

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/316241717>

Using Content Analysis on Thesis of Design Departments in Taiwan to Explore the Potential Trend of IT-related Product Design

Article · April 2013

CITATIONS

0

READS

116

3 authors:



Yung-Chung Tsao

Providence University

254 PUBLICATIONS 76 CITATIONS

SEE PROFILE



Kevin Hsu

National Central University

69 PUBLICATIONS 60 CITATIONS

SEE PROFILE



Yin Te Tsai

Providence University

115 PUBLICATIONS 451 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



智慧家庭之智慧插座 [View project](#)



Power Socket with Power Monitor [View project](#)

Using Content Analysis on Thesis of Design Departments in Taiwan to Explore the Potential Trend of IT-related Product Design

Yung-Chung Tsao¹, Kevin Chihcheng Hsu², Yin-Te Tsai^{3*}

¹²Dept. of Information Management, National Central University, Taoyuan, Taiwan

^{3*} Dept. of Computer Science & Communication Engineering, Providence University, Taichung, Taiwan

Abstract—Information technology (IT) has become the popular industries in Taiwan, and more and more researches focused on the commercial products related to IT-topics. The study wishes to understand the trend of the new product development (NPD) in Taiwan via academic research works. We explore the related-factors between the creators and new products and analyse the relationships.

Many designers in enterprises were graduated from the related design departments in Taiwan. Some of the graduate students are already experienced designers from industry before they enter the graduate program, and, in their thesis, write about the problems encountered in their industrial work. Analysing the content of their research works may reveal the trend of design. Most graduate students focus their researches on potential product issues or the undeveloped functions of some commercial product design (CPD) at the design departments in Taiwan. The study wishes to explore the increasing or decreasing trend of the product developments and make some explanations for those issues. As the works in thesis are mostly the result of deep reflection for the future or the past, they are good place to find the potential change of trend. This is not the same as polling the mass population to find the current trend of design. So the study analyses the thesis stored in the digital library in Taiwan to analyse the progresses and changes over past decades.

The study uses the content analysis (CA) methodology to collect the thesis of National Central Library in Taiwan and classifies the researching-issues based on the paper-title. Based on its IT-influence, we classified the thesis into five classifications (i.e. original, IT-involved, IT-extended, IT-system and IT-related). The goals of the study aims to find the trend of the academic researches toward IT-related issues and offer the summary finally.

Keywords—Information Technology (IT); Commercial Product Design (CPD); New Product Development (NPD); Content Analysis (CA)

I. INTRODUCTION

A. Background & Motivation

The developers of the new product developments (NPD) have become the critical members in the Research & Development (R&D) departments of the most enterprises today. In spite that most design-works have done by senior designers, novices or junior designers have still offered new idea and approaches with their creativeness and innovation. So the study wishes to explore their originative power and training during school-age. As the problems mentioned above, the academic training and domain-expertise before graduation may be the critical factors for their creativeness and enterprise innovation. As this reason proposed above, the study wishes to understand the trend of research domain which those designers have specialized in school-age. The change or turnover of their academic domains or researches for those new designers in school-age may reveal the trial evidence for their creativeness.

Information Technology (IT) has become the invisible and critical resource in our daily life. So the IT-related products are already useful and handy like Smart-Phone (iPhone, etc.), Mobile devices (iPad, GPS-Navigator, Notebook, etc.), etc.. If the study analyzes their researches, which are related IT-related issues for those graduated students (who will become the designers in the future) in Taiwan, maybe results of study can offer better explanation of evolution of design paradigm over past decades.

B. Methodology

The study uses a large number of the thesis stored in the digital library of the National Central Library in Taiwan [5] and queries the thesis by special keywords with paper-title.

The research methodology uses the Content Analysis (CA) to analyze the collected data, and normalizes the redundant and abnormal data, and summarizes the data into classified tables and draws the trend charts finally. So the study will find the trend and changes of the design evolution.

C. Study Constraints

The constraints of the study are listed following.

1. Only use the digital library of the National Central Library in Taiwan[5] as the source of the data collection.
2. Only use keywords as the querying string like 'design' or 'visual' on the field of department and 'thesis' on the field of the degree.
3. All data collected are limited to digital format stored in digital library of the National Central Library in Taiwan, if other data format kept like paper-based are exclusive.
4. The deadline of the querying is 12, June 2012 and any transactions and changes on the digital library of the National Central Library in Taiwan are exclusive.
5. The analytic methodology is Content analysis (CA).
6. The data normalization will eliminate the repeated and incomplete data records after the double-check the whole data.

D. Goals

The goals of the study are described following.

1. The evolution of the academic researchers for the graduated students in the design-related department of universities at Taiwan.
2. The trend of the design-issues related to information technology (IT).

II. LITERATURE SURVEY

A. Content Analysis

Content Analysis (CA) was applied firstly on the newspaper-content research in 1930. With the much progress of IT and Research Methodology (RM), CA has been become the important and popular one of the researching methodologies [1,2,7-8]. The researchers declare the further development of content analysis in the conferences[2-3] and enlarge its usability of content analysis.

Content analysis by using synonymously with "quantitative content analysis" is a research methodology in which the contents are systematically and objectively identified, with making inferences about the contexts, causes, and effects of these contents [1, 2, 4, 6]. In common, researchers have examined the content of texts for their characteristics. This methodology emerged only around the beginning of the 20th century, following the development of mass media like newspaper.

The characteristic of CA quantify the collected data systematically. The analytic report will be constructed from the statistical methodology. The processes of the research by CA will follow the essential of the quantified data instead of the personal subjective viewpoint. The final results of researches will statistic each sub-content by different view of point, then the report of the researches will be generated by descriptive explanations based on those quantified data statistics.

III. DATA COLLECTION

B. Collecting Data Methodology

The study queries thesis on the website of the digital library of the National Central Library in Taiwan[5] and uses 'design' or 'visual' on the field of department as the keywords and sets degree to thesis. The first results of the querying is 9011 records, and the study eliminated incomplete records to get more exact records. The first results after the double-check is 9009 records.

The study classifies the departments and universities, then gets 76 departments records totally. But the study finds more problems about the department-name inconsistency (which are caused by integrating different classes into one or eliminating departments with only one year, etc.) . The study will normalize those data in next session.

C. Elimination for the Abnormal and Redundant Data

The study checks all data records and finds the abnormal and redundant data based on the problems mentioned above. So the elimination of the abnormal and redundant data uses the different sorts by the different fields to find the redundant and repeat records. The study chooses the best one among the same data and deletes others by querying those data according by analyzing the paper-titles and abstracts. We find some problems caused by uploading the thesis repeated over one time by the graduate students or the staffs of the libraries.

D. Normalization for the Inconsistent Department

The another problems are that some thesis for their departments are not suitable to the subject of the study, although the department-names also include 'design' or 'visual' words. Those data records are not suitable to the subjective of the study like ' Industrial Technology R&D Master Program of ECE college' , ' Industrial Technology R & D Master Program ' and 'department of wood science and design' , etc. . The study summarizes all different departments by university-name and department-name and check each classified department carefully.

International Journal of Emerging Technology and Advanced Engineering

Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 3, March 2013)

The final correct data records are 8241 records. But the study finds that the different department belonged to the same departments like 'department of industrial product design of Da-Yeh University', 'department of industrial design of Da-Yeh University' and 'Graduate Program of Design and Art College of Da-Yeh University'. The study surveys the content of the departments' websites and understands the history of those departments. The study replaces the department-name of the data by choosing the best or latest department-name among those similarly department-name. Finally, the study summarizes all data records into 69 department totally. The study shows top 60 percentage data records by department as shown in TABLE 1.

TABLE 1 TOP 60 PERCENTAGE OF THE THESIS BY DEPARTMENT

Department Name	Abbr.	Recs	Percent	Acc.P
Department of Industrial Design	NCKU	569	6.9%	6.90%
Graduate Institute of Design	NTNU	471	5.7%	12.62%
Graduate Program of Design and Art College	DYU	456	5.5%	18.15%
The Department of Industrial Design	TTU	402	4.9%	23.03%
Department of Architecture	NTUT	366	4.4%	27.47%
Department of Industrial and Commercial Design	NTUST	341	4.1%	31.61%
Department of Visual Art	TMUE	312	3.8%	35.40%
Department & Graduate School of Industrial Design	NYUST	310	3.8%	39.16%
The Department of Interior Design	CYCU	303	3.7%	42.83%
Graduate Institute of Innovation & Design	NTUT	289	3.5%	46.34%
Graduate School of Applied Arts & Design	STU	285	3.5%	49.80%
Graduate Institute of Architecture and Urban Design	CYUT	255	3.1%	52.89%
Graduate School of Visual Communication Design	NYUST	215	2.6%	55.50%
Department of Visual Arts	NCYU	200	2.4%	57.93%
Graduate School of Design Management	MCU	182	2.2%	60.14%

The study sorts data by university to summary the accumulated thesis for each university and gets the reports of the top 80 percentage as shown in Table 2. This report can explain the growth of the different universities, which focuses more on the design departments.

TABLE 2 TOP 80 PERCENTAGE OF THE THESIS BY UNIVERSITIES

University Name	Abbr.	Records	Percentage	Acc. P
National Yunlin University of Science and Technology	NYUST	810	9.8%	9.8%
National Cheng Kung University	NCKU	711	8.6%	18.5%
National Taipei University of Technology	NTUT	655	7.9%	26.4%
National Taiwan Normal University	NTNU	471	5.7%	32.1%
Da-Yeh University	DYU	456	5.5%	37.7%

University Name	Abbr.	Records	Percentage	Acc. P
Chung Yuan Christian University	CYCU	445	5.4%	43.1%
Tatung University	TTU	402	4.9%	47.9%
Chaoyang University of Technology	CYUT	384	4.7%	52.6%
Taipei Municipal University of Education	TMUE	382	4.6%	57.2%
Shu-Te University	STU	340	4.1%	61.4%
National Taiwan University of Science and Technology	NTUST	341	4.1%	65.5%
Ming Chuan University	MCU	330	4.0%	69.5%
National Taipei University of Education	NYUE	275	3.3%	72.8%
Shih Chien University	SCU	236	2.9%	75.7%
National Chiayi University	NCYU	200	2.4%	78.1%
National Kaohsiung Normal University	NKNU	186	2.3%	80.4%

The study still faces the problems due to the heterogeneous department-name. The departments of universities make their department-name independently and the subjects of the departments are similar. So the study explores the objective of each department and tries to classify the similarly departments into the same classification.

E. The Methodology for the Department Classifications

Furthermore, the heterogeneous department-name problems are not only one problem in the study. Because the departments of universities make their department-name independently and the subjects of the departments are similarly in nature, so the study explores the objective of each department and tries to classify the similar departments into the same classification.

The study classifies all data records into nine catalogue as shown in Table 3 and the percentage chart as shown in Figure 1

TABLE 3 THE CATALOGUE OF THE DEPARTMENTS

Code	Department Classifications	Records	Percentage
01	Industrial Design Dept.	1885	22.87%
02	Visual Communication Design Dept.	1246	15.12%
03	Design Management Dept.	2219	26.93%
04	Architecture Design Dept.	993	12.05%
05	Landscape Design Dept.	579	7.03%
06	Digital Media Design Dept.	377	4.57%
07	Fashion Design Dept.	19	0.23%
08	Innovation Design Dept.	36	0.44%
09	Art & Deign Dept.	887	10.76%

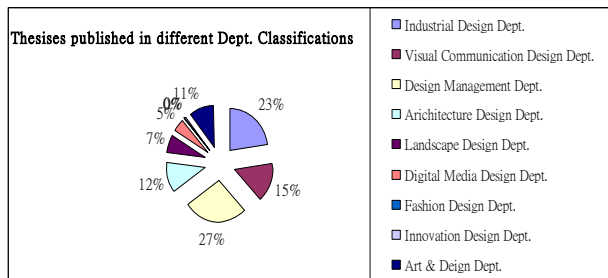


Figure 1 The Percentage for the Different Classification

IV. DATA ANALYSIS

The study uses content analysis(CA) to analyze the results of the querying. The analyzed-reports will be discussed in this session.

F. The Analysis of the Academic Thesis by Year

At first, the study analyzes the data records by year to understand the increasing ratios of the year as shown in Table 3. The reports show the increasing trend year by year. The reports reveal the graduate students from universities toward the positive increasing. The results can explain why more and more new IT products related to IT issues are created in the market.

We can see the large curve as shown in Figure 2 and the increasing progresses after 2000 year. So the study compares the thesis published year by year to understand the ratios of the progresses as shown in Figure 3. We can see the near 80% amount increased during 2000-2004 year as shown in Figure 3. This results describe IT requirements increasing after 2000 year.

We can see the slow increased amount during 2002-2010 year as shown in Table 4. The study explains the trend of the slow increased amount as to the slow increased amount enrolled graduate students of the design departments in Taiwan. So this results also describe the incremental IT growth over pass decades, not limited to the decreasing enrolled students.

TABLE 4 THE PUBLISHED THESIS BY YEAR

Year	Records	Percentage	Acc. P
~1991	137	1.66%	1.66%
1992	38	0.46%	2.12%
1993	38	0.46%	2.58%
1994	50	0.61%	3.19%
1995	50	0.61%	3.80%
1996	69	0.84%	4.64%
1997	88	1.07%	5.70%
1998	89	1.08%	6.78%
1999	120	1.46%	8.24%
2000	210	2.55%	10.79%

Year	Records	Percentage	Acc. P
2001	244	2.96%	13.75%
2002	435	5.28%	19.03%
2003	504	6.12%	25.14%
2004	578	7.01%	32.16%
2005	704	8.54%	40.70%
2006	750	9.10%	49.80%
2007	819	9.94%	59.74%
2008	1064	12.91%	72.65%
2009	1079	13.09%	85.74%
2010~	1175	14.26%	100.00%

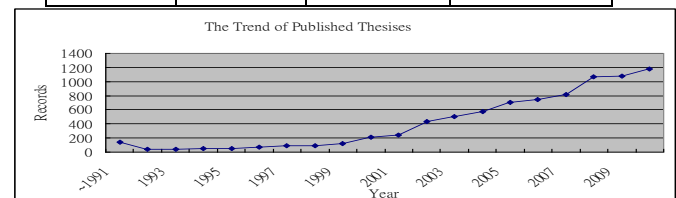


Figure 2. The Trend of the Published Thesis by Year

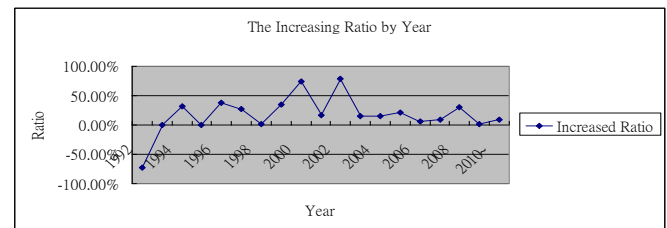


Figure 3. The Increasing Ratio by Year

The study uses the nine catalogue to classify all departments from all data records, as shown in Table 3. The top 3 is 'Design Management', 'Industrial Design' and 'Visual Communication Design' as shown in Figure 4. But we can't still omit the potential increasing power of 'Digital Media' as shown in Figure 4. This department is new departments in Taiwan. The large growth reveals the coming of the e-stage with the popularity of the digital and multimedia products. So the potential increasing for department of Digital Media reveals that IT related product developments need more and more digital contents and digital media developments.

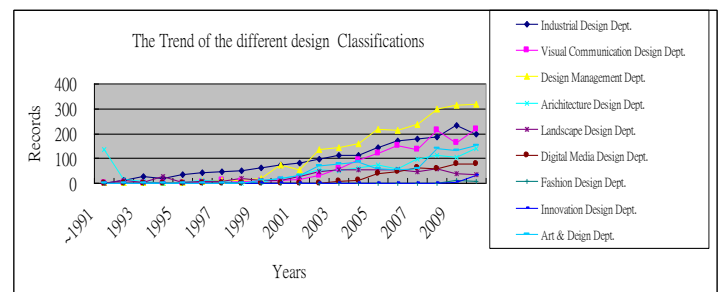


Figure 4. The Trend of the different design Classifications

G. The Analysis of the IT-related Issues

The goals of the study will discuss the IT-related issues for the academic thesis in this session. At first, The reports show the increasing curve for the accumulated records as shown in Figure 5. The curves above the curve of 'Normal Layer' are IT-related issues. The classification refers to classified rules as shown in Table 5. The study reads the each paper-titles and analyzes the essential and semantics and classifies the papers into their classifications according to the definition of the classifications as shown in Table 5. If any confusion or misunderstanding judgments happens, the study will refer the abstract and citation of the thesis as the referent contents.

TABLE 5 THE DEFINITION OF THE IT-RELATED ISSUE CLASSIFICATION

Classification	Definition
Normal	The research content don't IT-related issues
IT Topic	The research contents focus on the IT Topics
IT Case & Research	The research content focus on the extension of IT Topics
IT System Research	The research content focus on the essential and the extension of Information System
IT Related Methodology	The research content apply the methodology of IT to explore others

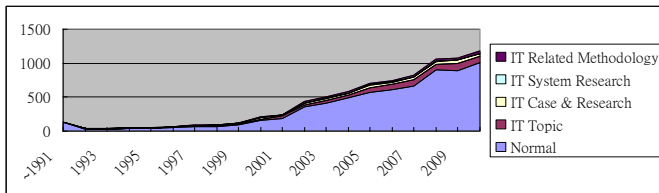


Figure 5. The Accumulated IT-related Issues by Year

The analysis results indicate 'IT Topic' as the main classification among IT-related issues as shown in Figure 5. The 'IT case & Research', 'IT System Research' and 'IT Related Methodology' are sub-topic related to 'IT Topic' as shown in Figure 6. The study finds the high-rate increasing amount after 2000 year. Although the end of the curve becomes more and more slow, the study consults the staffs of the department of the digital library of the National Central Library in Taiwan[5] and the answer to the curve is that the 12-18 months as the maximum work-time. So it can explain that 1175 data records in 2010 and 62 data records in 2011.

So the results concluded above show the more and more graduate students focusing on IT-related issues of NPD. Maybe it explains the large requirements of IT-related product designers.

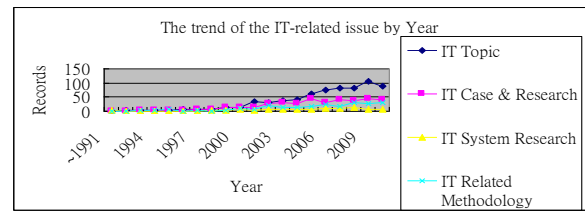


Figure 6. The trend of the IT-related issue by Year

H. The Mutual-Analysis

The final step will use department classifications and IT-related issues to analyze the mutual influences. The reports shows the percentage related to the total-amount according to the two dimensions as shown in Table 6. The study gets the detail-percentage.

TABLE 6 THE CROSS COMPARISON OF CLASSIFICATIONS

	Normal	IT Topic	IT Case & Research	IT System Research	IT Related Methodology	IT Issues
Industrial Design Dept.	66.8%	16.7%	8.1%	3.0%	5.4%	33.2%
Visual Communication Design Dept.	89.2%	5.1%	3.6%	0.9%	1.2%	10.8%
Design Management Dept.	82.2%	7.7%	6.4%	0.5%	3.2%	17.8%
Architecture Design Dept.	96.9%	0.5%	1.0%	0.2%	1.4%	3.1%
Landscape Design Dept.	97.8%	1.0%	0.5%	0.0%	0.7%	2.2%
Digital Media Design Dept.	48.5%	36.1%	9.5%	1.3%	4.5%	51.5%
Fashion Design Dept.	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Innovation Design Dept.	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Art & Design Dept.	95.9%	0.8%	1.4%	0.9%	1.0%	4.1%
	82.7%	8.5%	4.9%	1.1%	2.8%	17.3%

It shows the decreasing curves as shown in Figure 7. The study wishes to understand the trend of IT-related issue for each department classifications. So we must drill down the problems by the detailed analysis.

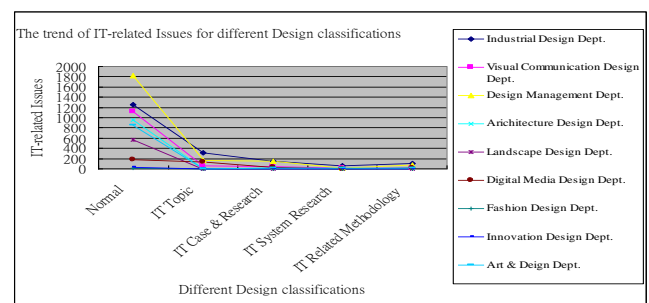


Figure 7. The Trend of IT-related Issues for the Different Classifications

But the study finds the increasing trend of published thesis as shown in Figure 8 , so the study uses a scale-up method to zoom out the curves in advance.

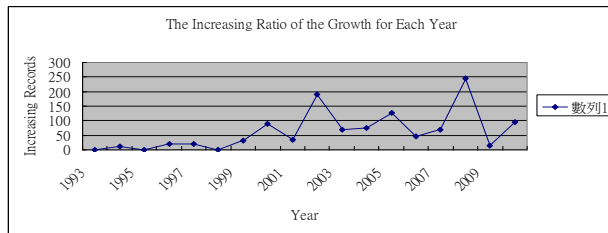


Figure 8 The Increasing Ratio of the Growth for Each Year

The study enlarges the curves by the micro-view into the new chart as shown in Figure 9. The micro-view is that we separate dependent growth into independent growth and construct the same fundamental basis. So the curve of IT-related issues multiply a factor (sum of non-IT-related / sum of IT-related) , new curve -IT-related (ScaleUp on Avg) is created and this curve can fit the non-IT related over 90% similarly.

If the curve of IT-related issues multiply another factor (start of non-IT-related / start of IT-related) , new curve -IT-related (ScaleUp on Start) is created and this curve show the high-rate slop than the non-IT related as shown in Figure 9. It can explain the large increasing amount for the new IT products in past decades.

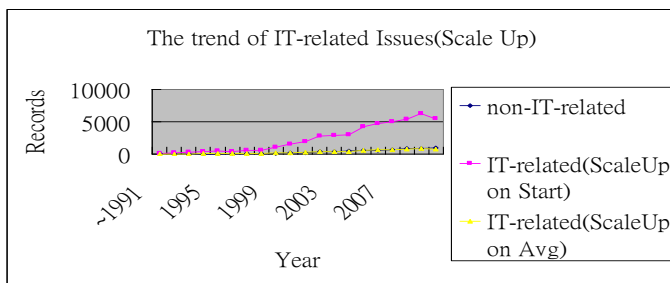


Figure 9. The trend of IT-related Issues(Scale Up)

It shows the unstable increasing curves as shown in Figure 8 to be transformed into incremental growth as shown in Figure 9, so the incremental growth matches real progress and growth of information technology products (ITP).

V. CONCLUSION

I. Conclusions

As the works in thesis are mostly the result of deep reflection for the future or the past, they are good place to find the potential change of trend. This is not the same as polling the mass population to find the current trend of design.

The study uses CA to analyze the academic thesis data and finds the increasing growth of IT-related issues. Although the amount of IT-related issues is 17.31%, but according to incremental growth, all graduate students in universities will engage in whole domains instead of those, which are only involved in IT-related area. The most important is that the increasing trend of IT-related product developments in the study have spread into cross-domain in the future.

The conclusion lists following.

1. The increasing growths of IT-related issues are many times than the growth of non-IT-related, which indicate the IT product developments become important issues today.
2. The direct IT researches are more popular and reveal more graduate students involving in IT-related product design in universities. That tells us that IT-related media and skills have become the important and critical domains in the future.
3. The methodologies of IT-related have become the popular research methodologies of the design departments. It can enrich the graduate students in universities to focus on the IT-related researches in the future. So the training and courses of IT-related research methodology (i.e. Data-mining, Algorithm, TAM, etc.) could be the good choices of graduate students of design departments today.
4. The more graduate students in universities to focus on IT-related product-design will enlarge the research domains of IT product developments and will validate the usability of the IT product designs in different domains in the future.

J. Future work

The study will compare cross-domains researches with other departments, so the future works are listed as following.

1. The thesis comparison of the non-design department will add into the data records for more detailed analysis.
2. The weighted-values added into the data-records according to the importance of the IT-related issues will increase confidence of different domains.
3. The weighted-values added into the data-records according to cited amount by other researches will increase accuracy of different domains.

VI. ACKNOWLEDGMENT

The study was partially sponsored by NSC 101-2218-E-126-001-, NSC100-2218-E126-001, NSC100-2410-H-008-051-, NSC99-2218-E-126 -001, NSC99-2632-E-126 -001 -MY3, NSC98-2511-S-008-003-MY2, NSC97-2410-H-008-039

REFERENCES

- [1] G. W. Domhoff, *The scientific study of dreams: Neural networks, cognitive development, and content analysis*: American Psychological Association, 2003.
- [2] K. A. Neuendorf, *The content analysis guidebook*: Sage Publications, Incorporated, 2001.
- [3] K. Krippendorff, "Reliability in content analysis," *Human Communication Research*, vol. 30, pp. 411-433, 2004.
- [4] K. Krippendorff, *Content analysis: An introduction to its methodology*: Sage Publications, Incorporated, 2012.
- [5] National Digital Library of Theses and Dissertations in Taiwan. Available: <http://ndltd.ncl.edu.tw/cgi-bin/gs32/gswweb.cgi/ccd=NQ11r7/search?mode=advance>
- [6] O. R. Holsti, "Content analysis for the social sciences and humanities," 1969.
- [7] R. P. Weber, *Basic content analysis vol. 49*: Sage Publications, Incorporated, 1990.
- [8] R. D. Wimmer and J. R. Dominick, *Mass media research: An introduction*: Wadsworth Publishing Company, 2006.



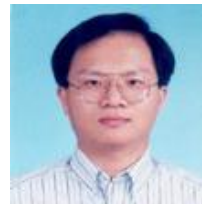
Yung-Chung Tsao received his Bachelor of Business Administrator from Chung Yuan Christian University, Master of Computer Science and Information Management from Providence University and a PhD of Information Management from National Central University. His current research interests include the design and analysis of algorithms, software engineering and product development management.

Email: tyc6095@ms1.hinet.net



Kevin Chihcheng Hsu is an Assistant Professor in Dep. of Information Management at National Central University, Taiwan. He received his Bachelor of Computer Science from National Taiwan University, a Master of Computer Science from State University of New York at Stony Brook, and a PhD of Computer Science from University of California, Los Angeles. He has extensive industry experience in distributed systems, workflow, B2B, multi-tier web application, and system integration. His current research interests include e-learning system integration, workflow learning in enterprise, business process management, IT support for Product Lifecycle Management, and multi-tier web applications within supply chain.

Email: khsu@mgt.ncu.edu.tw



Yin-Te Tsai is a professor of Dep. of Computer Science and Communication Engineering at Providence University. He received his B.S. degree in computer engineering from National Chiao Tung University, M.S. degree in computer science and information engineering from National Chiao Tung University, and Ph.D. degree in computer science from National Tsing Hua University, in 1987, 1989 and 1994, respectively. From July 1994 to May 1996, he was a computer instructor at Army Electronics and Communication School for the military service. His current research interests include the design and analysis of algorithms, bioinformatics and software development.

Email: yttasai@pu.edu.tw