Technology-Dependent Digital Learning in the Future Environment

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ABSTRACT: *The last decade is characterized by digital technology infusion in many walks of life including learning. Realizing this potential the study is framed with the intentional of creating new technology learning. This study intents to apply digital technology and the creative pedagogy to the curriculum of college of commerce and management at technology universities, in order to stimulate students' learning interests, learning initiatives, and critical thinking skills. This project is a three-year research plan and currently only the first year of the project was permitted and under engagement. This study compiled the digital-media teaching materials in the field of business administration, corresponding with the requirements of two courses "Innovative Technology Management" and "Cultural and Creative Industries Management". The innovative pedagogy is applied to the two courses to achieve the main goal of developing student's problem-solving knowledge and abilities. The participants will be the junior students in the college of commerce and management at China University of Science and Technology. The two courses require students to download and preview the digital teaching materials from the WebDrive in advance of each class. There are activities of group discussion and achievement evaluation during each class to facilitate enhancing students' learning interests and learning effectiveness. Both group discussion and achievement evaluation are conducted once every three weeks and there are total six group discussions and six assessments in the 16-topic/week session. For course "Innovative Technology Management", the digital teaching materials cover topics of creativity theories and practices, commercial innovation models and innovative technology management. And course "Cultural and Creative Industries Management" developed teaching materials of 16 units, and also held a "project planning contest for local cultural roots" for the junior students to cultivate their creativity, integration and implementation capabilities.*

Keywords: Digital Learning, Innovative Pedagogy, Creative Thinking

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1. Introduction

The prevalence of the internet in the 21st century of knowledge-based economy has changed the living and learning ways of human beings. The traditional lecture method, which lecturer speak and students listen is no longer sufficient to copy with the

fast-changing industrial environment. To cultivate students with 'mobile' ability that means ability which will not be taken away after leaving classroom, not only employment ability but also critical thinking, creative thinking, and gain knowledge by utility use.

The National Science Council accepted the "*National Level Technology project of e-Learning*" on January, 2002. Then, 4 billion New Taiwan Dollars to be invested in this project for promotion within 5 years to facilitate educational engineering named "*e-Learning*" continuously. The goal of Ministry of Education on information and communication technology aid teaching and learning for students and teachers of junior high school and elementary school by "Teaching and Learning Resource Net" establishment project in 2003. The participants can share their curriculum design and experience of Grade 1-9 Curriculum Guidelines in this platform. The "*E Generation Talent Cultivation Program*" to be promoted into priority of National Development Plan by Council for Economic Planning and Development, Executive Yuan in 2008. The "*Taiwan Digital Archives Program*" to be compelled by National Science Council, and integrated running plan "*Taiwan e-Learning Program*". Thus, students' creativity inspiration to be promoted into priority of National Development Plan besides the "Taiwan e-Learning Program". Therefore, combined e-Learning and Creativity Education either rise citizens' personal quality or enrich the soft-power of a nation, yet become the backstage driving force toward economic development.

Based on the essential value of "*e-Learning*" and "*Creativity Education*", this study expecting to syncretize those two elements than gain double effects from a positive relationships of each other. Thus, technological and vocational talents can receive hole new learning experience from those events. In summary, the selected business administration field courses and then infusing digital technology and innovative teaching method was employed to cultivate students' knowledge and ability for problem solving when they are facing challenge or barrier.

This study established a three-year project named "*Research on applying digital technology to and infusing innovative teaching to courses of business administration education*". So far, only the sub-project of business administration course to be accepted and put into practice. The digital technology media instructions to be constructed and "*Innovative (Technology) Management*", and "*Cultural and Creative Industry Administration*" courses were developed in the first year. The three-year purposes of this study are described as following respectively:

1. Construct multi-media digital instructions for business administration education field.

2. Develop an e-learning performance assessment scale.

3. Produce Creativity Assessment Instrument.

4. Conduct digital instructions and innovative teaching in the designed business administration courses, yet the action research approach to be employed for materials and teaching methods improvement.

1. Literature Review

1.1 Fundamental Theories of Learning

Research has built a variety of learning theories. Of those, the learning theories of cognitive development and constructivism are relevant with the current research. The Theory of Cognitive Development treats schema as the fundamental unit for individual learning. Schema learns with the process of assimilation, and engages in accommodation when the cognitive adjustment is required [1]. On the other hand, constructivism emphasizes that the learning environments, the excellent teaching tools, and high quality classrooms are for the purpose of attracting student learning attention, and offering students more options of learning channels [2].

1.2 Digital Learning

The theories related to digital learning are situated learning theory, cooperative learning theory and interactive learning theory.

1.2.1 The Founding Theories behind Digital Learning

Situated learning was first proposed by Jean Lave and Etienne Wenger as a model of learning in a community of practice. Lave and Wenger [3] argue that learning should not be viewed as simply the transmission of abstract and decontextualized knowledge from one individual to another, but a socializing process whereby knowledge is co-constructed. Ghefaili [2] utilized the technological anchored instruction to build an environment where students would feel easily feel and take lessons when they

learn. The instructional purpose was to help students construct knowledge for problem-solving. Therefore, the paradigm of situated learning emphasizes the interaction between learners and learning contexts, and the interactive process among learners.4

The approach of collaborative learning was proposed by Johnson and Johnson [4]. They thought that only few people would succeed in the competitive time. The current demands in job fields would require cooperation [4]. Moreover, Chang and Lin [5] defined cooperative learning as a student-centered instruction which teaches by facilitating cooperative interaction among students. Therefore the current project in the domain of business management would accumulate student the relevant knowledge and absorb the designated chapters and topics in the curriculum by leading students to engage in cooperative learning and exert their own ability to understand their own learning duties.

Interactive learning theory posits that the cognitive processes within individual, as well as the environmental input, constitute the important factors for learning. Therefore learning behaviors, psychological process and environment interact with one another to generate the cognitive activities and learning behaviors [6]. To step into the domain of online education, the statement by Sun [7] had that "Online learning depend mostly on building learning community. The first priority of Internet instruction is to establish and demonstrate interactivity. Besides the interaction between students and instructional systems, it emphasizes the function more to the interactions among students or the interaction between instructors and students. " Moore [8] also categorized the interactions during distant learning into the three types. (A) The interaction between students and learning contents. (B) The interaction between students and teachers. (C) The interaction among students. The interactive processes also support accumulation of knowledge for students.

Based on the theory above, the current research would apply digital technologies in every curriculum based on interactivity. The interaction among students and the interaction between instructors and students would be carefully implemented.

1.2.2 The Tools for Digital Learning

The current research is scheduled to apply the several materials and tools for digital instruction: Distant Education Devices, Electronic White Board, Digital Pens, and Cloud Computing Devices. The existing resources in China University of Science and Technology would support this plan. The resources of external videotaping support recording of MOOCS curricula. The instructors will use the projectors to load the educational materials on the water-blackboard in the studio, and also perform come chalk writing. The existing resources will also support self-videotaping. Self-videotaping would be achieved by loading power point slides with vocal instructions. To record the materials into storage, the EAR system will be able to support the mission. Any information which can be delivered via single-lens projector can be taken and burned into the disks for the online platform to share.

Within the scope of the current project, the students who would join the business management curricula will have the access to the above educational services. Also, China University of Science and Technology will serve electronic white boards, magic pens, and cloud devices for the student learning.

1.2.3 Flipped Classroom

The concept of flipped classroom originated in 2007. Bergmann and Sams suggested the advantages of flipped classroom in the seminar. Flipped classroom developed the learning attitude of taking responsibility, learning according to individual pace, and provides the opportunities to share inquiries about confusing knowledge. The instructors answer questions to individual students online in the system of flipped classroom.

The current research project will take students in China University of Science and Technology as the potential participants. China University of Science and Technology has the existing resource for distant instruction, and it can apply to recording the multi-media films which are for education of business management.

1.2.4 The Internet Instructional Platforms

Chang and Tang [9] state that instructional web-sites have provide the learning contexts which are highly interactive, in order to shape the mutual learning experiences for each learner. The learners would thus foster the sense of community, and this would define the educational success. Sang [10] compared the effectiveness of math learning attitude and learning achievements of the two groups of students who either participated in "*Uncle Chang Internet Information-fused Curriculum*" or "*Traditional Tool Instruction*". Sung found no difference in learning achievement across both groups of students. However, the students who took "*Uncle Chang Internet Information-fused Curriculum*" showed the significant improvement in math learning attitude.

Therefore, when the current project establish the instructional web-sites and supervise carefully, the learning attitudes of students who take the business management courses would further improve and they would be more motivated to learn.

1.3 Instructional Methods

1.3.1 Creative Thinking Instruction

Creative thinking refers to how individual solves a problem by integrating existing current ideas, knowledge, and resource [11]. The following introduces the relevant literature about the psychological mechanism, stages of creative process, meaning and strategies of creative thinking instruction. Creative thinking instruction cites the thinking strategies, and lead students to practice their imagination and fulfilling the course requirements. The sensitivity, fluency, flexibility, originality, and elaboration of thinking abilities would develop and improve [12].

The current research project is scheduled to cite the following creative thinking strategies into the classes: (1) Introduction of Innovative Cases: Introducing the main class ideas in the beginning, and then introduce the knowledge about innovative cases, in order to allow students basically understand these cases. (2) Story-telling of Innovative Stories: Creating corresponding thematic stories for each topic in order to inspire student learning interest and learning motives. (3) Practice of Creative Techniques—upon inspiring learning motive of students, they would do more active learning instead of passive learning.

1.3.2 Problem-Based Learning in the Curriculum

Broadly speaking, Problem-Based Learning means that setting up a problem-solving process to make learners face, understand and attempt to solve the problem. The process of problem-solving is a learning opportunity.

1.4 The Corresponding Research about "*Digital Technology-fused Curricula for Business Management Education*"

About the commercial behaviors which applied the digital technologies, Chen et al (2009) applied the technology of video on internet auction. Chen et al. [13] constructed an auction-oriented web-site which provides services of video entertainment. The designed the platform for editing the film streams. The measured outcome was to check the online shoppers' feedback. They found that the diligence of web-site supervisors to deliver service and their integrity were the keys to positive evaluation from the online shoppers.

However, nowadays the industry of internet video entertainment has not yet developed a legal system to manage the distribution of film copyrights. Future research should work on this issue. Huang and Lin [14] used the ibon services in the 7-11 shops as the research target to explore the innovative strategies for business management. From the results of case studies and induction, Huang and Lin [14] found that "*product innovation*", "*service innovation*", "*process innovation*", "*human resource*", and "*productivity*" are the five facets which determine the success of business management. All the five facets work to increase consumer convenience, provide more kinds of products and services, in order to strengthen the market share and be more competitive.

About combination between education and digital technologies, Chang and Tang [9] thought that computer-fused instructions were consistent with the goal of K-9 Consistent Education to develop the top 10 core abilities, face the new time of informational technology, and solve problems according to the model of learning theories. However in terms of technological development of learning platforms, Taiwan is in the phase of transition.

If Taiwan cannot practice widely the instruction of computer-fused education, and cannot allow students to practice to manipulate the computers, the education progress on information processing will be delayed. In such a time which knowledge develops so rapidly, people can use the informational technologies and take new knowledge quickly, therefore, computer will be a very important tool. Also, according to Huang [14], the development of mobile devices and wireless communication make learning activities proceed in the real contexts. Some new instructional methods and assessment which were difficult to practice will have the chances to actualize. The new learning will allow learners have more episodic and practical experiences, and the new learning system will be able to guide and assist students one-by one. To the enterprise of education, it is full of opportunities and challenges.

From the above, combining creative ideas and modern digital technologies will make commercial behaviors flourish. If the education is based on business management, conducting the instructions with digital technologies, the students will be benefitted by leading and be special.

2. Methodology

2.1 Subjects

The subjects of this study are the junior students of Department of business administration at China University of Science and Technology. The innovation-infusion pedagogy was applied to the two courses "*Innovative technology management*" and " *Cultural and Creative Industries Management*" lectured by Prof. Ming-Hsiung Wu and Prof. Ju-Yao Hung respectively in year 2014.

2.2 Instrument

This project is a three-year research plan and currently only the first year of the project was permitted and under engagement. The research instruments are teaching materials development in the first year, test construction and action research instrument and evaluation design in the second year.

2.2.1 Teaching Material Development Procedure

The researchers cooperatively constructed the theoretical and development framework of the digital media teaching materials. And they compiled the materials for courses" Innovative technology management" & "*Cultural and Creative Industries Management*" based on the procedure showing in figure 1.

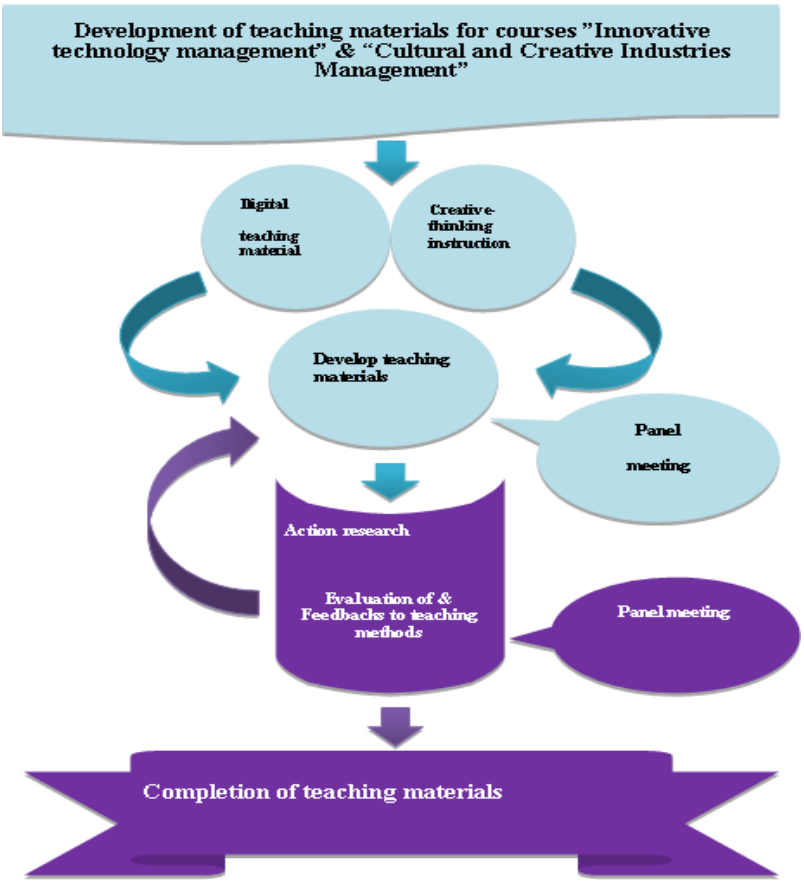

Figure 1. Teaching materials development flow chart (Resource: Produced by author)

2.2.2 Digital Media Teaching Materials

This study has exploited some digital teaching instruments to enhance students' problem-solving skills and abilities:

(1) Application of Digital Media Teaching Materials: This study took advantage of the distance education facilities at China University of Science and Technology to produce digital media teaching materials by ways of both external video recording and internal video recording for "*Innovative technology management*" & "*Cultural and Creative Industries Management*" courses. Then the researchers integrated and retouched the teaching elements by "*Camtasia Studio*" (a screen recording & Video Editing software).

(2) Flipped Classroom: The student participants were required to download and preview the digital teaching materials on school cloud drive, and have group discussion or take tests in class to motivate their learning initiative and improve their learning efficiency. Such inverted classroom method was implemented for 6 times in every three weeks during the semester.

(3) Application of Digital Technology Appliances: The digital technology appliances employed for the two courses are mobile phone, tablet computer and interactive whiteboard. These electronic devices are used with iTS Service Platform, an interactive Teacher & Students Service Platform to facilitate interactive learning. iTS Service Platform also functions as an e-learning platform with supplementary materials and other learning resources for students to review the course contents and extend their learning as remedial teaching. Furthermore, the instructors built an online learning community via free communication software for each course to increase instant communication with the students outside the classroom.

2.2.3 Test Construction

Following the teaching material development in the first year, the focus then moves to test construction in the second year. The professionals of digital technology and innovative teaching as well as senior teachers in business management field will be invited to evaluate the developed teaching materials in terms of curriculum rationale and instructional objectives. Panel meetings for educational professionals will be held to verify the content validity, scorer reliability and criterion-related validity of the achievement test and creativity test.

(1) The Test Development Procedure

Phase I: Determining the test constructs

A. Delineate the content domain of the achievement test and creativity test.

B. Edit test items and develop 30-50 items each test for formal item numbers as 10-30 each test.

C. Hold panel meetings composed of professionals and senior teachers in business administration field to collectively frame the achievement test and creativity test, and create test specifications including the type of testing format, the numbers and type of test items, the item scoring rules and so forth.

Phase II: Completing formal tests

A. Give a pretest to the junior students of department of business administration at the other university by purposive samples.

B. Conduct the item analysis statistics on pretest results for measuring item difficulty index and item discrimination index, and modify the test items accordingly.

C. Hold panel meetings to specify the scorer reliability and criterion-related validity of the achievement test and creativity test, as well as re-define and set up scoring criteria.

(2) The Evaluation Tools:

A. Creativity Test: The sub-project plans to develop a creativity test to evaluate students' problem-soling ability by manipulating digital technologies. About 30 test items will be developed by the panel meetings and then 10 items will be selected for the formal creativity test.

B. Achievement Test: The sub-project will develop achievement test with constructs of knowledge, attitude and performance. Estimated 50 items will be created primarily and 30 items for formal test will be determined by the professionals' evaluation.

2.2.4 The Reflection and Feedback Mechanism of Action Research

The teaching materials and lesson plan of "innovative digital pedagogy" developed in the first year will be continuously improved with action research to synchronize teaching practice and research. The action research instruments used in the second year are as follows:

(1) **Questionnaire:** Questionnaire is taken by the student participants at the end of each class to obtain student reactions to the teaching and assess student progress.

(2) **Teaching Log:** The lecturers systematically chronicle the noteworthy and illustrative examples of teaching and learning events, to deepen reflection on teaching portfolios and approaches and prompt reflection for development

(3) **Panel Meeting:** continuously adjust the teaching materials and lesson plans as per professionals' evaluation result and suggestions.

(4) **Third-Party Observation:** The third party conducts classroom observations of the two courses for fair and comprehensive feedback and evaluation.

2.3 Methodology

The research develops digital teaching materials in the first year, improves these materials through action research in the second year, and conduct quasi-experimental design in the third and last year. The methodologies employed are literature review, panel meeting, creative-thinking methods, action research and quasi-experimental design.

2.3.1 Literature Review

First, this study examines the literature relating to digital pedagogy and creative-thinking techniques. Then it selects the techniques and pedagogies that best suit to the course contents of business management.

2.3.2 Panel Meeting

The researchers hold panel meetings by inviting professionals and teachers of business management, experts of digital technology and creativity researchers to cooperatively develop the innovative digital teaching materials and methods.

2.3.3 Creative Thinking Instruction

This study develops digital innovative teaching materials for "Innovative Technology Management" and "Cultural and Creative Industries Management" courses. It aims to apply digital technologies and infuse creative-thinking skills with the digital learning environment to cultivate students' creativity besides enrich their professional knowledge. This research uses the following creative teaching techniques:

(1) Innovation and Creativity

A. Flipped classroom: The student participants need to download and preview the digital teaching materials on school cloud drive, and participate in group discussion or take tests in class to motivate their learning initiative and increase the learning effectiveness.

B. Digital Devices and Digital Teaching: This study integrates internet and other digital technologies, and make use of mobile devices like smartphones, tablet computer and desktop computer to create more flexible and versatile teaching content.

(2) Creativity Enlightenment

A. Introduction of Examples of Innovation: The teaching materials demonstrate some outstanding practical examples from the business world to strength the links between theory and practice, such as the example of innovative business model and reutilization of commercial facilities.

B. Introduction of Innovative Stories: The remarkable stories of business and industry involving emerging technology and unique ideas are infused in the teaching materials to arouse students' learning interests and initiatives.

C. Practice of Creative - Thinking Techniques: For course "*Cultural and Creative Industries Management*", the lecturer holds "*project planning contest for local cultural roots*" for the junior students at university to cultivate their creativity, integration and implementation abilities. And for course "*Innovative Technology Management*", a diversity of creative-thinking techniques like brainstorming, lateral thinking, Mandala thinking, Fishbone diagram, free association techniques and role playing are applied to the course activities. And cooperative learning is emphasized to increase students' sense of participation and sharing of ideas and thoughts.

2.3.4 Action Research

In terms of practical reflection, action research is performed in iterative cycles consist of five main steps: diagnosing (analyze the context and name a change situation or a problem), planning action (compare alternative plans and prioritize the tasks effectively), mutual collaboration (a participatory and dialogical approach for the participants seeks to solve problems collaboratively), taking action(implement the plan), evaluating action(examine the outcomes of the actions, both intended and unintended) and specifying learning(fact-finding about how learning and results can be used to help future issues). This cyclical process helps the practitioner to better identify different levels of reflection (Elliot, 1992; [15] Schon, 1987 [16]). The cyclical process of action

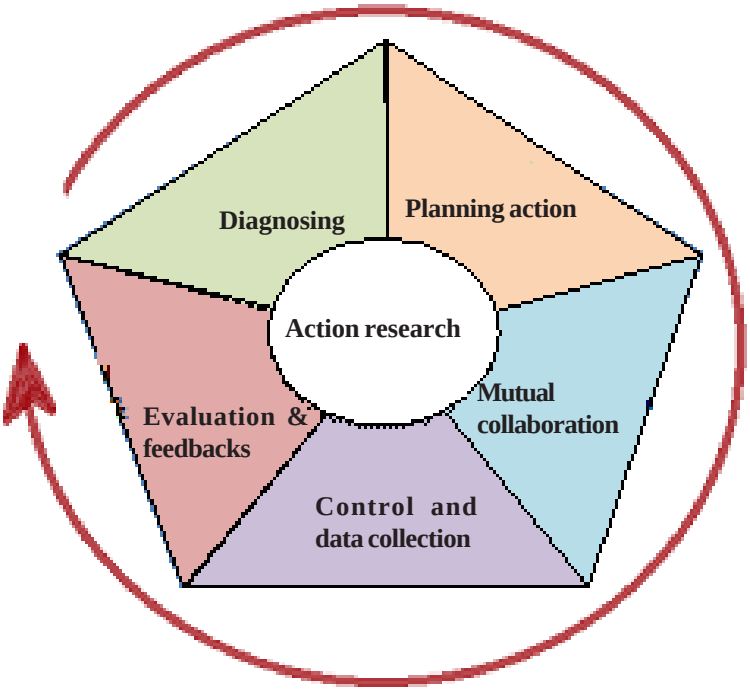

Figure 2. Action research cycle
(Resource: Produced by author)

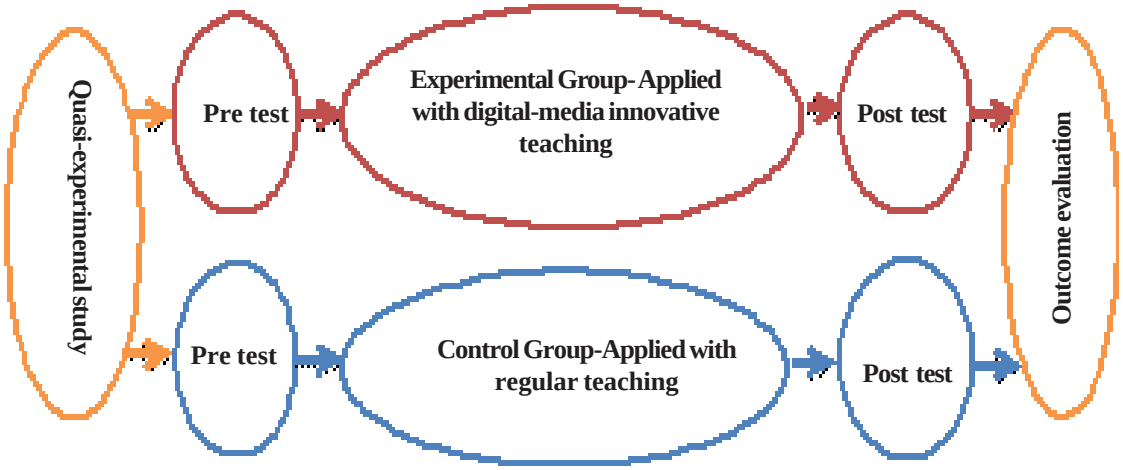

Figure 3. Quasi-experimental design
(Resource: Produced by author)

research as Figure 2 is conducted by the researchers and the lecturers to enable continuous improvement and development of the innovative teaching materials and teaching plans.

2.3.5 Experiment Design

The researchers will perform a quasi-experiment with the innovative teaching materials in the third year. This study uses the non-equivalent control group's pretest/post-test design as Figure 3 that the student participants take the achievement test and creativity test in the beginning and before the end of the semester. And the ANCOVA is used to determine whether there are any significant differences the treatment group and the control group across the span of the study.

2.4 Research Procedure

The duration of the first year of this study ranges from Dec. 2013 to Oct. 2014. Workshops on the topics of action research, creative-thinking instruction, experimental research and teaching evaluation are held for the researchers and lecturers to enhance their prior knowledge and background knowledge in the preliminary research stage. And the study is implemented in the following steps:

1. Examine the 2010 interim Course syllabus of China University of Science and Technology and analyze the subjects that are favorable to apply digital technology and creative instruction, and select corresponding technologies accordingly.

2. Select the subjects "*Innovative Technology Management*" and "*Cultural and Creative Industries Management*" for the junior students at department of business administration to develop the digital innovative teaching materials. And choose the digital devices tablet computer, interactive whiteboard and cloud drive as learning tools. Utilize software "*3D Pageflip, Camtasia Studio and MinicPad*" to integrate and retouch the teaching materials.

3. Develop the course evaluation form for the two selected courses

4. Hold panel meetings by inviting professionals and senior teachers of business management to assess and verify the degree of difficulty and discrimination of the innovative digital teaching materials.

3. Outcomes

This project is a three-year research plan and currently only the first year of the project was permitted and under engagement. This study has developed the digital innovative teaching materials for the 2-credit courses "*Innovative Technology Management*" and "*Cultural and Creative Industries Management*" at department of business administration. For "*Cultural and Creative Industries Management*" course, 16 units/hours of digital innovative teaching materials were completed including "*introduction to Cultural and Creative Industries*", " Legal and regulatory framework for the Cultural and Creative Industries Cultural and Creative Industries " and so on. Furthermore, the lecturer held a "*project planning contest for local cultural roots*" in June 2014 for the junior students at department of business administration of four-year college, two-year college and college of continuing education to stimulate their creativity and strength their integration and implementation capabilities. For "*Innovative Technology Management*" course, the innovative teaching materials comprise three themes: creativity theory and practice (4 units), innovative business models (14 units) and innovative technology management (2 units).

References

[1] Chu, J. H. (1993). (Ed.), Educational Psychology, Wunan, Taipei.

[2] Ghefaili, A. (2003). Cognitive apprenticeship, technology, and the contextualization of learning environments. *Journal of Educational Computing, Design & Online Learning* **4**, http://coe.ksu.edu/jecdol/Vol_4/Articles/Aziz.htm

[3] Lave, J., Wenger, E. (1991). Situated Learning. Legitimate peripheral participation, Cambridge: University of Cambridge Press.

[4] Johnson, D. W. (1985). Johnson, R. T., The internal dynamics of cooperative learning groups.

[5] Chang, C. H., Lin, C. H. (1993). (Eds.), *Educational Psychology*, Donhwat, Taipei.

[6] Huang, C. C. (1997). *Teaching Principles*. Shida Shyuan, Taipei.

[7] Sun, C. T. (2000). Internet Learning Trend and Principle. Paper presented at the Conference of Internet Learning Theory and Practice. Taipei, Taiwan.

[8] Moore, M.G., Kearsly, G. (1996). (Eds.). Distance education: a system view. Belmont CA: Wadsworth. Project. *Manchester Metropolitan University research*. Massachusetts, MA: Addison-Wesley.

[9] Chang, C. C., Tang, H. W. (2002). A study on implementation of university web-based learning community: relative problems, instructional strategies and implementation model. *Journal of Information and Education* 86, 65-80.

[10] Sang, M. C. (2005). The influence of integrating changba's mathland website into mathematics instruction on learning achievement and attitudes toward mathematics. Unpublished dissertation, Institute of Educational Information, Fo Guan University. Yilan, Taiwan.

[11] Chang, C. H. (1989). (Ed.), *Chang's psychology dictionary*, Donhwat, Taipei.

[12] Chen, L. A. (2001). *Creative thinking series six sets of audio books*, Chin Lung In, Kaohsiung.

[13] Chen, Y. M., Hsu, C. H., Wang, C. W., Chen, C. Y., Chang, Z. Z., Yuan, W. (2009). Design and implementation of the combination of online-auction and video service. Paper presented at the 2009 Conference of Digital Technology and Innovation Management. Taipei, Taiwan.

[14] Huang, C. Y., Lin, Y. C. (2012). The Study of Business Model Innovation: The Case of 7-Eleven ibon. *Yu Da Academic Press* 33, 85-112.

[15] Eisner, Elliot W. (1992). Educational reform and the ecology of schooling, *Teachers College Record* 93 (4) (1992), 610-627.

[16] Schon, D. A. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*, Jossey-Bass, San Francisco.