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Strategic Role of ICT for E-Education*

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〈목 차〉

Ⅰ. Changes in Educational Environment

Hammer(1990) observed that US firms had not improved productivity significantly despite extensive applications of information and communication technology (ICT). His point was well summed up in the title of his monumental paper, "Regineering Work: Don't automate, Obliterate." He claimed that firms failed to take a strategic advantage of ICT by simply automating their existing processes rather than reengineering them. His insight served as a wake up call to many US firms to use ICT as an enabler for new and innovative processes to gain not incremental but substantial productivity improvement. The same claim may be true for the education sector which lags behind the business sector in terms of applications of ICT for productivity improvement. The daunting challenge that today's educational organizations face is how to improve academic quality while containing or reducing costs. This paper discusses major changes in educational environment, ICT-based course improvement, and course redesign; explains some successful cases for course redesign, and proposes an e-education

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implementation strategy for an educational institution to use ICT strategically in order to achieve both academic quality improvement and cost saving together.

Let's look at three major changes in the educational environment that re-shape the future. First, Weiser and Brown(1996) predicted that ubiquitous computing would be the third wave after the first wave of mainframe computing, the second wave of personal computing, and a transitional wave of Internet computing. In a ubiquitous computing environment, convergence between digital devices - cellular phones, PDAs, MP3 players, smart appliances, etc. - enables instantaneous access to information anywhere, anytime, and any device. Second, Competition within the education market becomes intense since traditional educational institutions and newly emerging for-profit organizations compete with each other (White,2003). Furthermore, they are challenged by overseas counterparts. When the so-called 'brick-and-mortar' business organizations were threatened by their online counterparts, they started adopting the so-called 'click-and-mortar' operations. Education sector follows the same pattern by adopting ICT-based learning models like online learning and e-learning. Third, today's technology savvy students are good at shopping and comparing courses through the Internet. They demand more flexibility in terms of course offerings. They also require more personalized learning environments based on individualized learning needs and styles (Howell et al,2003). A 'Walmart' model in education is possible by switching from the traditional batch-based learning mode for mass production to a repetitive mode for mass customization.

Ⅱ. Course Improvement

Online learning programs are showing signs of substantial growth as resident students have begun enrolling in them (Carr,2000). Roach(2002) estimated "As many as half the students in online courses are from the traditional 18-to-25year-old student cohort who normally take campus-based courses." Zemsky et al.(2004) also found that more than 80% of online enrollment came from resident students in their survey institutions. As resident students begin to enroll in online courses, many institutions struggle to define who their online students are (Hickman,2003). Fairleigh Dickinson University(2005) in New Jersey became the first traditional university to require all undergraduate students to take at least one online course for every 32 credits. In contrast, a private university in Connecticut where we taught prohibits regular students from taking more than one online course per semester to circumvent cannibalism of traditional courses. Some universities offer Web-based online sections in parallel with face-to-face ones, allowing students to select based upon preference or convenience. In an extreme case, the University of Illinois at Springfield (Carnevale,2004) attempted to mirror all

classroom programs online.

Web technologies are also used to enhance learning activities in a face-to-face course. For instance, students may have access to all lecture notes via the Internet, take self-guided online exams, and/or participate in online discussions, do collaborative work within the context of a face-to-face course. Salter(2003) identified eight conditions for learning: (1) a learning environment rich in resources, (2) multiple representations of content, (3) authentic tasks and assessment, (4) active engagement, (5) opportunities for practice, (6) modeling of meta-cognitive strategies, (7) social negotiation, and (8) collaborative learning. After discussing the role that technology might play in enabling each condition, he advised that "We need to explore the ways in which we can use technology to meet our needs and be careful not to have our practices dictated by the available technology (Salter,2003, p.144)." For instance, Cappel and Hayen(2004) incorporated online courses offered by the Michigan Virtual University (www.mivu.org) into their traditional, instructor led graduate course as self-paced, independent study projects. It becomes imperative for instructors to learn how to take advantage of e-learning in consideration of its characteristics, critical success factors, obstacles, etc. (Choi,2008; Lee, Yoon & Hong,2008; and Lee, Ahn & Choo,2008).

Ⅲ. Course Redesign

Impact of ICT on the learning process has been

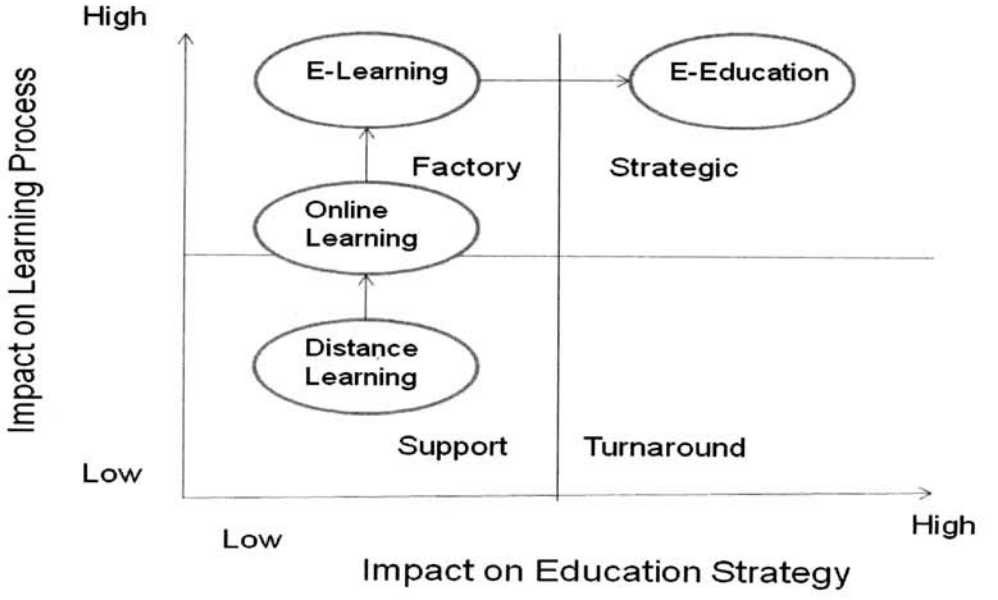

Figure 1. Impact of ICT on Education

growing, as shown in the Figure 1. ICT-related costs are typically treated as overhead in education like earlier days in business since they are not for revenue generation or cost saving but for quality improvement. Ever increasing ICT-related costs have partially contributed to the hike in college tuitions in recent years. Though an ICT-based course improvement effort through distance learning, online learning, or e-learning may enhance the learning process, it doesn't result in strategic competitiveness, which can be achieved only through course redesign - a radical change in a course (Wieman,2008). The goal of course redesign is to use ICT for strategic advantage. Rather than improving an existing learning process, learning activities of a course should be analyzed to find out what a human instructor can do better than ICT and vice versa. Carey(2008) points out that "The key is letting computers do what do best - grading multiple-choice tests, providing 24/7 access to text, audio, and video, connecting people to one another at a distance-while retaining the human element when only real people will suffice."

E-commerce transforms the mail ordering business model from a marginal player to the business mainstream (Tsang,2006). The core of e-commerce is a "fully-digital business" where all three components are digital (or virtual): (1) digital agents, (2) digital products, and (3) digital process in comparison with traditional commerce where all of them are physical. For instance, a customer who visits the Amazon.com website, searches for, downloads and pays for an e-book with an automated transaction and payment system. In this example, the whole transaction of buying the digital product is processed digitally by a virtual agent. The same can be done in education. When the National Association of State Boards of Education (NASBE,2001) set four goals of e-learning as "Any Time, Any Place, Any Path, Any Pace," e-learning can accommodate all but "Any Path" since it mainly focus on the learning process. Today's students grow up digitally with laptops, broadband speed, wireless connectivity, cellular phones, TiVo, DVR, iPods, etc. Increasingly, more and more contents become digitized and are made available through digital agents.

Im(2006) developed in order to accommodate all three components in education. In his e-education model, an area marked with 'P, P, P' represents traditional education where students receive education as service from an instructor in a face-to-face learning mode with physical materials such as books, transparencies, chalkboards, etc while the area with 'D, D, D' encompasses the core of e-education as a "fully-digital education" where students learn digitally from a digital (or virtual) instructor using digital materials such as ebooks, self-paced exercises, multi-media-based simulations, etc. Advancement in digital technology makes it easier for educational institutions to move toward the fully digital e-education. To make e-education work, simple conversion of physical learning materials into digital equivalents is not sufficient unless they become re-usable, sharable, and

compatible. The focal point is course redesign. Course redesign is a real challenge to make learning materials re-usable over semesters; sharable across sections, courses, and campuses; compatible over different devices; and interoperable over various course management systems (Haugen et al.,2006). Regarding digital contents, there are three main issues to be addressed by the academic communities: (1) intellectual property, (2) content development, and (3) compatibility. Who owns the copyright of developed course contents? The answer is still murky and unclear (Diaz,2005). From the economy of scale's viewpoint, it makes sense to share proven course contents across sections, departments, and campuses. It therefore becomes necessary to explore how to motivate instructors to share their digital contents with colleagues and how to make sharing easy.

In addition to internal sharing, instructors may also exchange online learning materials with outsiders through an open resource like the Multimedia Educational Resource for Learning and Online Teaching (MERLOT) at http://www.merlot.org. Blackboard Inc. (Komo TV,2005) added an enterprise learning object catalog to its widely used course management system so that educational institutions might allow instructors to store learning objects at a central repository for re-use and sharing purpose. MIT offers all teaching materials such as syllabi, readings, lecture notes, assignments, study materials for virtually all of its courses freely to anyone in the world through its OpenCourseware Web site at http://ocw.mit.edu (Vest,2004). Though these materials may serve as valuable resources, it is not easy to simply plug them into a learning process directly. The Advanced Distributed Learning (http://www.adlnet.org) initiated development of the sharable content object reference model (SCORM) (http://www.adlnet.org/scorm) on common specifications and standards for sharable content objects for interoperability among e-learning contents in various organizations across federal and private sectors. Courses may be developed more efficiently and effectively when more sharable learning pieces of content such as documents, images, multi media modules, and the like are available (Watson et al.,2005).

Ⅳ. Course Redesign Cases with Implications

Bottom-line conscious business organizations already achieved 40% to 60% cost

savings by switching to self-paced e-learning (Zhang et al.,2004). M.I.T. made a radical change in its introductory physics by replacing "the traditional large introductory lecture with smaller classes that emphasize hands-on, interactive, collaborative learning" (Rimer,2009). The National Center for Academic Transformation (NCAT, 1) supported course redesign "to take advantage of the capabilities of information

technology to transform their academic practices" and reported that "Most dramatically, all thirty institutions reduced their costs by 37% on average, ranging from 20% to 77%" while improving quality in its program through course redesign. Largely there are two ways to achieve such cost reduction. One way is to use self-paced units for certain learning elements such as exams and exercises. The other way is to build self-contained reusable lesson modules or objects that can be used across multiple sections, multiple courses, or even multiple campuses. Some redesigned courses sponsored by the NCAT (2) are shown, below:

Case 1: Web-Based Electronic Homework System Leads to Savings An electronic homework system developed by the Chemistry Department at the University of Massachusetts is used by over 2,000 students each semester. It eliminates traditional faculty-led recitation sections and hand-graded quizzes and results in substantial faculty and TA time savings.

Case 2. Colorado State University: Essential IT Skills Colorado State University has converted its College of Business' computer literacy course from a classroom approach to one that is "self-paced with milestones." Now, rather than offering seven lecture and 31 lab sections annually to about 1400 students, CSU students work through 80 hours of material, exercises and projects at their own pace using e-learning software and a textbook.

Case 3. Disaggregating the Curriculum The Department of Agronomy and Horticulture of the University of Nebraska at Lincoln offers crop technology one lesson at a time. The mini-lessons are actually exercises from a variety of courses that focus on the understanding of concepts.

Case 4. University of Mississippi: Geospatial Science The Institute of Advanced Education in GeoSpatial Science at the University of Mississippi develops a repository of dynamic online coursework for geospatial remote sensing. Now interested institutions can develop majors in these fields based on the repository of modules that can be used individually or combined as whole courses.

Traditionally, quality and cost are considered as two incompatible goals in education. The tradeoff effect between those two doesn't allow improving quality and reducing cost simultaneously. For instance, quality is compromised for cost reduction or vice versa. However, ICT-based course redesign makes it possible to achieve both as shown in the above-mentioned cases. An e-educational model can't be applied to all courses in view of different characteristics among them. For instance, freshman-level foundational courses are required for all students to take, thus being offered in many sections with multiple instructors. Since it would

be too costly to assign tenured or tenure-track qualitied faculty to teach these multi-sectional courses, less-paid, less-motivated, less-qualified instructors and teaching assistants are extensively staffed. Typical academic problems in these courses are lack of consistency in course objectives, inability to accommodate different student academic preparation and learning styles, inadequate student interaction with learning materials, a remarkable lack of uniformity in learning outcomes, a high rate of failures and drops, etc. An e-educational model that focuses on cost reduction would be the best choice for the foundation courses by switching most learning activities from an instructor-led lecture-based passive format to an ICT-intensive active self-learning one. On this other hand, an ICT-supplemented face-to-face discussion-oriented model is recommended for elective courses that are taken by upper-level students to improve quality. A hybrid model for core courses would be appropriate as a balanced approach to quality improvement and cost reduction. An e-education implementation strategy is developed and presented in the Figure 2.

V. Conclusion

The daunting challenge that today's educational organizations face is how to improve academic quality while containing or reducing costs. College tuitions have been going up much higher than

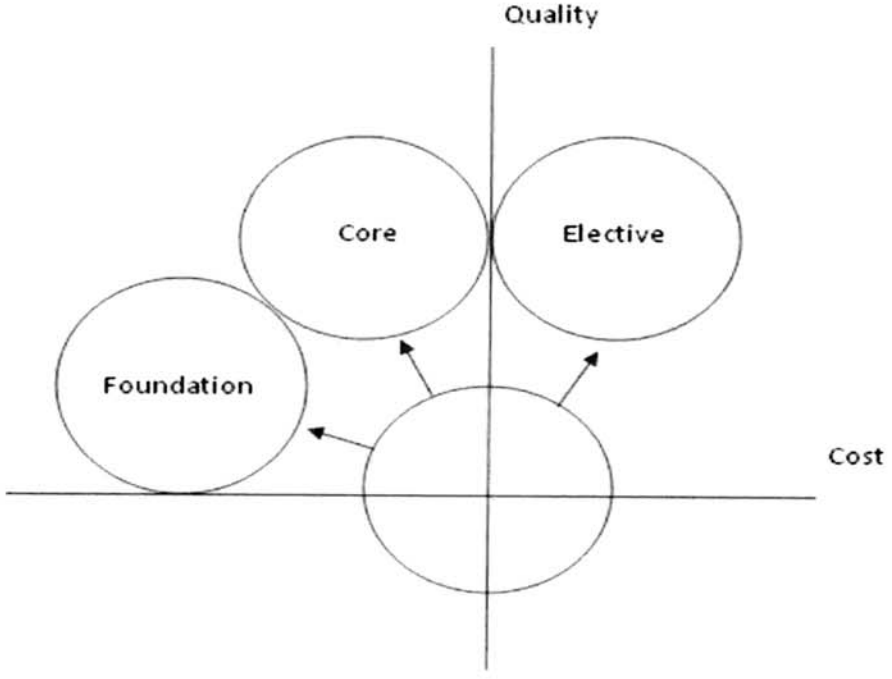

Figure 2. E-education Implementation Strategy

inflation rates. Ever increasing ICT-related costs have partially contributed to the college tuition hike in recent years. Like business organizations, it is time for educational institutions to think of using ICT strategically as an enabler for course redesign with an ROI-based e-education model. An educational institution may move toward e-education either reactively or proactively depending on how stake holders, particularly faculty, embrace such changes (Bates,2000; Maguire, 2005; Zemsky et al.,2004). The real challenge is how to respond to such changes in the education environment with strategic innovation by exploring new ideas and models (Drejer,2006). School administrators and faculty should take advantage of ICT not just to enhance the traditional learning process but to redesign the process itself for e-education in order to proceed through the uncharted territory ahead.

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임진혁(Jin-Hyouk Im)

미국 네브라스카 주립대학교에서 박사학위를 취득한 후 미국내 여러 대학에서 근무하였으며, 현재는 울산과학기술대학교(UNIST)에서 학술정보처장 겸 테크노경영학부 경영정보학과 교수로 재직 중이다. MIS Quarterly을 비롯한 여러 국제학술지에 21편의 논문을 발표하였으며, 주요 연구 분야로는 교육의 질 향상과 원가절감을 동시에 추구하는 e-Education과 e-Government/e-Community 등이 있다.

유상진(Sangjin Yoo)

서강대학교 물리학과와 경영학과를 졸업하였으며, 미국 University of Nebraska at Lincoln에서 MIS전공으로 Ph.D를 취득하였다. 그는 현재 계명대학교 경영대학 경영정보학과 교수로 재직하고 있으며, 현직에 오기 전에는 미국 Bowling Green State University에서 조교수로 근무하였다. 주요 관심분야는 IS/IT의 전략적 활용, 경영혁신, e-Business, 벤처창업과 성장전략 등이다.

<Abstract>

Strategic Role of ICT for E-Education

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The daunting challenge that today's educational organizations face is how to improve academic quality while containing or reducing costs. This paper discusses major changes in the educational environment and ICT-based course improvement efforts; examines some successful cases for course redesign, and proposes an e-education strategy for an educational institution to use ICT strategically in order to achieve both academic quality improvement and cost reduction together.

<한글초록>

모든 대학들이 예외없이 경쟁력 강화에 전력을 다하고 있는 현실에서 교육의 질 향상과 비용절감은 대학들이 당면하고 있는 긴급하고도 중대한 과제이다. 이를 위하여 본 논문은 변화하는 대학 교육환경, 정보통신기술(ICT)을 바탕으로 한 교육 개선 방법들, 그리고 교과목 개편의 성공적 사례들에 대한 기술을 한 후에 질 향상과 비용절감을 동시에 추구하려는 e-Education 실행을 위하여 어떻게 ICT를 이용해야 하는가에 대한 전략적 틀을 제시한다.

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