行政院國家科學委員會補助專題研究計畫 □期中進度報告 ■期末報告

大學工程學系學生運用不同教學策略在知識管理學習成效之研究:總計畫(1/3-3/3)

計畫類別：□個別型計畫　■整合型計畫
計畫編號：NSC 99-2511-S-276 -005 -MY3
執行期間：99 年 08 月 01 日至 103 年 07 月 31 日(延期一年)

執行機構及系所：美和科技大學經營管理研究所

計畫主持人：曾國鴻教授
共同主持人：張基成教授、羅希哲教授
計畫參與人員：張立中、饒育宗

本計畫除繳交成果報告外，另含下列出國報告，共__份：
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中　華　民　國　103　年　10　月　30　日

大學工程學系學生運用不同教學策略在知識管理學習成效之研究: 總計畫

(1/3-3/3)

子計畫名稱

- 子計畫一：大學資訊工程系學生網路化學習歷程檔案在知識管理成效之研究(主持人: 張基成)
- 子計畫二：大學機械工程系學生混成式創意學習系統在知識管理與產品創新成效之研究(主持人: 羅希哲)

茲將本總計畫探究「運用不同教學策略在知識管理學習成效」與「Cross-lagged relationships between motivation and KM learning engagement for college engineering students」之等兩部份的研究成果敘述如下：

A. 運用不同教學策略在知識管理學習成效」之差異比較

一、研究目的

第一年：引導發展大學資訊工程、機械工程（以下簡稱二系）在網路平台上的學習系統與教材，並比較其差異情形。

第二年：引導發展二系教學策略與知識管理（以下簡稱 KM）成效之相關評量工具，並比較其差異情形。

第三年：引導二系驗證知識管理（KM）的教學成效與學習態度，並比較其差異情形。

二、研究程序與方法

整合計畫之理念架構如圖 1 所示，其係由下端的「大學學系本質」與上端的「知識管理教學策略規劃」分別開始，逐漸達到圖 1 中間的知識管理學習成效及知識管理學習系統使用態度之最終目標。詳細而言，大學工程學系的本質，可由資訊工程學系與機械工程學系及其他系等予以涵蓋；另一方面，本研究以上述所涵蓋二個類別之學生作為研究對象，分析其知識管理的相關因子與模式，俾發展不同教學策略運用在知識管理的學習模式，進而根據此模式建構軟硬體教學環境（含單元課程活動、教學策略與知識管理學習系統之網路平台），並檢測大學學生知識管理的學習成效與知識管理學習系統使用態度。

整體研究內涵架構如圖 2 所示。詳細而言，本研究內涵依三個年段的實施過程分為建構期，亦即先分析知識管理成功案例，以建構大學學生知識管理的學習系統模式與教學網路平台；發展期，亦即發展衡量大學學生知識管理學習成效、知識管理學習系統使用態度量表及其教具；評估期，亦即應用知識管理學習系統之教學網路平台，以評估大學學生採用不同教學策略之知識管理的學習成效及其態度，並提出大學工程學系學生知識管理之理論模式。

本研究之研究方法包括整合會議或座談(每週 1 次約 3~4 時), 比較研究法、訪談法修正式德懷術(Modified Delphi Technique)問卷調查法、AHP 問卷調查法、系統開發法、準實驗研究法、質性的學習歷程檔案等，其研究流程如圖 3、圖 4 與圖 5。

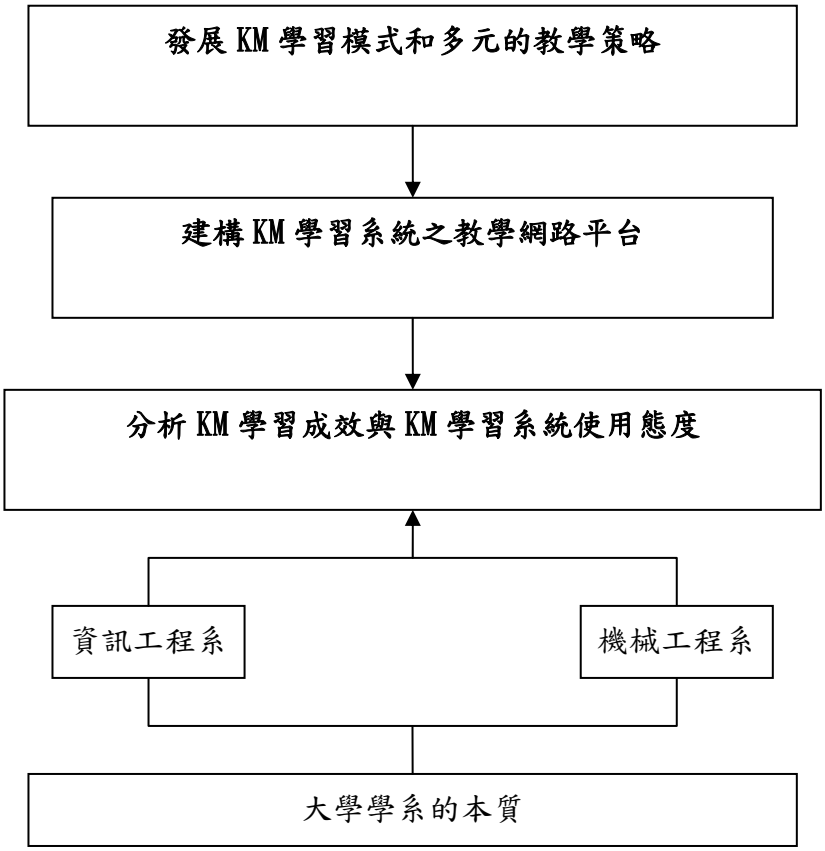

圖 1「大學學生知識管理之研究」整合計畫的理念架構

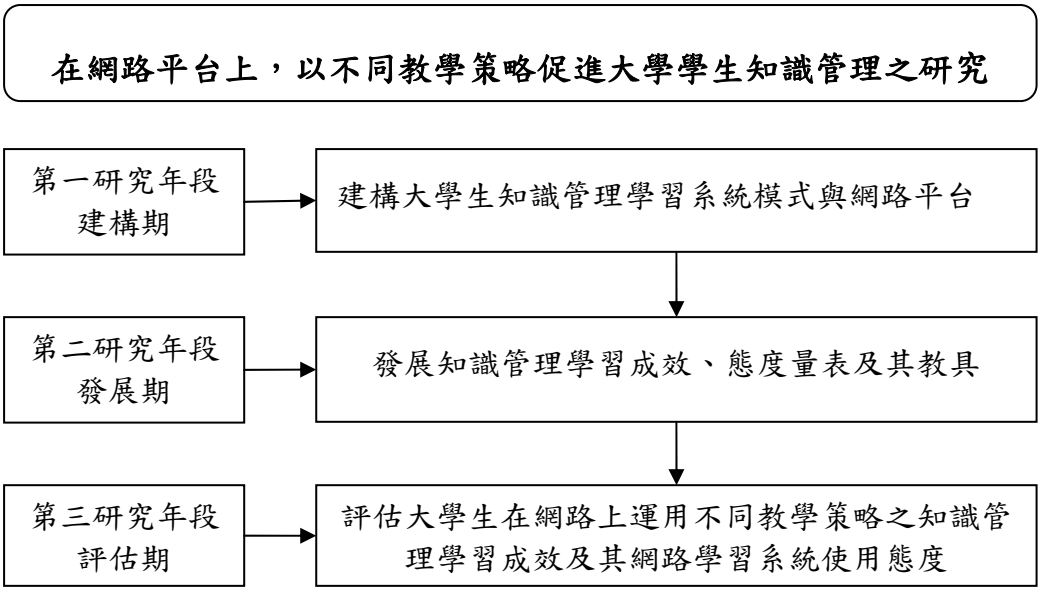

圖 2 三年段的整體研究內涵架構圖

第一年實施流程

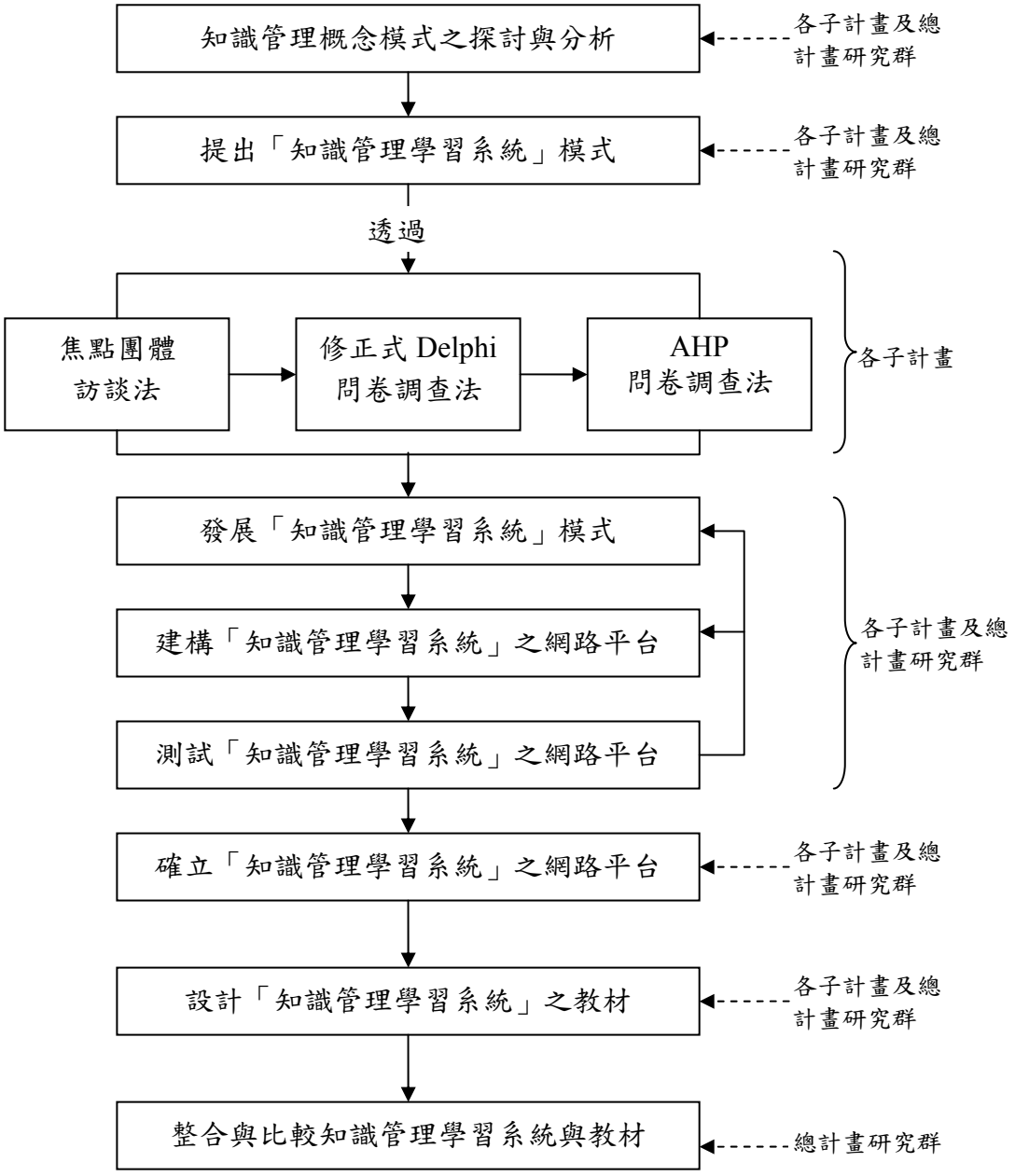

圖 3 第一年—建構大學生「知識管理學習系統」與發展教材

第二年實施流程

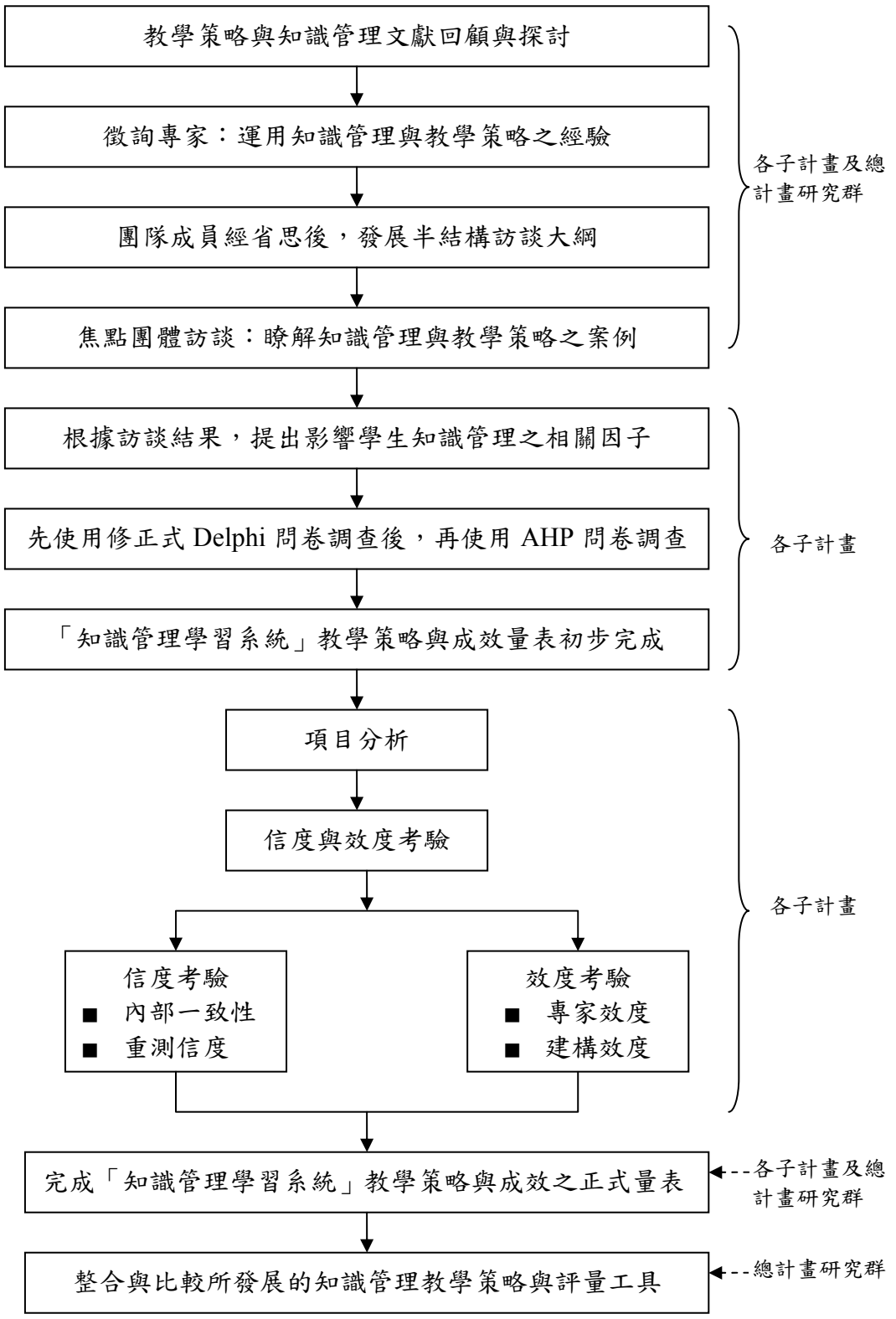

圖 4 第二年—發展「知識管理學習系統」教學策略與知識管理成效量表

第三年實施流程

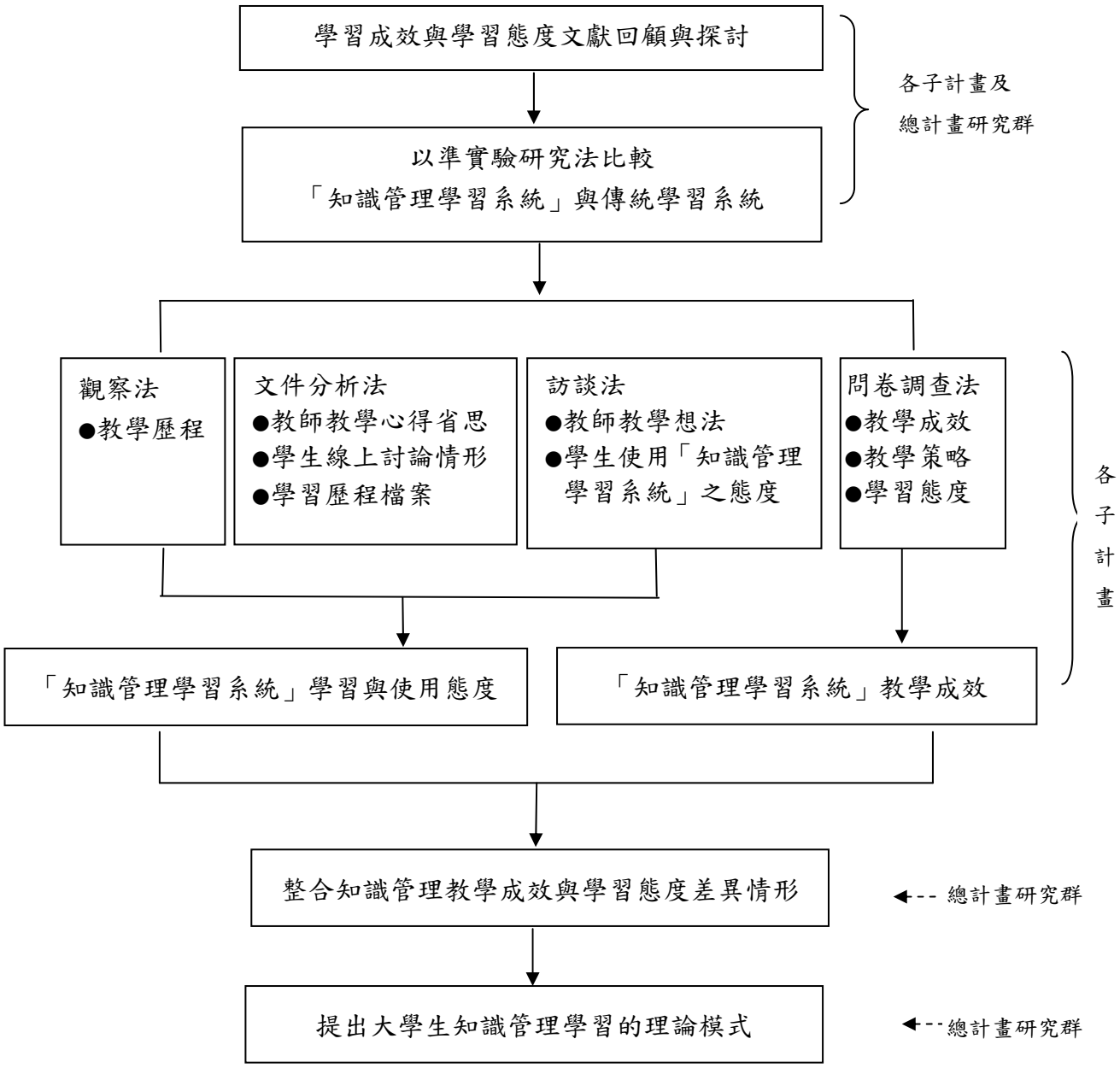

圖 5 第三年—「知識管理學習系統」教學成效評估

三、研究的樣本與工具

各子計畫依據各專家學者不同之專業背景，進行專家諮商及訪談，茲臚列如下：

- 子計畫一：訪談 15 位專業人士
- 子計畫二：訪談 7 位專業人士

另，各子計畫各種工具的信效度均經嚴謹的考驗，而予以建立。

四、研究成果比較

1.兩子計畫內涵架構如下表 1：

表 1 兩子計畫內涵架構

階段與目標	資訊工程系（子計畫一）	機械工程系（子計畫二）
第一年 建構期:建構大學生 KM 學習系統模式與網路平台	建置完成大學生「網路化學習歷程檔案分享與觀摩平台」	建置完成「高中組及大學組創意設計教學與競賽網路平台」。
第二年 發展期：發展 KM 學習成效、態度量表及其教具	發展完成「大學生網路化學習歷程檔案 KM 行為量表」	發展完成創意學習成效、態度量表、創意學習教具-船錨型的鉛筆切削器與水陸兩用船
第三年 評估期:評估大學生在網路上運用不同教學策略之 KM 學習成效及其網路學習系統使用態度	製作比未製作網路化學習歷程檔案學生在 KM 較有顯著成效	在學生創造力學習及學習成效上，傳統教學比 BOPPP & TRIZ 教學較有顯著成效

2. 兩子計畫資料範疇的比較結果

(1)研究對象的資料範疇

- 子計畫一：實驗組 43 位，對照組 45 位
- 子計畫二：實驗組 52 位，對照組 55 位

(2) 歷程與成效資料收集範疇

二子計畫區分 KM 應用範疇領域不相同。如資訊工程系用「e-portfolio」操弄,以獲知識管理的分享、創新、取得、應用、蓄積成效；機械工程系用「BOPPPS & TRIZ 教學」操弄以獲「知識創新」成效。

- 子計畫一：實驗組：KM 的網路化作品成果、線上互動與反思歷程；控制組：書面作品、口頭互動。
- 子計畫二：實驗組: 知識創新的網路互動歷程、產品創新成果；控制組：BOPPPS 教學成效。

3. 兩子計畫平台設計法的比較結果

- 子計畫一：

  (1)平台需求分析與說明：徵詢學生與教師的需求等

  (2)KM 的系統平台製作：以部落格作為網路化學習歷程檔案之工具

  (3)KM 的系統平台使用：檔案觀摩、線上討論、紀錄學習過程

  (4)以 e-portfolio 導入 KM 的成效評估

- 子計畫二：

  (1)平台需求分析與說明：舉辦說明會、告知學生活動目的、方法

  (2)網路平台製作(含手冊、專案式學習案例、電子書等創意學習教材)

  (3)網路平台使用（分享發明家的知識與經驗、參與學生問題討論、給予諮詢）

  (4)以產品導入知識創新與成效評估

兩子計畫切入點不同，而產生不同的平台設計法：子計畫 一較傾向於以 KM 整個內涵為導向平台設計較傾向於以產品 導入知識創新為導向所發展的平台設計。

4.知識管理的內涵比較結果

- 子計畫一：KM 的內涵共有六個構面，包括：(1)分享、(2)創新、(3)取得、(4)應用、(5)蓄積、(6)整體。
- 子計畫二：想像力與創造力知識創新應用在產品製作歷程上，其內涵共有二個構面，包括：(1)融入想像力(含發想、聯想、轉想、串想等想像力歷程)、(2)以創造力完成創新電銲作品；藉以上知識創新引導，可協助學生累積知識、分享知識、獲得知識。

5.對知識管理內涵最主要學習方式的差異分析

- 子計畫一：

  (1)上課抄筆記、網路找資訊,以彙整、保存知識（知識取得&蓄積）

  (2)部落格寫反思:知識應用&創新

  (3)分享想法與見解（知識分享）

  (4)學生互動&完成遊戲產業案例分析作品（知識分享&應用）

  (5)教師評論與給分（知識分享）

  (6)學生獲得整體性的回饋並產生新的想法(知識創新）
- 子計畫二：

  (1)學生獲得整體性的回饋並產生新的想法(知識創新）

  (2)聯想(知識創新）

  (3)轉想(知識應用）

  (4)串想後再回饋到發想(知識創新&應用）

  (5)學生完成創新作品(知識創新）

  (6)教師評論、給分與學生獲得回饋並產生新想法（知識分享&創新）

6.兩子計畫學生知識管理問卷調查結果比較

- 子計畫一：1.透過平台互動的層面依序偏向「知識創新」、「知識蓄積」、「知識分享」、「知識取得」、「知識應用」五個向度；其中又以「知識創新」效果最高，「知識應用」效果最低。2.在知識的:(1)分享、(2)創新、(3)取得、(4)應用、(5)蓄積、(6)整體態度等量表表現上，實驗組均顯著高於對照組。
- 子計畫二：1.在知識創造力學習的 80%個題項表現上，實驗組均顯著高於對照組。2.混成式 TRIZ 創意學習對學生學習成效、學習態度及學習平台應用上具顯著正向的影響。3.BOPPPS & TRIZ 教學模式於大學生創造力學習成效上具正向顯著性。

7.兩子計畫學生使用平台態度結果比較

- 子計畫一：KM 平台能協助學生增進資訊相關知識的分享、創新、取得、應用與蓄積的效能。
- 子計畫二：透過學習平台的應用，能有效幫助學生將知識或想法具體化及文字化，並且幫助學生快速的累積、分享及獲得知識。

兩領域受訪學生對使用此平台來進行個人 KM 均持顯著的正面態度。

七、結論

本研究結論如下：

1.帶動知識管理研究產業蓬勃發展。

2.提升學生知識管理的成效。

3.鼓勵大學生採用「網路（web-based）工具」（例如：部落格 blog）及「專題製作」（例如：混成式專題製作）來進行知識管理的學習。

B.「Cross-lagged relationships between motivation and knowledge management (KM) learning engagement for college engineering students」的研究成果

1. Purpose

The purpose of this study is to test the self-determination theory (SDT) and to clarify the casual relationship between motivation and KM learning engagement, which has been unclear in past cross-sectional studies.

2. Hypotheses

H1-1: There is a significant positive impact of intrinsic motivation at Time 1 on intrinsic motivation at Time 2 for college engineering students.

H1-2: There is a significant positive impact of motivation of identification at Time 1 on motivation of identification at Time 2 for college engineering students.

H1-3: There is a significant positive impact of motivation of introjection at Time 1 on motivation of introjection at Time 2 for college engineering students.

H1-4: There is a significant positive impact of motivation of external regulation at Time 1 on motivation of external regulation at Time 2 for college engineering students.

H2: There is a significant positive impact of KM learning engagement at Time 1 on KM learning engagement at Time 2 for college engineering students

H3-1: There is a significant positive impact of intrinsic motivation at Time 1 on KM learning engagement at Time 2 for college engineering students.

H3-2: There is a significant positive impact of motivation of identification at Time 1 on KM learning engagement at Time 2 for college engineering students.

H3-3: There is a significant positive impact of motivation of introjection at Time 1 on KM learning engagement at Time 2 for college engineering students.

H3-4: There is a significant positive impact of motivation of external regulation at Time 1 on KM learning engagement at Time 2 for college engineering students.

H4-1: There is a significant positive impact of KM learning engagement at Time 1 on intrinsic motivation at Time 2 for college engineering students.

H4-2: There is a significant positive impact of KM learning engagement at Time 1 on motivation of identification at Time 2 for college engineering students.

H4-3: There is a significant positive impact of KM learning engagement at Time 1 on motivation of

introjection at Time 2 for college engineering students.

H4-4: There is a significant positive impact of KM learning engagement at Time 1 on motivation of external regulation at Time 2 for college engineering students.

3. Participants

The sample was comprised of 111 students (102 males and 9 females) from two classrooms of students majoring in Electrical Engineering and Civil Engineering. There were 63 students of Electrical Engineering and 48 students of Civil Engineering. The participants came from the same technological university. Participants were all freshmen of the ages of 19 to 20. These students were measured at time 1 in the beginning of semester and at time 2 (two months after first measure).

4. Measurements (A pretest was conducted with 50 college students and all the reliabilities of Cronback's α are over 0.76)

4.1 Translation of Self-regulation Questionnaire (Instrument of motivations)

4.2 Translation of KM learning engagement scale

5. Results and Discussions

5.1 Descriptive statistics analysis

The mean and standard deviation for variables of intrinsic motivation, identified regulation, introjected regulation, external regulation and KM learning engagement in two time points are shown in Table 1. Paired sample t test reveals that the average scores of KM learning engagement and the four kinds of motivation raised significantly from the first survey at time 1 to the second survey at time 2.

The paired sample t test also indicates that students have the highest average score, 3.49, of intrinsic motivation among four motivations at time 1. The lowest motivation score is in introjected motivation with an average score 3.39. The results of the t test for the difference between each pair of motivations at time 1 are statistically significant. To sum it up, for the college engineering freshman, their learning motivations can be listed significantly from high to low in the order of intrinsic motivation, external regulation, identified regulation to introjected regulation at time 1. Due to a larger standard deviation of motivation scores at time 2, there is not any significant difference between the four types of motivation.

Hence, based on the findings of this study, it is concluded that within the time period of two months, the college engineering freshmen experienced significant learning motivational change (increase) and a change of KM learning engagement (increase).

Table 1 Descriptive statistics for all variables of KM learning engagement and motivations in time 1 and time 2

Variables	Mean	S.D.	Paired sample t test	Value for Difference
Intrinsic_Mot_t1	3.49***	.721	Intrinsic_Mot_t1 - Identified_Reg_t1	.061***
Identified_Reg_t1	3.43***	.748	Intrinsic_Mot_t1 - Introjected_Reg_t1	.099***
Introjected_Reg_t1	3.39***	.732	Intrinsic_Mot_t1 - External_Reg_t1	.013*

External_Reg_t1	3.48***	.722	Identified_Reg_t1 - Introjected_Reg_t1	.037***
Intrinsic_Mot_t2	3.87***	1.284	Identified_Reg_t1 - External_Reg_t1	-.048***
Identified_Reg_t2	3.88***	1.471	Introjected_Reg_t1 - External_Reg_t1	-.085***
Introjected_Reg_t2	3.73***	.971	Intrinsic_Mot_t1 - Intrinsic_Mot_t2	-.375**
External_Reg_t2	3.87***	1.293	Identified_Reg_t1 - Identified_Reg_t2	-.446***
KM learning engagement_t1	3.15***	.946	Introjected_Reg_t1 - Introjected_Reg_t2	-.336***
KM learning engagement_t2	3.52***	.848	External_Reg_t1 - External_Reg_t2	-.394***
			KM learning engagement_t1 - KM learning engagement_t2	-.363***

N=111; * α=.05, ** α=.01, *** α=.001.

5.2 Correlation analysis

Table 2 Pearson correlation coefficient for all variables of KM learning engagement and motivations at time 1 and time 2

	Identified_ Reg_t1	Introjected_Reg_t1	External_ Reg_t1	Intrinsic_ Mot_t2	Identified _Reg_t2	Introjected _Reg_t2	External_ Reg_t2	KM learning engagement_t1	KM learning engagement_t2
Intrinsic_Mot_t1	.994(**)	.983(**)	.997(**)	.354(**)	.319(**)	.551(**)	.359(**)	.571(**)	.401(**)
Identified_Reg_t1		.988(**)	.993(**)	.341(**)	.306(**)	.544(**)	.346(**)	.575(**)	.395(**)
Introjected_Reg_t1			.979(**)	.333(**)	.301(**)	.519(**)	.339(**)	.618(**)	.432(**)
External_Reg_t1				.337(**)	.300(**)	.544(**)	.343(**)	.565(**)	.400(**)
Intrinsic_Mot_t2					.993(**)	.681(**)	.999(**)	.275(**)	.324(**)
Identified_Reg_t2						.641(**)	.994(**)	.255(**)	.274(**)
Introjected_Reg_t2							.684(**)	.432(**)	.435(**)
External_Reg_t2								.279(**)	.318(**)
KM learning engagement_t1									.476(**)

** α=.01.

Table 2 is the correlation matrix for the variables of KM learning engagement and motivations. The four subscales of motivation had high positive correlations (between .983 and .997) at time 1. At time 2, except for motivation of introjected regulation (.681 with intrinsic motivation, .641 with identified regulation, and .684 with external regulation), the other three subscales of motivation had a high positive correlation as well (between .993 and .999). It is concluded, based on these findings of the correlation between the four subscales of motivation, that the four regulatory styles of motivation do not fall along a continuum anchored by controlled and autonomous regulation (Deci & Ryan, 2000). The four subscales of motivation at time 1 had a low correlation with the four subscales of motivation in time 2 (which is between .300 and .359). The exception is that the motivation of introjected regulation at time 2 had a relative higher correlation with the

instrinsic motivation (.551), motivation of identified regulation (.544), motivation of introjected regulation (.519) and motivation of external regulation (.544) at time 1.

The correlation between motivations and KM learning engagement at time 1 (between .565 and .618) is higher than the correlation between motivations and KM learning engagement at time 2 (between.274 and .435). The correlation between KM learning engagement at time 1 and KM learning engagement at time 2 is .476.

5.3 Cross-lagged relation analyses

Four cross-lagged panel models are examined in this current study by regression analysis. For each model shown from figure 1 to figure 4, the KM learning engagement at time 2 was predicted by the KM learning engagement and respective motivation at time 1, and the respective motivation at time 2 was predicted by the KM learning engagement and corresponding motivation at time 1. Figure 1 showed the model of KM learning engagement and intrinsic motivation, figure 2 showed the model of KM learning engagement and motivation of identified regulation, figure 3 showed the model of KM learning engagement and motivation of introjected regulation, and figure 4 showed the model of KM learning engagement and motivation of external regulation. The coefficients shown from figure 1 to figure 4 are standardized coefficients.

5.3.1 Intrinsic motivation and KM learning engagement

The results of the relation between intrinsic motivation and KM learning engagement are shown in figure 1. In figure 1, the KM learning engagement and intrinsic motivation at time 1 significantly and positively predict the KM learning engagement at time 2, which confirms hypothesis 2 and hypothesis 3-1 (with a well-fit regression model of R-square .251, adjusted R-square .237, $F(2,108)=18.12$, p-value<.0001).

The intrinsic motivation at time 1 significantly and positively predict the intrinsic motivation at time 2, which confirms hypothesis 1-1 (with a well-fit regression model of R-square .133, adjusted R-square .117, $F(2,108)=8.27$, p-value<.0001). However, there is no significant evidence showing that the increase of college engineering students' KM learning engagement predicted the increase of intrinsic motivation. H4-1is not supported.

Accordingly, it is concluded that H1-1, H2 and H3-1 are confirmed in the current study in the cross-lagged panel model of the relation between intrinsic motivation and KM learning engagement. More specifically, there were stable relationships with regard to final KM learning engagement predicted by prior KM learning engagement and final intrinsic motivation predicted by prior intrinsic motivation in the two months of time lag in college engineering students. Also, there was a cross-lagged relation of the prediction concerning final KM learning engagement predicted by prior intrinsic motivation, which is the prediction of SDT (self-determination theory). Hence, it is concluded that the increase of college engineering students' intrinsic motivation predicted the increase of students' KM learning engagement.

5.3.2 Motivation of identified regulation and KM learning engagement

The results of the relation between motivation of identified regulation and KM learning engagement are shown in figure 2. In figure 2, the KM learning engagement and motivation of identified regulation at time 1 significantly and positively predict the KM learning engagement at time 2, which confirms hypothesis 2 and

hypothesis 3-2 (with a well-fit regression model of R-square .249, adjusted R-square .235, F(2,108)=17.87, p-value<.0001).

Additionally, the motivation of identified regulation at time 1 significantly and positively predict the motivation of identified regulation at time 2, which confirms hypothesis 1-2 (with a well-fit regression model of R-square .103, adjusted R-square .087, F(2,108)=6.22, p-value<.0001). Yet, H4-2 was not supported. Thus, there is no significant evidence showing that the increase of college engineering students' KM learning engagement predicted the increase of motivation of identified regulation.

So, it is concluded that H1-2, H2 and H3-2 are confirmed in the current study in the cross-lagged panel model of the relation between motivation of identified regulation and KM learning engagement. More specifically, there were stable relationships in respect to final KM learning engagement predicted by prior KM learning engagement and final motivation of identified regulation predicted by prior motivation of identified regulation in two months of time lag in college engineering students. There was a cross-lagged relation regarding KM learning engagement predicted by motivation of identified regulation, which is the prediction of STD. Hence, it is concluded that the increase of college engineering students' motivation of identified regulation predicted the increase of students' KM learning engagement.

5.3.3 Motivation of introjected regulation and KM learning engagement

The results of the relation between the motivation of introjected regulation and KM learning engagement are shown in figure 3. In figure 3, the KM learning engagement and motivation of introjected regulation at time 1 significantly and positively predict the KM learning engagement at time 2, which confirms hypothesis 2 and hypothesis 3-3 (with a well-fit regression model of R-square .258, adjusted R-square .244, F(2,108)=18.74, p-value<.0001).

In addition, the KM learning engagement and motivation of introjected regulation at time 1 significantly positively predict the motivation of introjected regulation at time 2, which confirms hypothesis 1-3 and hypothesis 4-3 (with a well-fit regression model of R-square .290, adjusted R-square .277, F(2,108)=22.03, p-value<.0001).

Accordingly, it is concluded that the H1-3, H2, H3-3 and H4-3 are confirmed in the current study in the cross-lagged panel model of the relation between motivation of introjected regulation and KM learning engagement. More specifically, there were stable relationships in regard to final KM learning engagement predicted by prior KM learning engagement and final motivation of introjected regulation predicted by prior motivation of introjected regulation in two months of time lag in college engineering students. There was a cross-lagged relation concerning final KM learning engagement predicted by prior motivation of introjected regulation, which is the prediction of SDT. In addition, there was a cross-lagged relationship with respect to final motivation of introjected regulation predicted by prior KM learning engagement, which is a cross causality of SDT. Therefore, it is concluded that the increase of college engineering students' motivation of introjected regulation predicted the increase of students' KM learning engagement. Additionally, there is significant evidence to show that the increase of college engineering students' KM learning engagement predicted the increase of motivation of introjected regulation.

5.3.4 Motivation of external regulation and KM learning engagement

The results of the relation between motivation of external regulation and KM learning engagement are shown in figure 4. In figure 4, the KM learning engagement and motivation of external regulation at time 1 significantly and positively predict the KM learning engagement at time 2, which confirms hypothesis 2 and hypothesis 3-4 (with a well-fit regression model of R-square .252, adjusted R-square .238, F(2,108)=18.19, p-value<.0001).

In addition, the motivation of external regulation at time 1 significantly and positively predict the motivation of external regulation at time 2, which confirms hypothesis 1-4 (with a well-fit regression model of R-square .128, adjusted R-square .12, F(2,108)=7.95, p-value<.0001). However, H4-4 was not supported. There is no significant evidence showing that the increase of college engineering students' KM learning engagement predicted the increase of motivation of external regulation.

In conclusion, it was found that H1-4, H2 and H3-4 are confirmed in the current study in the cross-lagged panel model of the relation between motivation of external regulation and KM learning engagement. More specifically, there were stable relationships in regard to final KM learning engagement predicted by prior KM learning engagement and motivation of external regulation predicted by prior motivation of external regulation in two months of time lag in college engineering students. At the same time, there was a cross-lagged relationship in respect to KM learning engagement predicted by motivation of external regulation, which is the prediction of SDT. Hence, it is concluded that the increase of college engineering students' motivation of external regulation predicted the increase of students' KM [illegible]ent.

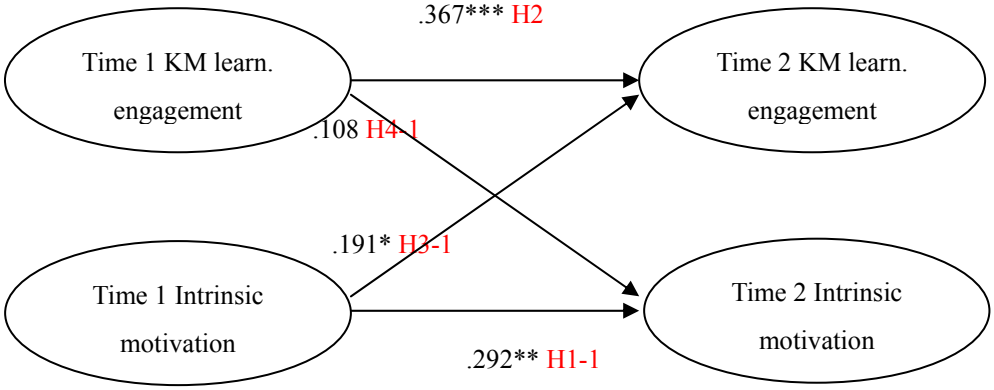

Figure 1 Cross-lagged relation of intrinsic motivation and KM learning engagement (standardized coefficients)

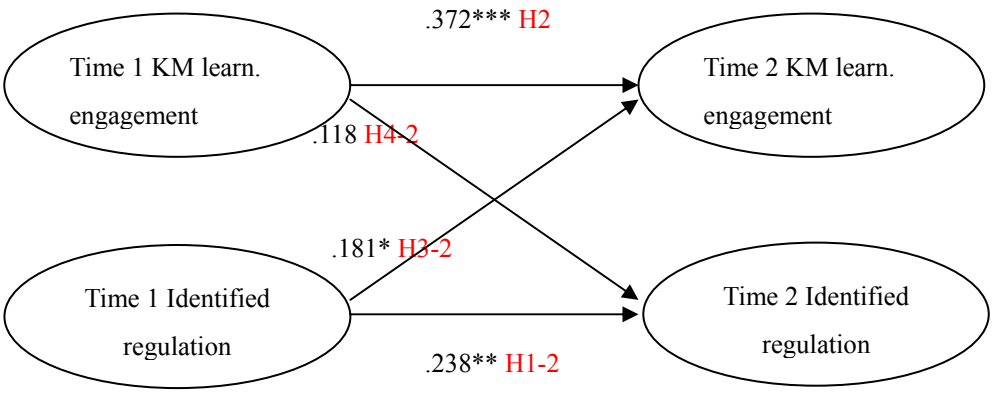

Figure 2 Cross-lagged relation of identified regulation and KM learning engagement (standardized coefficients)

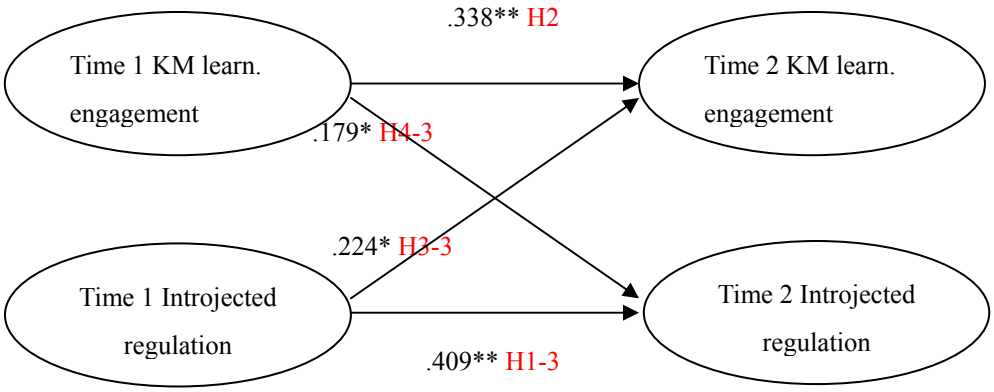

Figure 3 Cross-lagged relation of introjected regulation and KM learning engagement (standardized coefficients)

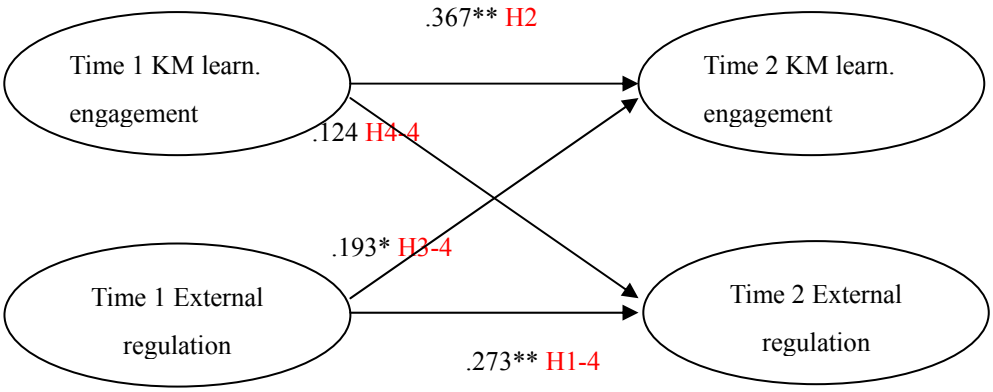

Figure 4 Cross-lagged relation of external regulation and KM learning engagement (standardized coefficients)

6. Conclusions

One major limitation of this current study is the fact that the results are based on several independent regression analyses. These analyses are not able to examine the influences between individual motivations that were assumed in the Cognition Evaluation Theory (CET); that intrinsic motivation is diminished by external motivation. The use of regression analyses also raised a concern of the difficulty to estimate errors when combining all regression models together into the same framework. It is suggested that employment of a more robust model, which includ the four regression models, such as structural equation modeling, be used in a future study. A second limitation is that there is no reference of the proper time gap between two surveys when conducting a cross-lagged panel study. The arrangement of a time gap in a longitudinal analysis might be a decisive factor in the findings. Past studies of motivation and KM learning engagement did not suggest a time gap in which students' change of motivation and KM learning engagement could be observed properly. This study shows that in a short period of two months, we can observe the effect of the change in motivation and KM learning engagement. It is suggested that a long term and multiple panel data collection might be able to get more reliable evidence of cross-lagged panel relations.

Reference (因篇幅過多，故暫略)