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学位論文の要旨

With the wide success of technology aids in distance learning, learning methods supported by Information and Communication Technologies (ICT) have been not only reshaping traditional classroom environments but also initiating many cooperative learning between countries. Through the Internet, institutions can enroll distance learners from different countries and experiences can be shared. Many prominent universities especially in developed countries consider online lesson as a part of their strategy to cope with increasing competition among them, and some counties have undertaken to transfer educational know-how to developing countries. Developing countries, on the other hand, are looking for a way to satisfy insufficient educational infrastructure and teaching staff as a means of coping with growing demand for higher education. Distance learning thus meets the desires of both developing and developed counties, and clearly enhances international exchange in academic cooperation. In this dissertation, international distance education experiences between developing and developed countries as Japan and Thailand are selected as case studies.

This dissertation attempts to analyze whether and how the original aims of distance education in a wider range as an international learning context are achieved during or after the implementation using rigorous statistical inferences. This dissertation is multidisciplinary in scope, representing the work of scholars across an array of fields including (1) course design based on learning performance of student and technological implementation aspects and (2) statistical analysis aspects. This dissertation draws some experiences from developing courses with international students and raises issues to identify the effectiveness of related components of instructional processes or course design and ICT utilization.

Many academic researches offered various kinds of course design or analyses based on technological capacities or individual instructional experiences rather than studying actual learning impacts on learners. This dissertation therefore aims at analyzing learning effectiveness by focusing on students' learning performances based on theoretical and statistical methods. In other words, prior to the implementation, a course design is planned in order to achieve the highest degree of performance by combining various ICT media and equipment as well as by designing course in selecting contents, instructional processes and teaching materials, for example. Regarding the international distance education, collaborative learning across different cultures should be tracked by international regulatory frameworks for quality standards and meet local/global educational needs.

The structure of the course which offers promising about the suitable role of learning and teaching process for both student and teacher sides is important. Constructivism principle, which focuses on how to organize learning process to construct higher learning achievement, is adopted to provide a set of guidelines to create learner-centered collaborative environments. Learning, however, is not simply the effective transfer of knowledge. The learning process requires clear understanding how well students access desirable knowledge. Bloom Taxonomy is applied to classification the learning outcome of students both for determining the learning objectives at each learning stage of course designing and for guideline a survey format to examine the learning outcome of students. Students' learning performances which promote effective learning outcomes: (i) comprehension; (ii) cognitive load; and (iii) motivation, are observed. Besides the learning preferences including cognitive load and motivation towards learning methods and ICT utilizing, the satisfaction towards ICT quality also asked. All survey data were collected by a reliable method namely classroom-assessment technique such as CATs. Moreover, a rigorous evaluating methodology is adopted in this study to identify the relationship of those related components with multiple sites. In chapter 2, the estimation aims to learning perceptions of students in each stage of the course (traditional lecture, self-learning and collaborative learning). OLS (Ordinary Least Square) estimation was adopted to estimate separately divided by countries and teaching stage. In chapter 3, the estimation in this part includes comprehension of students and other learning outcomes of a previous stage as independent variables. Panel data analysis methods, the random effect and fix effect models were applied to observe over a defined timeframe when each stages of learning methods were shifted into next learning stage. In chapter 4 and 5, the estimation aims to examine the effectiveness of the course by evaluating the perception

of students towards ICT utilization and learning environment. Learning outcome was set as a dependant variable, and ICT use and classroom setting components as independent variables.

The characteristics of this dissertation are found in the following points: (1) the effectiveness of not only ICT use but also course design is evaluated by rigorous statistical methods; and (2) practical recommendations for distance education are obtained. As for the latter, necessary components are identified and the new significant characteristics which are important to add into a framework for the international distance education are reviewed. Regarding the evaluating of learning impact toward the course design, the results obtained in this dissertation are (1) a single learning material does not meet the need of all participants particularly for those in different countries; (2) learning perceptions of Thai and Japanese students is strengthened in a more complex setting, such as self-learning and collaborative learning; (3) high quality of audio and images are important to students' learning outcomes. In addition, although ICT enhance communication in distance education to be more real-time, we found that the actual interpersonal communication of students in the same class affects students' learning outcome significantly. Thus, traditional communication methods, the intimacy of communication as in face to face communication should be considered; and (4) student show the difference in their decision making for selecting ubiquitous ICT tools and teaching methods.

With this evaluation methods allow us to verify the cause and problems related to the perception of students with accurate statistic results. This evaluation method will be of benefit in developing guidelines for prioritizing learning factors such as contents, materials and ICT media in distance education.

論文審査の結果の要旨

本研究では、日本とタイ国間での 3 つの遠隔教育実施例を取り上げ、ICT がその有効性に与える効果を受講生のアンケート調査から実証的に分析したものである。本研究の特徴は次の二つである。まず、遠隔講義の有効性を受講生の学習効果でもって測定し、それに対してコース・デザイン、教育内容、ICT、受講生の学習意欲等がどのように影響したかを統計的に厳密な手法で明らかにしたことである。さらに、統計的手法として、通常の OLS (最小自乗法)に加えて、パネルデータ分析という新しい手法を用いたことにある。

本研究は以下の構成となっている。

第 1 章の序論に続き、第 2 章では、日本とバンコクの中学校をインターネット回線を用いて接続し、コンピュータ・アニメーション・ソフトである MX フラッシュを学習する遠隔講義を取り上げ、受講生の理解の程度（Comprehension）は、講義内容の難しさ（Cognitive load)、受講生への動機付け（Motivation）によりどのような影響を受けるか分析した。また、日本とタイの受講生の理解にはどのような相違があるのか明らかにした。分析手法としては OLS を用いている。

第 3 章は、第 1 章と同じ遠隔教育事例を取り上げ、受講生のアンケートへの回答から、受講生の理解を第 2 章と同じ枠組みの中で、パネルデータ分析を用いて分析した。この分析の特徴は、遠隔講義のコース・デザインが受講生の理解にどう影響したかを検討できることである。この講義では、通常講義、自己学習、集団学習という 3 つの段階から構成されているが、日本人受講生は、前段階の理解が後段階理解に有意に正の影響を与え、コース・デザインは有効であると評価された。

第 4 章では、兵庫県立大学とタイのタマサート大学を結ぶ遠隔講義を例に取り、臨場感の点で通常講義に劣る遠隔講義が、ICT によりこの弱点がカバーできるかどうかを検討した。講義では、受講生の一人一人をモニターし、その表情から理解度を確認するチャット・システム（chat system）を用いた。同システムを用いた受講生とそうでない受講生の理解を比較することにより、同システムの有効性がパネルデータ分析により確認された。

第 5 章では、タイの高校と日本の高校 2 校を結び、各種のユビキタス環境センサーを用いて、受講生がライフログ・データを入力し、結果的にどれだけの環境負荷を削減したかを学習する遠隔環境教育を取り上げた。様々な環境センサーの利用がどれだけ受講生の学習意欲を高めたか、アンケート質問を元にパネルデータを用いて分析した。

最終章の第 6 章では、本研究の総括と残された研究課題を検討した。

現在パネルデータ分析は社会科学では一般的となってきたが、教育学では適応例が少なく、本研究は教育評価の分野で同分析手法適用の嚆矢となるものである。同分析により、これまで分析されてこなかったコース・デザインの有効性を評価したことが、本博士論文の新しい貢献である。

以上の観点から、論文は博士（応用情報科学）に値するものと認められる。