EXPLORING THE ACTIVITIES AND EFFECTS OF TEACHING WITH ENTERPRISE INFORMATION SYSTEMS (EIS) IN HIGHER EDUCATION

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Abstract - This study aims to explore the activities and influence factors of Enterprise Information Systems learning in higher education. A research model combing with activities theory, 3P, and HSM wasdeveloped to comprehensively explore and exam. The data were collected from the students who have studies ERP related courses. Total 107 valid samples were analyses by SPSS and PLS 2.0. The research finding indicates that: (1) previous experiences, perceived ease of use, course content, course quality, and situational involvement have positively effect on EIS learning attitude, (2) the attitude on EIS learning has positively effect on the ES Learning Performance, (3) the attitude on ES learning attitude is mediator of course quality, situational involvement and EIS learning Performance, and (4) EIS main learning path is systematic cue, and then heuristic cue has partial to effect on the performance of ES learning. The results can provide the alternatives for further research and implications both of academic and practical parties.

Index Terms - Enterprise Resource Planning (ERP), Activity Theory, Presage-Process-Product (3P) Model, Heuristic Systematic Model

I. INTRODUCTION

With globalize and knowledge economy coming, enterprise information systems (EIS) as well as enterprise resource planning systems (ERP) have been considers as one of strategic solutions[1, 2](Strong, Fedorowicz et al. 2006; Marston, Li et al. 2011)Then, the learning related to EIShas been common and popular in colleges or universities since that ERP system plays a critical role for assisting business operation and performance. However, to the students who lack of practical experience and imagination about the real business, it is a challenge for learning performance. Thus, this study addresses the research gaps from EIS learning related research which used to emphasis on technology and teaching perspectives

II. THEORETICAL BACKGROUND

In this study, the previous research related to EIS learning was reviewed and a research framework was constructed combining with Activity Theory, Presage-Process-Product Model, and Heuristic-Systematic Model to explore the activities and learning performance.

A. Enterprise Information Systems

The evolution of ES can be traced back to material requirements planning (MRP) in the 1980s. With the development of information technology and industrial demand changes, extended from MRP to Manufacturing Resource Planning (MRPII) in the 1990s, extended to ERP in 2000s, and then integrated SCM and CRM(that called ERPII/E-Business).With the approaching of knowledge economy and the era of huge amounts of data, thereby integrated BI to compose of ES(that called Enterprise Information System, EIS)[3]. In this study, we reviewed EIS related research and ERP was found as one of the main issues in this field, which especially focus on how to demonstrate its benefits for enterprises' operation and management and critical success factor(CSF) such as the issues of implementation, expansion, and integration with SCM, CRM, and BI. It also indicates that integrating of Knowledge Management, the rising information technology (e.g.Cloud Computing, Service-Oriented Architecture), and small and the applications in medium (SME) are current potential issues. It seems relatively lack of the issues about learning in EIS. With the developing of knowledge economy, EIS related knowledge and skills have become enterprise important invisible intellectual property. It shows that how to train professional through education is enterprise attention issues, and ES education implementation has affected ES implement performance in practical [4]. In this study, we well address the gaps of EIS learning related research to clarify its context.

B. EIS Learning

According to statistics data of website of Taiwan ministry of education, it shows that there have 165 universities in Taiwan (Taiwan ministry of education, 2015). Most of enterprise adopted Digiwin ES as operation strategy tools in Taiwan industrial market. As a result, the study refers Digiwin ES amount as sample to evaluate ES usage situation in campus. The study found that 102 universities adopt ES to teach student related MBA Courses ([5]). Reviewing EIS related literatures, ERP is the most EIS to teaching with enterprise resource planning and management, and BI and CRM are in second. It shows that EIS become an important component of information-related disciplines and courses at tertiary

institutions [6], expecting to cultivate the professionals can link the needs of industry, and adapting to the future of complex industrial environment. However, ES has imported in campus over the years [7, 8] and found that students' ES learning outcome is not as expected. The study reviewed ES research issues, found ES education research issues is rarely, and ERP as main research issues among them (J.C. Wu et al., 2016). Most of research used empirical method and case study method to research, and then used technical acceptance related factors, situational systematic teaching (e.g. ERPSims) to survey ES education implementation [9].

The study summarizes the foregoing argument that found rare researches are from student perspective to survey students' ES learning situation, what kind of component in ES learning activities is incompletely. Resulting in students' learning relationship is unknown that cannot improve teaching factors in activity of ES course thoroughly. It shows that focus on ES learning activities to research ES learning component and relationship ([10]). Therefore, the study focus on ES learning activity as research theme, used activity theory framework to describe learning and teaching factors in activity of ES course and then to deduce ES learning components.

C. Activity Theory

Activity theory (AT) concept is originated from Cultural-History Theory that describes Subject and Object interaction is by way of Tool ([11]). Leont'ev (1978) based on activity concept to develop activity theory that added Community component, the Division of labour component, Rules component consisted of Second-generation activity theory framework ([12]). Contradictions become the core of the activity analysis that demonstrate mediational structure in activity as foundation of activity system development. Engeström developed Third-generation activity theory to understand dialogue, multi-perspectives, and interaction in activity system [13]. It focusses on situational perspective that set object, target, tool, and related component to framework (White, Burger et al., 2016) that can help researcher to know complex work, relationship, and social activity ([14]).

There has applied AT in information technology area and technology implementation into classroom in the number of issues is increasing (Allen, Brown et al. 2013; Lim, 2007), e.g. mobile learning ([15]). It provides conceptual framework for the study to survey student ES learning factors, it clearly describe students' learning factors around ES learning activity. Therefore, this study used second-generation AT framework and eight-step model ([16]) based on EIS support mechanism, subject, and object in EIS learning activity to ensure dimensional factors. The study found that student, instructor, mechanism, content, systematic dimensions, and then deduced every ES dimensional learning factors. This study concludes ES learning dimension are as following:

(1) Student dimension: student as learning subject in ES activity. ES has practical work skills and information system characteristics. If student with prior ES works or learning experiences and computer self-efficacythat affecting student learning performance.
(2) Instructor dimension: instructor has professional knowledge, technical ability may affect ES course implementation, performance, and teaching effect.
(3) Content dimension: ES content has professional knowledge (e.g. technical skills, managerial skills, systematic skill), causing course content and quality affect student-learning performance.
(4) Mechanism dimension: mechanism is a structure arrange that support partners' two-way interaction ([17]). Therefore, it needs technical fundamental service and situation support ES learning activity. It shows that technical quality, course interaction, and situational involvement affect mechanism in ES learning activity.
(5) Systematic dimension: perceived usefulness and perceived ease of use affect student ES learning. Because ES interface is designed for enterprise, and therefore it hard to operate for students, and hard to know its usefulness that will affect student perception, and then affect student-learning performance.
(6) EIS learning attitude: attitude used to examine what degree of student involvement in the activity ([18]).
(7) EIS learning performance: Evaluating Students' learning outcome.

The study used AT unit analysis and examination of contradiction to ensure the study deduced learning factors were all EIS learning activity component (shown in Fig 1), and then used presage-process-product learning model to check relationship among ES learning factors, learning attitude, and performance

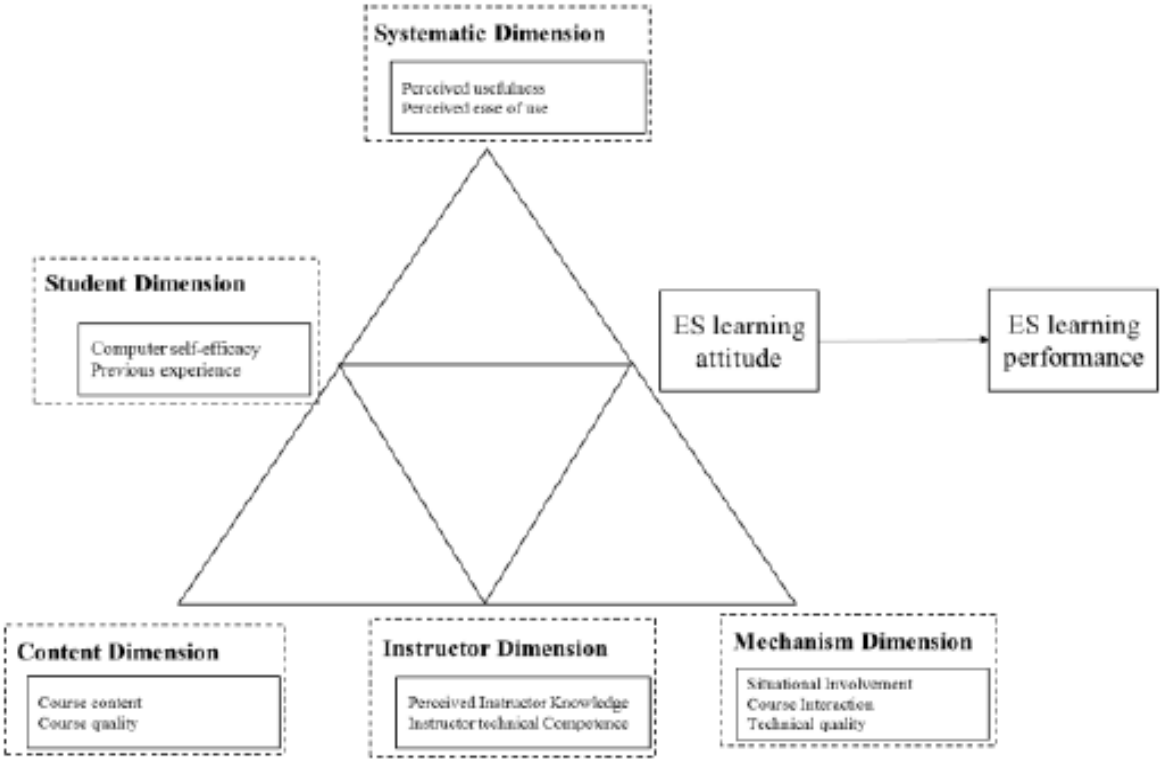


Figure 1 The Conceptual Framework of EIS learning Activities

D. Presage-Process-Product (3P) Learning Model

Presage-process-product learning model is widely used to view students' perception in learning activity[19]. It can fall into three procedures to understand student learning process, including:(1)Presage level: There have student factors, situational factors, and other teachingfactors that may direct or indirect affect factors in Process, Product level at same time[20]; (2)Process level: There have learning approach(Biggs, 2001) in learning-focused activities is core of 3P learning model.It describes individual difference making student having difference learning approach (surface/deep approach to learning), and affecting factors in Product level. (3) Product level: student-learning result. It shows student factors, course situational factors affecting student adopting different approach to learn and learning performance. It forms dynamic learning system[21], and to provide the way to know whether student-learning performance as expected.

The study reviewed 3P learning model issues over the years, most of research used 3P learning model as basic framework to develop research model, to describe evolution of technical application[22], and to describe component in learning system[23]. Research trend has shifted from students' knowledge transformation to technology apply to teaching[23, 24] and practical education[25].

Previous research used technical acceptance model (TAM) to survey EIS education that overpass student, teaching environment dimensions. Lacking of other learning factors in leaning activity of EIS. 3P model provides theoretical framework to survey students' learning process. Therefore, the study used 3P model as fundamental framework to survey relationship in ES learning process. In Presage level of ES learning activity, not only content and student dimensional factors, but also have instructor, systematics and mechanism dimensional factors that affects student learning in Process level. In Process level, comparing to learning approach, learning attitude can demonstrate ES learning factors, and affecting student perceptional transformation status directly. In Product level, that is hard to use score to measure student-learning performance in ES course ([26]).

In this study, the EIS learning factors in Presage level, adopted ES learning attitude in Process level, and used self-efficacy to measure EIS learning performance. Let student examine confidence standard of what they learn to apply to work task. To examine EIS learning process, ES learning factors in Presage level may affect EIS learning attitude in Process level, and indirectly affect EIS learning performance. In addition to this, EIS learning factors may directly affect EIS learning performance at same time. The study also examine learning factor effectand to predict the medium effect of learning attitude and learning performance.

E. Heuristic Systemic Model

Heuristic-Systematic Model (HSM) is developed by Chaiken (1987), is belonged to research of attitudinal

change of Dual-process model. It explains how people receiving and evaluating the validity of messages during communication. There have heuristic (Peripheral) and systematic (Central) cues provide to view persuasion process. The heuristic cue means that people rely on their own experiences independent of the message clues. If people pay more attention to understand whether message is true or false, people will adopt systematic cue (Zhan et al., 2008). It also assumes reason for influencing people to adopt systematic or heuristic cues is that they are motivated by personal motivations and the ability to deal with information influence route choice. People have a higher degree of comprehension and deeper understanding of the accepted messages, people tend to choose the system path, and then to consider, to analyze the information. Otherwise, choosing the heuristic cue. Comparing to Elaboration Likelihood model, (ELM). HSM emphasizes that central path and peripheral cues may co-occur in process of persuasion. In recent years, HSM has applied a wide range of IT application topics, such as mobile business impulse buying behavior, information-processing mode of business intelligence analysis, and user information processing mode for software and systems. HSM is able to provide this study toexamine students' main way to learn ES.

F. Research Model and hypothesisDevelopment

The research framework was constructed according to the previous theoretical background review as shown in Figure 2.

In this study, the hypotheses aretherefore proposed as following.

H1: Computer self-efficacy will have a positive relationship with student EIS learning attitude.

H2: Previous experiences will have a positive relationship with student EIS learning attitude.

H3: Perceived Instructor Knowledge will have a positive relationship with student EIS learning attitude.

H4: Instructor Technical Competence will have a positive relationship with student EIS learning attitude.

H5: Perceived Usefulness will have a positive relationship with student EIS learning attitude.

H6: Perceived Ease of Use will have a positive relationship with student EIS learning attitude.

H7: Course Content will have a positive relationship with student EIS learning attitude.

H8: Course Quality will have a positive relationship with student EIS learning attitude.

H9: Situational Involvement will have a positive relationship with student EIS learning attitude.

H10: Course Interaction will have a positive relationship with student ES learning attitude.

H11: Technology Quality will have a positive relationship with student ES learning attitude.

H12: ES learning attitude will have a positive relationship with student ES learning performance.

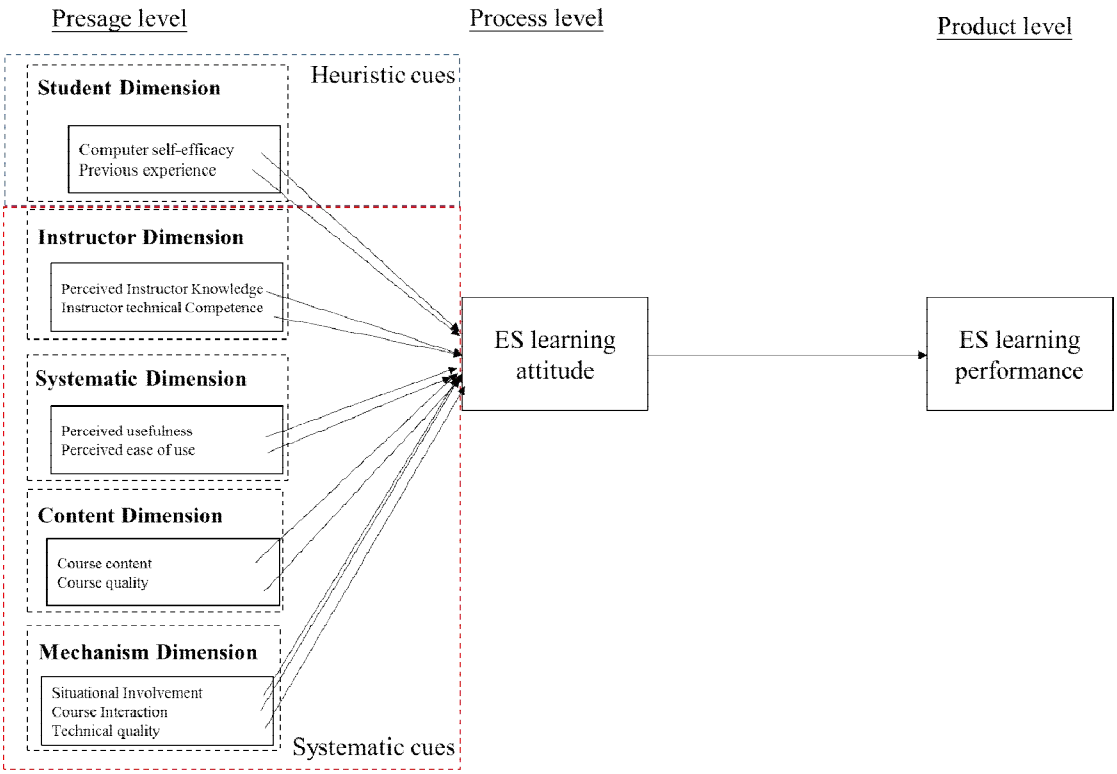


Figure 1 Research Framework (source: this study)

III. METHODS

In this study, a research survey with questionnaires are developed from previous literature review, the invited participants are the students who have EIS related learning experiencesas well as ERP, CRM, BI, and etc. The measurement with six-point Likert-type scale was employed for evaluating the constructs from strongly disagree (1) to strongly agree (6). The study examines factors relationship in EIS learning activity by quantification of data of questionnaire.

After data collections, the data analysis proceed (1) SPSS Statistics for Windows 22.0 to examine data, to analysis descriptive statistics, and examination of reliability and validity. It can help us to understand structure of sample and attributes, and then to examine sample credibility and convergence. In second stage, the study adopted SmartPls2.0to test hypothesis, and then to examine relationships among EIS learning factors, EIS learning attitude, and ES learning performance. In third stage, the study adopted Sobel Z testing to examine the medium effect of learning attitude and learning performance.

IV. RESEARCH FINDINGS

A. Data Profile

In terms of gender, main subject of the study is women that accounting for all the subjects of 51.40%. In terms of age, main subject of the study is person between 22-25 age group that accounting for all subject of 59.81%. In terms of system of university, main subject of the study is public university that accounting for all the subject of 57.01%. In terms of majoring department, main subject of the study majors management department that accounting for all the subject of 52.34%. In terms ofgrade, main subject of the study is second-year students that accounting for all the subject of 31.58%. In terms of years of work, main subject of the study is student without work experiences that accounting for all the subject of 40.79%. In terms of ES learning course, main subject of the study learns ER that accounting for all the subject of 50.94%. In terms of ES usage experience, main subject of the study used Digwin Workflow GP that accounting for 56.58%. It shown that ES courseimplementation focus on management and information disciple that in the second grade (above) courses, distribution module of ERP as the main implementation of the curriculum.

B. Reliability and Validity Test

The reliability and convergent validity of the scales was verified by using the three normal criteria: (1) item reliability of each measure by using factor loading (>0.7), (2) Cronbach's alpha and composite reliability (CR) of each construct (>0.7) and (3) the average variance extracted (AVE) (>0.5) that shown in Table 1.

Construct	Factor loading	Cronbach's α	CR	AVE
Computer Self-efficacy	.85~.93	.88	.93	.80
Previous experience	.82~.91	.88	.92	.74
Perceived Instructor Knowledge	.93~.95	.95	.97	.88
Instructor technical competence	.93~.95	.96	.97	.88
Perceived usefulness	.79~.89	.93	.94	.73
Perceived ease of use	.87~.92	.95	.96	.82
Course Context	.88~.95	.92	.94	.81
Course Quality	.89~.94	.90	.94	.84
Situational Involvement	.89~.92	.95	.96	.82
Course Interaction	.91~.96	.87	.95	.93
Technical Quality	.85~.89	.84	.90	.75
ES learning attitude	.88~.92	.94	.96	.82

Table 1 The Results of Re ability and Validity

C. Hypothesis Test

The analysis based on partial least square (PLS) path modeling using the SmartPLS2.0 to examine hypothesis test, and used bootstrapping method to set sample as 5,000(Chin, 1998). It can stabilize result of parameter estimation. And PLS method can avoid limitation of small sample ([27]) and more suitable for to handle small sample. It can help the study to build normal distribution that can present population, and then to view relationship among parameters of research model whether fall in rejection region(T>1.96) of 95% confidence interval(α=.05)

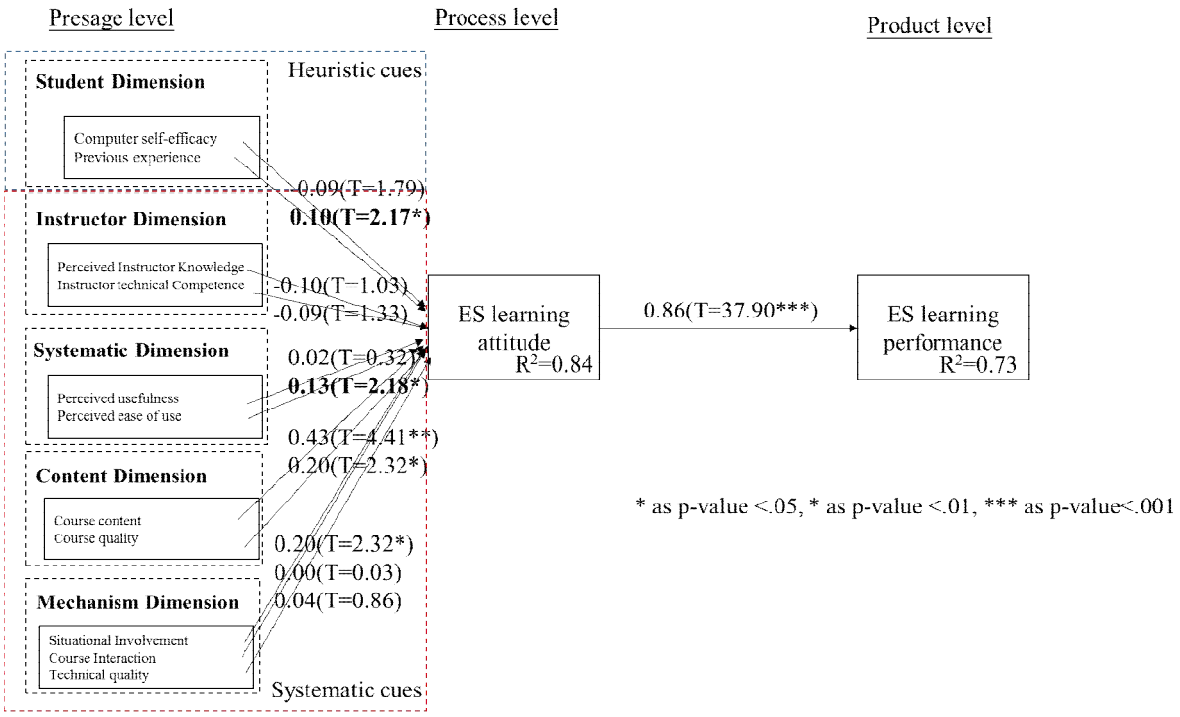


Figure 2 The path coefficients of this study

After hypothesis testing, the result shown that previous experience, course content, course quality, perceived ease of use, and situational involvement factor have positive effect on EIS learning attitude. EIS learning attitude has position effect on EIS learning performance, other hypothesis is not inclined support. Result of hypothesis testing shown in Figure 3.

V. DISCUSSION AND IMPLICATIONS

In this study, the EIS learning related factors have been explored with the perspective of student. A research framework combining three theories was developed to exam the our research idea, that AT is applied to explore the related activities about EIS learning, 3P model is to exam the EIS learning process and the relationships among different activities. The study found that course quality, course content, situational involvement, perceived ease of use would affect students' perception. And then they noticing, trying to involve EIS course situation that have positive effect on EIS learning attitude. It shows that the students adopts the systematic cue to learn, and then adopts the heuristic cue to learn in the process of learning,

(1) Most of students understand EIS learning is helpful to their future career.
(2) Most of universities provide sound IT infrastructure service and simply user interface that strength students want to use EIS.
(3) Students have previous experiences can help them to understand process and framework in EIS quickly, reducing obstacles of technical operation and theoretic concepts, and then knowing how to apply ES knowledge to new work situation.
(4) Most of research focus on EIS simulated learning system whether helping student to learn easily than previous. However, with demonstrating of EIS situation in course, it should focus on student whether they can involve situation. And then they want to notice, to reserve ES information related to whether they understand content in EIS course.
(5) Course content is important medium of ES activity of student learning. Content dimensional factors become main influence factors of EIS learning.
(6) Although instructor dimensional factors have not effect on ES learning attitude and performance. The results of questionnaire shown that perceived instructor knowledge have effect in EIS learning activity. The ES learning environment provided by the school have potential effect on students' learning.
(7) EIS learning attitude has positive effect on EIS learning performance. The study adopted self-efficacy to measure students' learning performance. Let students evaluate confidence level of their EIS learning performance by themselves. That can put remember level, understand level, and apply level in Bloom's six levels of cognitive learning into practice (Anderson, Krathwohl et al., 2001). It can help to understand what student learn, what student understand, and what can student describe about ES content under interaction between instructor,

environment and content factors (Leney, Gordon et al., 2008). Training students apply what they learn to solve task questions, and then stimulate them to high-level thinking (Anderson, Krathwohl et al., 2001).

CONCLUSION

In this study, therelationship among determinants about EIS learning was emphasized and further exam including attitude and performance. However, there are some research limitations are found and also accompanying with insignificance are described as following:

(1) The study collected cross-sectional data to examine what relationship and component in ES learning activity resulting in observing behavior of research object on specific time point. Although it helps us to understand specific matter or sample attributes quickly that cannot understand relationship of ES learning factors on longitudinal-section period.
(2) Data of the study collect from Google Questionnaire. Compare to Paper-based questionnaire, it hard to understand subjects whether understand semantic item that producing potential error on measuring procedure.
(3) Because there use ERP as teaching tool in ES course that makemost of subject who learn ERP.
(4) The samples of are main major in department of information or management, and the study number of sample is small. It cannot demonstrate whole situation in EIS learning activity.

This study not only comprehensively explores the EIS learning related components and activities about EIS learningbut also provides some insights for further research as following.

(1) Based on ES learning factors of the study to extend to research learning factors of ES content dimension that strength component in ES learning activity.
(2) In addition to classroom environment factors, ES learning will be affected by external factors ([28]).
(3) To expand the scope and number of sample, to observe EIS learning activities continuously, and to explore the learning factors associated with the situation in order to seek more effective and reasonable verification results.

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