually gather necessary information. 2. I know how and where to gather information. 3. I usually look up Internet sites or go to a library if I have questions while studying.

		4. I usually ask my friends if I have questions. 5. I get help from teachers or others to complete my assignments. 6. I know how to categorize various kinds of information.
CI 2	Constructing Knowledge	1. I often ask myself questions in order to understand the class content. 2. I usually draw figures or diagrams when I study. 3. I write memos on what I understood in a notebook or in the text. 4. I tend to rethink the context even after class. 5. In class, I tend to ask critical questions. 6. I try to gain a complete understanding during class even by asking my friends.
AI 1	Self-identity	1. I think I am a valuable person 2. I know my strengths and weaknesses. 3. I know I have unique characteristics. 4. I set goals and try my best to achieve them. 5. I am proud of myself. 6. I am aware of the areas in which I need to make a greater effort.
AI 2	Self-value	1. I have a role model. 2. I believe that there are more important things than money. 3. I do not tolerate any dishonest behavior on my part. 4. I try to keep my word even if it might be to my disadvantage 5. I believe that living honestly will bring success in the long run. 6. I respect public order, such as standing in line.
SI 1	Social Membership	1. I often feel a strong bond with my friends. 2. I trust my friends to help me get through things when I'm in trouble. 3. I usually get along well with my friends at school. 4. When I have troubles with friends, I tend to find a way out. 5. I am not afraid of being left out when forming teams in school. 6. I go to fun places with friends after school.
SI 2	Social Receptivity	1. I like to make friends from other classes in school 2. I can get along well with a student even though he/she may act strangely. 3. I am usually nice to a person who is bullied at school. 4. If a transfer student is of a different skin color, I am willing to be friends with her/him. 5. I might be able to make friends with students who speak different languages. 6. I know how to live with others in a multicultural society.
CE	Creating	1. I know how to make the right decision.

1	Alternatives	2. I try to apply what I've learned in class to real life. 3. I trust my decision-making ability in urgent situations. 4. I tend to question stereotypes, and look for alternatives. 5. I give critical opinions and share them using various tools like computers. 6. Sometimes I give critical opinions on solutions that my classmates come up with.
CE 2	Problem-solving	1. I solve difficult problems systematically. 2. I enjoy considering and making new solutions. 3. I often make creative solutions that no one can think of. 4. I am well aware of how to solve difficult and complicating problems. 5. I often read books and search the Internet to find out a new way to do something. 6. When I have a problem, I usually take steps to make a concrete solution.
AE 1	Self-directedness	1. I know how to manage my time efficiently. 2. I usually make an effort to complete all my assignments. 3. I try to avoid things I don't understand. 4. I am sure to get good grades if I try hard. 5. I tend to concentrate on the task I've decided to do. 6. I feel happy when I complete a difficult task I thought was beyond my ability.
AE 2	Self-accountability	1. I try my best to keep promises. 2. My teammates tend to trust me when I do team work. 3. I don't feel frustrated even if I fail. 4. I make the time to learn something that I've decided to learn. 5. Once I have an assigned task, I finish it even if I dislike it. 6. I usually submit my school assignments before the deadline.
SE 1	Socialization Ability	1. I know how to make myself understood through effective communication. 2. I find it difficult to speak frankly with a stranger. 3. I know how to explain my intentions to others. 4. I insist upon my opinion when I disagree with others' perspectives. 5. I am well aware of how to earn the trust of my friends. 6. I don't like dealing with complicating issues that result in someone's gain or loss.
SE 2	Social Fulfillment	1. In a group activity, I try my best to lead my team. 2. When making a decision, my friends tend to follow my opinion.

		3. I can work more efficiently with my friends than when I work alone. 4. I know how to conduct myself in an uncertain situation. 5. I am aware of what I should do to be a responsible person. 6. I know what is efficient when I work with my friends than when I handle the task alone.

IV. Further investigation

Table 3 shows the next steps of further investigation to achieve the goals of this study.

Table 3 Further investigation

Activities	Purposes	Timelines
Conducting expert reviews at a national and international level	To refine the conceptualization of educational performance, and validate the measurement scales of ICT use and educational performance	March 15, 2008 ~ April 20, 2008
Conducting pilot studies with 10th graders (15 years old)	To validate the measurement scales of ICT use and educational performance	April 30, 2008 ~ May 30, 2008
Conducting nation-wide investigation	To investigate the impact of ICT use on educational performance of NMLs	June ~ July, 2008
Analying and reporting		August ~ November, 2008