教育資料與圖書館學

JOURNAL OF EDUCATIONAL MEDIA & LIBRARY SCIENCES

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Contents

EDITORIAL
In and Beyond This Issue

Among the fifteen manuscripts submitted for this issue (Vol. 50, no. 3), five were accepted and ten were rejected, with a rejection rate of 66.67%. In addition, thirteen articles were still in review process. For addressing the problem of accumulated manuscripts, we have shortened the original four-month review process to 4-8 weeks, depending on different requirements for revision and publication procedures. With the number of manuscripts submitted increased, the rejection rate has also rose to two-third. As to the subjects, manuscripts addressing "educational technologies" have increased to share an almost equal quantity with articles focusing on "library and information science". This indicates that there is a paradigm shift happening in the journal which originally aimed at addressing library and information science issues.

Those manuscripts from other related academic fields are submitted and accepted in this journal; it not only enriches sub-subjects of this journal, but also reveals a fact worth noticing for scholars in library and information science field. For we know that the development of a new paradigm indicates a dramatic change of the surrounding environment. If a traditional paradigm and academic field is not able to provide appropriate methods of solving research problems or to attract researchers to conduct more related studies, it will be marginalized. However, at this moment we may not need to be too concerned, for the small-scale paradigm shift in this journal may be just reflecting what the title of our journal indicates and what our historical background it involves. It might not mean a large-scale paradigm shift in library and information science field. Furthermore, in this time of internet communication, many research topics are interdisciplinary, involving different academic fields at the same time. These research papers could not be categorized into a single research field. However, if we acknowledge what S. R. Ranganathan advocates—"The library is a growing organism", and embrace other subjects into library and information science field, then we should be able to overcome challenges of the surrounding environment.

Let's look at the five outstanding articles accepted for publication of this issue—"Citation Analysis on Social Science Literature of Taiwan" by Ming-Yueh Tsay (蔡明月) and Min-I Lee (李旻嬟); "Subject Analysis of E-LearningResearch" by Ching-Fu Lee (李清福), Chih-Ming Chen (陳志銘), and Yuen-Hsien Tseng (曾元顯); "A Content Analysis of Facebook Pages for Children with Disability" by Ming-Hsin Phoebe Chiu (邱銘心) and Man-Jiun Juang

(莊曼君); "The Comparison Study of Factors Influencing Information Behaviors between Undergraduate Students and Teachers in University" by Hsin-Yih Shyu (徐新逸) and Kang-Jiun Pern (彭康鈞); "What Stimulates Web Design Students' Imagination? The Mediator Effect of Inspiration through Action" by Chaoyun Liang (梁朝雲). With these five articles involving different research fields published in this issue, we believe it's a positive and healthy "paradigm shift".

Jeong-Yeou Chiu
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Citation Analysis on
Social Science Literature of Taiwan

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Abstract

Through citation analysis, this study explored the distribution of document type, language and publication year among citations in social science journals that published in Taiwan and indexed in Taiwan Social Science Citation Index (TSSCI). Samples as research subjects were research articles published in 2010 from first-rank journals assessed by Department of Humanities and Social Sciences, National Science Council. Sections in which citations appeared, namely introductions, methodologies, results, and conclusions, were to be examined as well. Conclusions and suggestions were made based on research results and intra/interdisciplinary comparisons. While citing characteristics and information needs of social scientists revealed in this study could be valuable in collection development of libraries or refinement of information services, analysis of research results may serve as reference for publishers of social science journals, scholars and providers of citation index databases- especially for domestic ones- on notes, citation formats and indices. Aiming at further exploration of citations, this study is also expected to provide a better understanding of citation nature, and serve as a stepping stone for future empirical studies.

Keywords: *Social sciences; Citation format; Classification of citation; Citation analysis*

SUMMARY

Journal articles are very important for scholarly communication. The present study will explore and compare the characteristics and types of citations in Taiwanese social science journal articles using informetrics and citation analysis. In addition to citations appearing in the text, the phenomena of content notes and note-within-notes will be discussed in the latter part. Research articles published in 2010 from top social science journals in Taiwan were collected and analyzed by document type, language, publication year, and location of citations (i.e.,

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introduction, methodology, results and conclusion sections). Content note, in this study, refer to note as illustrations for main texts, while note-within-notes refers to content-notes citing other publications.

The journals selected in this study were based on a 2002 assessment conducted by the National Science Council's Institute for the Humanities and Social Sciences, which ranked journals of various disciplines in the domain of social science research. Journals ranked first in each discipline were chosen and cross-referenced with the Taiwanese Social Science Citation Index (TSSCI). Research articles in these journals which were published in 2010 and compliant with the IMRAD format were then selected as the research sample. Articles published earlier than 2010 were also collected if the number of samples did not suffice. IMRAD is the acronym for Introduction, Methods, Results and Discussion, which is the widely-accepted structure for scientific articles. In this study, if the introduction and literature review were found in two different sections, this would be viewed as an "introduction in combination"; if the results and discussion were combined in one section, this would be categorized as "results".

Articles from the top journal in each of the following disciplines were evaluated: sociology, education, psychology, political science, economics and management. The number of articles and the journal title selected for each discipline, respectively, were as follows: 15 articles from the Taiwanese Journal of Sociology, (2008-2010); 31 articles from the Bulletin of Educational Psychology (2010); 16 articles from the Chinese Journal of Psychology (2010); 16 articles from the Taiwan Political Science Review (2008-2010); 13 articles from Academia Economic Papers (2010); and 25 articles from the Journal of Management (2010). Full texts and references for all 116 articles were downloaded from online databases or photocopied from the printed journals and analyzed by the document type, language, publication year, format of notes, and location of citations. The results are discussed as follows.

1. Journals and books were cited most frequently by social scientists, while newspapers and research reports were cited the least.

According to the bibliographic data collected, journals and books were the most frequently cited, accounting for 87% (journals 64.8% and books 22.7%) of all cited material. The use of journals and books in the field of economics was quite different, with a deviation over 75%, in which journals accounted for 81% of cited material. In other disciplines, such as social science and political science, however, the difference in use of journals and books was rather small, indicating their equal importance to both disciplines. Overall, social scientists preferred to use journals in exploration and support of their own research.

2. English language publications were the most cited in social science articles. In particular, English language publications accounted for over 90% of references in the field of economics and management.

Publications in traditional Chinese and English languages were the main source of citations in social science articles, accounting for 21.5% and 78%, respectively, of the total references collected. The majority of citations in economics (93.5%) and management (92.1%) were of English language papers, while Chinese language literature was rarely cited by both disciplines. Domestic research articles and reference materials were valued by researchers in sociology (30.7%) and political science (43.4%). Although English language materials were cited more frequently, the citation rate of Chinese language publications in sociology and political science has been rising in recent years.

3. Social scientists tended to cite material published within the last 10 years, with a citing half-life of approximately 11 years.

For social scientists in most disciplines, 50% of citations came from literature published after 2000. The frequent use of recently published articles shows the continuous progress of social science research.

4. The proportion of articles compliant with the IMRAD format was high in the social sciences.

Both review papers and original research articles were common in the disciplines of political science and sociology, while journals in the fields of psychology, education, economics and management preferred original research articles. In either case, the strict requirements for article formats indicate the progression of social sciences in Taiwan into a mature research domain.

5. Social scientists used citations primarily to set the stage for their own study and to provide background information. Citations most often appeared in the introduction section, with the fewest appearing in the conclusion.

The distribution of citations in an article may indicate the status and characteristics of a research domain. In this study, citations were most often seen in the introduction for each social science discipline examined. The introduction sometimes included a literature review, and references were used to set up their motivation for the research. The fields of economics and management had a high percentage of citations in the methods section, which can be explained by the adoption or revision of models, designations, or operations from other research, by scholars in these disciplines. As for the results section, economists and psychologists tended to cite more articles for comparison and contrast. Psychology and education had the highest rates of citations appearing in the conclusion section, which shows their concern for further discussion and evaluation of research results. In general, the conclusion section of articles had the fewest citations.

6. Content notes were common in social science publications and appeared most frequently in economics articles.

Among all the social science disciplines examined, content notes were seen most often in economics articles. Content notes appeared in every article collected from the economics journal. Both political science and sociology were second to economics, with content notes appearing in over 90% of articles. Content notes appeared in 76% of management articles and in fewer than 20% of psychology and education articles (i.e., only 2-3 articles).

In this study, citation characteristics of social scientists in Taiwan were analyzed using bibliographic data, such as the type of cited materials and the language of cited materials. The results show the citation characteristics and information needs of domestic social scientists, which could be valuable in the development of library collections or in the refinement of information services. Assuming that citations indicate actual use of materials, the distribution of publication years and the citing half-life may inform libraries as to which information resources to continue or suspend (e.g., electronic journals), which could help with budget allocation.

In view of citation formats and copy-editing, it is recommended that, for both domestic social scientists and journal publishers, content notes and note-within-notes be avoided, based on the research outcome. A simpler layout of the text may lead to easier reading and understanding of research articles. For citation index services such as TSSCI, it is recommended that note-within-notes be included in databases as citations, to prevent authors and publications from being left out. This study is expected to provide a better understanding of the nature of citations and to serve as a foundation for future empirical studies.

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Subject Analysis of E-Learning Research

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Abstract

In recent years, the global trend of applying information technology to teaching and learning has seen many countries promote e-learning as an important policy. This trend has led to the development of research topics in e-learning. The present study used a generalized definition of e-learning as its search strategy and retrieved a total of 2,125 SSCI journal articles in the field of e-learning from 2000 to 2009. The articles were analyzed with the scientometric tool, CATAR, based on co-word and bibliographic coupling analyses to determine the salient research subjects. These e-learning research subjects were verified and compared with those compiled by domain experts. The results of this study will help researchers look into their own field specialties, understand the developing trends in e-learning research, indicate researchers who have had influence in e-learning research, and determine future research subjects.

Keywords: *E-learning; Subject analysis; Clustering analysis; Co-occurrence words; Bibliographic coupling*

SUMMARY

Introduction

The development of digital technology and communication networks in the past decade have changed the methods by which information is acquired. Being a computer and network mediated learning method, e-learning enables learning

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at any time and place. The United States started the NLII (National Learning Infrastructure Initiative) program in 1994 to promote e-learning, and in 1996, Taiwan began developing e-learning with the promotion of distance learning in higher education. E-learning is currently one of Taiwan's key national science and technology programs. In 2002, the Executive Yuan, the highest level of government councils in Taiwan, started a six-year program "Challenge 2008— National Development Plan of the National Science Council" and completed the first stage of its E-Learning Program by 2007. The goal of this program was to promote e-learning with in Taiwan with a view to enhance the country's overall competitiveness. In 2008, the National Science Council merged the "E-Learning Program" and "Digital Archives Program" into the "Taiwan e-Learning and Digital Archives Program" (TELDAP), with the aim of bringing together government, academic, and private sector resources to make Taiwan a center of global e-learning. According to the analyses of Tseng, Chang, Tutwiler, Lin, & Barufaldi, the effectiveness of this program was significant. In 2000, one of the European Union's targets for 2010 was to make Europe the world's most competitive knowledge-based economy, in which e-Learning would be a key strategy, with ICT (Information & Communication Technologies) applied to teaching resources and services to improve learning quality.

According to the Science and Technology Yearbook, both the quality and quantity of e-learning research in Taiwan were ranked third in the world. The country's investment in e-learning seems to have yielded high visibility and influence globally. However, few domestic and international researchers have conducted over all bibliometric analysis in the field of e-learning to determine the impact of individuals (researchers, institutes, and countries) and trends in the research subjects. In this study, SSCI journal articles on e-learning were selected and research subjects analyzed using automatic literature content mining. Concurrently, experts in the field were interviewed to confirm the consistency and rationality of subject areas in order to present a data-driven and evidence-based subject classification framework. This study aims to help researchers understand the field specialties and developing trends in e-learning, and suggest areas for future research. In addition, the most productive researchers, the most influential countries, and the most representative research subject areas acquired from the bibliometric analysis will help e-learning researchers to be strategic in their research plans.

Research Method

Using 17 keywords related to e-learning, the bibliographic records were collected from the WoS (Web of Science) database and the bibliometric tool, CATAR, was applied to conduct the analysis based on bibliographic coupling and

co-word analyses. The results were compared with and verified by the e-learning classification frameworks of international periodicals and by field experts, respectively.

The 17 keywords for searching on the WoS database were: e-learning, elearning, electronic learning, digital learning, online learning, on-line learning, distance learning, distant learning, web-based learning, computer-based learning, networked learning, Internet-based learning, mobile-learning, m-learning, ubiquitous learning, u-learning, and distant education. Articles published between 2000 and 2009, with titles, abstracts, or keywords matching any of these 17 terms were collected. In total, 2,125 bibliographic data were retrieved.

CATAR (Content Analysis Toolkit for Academic Research) is anautomatic content mining tool downloaded from the internet, which can be used for the development of field subjects and is effective in assisting traditional manual analyses to achieve semi-automatic subject analyses. The bibliographic data downloaded from the WoS database, including titles, abstracts, keywords, year of publication, authors, institutes, nationality, name of journal, and cited references, were analyzed using CATAR. The structural data acquired from the over view analysis was then further analyzed using bibliographic coupling and co-occurrence words (co-word) analyses. The data for co-word analysis were from the titles and abstracts, while the data for bibliographic coupling was based on the cited references (CR).

Five experts in e-learning were interviewed to verify and compare the subject clustering results acquired from CATAR. During the interviews, subject areas derived from co-occurrence words and bibliographic coupling, the knowledge clustering subject classification of the C&E (Computers & Education) journal, the clustered keywords in the journal of BJET (British Journal of Educational Technology), and the keyword clustering in the ASTD (American Society for Training and Development) were provided for comparison and adjustment of the obtained subject clustering. This produced more accurate and rational research subject areas.

Results and Discussions

From the overview analysis, seven of the top ten most productive researchers in the past decade were Taiwanese, representing the research energy of Taiwan in the e-learning field. Additionally, the number of published research from Taiwan has increased exponentially since 2006.

From the clustering results of CATAR, there were 11 research subjects and 55 categories that could be found in the C&E subject classification with a rate of correspondence of up to 77.5%. It is possible that subject clusters were

not yielded by CATAR because relevant literature was excluded. For example, the following subjects: authoring tools, groupware tools, user interface design, emerging technologies & accessibility, and new roles for teachers/learners would not be extracted when **e-learning** was not mentioned. Also, some subjects clustered by CATAR were not included in the subject categories of C&E.

For those subjects obtained only from CATAR, Game, Health, Nurse, Cognitive, Motivation, and Mentoring are representative emerging research subjects, while Formative Assessment, Peer Assessment, and Quantitative Research were the developing subject categories. In addition, Knowledge-based System, Content Management, Learning Management Systems, and Learning Technology were the primary research issues related to e-learning not shown in the C&E subject categories. It was evident that some important research issues or emerging research subjects obtained from CATAR could be used to suggest additional categories for manual subject classification, with the help of keywords in the BJET and ASTD.

From our comparison, in terms of subject clustering capability, the co-word analysis extracted more research subjects, while the bibliographic coupling method yielded more definite subject categories.

In summary, the subject categories identified by experts could be extracted with CATAR and it was possible for new research subjects not in the manual categories to be discovered using this data-driven, evidence-based approach.

Conclusion and Suggestion

The vitality of Taiwanese researchers in e-learning is related to the governmental promotion of E-Learning Program. It is evident that the appropriate investment of national resources has enhanced the international visibility and influence of Taiwan in this area of research.

The subject classification of C&E, one of the core periodicals for e-learning, is formulated based on expert knowledge. Comparison of C&E's classification with CATAR's automatic clustering showed correspondence between nearly 80% of subjects. The subordinate relationship between subjects and categories is also clear with CATAR analyses, which could help novice researchers explore the relevant literature.

Research subjects in the field of e-learning are under continuous change as they are influenced by technology development. Regular subject analyses is therefore important to assist researchers in understanding the past, present, and future directions of research. Automatic content mining can also improve the efficiency of manual analyses.

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A Content Analysis of Facebook Pages for Children with Disability

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Abstract

The rapid development of the Internet changes how everyday consumers seek health information. Health information seeking practice on the Internet is becoming inevitable, and health communication through social networking communities is becoming more and more popular. Facebook is one of the most popular social networking services because of its capability to connect social networks, realize interaction, and create extended value of collaboration and information sharing for the society. This study observed 49 Facebook fan pages for children with disability up to December 31, 2011. With consumer health informatics as the grounding perspective and content analysis as data collection and reasoning methods, this study attempted to investigate the development of the Facebook community, the focus of the platform exchange, and patterns of interaction. The study shows that "awareness raising" is the most common types of information posted on the Fan Pages by the community members. Even though community members didn't actively participate in "help seeking", the interaction on Facebook still realize its role and importance in health information communication. Other roles include health care improvement, health promotion, medical decision making, insurance provision, and medication safety. In addition, members interact most often through "like", "comment", and "share". Comments are frequently found with evaluative judgment. The study also provides constructive suggestions for different types of stakeholders, to better design and provide health information services.

Keywords: Consumer health information; Facebook; Children with disability; Content analysis; Social support

SUMMARY

The rapid development of the Internet has changed how everyday consumers seek health information. Seeking health information on the Internet is becoming

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an inevitable trend, and health communication through social networking communities is becoming more and more popular. Facebook is one of the most popular social networking services because of its capabilities to connect social networks, realize interaction, and create extended value of collaboration and information sharing for the society. Health communication on Facebook is a growing practice. Past research has investigated Facebook use for patient support groups of diabetes mellitus and breast cancer, and revealed that the similarities in background and health situation of group members would lead to common health goals.

Patient groups of children with disability should deserve equal opportunities, rights, and access to health communication on Facebook. With this regard, this study has observed 49 Facebook fan pages addressing children with disability, with an observation period lasting from June 1, 2011 to December 31, 2011. With consumer health informatics as the grounding perspective and content analysis as data collection and reasoning methods, the researchers of this study attempted to investigate the roles of Facebook fan pages to patient groups of children with disabilities, as well as the situation of social support. This study was guided by two research questions: (1) What are the common types of information posted on Facebook fan pages for children with disability? and (2) What are the interaction patterns among members of the Facebook fan pages for children with disabilities? It is hoped that by identifying the information needs of the patients, families, or whoever cares about children with disabilities, an awareness of supporting and care for this group could be raised, and services and related policies can be put into effect.

In the pilot study conducted prior to data collection, 118 Facebook fan pages regarding disabilities and operated in Traditional Chinese were found, and only 49 fan pages exclusively for patient groups for children with disabilities were based in Taiwan. The 49 fan pages were first examined for their activeness and authority, and later categorized into 13 disability types, ranging from physical disabilities, sensory disabilities, mental disabilities, to intellectual disabilities.

An analytical framework was developed based on the past research literature and the operational procedures of content analysis. With two research questions mentioned above, two research themes were developed to be probed: content of information shared and member interaction. More specifically, sub themes of "content of information shared" included types of information posted, types of social support, types of consumer health information, types of source of consumer health information, and types of needs; sub themes of "member interaction" included types of interaction and characteristics of comments posted. Two themes and the corresponding sub themes were used to guide the development of the

operational coding scheme. An unobtrusive, descriptive quantitative content analysis was conducted. The principal researcher along with two additional coders participated in the data coding and analysis process. In analysis of "content of information shared" theme, the inter-coder agreement coefficient reached 0.81, and inter-coder reliability reached 0.93. In analysis of "member interaction" theme, the intercoder agreement coefficient is 0.72, and inter-coder reliability is 0.89.

Considering the fact that the researchers directly accessed the 49 Facebook fan pages, and observed and recorded what was shared on the fan pages, this study was subject to Facebook's Terms of Service statement "When you publish content or information using the Public setting, it means that you are allowing everyone, including people off of Facebook, to access and use that information, and to associate it with you (i.e., your name and profile picture), and employed this statement to ensure the legitimacy of data collection. Additionally, this study was also subject to the Copyright Law of the Republic of China, Article 52, verifying that this study is educational, research-based, and fair use in nature. It is the current study's utmost concern to ensure privacy, safety and dignity for research participants.

Among 49 fan pages under investigation, 12 were for autism, and six were for intellectual disabilities, developmental disabilities, and general disabilities. Fan pages for physical disabilities, language disabilities, and learning disabilities have not yet been established.

In Table 1, we summarized the complete distribution of content type of information shared. It showed that "awareness raising (28.4%)" is the most common types of information posted on the fan pages by the community members. "Social support (19.48%) is proved to help alleviating pressure and sense of helplessness. Social support can take forms in affection-based, information-based, and resource-based. Affection-based social support shows empathy and encouragement through texts, images, as well as audio and video clips. Information-based social support can be divided into consumer health information and other types of information. Most commonly found types of consumer health information are healthcare information (64.71%), preventive health information (15.90%), others (8.25%), health information provider information (4.58%), insurance information (3.70%), and drug and medicine information (2.82%). Resource-based social support (6.04%) provides most substantial benefits for families with needs. It could take forms in free clinical services or donations. Marketing and outreach (17.80%) information is for promoting and advertising members' activities, and gathering members to strengthen their relationship.

Table 1 Content Type of Information Shared

Content type of information shared	%
Awareness raising	28.4
Social support	19.48
Marketing and outreach	17.80
Everyday life	16.75
Other related information	7.48
Others	5.79
Help seeking	2.00
Volunteering	1.99

Regarding patterns of members' interaction, we found that members interact most often through the "Like", "Comment", and "Share" functions on the Facebook interface. "Like" is a popular way to express support on Facebook. Comments are frequently found with evaluative judgment. Three most common types of comments are "delivering opinion (33.46%)", "expressing emotion (20.66%)", and "providing information (9.87%)". Opinion could be positive, negative, or neutral. People post an opinion on Facebook to make sure one's voice is heard. Expressing emotion on fan pages is common for families with children with disabilities. Comments for expressing emotion are found in short sentences and highly empathetic, often accompanied with emoticons. Comments that provide information diversify and extend the scope of information shared through posts.

In conclusion, even though community members didn't actively participate in "help seeking" through other forms, the interaction on Facebook played an equivalent role in health information communication. Other contributions of Facebook communication include health care improvement, health promotion, medical decision making, insurance provision, and medication safety. Future research can be designed and conducted by using a diverse approach, such as employing qualitative interviews or quantitative surveys to investigate members' goals, motives, and trust of participating in Facebook communication. This study has also raised awareness regarding information correctness, authority, and usability, considering the importance of health to life. Last, the role of online health information should also be defined with perspectives of health communication, health literacy, and health information quality.

The study also provides constructive suggestions for different types of stakeholders, for a better design and provision of health information services. Founders and management members of Facebook groups and fan pages for children with disabilities are encouraged to transform Facebook fan pages into an information exchange platform for patients, families, and medical professionals.

This multi-purpose platform could be used not only for information exchange, but also for awareness raising and support calling. For family members and friends of children with disabilities, Facebook should be taken as more than just a place for social support. Social Media, such as Facebook, has the potential to expand its role to a consumer health information perspective. This study suggests that information shared on the fan pages for children with disabilities can be used to facilitate patients' health consultation with medical professionals, and to accelerate healing and recovery process.

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The Comparison Study of Factors Influencing Information Behaviors between Undergraduate Students and Teachers in University

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Abstract

The purposes of this study were to explore the consideration factors of influencing undergraduate students' information behavior, and to compare differences in consideration factors information behaviors between undergraduate students and teachers in university. Based on the literature review and principal component analysis, this study generalized 7 consideration factors, including (1) Attitude toward the information, (2) Barriers & Facilitating Conditions, (3) Physical Information Sifting, (4) Social Influences, (5)Information Collecting, (6)Internet Information Sifting, and (7) Interaction with others via internet. The results from t-tests indicated that there were differences in factors of "Information Collecting", "Internet Information Sifting"and "Interaction with others via internet"between undergraduate students and faculty. Based on the research result, the study provides several suggestions for faculty and undergraduate students in their teaching and learning.

Keywords: *Digital natives; Digital immigrants; Information behavior; Higher education*

SUMMARY

Information behaviors are a series of human behaviors driven by information needs and involve dealing with information sources and channels for satisfying individuals' needs for achieving goals. Such behaviors include information seeking, information searching, and information use. Factors influencing human information behaviors are varied, depending on individual's internal personal traits

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and external surrounding environments. In the past decades, technologies have advanced greatly and affected daily human information behaviors enormously. Information sources and usage have a great influence on individuals' information processing. Dramatically different from the past generations, university students today have their own styles regarding information needs, information seeking and using. Therefore, there might be gaps or differences in information behaviors among different generations. It is especially true when considering the newer generations who have grown up using a lot of new technologies. Based on the literature on digital natives, we know that people who were born after 1980 could be considered as digital natives and their behaviors are somewhat different from their previous generations. Take university environments for example, teacher faculty and undergraduate students belong to two different groups of generations. Based on the differences in digital capabilities and growing environments, students are regarded as digital natives and the teachers as digital immigrants. It is interesting and important to compare factors influencing information behaviors between those two groups. Hence, the purposes of this study were to identify factors influencing undergraduate students' information behavior, and to compare differences in factors influencing information behaviors between undergraduate students and teachers in university.

Based on the literature review and principal component analysis, the researcher of this study identified seven factors influencing information behaviors, including (1) Attitude toward Information, (2) Barriers and Facilitating Conditions, (3) Printed Information Sifting, (4) Social Influences, (5) Information Collecting, (6) Internet Information Sifting, and (7) Interaction with Others via Internet.

This study was conducted during the time period from October 2009 to May 2010. A survey research method and stratified sampling were used. A questionnaire was developed to investigate information behavior factors identified above. The questionnaire included 29 items addressing seven aspects of factors. The face validity of this study was good since three experts were asked to review the questionnaire and test the internal validity. 100 copies of questionnaires were used to pre-test the internal validity, with the Cronbach's alpha as .87.

Subjects of this study were from two major groups—undergraduate students from T University representing the generations of digital natives and full-time faculty members randomly selected as digital immigrants. According to the school official statistics, 19,869 undergraduate students were enrolled during the school year when this study was conducted. 1,200 questionnaires were sent to randomly selected class units targeting the students group. 1,107 were filled out and returned, and 1,107 were deemed as valid ones, with the effective response

rate as 96.5%. There were 764 full-time teachers at T University, and 450 questionnaire copies were sent to teachers using a stratified sampling approach. 206 questionnaires were filled out and returned, 202 were deemed as valid, with the effective response rate as 44.9%.

The results regarding undergraduate students indicated that the "Attitude toward Information" factor showed the highest score among those seven factors, revealing that undergraduate students tended to have more positive attitudes toward information. They used to search information using their favorite technologies, such as internet and TV media. Students were influenced more by external barriers or facilitating conditions, and would take budge issue into consideration when adopting information tools. It is interesting to note that students tended to believe more in the correctness and reliability of information collected from real libraries than from internet, despite they used to collect information through internet technologies. Thus, when using information collected from the internet, they would be selective based on their own judgment. When adopting information behaviors, students would consider peers' opinions, and would change information channels or alter their opinions toward information seeking based on their working or learning conditions; however, they took less consideration of teachers' opinions, indicating that teachers had a relatively small influence on college students' information behaviors. When seeking information, students relied more on internet news media than on traditional printed materials, such as books, magazines or newspapers. Students were more comfortable about interacting with others through internet technologies, and would be more likely to discuss and share personal information on the web.

Data regarding the teachers seemed to have opposite results from those of the students. Although teachers would consider factors such as convenience, time and money, these factors did not have a great influence on their information behaviors. Teachers tended to believe in the correctness and reliability of information collected from real libraries, but they would hold a more conservative attitude toward the authoritativeness of information providers. External environmental factors tended to have less influence on teachers' information seeking and selecting. Teachers had a variety of information tools, including internet and printed materials, such as books or newspapers. Teachers had a more skeptical attitude toward the correctness and reliability of information collected from the internet, and would be more selective when adopting the information content. They were uncomfortable to use internet technologies in communicating with others, and tended not to share their personal information through the internet.

As to the comparison between these two groups, the results from t-tests indicated that there were significant differences in factors of "Information

Collecting", "Internet Information Sifting" and "Interaction with Others via Internet "between undergraduate students and teachers. Teachers relied significantly more on information collected from real libraries than from websites, this might be due to their unfamiliarity with identifying sources and collecting information on the internet, therefore would not develop confidence in the correctness and reliability of internet information . Teachers paid more attention than students to the authoritativeness of information provider for evaluating the correctness and reliability of information collected from real libraries. The same result showed in the "Internet Information Sifting" factor. As to the "Interaction with Others via Internet" factor, it showed that teachers tended not to interact or share personal information with others through the internet, while students were more likely to participate in internet groups and unleash their creativity.

In the last part, the study provides several suggestions regarding information behaviors for teachers and students in university. Teachers in university are encouraged to use digital content and resources provided by libraries, and to adopt constructivist strategies for promoting students' reflections and enhancing higher-order thinking abilities. Teachers are also suggested to incorporate new learning technologies and open educational resources into classrooms for communicating with students and developing students' ideal information behaviors. As to the students, it is recommended for them to take information literacy classes and participate more in library education. Students are also advised to have more focus on learning rather than communication while using technologies. Students are encouraged to use more the free open educational resources on the web, and participating in on-line learning groups. Students should also develop more of their self-management ability regarding information behaviors.

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What Stimulates Web Design Students' Imagination? The Mediator Effect of Inspiration through Action

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Abstract

This study aimed to analyze what psychological and environmental variables influenced the imagination of web design university students, and the effects these variables had on their imagination. A survey (n = 821) was administered from seven universities across different regions of Taiwan. The results of this study supported that imaginative capabilities consisted of ten characteristics namely: concentration, crystallization, dialectics, effectiveness, exploration, intuition, novelty, productivity, sensibility, and transformation. The psychological influences were comprised of six indicators namely: generative cognition, intrinsic motivation, positive emotion, negative emotion, inspiration through action, and self-efficacy. The environmental influences were composed of five indicators namely: physical component, learning resources, organizational measure, social climate, and human aggregate. The hypothesis of the study that inspiration through action plays a mediator in imagination development was partially supported. The structural model also showed that the variables of human aggregate, generative cognition, intrinsic motivation, negative emotion and self-efficacy have significant and indirect effects on imagination. Reflections on talent development of web design were proposed, future inquiries were discussed, and limitations of the study were acknowledged.

***Keywords:** Environmental influences; Imagination; Inspiration through action; Mediator effects; Psychological influences*

Introduction

People talk, share, explore, work, play, and even shop on web. These activities are created by web engineers, instructional designers, game developers, etc. They however, share a common role, namely that of a web designer. Surfing around employment pages on the Internet, we often see the job title of a web designer with descriptions as follows: "performs a wide variety of professional tasks, which demand a high level of creativity and imagination, as well as a

thorough knowledge of the applicable customer needs and expectations." We also see announcements of contract-to-hire web designers with certain requirements: "being naturally creative and imaginative", and "design innovative interactive experiences that delight the imagination and provoke the mind".

Howard, Culley, and Dekoninck (2008) claimed that without imagination and creativity in design there is no potential for innovation, which is where imagination is implemented and creativity is transformed into commercial value. Imagination is one of the most important cognitive capacities for learning. Perhaps in reaction to their mystifying natures, imagination was relatively neglected in twentieth-century research. There has been much less concern to offer empirical clarification of various philosophical formulations of imagination, let alone to elucidate the relationships between these formulations and creativity (Beaney, 2005). Taking these concerns into account, this study aimed at exploring what psychological and environmental variables influenced the imagination of web design university students, and the effects these variables had on their imagination.

Imagination

Imagination is "a creative faculty of the mind" or "a power of the mind", which enables people to go beyond actual experience and construct alternative possibilities in which a fragmented situation becomes a meaningful whole (Passmore, 1985; Perdue, 2003). Therefore, imagination can be viewed as the basis for cultivating creative thinking, and thus the driving force of innovation (Finke, 1996). Furthermore, Colello (2007) contended that the activities of human imagination can be classified into two different categories: reproductive imagination and creative imagination. Reproductive imagination is characterized by the ability to reproduce mental images described by others or images from less accurate reflections/recollections of reality. Creative imagination, on the other hand, emphasizes the attributes of initiation and originality.

From the related literature, several characteristics were compiled to represent human imaginative capabilities (e.g., Liang, Hsu, Chang, & Lin, 2012). These characteristics were concentration, crystallization, dialectics, effectiveness, exploration, intuition, novelty, productivity, sensibility and transformation. First, or initially, Folkmann (2010) claimed that the process of focusing lies in the span between clear and rational discourse and the inaccessible mental space, and is open to ongoing reformulation. **Concentration** thus refers to an individual's ability to formalize ideas through focus. Second, imagination bridges "images" and "ideas", implying that rational thought takes place in the form of images (Perdue, 2003). Vygotsky (2004) also held that all objects of common life appear as a **crystallization** of the imagination.

Third, Cartwright and Noone (2006) also explained that imagination is what occurs as a person encounters new ideas and logically engages in confrontations, arguments, and controversies. **Dialectics** thus refers to an individual's ability to seek improvement by logically analyzing ideas. Fourth, the imagination of inventors is influenced directly by the constitution of end products and confined within certain constraints (Ribot, 1906). Shin (1994) stated that problems are resolved only as imaginative anticipation begins searching for **effective** solutions to problems.

Fifth, Valett (1983) illustrated that children **explore** the world through play, and then satisfy themselves through exaggerations of their intuitive impressions. Folkmann (2010) claimed that imagination can be seen as a structure in consciousness that negotiates, exchanges, and explores between the known and unknown. Sixth, Reichling (1990) contended that knowledge is gained directly as an insight or a grasp of the whole through **intuition**. Townsend (2003) anchored that if people utilize more intuitive representations, then their imagination would last longer.

Seventh, Beaney (2005) indicated that someone who is imaginative is good at creating new possibilities, and able to offer fresh perspectives on what is familiar. Eighth, imagination corresponds to four particular sets of conditions namely: quantity of images; quantity and intensity of images; quantity, intensity and duration of images; as well as complete systematization (Ribot, 1906). All of these evolving conditions are related to physical dimensions of imaginative **productivity**, continuity and fluency.

Ninth, inventors strive to achieve their goals and overcome problems, often experiencing painful struggles in thoughts, feelings, and emotions during creative activity (Ricoeur, 1978). Reichling (1990) also contended that most of imagination is emotive content, with an intuitively **sensible** meaning. Tenth or finally, Ribot (1906) held that the essential element of imagination in the intellectual sphere is the capacity of thinking through analogies. The core principle behind analogy is **transformation**. Vygotsky (1978) stressed that this transformation enables children to learn how to control a situation through the use of symbols.

Influential Variables on Imagination Stimulation

Byrne (2007) indicated that human imagination may be stimulated by psychological sources such as motivation, emotion, self-efficacy, and cognition. According to Rosenbaum (2002), people's performance at a given time is influenced by what they imagine and plan to do next. Such anticipatory effects have been treated as clues to the nature of human perceptual-motor planning.

Oettingen and Mayer (2002) also indicated that positive expectations would predict high-effort and successful performance. This form of thinking about the future is closely related to **motivation**.

Fredrickson (2001) suggested that **emotions** such as joy and love broaden a person's available repertoire of cognitions, thus enhancing creativity and imagination. Although emotions have been studied as facilitating variables in changing people's creativity and problem-solving skills (e.g. Erez, & Isen, 2002), there are conflicting studies however, that argue conversely. For example, emotions experienced during learning processing can be viewed as an unnecessary load on working memory, and it can have a negative effect on reasoning (e.g. Paas, Renkl, and Sweller, 2003).

Many studies indicated that individuals with high **self-efficacy** perceive themselves as capable of taking the necessary steps to resolve problems (e.g. Bandura, 2000). They believe and imagine that they can affect change, and have control over their thoughts and actions. They are confident in their capacities, and consider difficult tasks as challenges rather than threats. People with high self-efficacy are confident and imagine themselves able to do it!

Recent studies in the field of creative imagery revealed the **cognitive structures** and processes that are involved in creative thinking and imagination (Finke, 1996). For example, O'Connor and Aardema (2005) situated imagination within consciousness complete with its own pre-cognitive, cognitive and meta-cognitive domains. It allows us to realize how "believed-in imaginings" develop and become under some circumstances "lived-in experiences." In other words, internalization of acquired knowledge and experience is a crucial way to facilitate imagination (Valett, 1983). Many studies supported that cognitive activities are closely associated with the learner's perceptions, feelings, motivations and other ways to trigger ideas (e.g. Finke, 1996; Taylor, Pham, Rivkin, & Armor, 1998).

In the geneplore model of creative cognition, Finke (1996) claimed that the creativity of cognition would help to deliberate cognitive structures and processes involved in creative thinking and imagination. Two aspects accounted for creative thinking, a generative phase, where an individual formulates mental representations called pre-inventive structures, and an exploratory phase where those structures are adopted to establish creative ideas. When it comes to design experiences, Fukasawa believed that the true essence of design is the "Wow!" which we say later when using the object, and realize something that we did not notice before (Gotō, Sasaki, & Fukasawa, 2004). Fredrick (2007) also indicated that the most effective and creative problem-solvers engage in a process of **meta-cognition** in which they are aware of how they are thinking as they are doing the thinking.

In addition, research has shown that the environment can facilitate, modify

or hinder certain human behaviors and emotions (e.g. Strange, & Banning, 2001). Komives, and Woodard (2003) indicated that the campus environment can be divided into four dimensions: its dominant human characteristics, its physical components and design, the organizational structures that serve its purposes, and the participants' constructions of its social climates.

The **human aggregate** dimension represents the collective characteristics of people who inhabit the environment. This dimension creates features in an environment that reflect varying degrees of consistency, especially in terms of organizational culture, tradition or style (Huebner, & Lawson, 1990). Modern research (e.g. Claxton, Edwards, & Scale-Constantinou, 2006; Treadaway, 2009) also echoes the impacts of social climate and human aggregate dimensions on an individual's imagination.

The **physical** dimension of a campus consists of its natural environment (e.g., location, topography, temperature) and man-made environment (e.g., architecture, facilities, messages). Both components define space for activities and events, thereby encouraging some phenomena while limiting others (Strange, 2000). There are numerous follow-up studies which indicate that the environment has a profound impact on student imagination (e.g. Büscher, Eriksen, Kristensen, & Mogensen, 2004; Claxton et al., 2006).

The **organizational** dimension arises from the myriad decisions made about environmental purposes and functions (Strange, 2000). As a result of this need, rules and regulations are formed, rewards systems are developed, and reports become necessary for resource allocation. Many studies by modern scholars (e.g. Claxton et al., 2006; Kangas, 2010) also give evidence as to the influence of organizational measures on the development of student imagination.

Furthermore, the **social climate** dimension focuses on the subjective experiences of participants, and can be described in terms of their social climates (Strange et al., 2001). The social climate has both intrinsic influence and external impact. McMillan (1995) thus held that all schools should create a context that is full of encouragement and support in order to cultivate students' imagination.

Hypotheses

In regards to the role of meta-cognition, Deci, Connell and Ryan (1989) indicated that environmental conditions affect human cognition. Many scholars also claimed that people's motivation could be augmented by their meta-cognition (e.g., Paris, & Winograd, 1990). In addition, Fredrick (2007) suggested that the most effective problem-solvers engage in a process of meta-cognition. In his MASRL model, Efklides (2011) indicated that meta-cognition has positive relationships with both emotions and self-efficacy.

Vasquez and Buehler (2007) further found that people feel more motivated to succeed on a future task when they visualize its successful completion via a third-person. That is, recognition from third-persons (e.g., teachers, classmates) toward individuals' meta-cognition with hands-on practice can greatly motivate their imaginative tasks and creative performance. The factor analysis study done by Hsu, Liang, Chang, and Lin (2013) suggested to name this type of meta-cognition as **inspiration through action**, which refers to the examination of how participants felt regarding their imagination being influenced by meta-cognition with hands-on practice.

Web designers need to anticipate each of the user's choices and actions which require them to convert and objectify their imagination into the user's experiences. Web designers also need to understand their users' psychological activities and, in turn, incorporate those into their design strategies. Web designers often evaluate their designs with constantly-changing concepts envisaged in mind. Imagination, for web designers, is about seeing things in a new light and being able to make a difference as a result (Liang et al., 2012). Taking into account both the crucial role of meta-cognition on stimulated imagination and the practice-oriented nature of the web design, we hypothesized that **inspiration through action** plays a mediator between the influential variables and imagination. Subsequently, the following relationships were hypothesized in this study:

Hypothesis 1. Inspiration through action is positively associated with both reproductive and creative imaginations.

Hypothesis 2. Inspiration through action will mediate the effects of environmental influences and the imaginations.

Hypothesis 3. Inspiration through action will mediate the effects of psychological influences and the imaginations.

Method

Participants and procedure

The participants in this study were 907 university students recruited from seven major web design programs, across different regions in Taiwan. Taken the professional maturation into account, we did not include college freshmen in the census survey. Of the participants, 821 completed all the parts of this study. The majority (65%) was female; 37.5% were juniors, 32.6% were sophomores, 22.4% were seniors, and 7% were graduate students.

Upon securing participant approval at each program, the students participating in this study were asked to complete a questionnaire containing the measurements included in this report. In the questionnaire, the students were asked to determine their level of agreement with regards to each imaginative capability, and the strength of influence that each item had on their imagination.

All participation was voluntary and anonymity was guaranteed. They held the right to review the results of their responses.

In order to ensure the quality of this study, the survey in each university was conducted according to the same procedure and included the tutorial groups who were accompanied by their class instructors. Each of the survey assistants received an 8-hour training in order to ensure the quality of the investigation. In this manner, the problems participants faced when answering the questions could be resolved directly. The survey took approximately 15 minutes to complete and held either during or immediately following regular class time.

Measurement

Influential variables in regards to imagination were measured using a questionnaire combined three scales. This questionnaire consisted of fifty-seven items, in which a total of ten items represented imaginative capabilities, twenty-one items represented environmental influences, and twenty-six items represented psychological influences. Both the internal and external validities of these variables are well documented in the literature (e.g., Chen, Huang, & Liang, 2012; Hsu et al., 2013; Liang et al., 2012).

Imaginative capability. Based on Liang et al. (2012), the measure for imaginative capability was composed of two dimensions: reproductive imagination and creative imagination. The reproductive imagination dimension comprised items of crystallization, dialectics, effectiveness, and transformation. The creative imagination dimension comprised items of exploration, focusing, intuition, novelty, productivity, and sensibility. Respondents answered on a six-point scale ranging from 1 = strongly disagree to 6 = strongly agree. Some representative items are: "I often have uncommon ideas compared to others" (refers to **novelty**), "I often help myself imagine by arousing personal feelings" (refers to **sensibility**), and "I am good at seeking improvement by logically analyzing ideas" (refers to **dialectics**).

Environmental influences. Based on Chen et al. (2012), environmental influences were measured with a scale which was composed of five subscales namely: physical component, learning resources, organizational measure, social climate, and human aggregate. Respondents answered on a six-point scale ranging from 1 = strongly disagree to 6 = strongly agree. Some representative items are: "Public spaces for creation, discussion and exhibitions" (refers to **physical component**), "Dynamic audiovisual stimuli such as rhythm, sound, and movies" (refers to **learning resources**), "Teacher's encouragement and praise for taking risk" (refers to **organizational measure**), "Communication and discussion with classmates" (refers to **social climate**), and "There is a culture on campus of putting imagination into practice" (refers to **human aggregate**).

Psychological influences. Based on Hsu et al. (2013), psychological influences were measured with a scale which was composed of six subscales namely: intrinsic motivation, generative cognition, positive emotion, negative emotion, inspiration through action, and self-efficacy. Respondents rated themselves on a six-point scale ranging from 1 = strongly disagree, to 6 = strongly agree. "Courage to present different ideas" was a representative item for **intrinsic motivation**; "Use immersive sensory exploration to spark imagination" was a representative item for **generative cognition**; "Joyfulness from the surroundings" was a representative item for **positive emotion**; "Anxiety felt by individuals" was a representative item for **negative emotion**; "Be determined to achieve set standards" was a representative item for **self-efficacy**; and "Hands-on design with constantly-changing concepts envisaged in mind" was a representative item for **inspiration through action**.

Results

Descriptive analysis

The data were analyzed using SPSS version 17.0 software. In Table 1, the results of descriptive analysis, with regard to the means, the standard deviations, the Cronbach's α values and the correlation among variables, are illustrated.

Table 1   The *M, SD*, Cronbach's α, and Correlation among Variables

Variables	M	SD	α	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Reproductive imagination	4.35	0.75	.82	--												
2. Creative imagination	4.30	0.69	.89	.65*	--											
3. Physical component	4.45	0.68	.78	.13*	.14*	--										
4. Learning resources	4.64	0.81	.81	.17*	.11*	.45*	--									
5. Organizational measure	4.88	0.79	.83	.19*	.16*	.42*	.48*	--								
6. Social climate	5.34	0.63	.82	.14*	.12*	.34*	.38*	.55*	--							
7. Human aggregate	4.52	0.89	.85	.16*	.15*	.29*	.42*	.50*	.46*	--						
8. Generative cognition	4.81	0.78	.82	.23*	.29*	.37*	.35*	.37*	.39*	.31*	--					
9. Intrinsic motivation	5.20	0.77	.78	.30*	.30*	.34*	.36*	.43*	.53*	.35*	.50*	--				
10. Positive emotion	4.95	0.81	.84	.11*	.12*	.28*	.28*	.39*	.35*	.33*	.39*	.45*	--			
11. Negative emotion	4.69	0.97	.90	-.04	-.02	.13*	.12*	.27*	.26*	.28*	.24*	.24*	.34*	--		
12. Inspiration through action	5.02	0.75	.83	.29*	.28*	.30*	.34*	.41*	.43*	.34*	.53*	.63*	.45*	.28*	--	
13. Self-efficacy	5.02	0.67	.85	.27*	.23*	.33*	.31*	.42*	.45*	.37*	.44*	.57*	.42*	.33*	.54*	--

*$^*p < .05$.

Hypothesis testing

Confirmatory factor analysis (CFA) with maximum likelihood estimator was performed with LISREL 8.80 to determine and test the most appropriate structure of the scales. We used the following indicators recommended by Hu and Bentler (1999) and Tabachnick and Fidell (2001) to assess goodness of model fit: Comparative Fit Index (CFI; .95 or above indicating excellent fit, .90-.95 indicating an acceptable fit), Root-Mean-Square Error of Approximation

(RMSEA; .05 or below indicating excellent fit, .05-.08 indicating an acceptable fit), Standardized Root Mean Squared Residual (SRMR; .05 or below indicating excellent fit, .05-.08 indicating an acceptable fit), Tucker-Lewis Index (TLI; .95 or above indicating excellent fit, .90-.95 indicating an acceptable fit).

The results of this CFA showed that the thirteen-factor solution (two-factor imaginative capability, five-factor environmental influences, and six-factor psychological influences) yielded acceptable fit for this study (χ^2 = 3790.36, df = 1461, p < .005, CFI = .97, RMSEA = .047, SRMR = .047, TLI = .96). In regards to the measurement of imaginative capabilities, the factor loadings ranged from .52 to .80, the values of construct reliability ranged from .77 to .85, and the measurement errors ranged from .35 to .70. In regards to the measurement of environmental influences, the factor loadings ranged from .53 to .92, the values of construct reliability ranged from .76 to .91, and the measurement errors ranged from .16 to .72. In regards to the measurement of psychological influences, the factor loadings ranged from .60 to .96, the values of construct reliability ranged from .84 to .94, and the measurement errors ranged from .08 to .65. The results indicated that construct reliability, external and internal validities were also achieved.

The present hypotheses suggested that three sets of variables (inspiration through action, environmental influences, and psychological influences) stimulate imagination, and that **inspiration through action** mediates the effects of the other two clusters of variables on imagination. According to these hypotheses, we first examined the effects of the mediator (**inspiration through action**) on both reproductive imagination and creative imagination. As Figure 1 illustrated, our data showed a good fit to the present data (χ^2 = 301.90, df = 74, p < .005, CFI = .97, RMSEA = .060, SRMR = .045, TLI = .97). Each of the standardized path coefficients reached the significance level (p < .05).
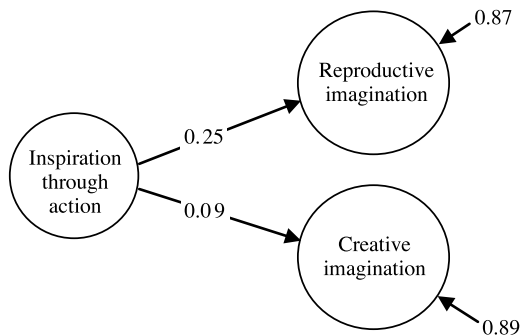

Fig. 1   The Effects of Inspiration through Action on the Imagination

We then tested the effects of the influential variables on both reproductive imagination and creative imagination. The results of this analysis showed a good fit to our data (χ^2 = 3283.21, *df* = 1259, *p* < .005, CFI = .97, RMSEA = .048, SRMR = .049, TLI = .97), but not all analyzed variables were significantly associated with imagination. We then removed the non-significant paths, and revised the model. In the revised model (refer to Figure 2), only the four significant paths respectively, **generative cognition**, **intrinsic motivation**, **negative emotion**, and **self-efficacy** to imagination were kept (χ^2 = 1532.51, *df* = 364, *p* < .005, CFI = .95, RMSEA = .067, SRMR = .058, TLI = .96). Each of the coefficients reached the significance level (*p* < .05).
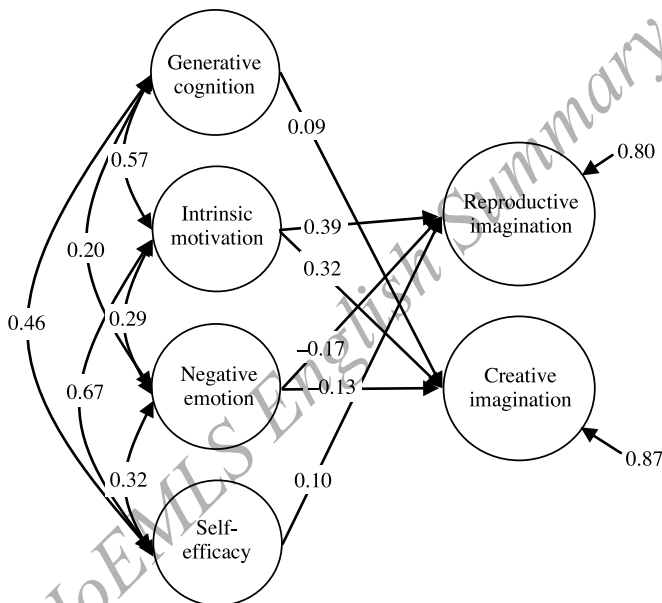

**Fig. 2　The Effects of Influential
Variables on the Imagination**

We continually examined the effects of the influential variables on the mediator. The results of this analysis showed a good fit to our data (χ^2 = 2934.12, *df* = 979, *p* < .005, CFI = .97, RMSEA = .052, SRMR = .049, TLI = .97), but not all variables were significantly associated with the mediator. We then removed the non-significant paths, and revised the model. In the revised model (refer to Figure 3), only the four significant paths respectively, **human aggregate**, **generative cognition**, **intrinsic motivation**, and **self-efficacy** to the mediator were kept (χ^2 = 1302.35, *df* = 242, *p* < .005, CFI = .96, RMSEA = .072, SRMR = .055, TLI = .96). Each of the coefficients reached the significance level (*p* < .05).
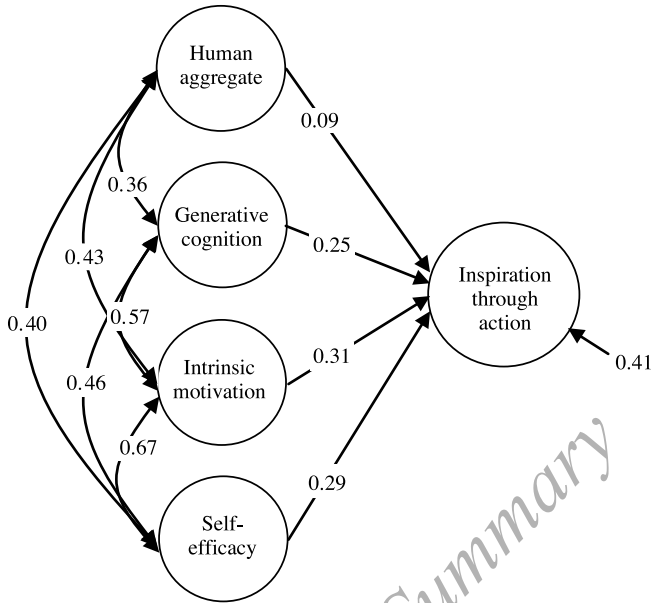
**Fig. 3   The Effects of Influential
Variables on the Mediator**

We then proposed a partial mediation model. In this model, **inspiration through action** would mediate the influences of these variables on both reproductive imagination and creative imagination. Although the initial model (χ^2 = 2045.56, df = 601, p < .005, CFI = .97, RMSEA = .055, SRMR = .048, TLI = .97) showed a good fit to the present data, not all variables were significantly associated with two kinds of imagination. We decided to remove the non-significant paths and then revise the structural model. In the final model, only the four paths respectively, **human aggregate**, **generative cognition**, **intrinsic motivation**, and **self-efficacy** to the mediator (**inspiration through action**) were kept. In addition, the influences of **negative emotion** on both reproductive imagination and creative imagination were significant, and thus these paths were also retained.

This final model showed a model fit comparable to that of the initial model, χ^2 = 2003.19, df = 607, p < .005, CFI = .97, RMSEA = .055, SRMR = .049, TLI = .97. It accounted for substantial variance in **inspiration through action** (R^2 = .59), **reproductive imagination** (R^2 = .21) and **creative imagination** (R^2 = .15). The standardized path coefficient of **inspiration through action** (the mediator) to reproductive imagination reached .18, and the path of **inspiration through action** to creative imagination reached .23. Each of the coefficients reached the significance level (p < .05).

With regard to independent variables, our results showed that **human aggregate** had indirect effects on reproductive imagination (.0162) and creative imagination (.0207). Similarly, **generative cognition** also had indirect effects on reproductive imagination (.045) and creative imagination (.0575). **Intrinsic motivation** contained both direct and indirect effects on imagination. Its direct effect on reproductive imagination was .28, and the direct effect on creative imagination was .21. At the same time, the indirect effects resulted from **intrinsic motivation** on reproductive imagination reached .0558 and on creative imagination reached .0713. Although **negative emotion** had no indirect effect on imagination, it had direct effects on both reproductive imagination (–.19) and creative imagination (–.15). Lastly, **self-efficacy** had both direct (.09) and indirect (.0522) effects on reproductive imagination, and this variable only had an indirect (.0667) effect on creative imagination.

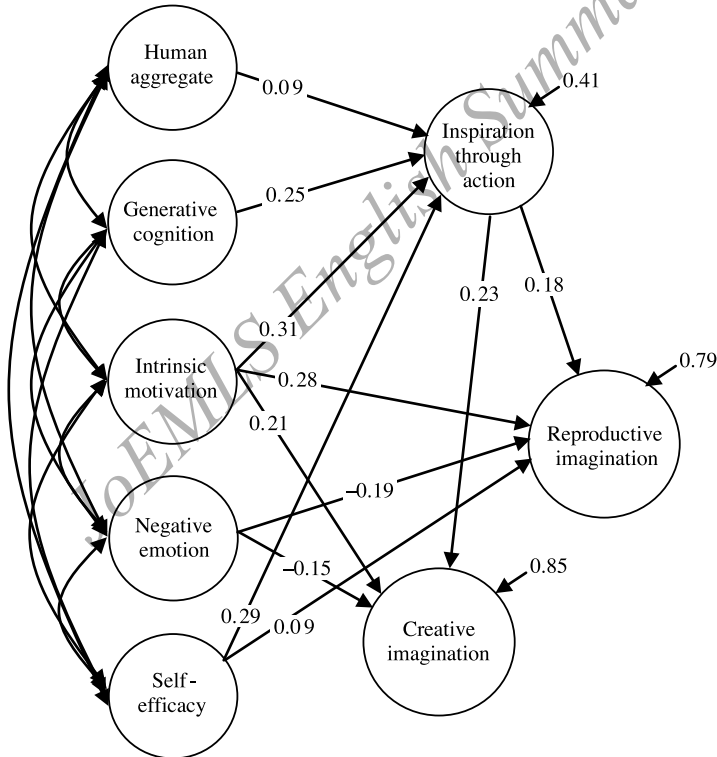**Fig. 4   Structural Model Depicting Inspiration Through Action as Mediator of Influential Variables and Imagination**

The case of model trimming suggested that the final model is a more presentable model, and hence, should be supported. Overall, the SEM results summarized in Figure 4 partially support the present hypotheses. **Inspiration through action** directly influenced imagination (Hypothesis 1 was supported).

Partially confirming the mediating hypotheses (Hypothesis 2 and 3), one environmental variable (**human aggregate**) and three psychological variables (**generative cognition**, **intrinsic motivation**, and **self-efficacy**) influenced imagination through their impacts on inspiration through action. **Negative emotion** retained its direct effects on imagination. The correlation of latent independent variables reports in Table 2.

Table 2   The Correlation of Latent Independent Variables

Variables	1.	2.	3.	4.	5.
1. Human aggregate	--				
2. Generative cognition	.36	--			
3. Intrinsic motivation	.43	.57	--		
4. Negative emotion	.27	.20	.29	--	
5. Self-efficacy	.40	.46	.67	.33	--

Discussion

While philosophical studies abound on the influences of external environment and internal cognition on imagination development, little research articulates about imaginative capabilities, nor the variables that may affect these capabilities. The results of the current study supported that human imagination could be categorized into two groups. First, reproductive imagination consisted of crystallization, dialectics, effectiveness and transformation. Second, creative imagination consisted of exploration, focusing, intuition, novelty, productivity and sensibility. In no way definitive or exhaustive, nonetheless, the study has yielded a path for further inquiries.

In addition, this study proposed and examined a mediator model of **inspiration through action** in which psychological and environmental variables, both directly and indirectly influenced the creative and reproductive imaginations of web design students. Our findings supported that this mediator effect results from **inspiration through action**. No matter what forms of inspiration were kindled during the production process, or evaluation of semi-products with constantly-changing concepts envisaged in the mind, **inspiration through action** proved to be a key to triggering student imagination, especially the creative one. Our results also showed that **intrinsic motivation**, **self-efficacy**, **generative cognition**, and **human aggregate** had their influences on imagination through this mediator. These findings imply that researchers and instructors may need to focus more on understanding the mediator effects and the applications of meta-cognitive tools.

Although the results supported the mediator role of **inspiration through action**, we wonder if any other mediators exist in this vein? What if **intrinsic**

motivation or **self-efficacy** becomes a mediator, what then? What if there are double or even triple mediators, what then? Furthermore, do any moderators or non-linear relationships exist among the variables discussed in the present study? In addition, since different academic standings of web design students (i.e., sophomores, juniors, seniors, and graduate students) represent different levels of professional maturation, the future studies may need to focus on the differences resulting from different academic standings. Much more work needs to be done in order to shed light on this issue of mediation.

With respect to **human aggregate**, our results showed that this variable had slight but significant effects on both reproductive and creative imaginations. These effects were indirect and functioned through the mediator of **inspiration through action**. As the final model indicated, similar to human aggregate, **generative cognition** also contained only indirect effects on both imaginations. Elaborating on these findings, the issue would become how to incorporate institutional culture and various thinking skills into meta-cognitive strategies (e.g. Claxton et al., 2006; O'Connor et al., 2005). There are few academic discussions around this issue in the field of web design, which underlines a demand for more efforts to be devoted to this research in the future.

In addition, the current study highlights the critical role of **intrinsic motivation**. The motivation variable not only greatly contributed to the mediator effects, but also strongly impacted both reproductive and creative imaginations. Scholars have long argued that people are likely to be creative when they experience high levels of intrinsic motivation (e.g., Amabile, 1996), since such motivation increases their tendency to be curious, cognitively flexible, and risk taking (e.g., Utman, 1997; Zhou, & Shalley, 2003). Although creativity is different from imagination (Robinson, & Aronica, 2009), many scholars agree that imagination serves as the vehicle of active creativity (e.g., Gaut, 2003). The current study extends the argument to the potential effects of **intrinsic motivation** on imagination.

With regard to **self-efficacy**, our findings showed that this variable had an indirect effect on both imaginations, and a direct effect on reproductive imagination. These findings lend additional supports to the influence of self-confidence on positive expectation in problem-solving (Bandura, 2000). According to the results, learners' belief in their own competence to accomplish the assigned tasks greatly contributed to their meta-cognition with hands-on practice, and in turn, meta-cognition facilitated student imagination. How to increase learner's self-efficacy, while maintaining the necessary task-complexity at the same time, becomes a critical issue for web design education.

Interestingly, **negative emotion** had no significant impact on the mediator of

inspiration through action, but had direct effects on both reproductive and creative imaginations. These results indicated that an individual's negative psychological state and the surroundings could be viewed as an unnecessary load on the thinking process, which is consistent with earlier studies in this topic (e.g. Paas et al., 2003). However, we is aware that negative emotion can also be used to derive enormous creative energy for some genius artists and scientists (Amada, 1999). Bearing in mind the opposite-sided influences brought from negative emotion, future inquiries may test the moderating or non-linear effects caused by this variable.

In respect to reproductive imagination, our findings showed that this type of imagination would be greatly influenced by the learner's motivation, especially the driving forces such as interesting assignments and positive expectations (e.g. Oettingen et al., 2002). Self-confidence in regards to personal ability seemed to play a facilitative role to enhance intrinsic motivation, which echoes Bandura's series works. Without an indirect effect, **negative emotion** directly but negatively influenced reproductive imagination. **Inspiration through action** was positively associated with this type of imagination. Thus, to improve the student reproductive imagination, it may be important to use the following strategy: promote intrinsic motivation as the main approach, enhancing with inspiration through action and self-efficacy, while avoiding the arousal of negative emotion.

In regard to creative imagination, our results indicated that this type of imagination in the web design field would be greatly influenced by the learner's meta-cognition with hands-on practice. **Intrinsic motivation** here still plays a crucial role in contributing to imagination-stimulation. **Negative emotion** remained a direct but negative impact on creative imagination. These results may suggest that strategies of **inspiration through action** paired with **intrinsic motivation** should be embedded in learning activities in order to trigger the student creative imagination. This also suggests that instructors should be adept at recognizing negative emotions while encouraging and intervening to change students' affective states whenever possible.

Limitations and Closing Remarks

The are a couple of limitations in the current study. First, the final model fits the data well, but the predictive validity could be stronger. This result may be due to the high correlations between some of the variables. Another inference similar to multiple influential variables on human creativity, is that both psychological and environmental influences are but two variables stimulating learners' imagination. Additional variables, such as learner's personality and ethnicity, should be taken into future account.

A second limitation is the use of self-reported influence. This choice however, was justified by the preliminary nature of the study. The questions asked in our study did not include sensitive items that would cause the respondents to present themselves in a more socially acceptable manner. The results of our pilot study were consistent with the current study, indicating that the factor structure of our measure is stable across sample groups and did not seem to suffer from self-report bias. In addition, using self-report surveys enables us to study large samples of students. In the current study, we had nearly a thousand students participate and our samples were large enough across universities allowing us to generalize our findings to a larger population.

Although the limitations of this study must be kept in mind, the results reported here provide intriguing insights into the complexities of human imagination. In addition to having a remarkable depth for creativity and a mastery of computer applications, web designers are commonly required to be outstanding communicators with exceptional imaginations. Clients often find it difficult to verbalize their needs. Web designers are required to ask pointed questions and imagine their visions. Imagination, for web designers, is about seeing things in a new light and being able to make a difference as a result. Web designers need to anticipate each of the user's choices and actions which require them to convert and objectify their imagination into the user's experiences.

How can we, as web designers, sympathize with users' needs and feelings in cyberspace? How can we understand their psychological activities and, in turn, incorporate those into our design strategies? How can we equip ourselves with sufficient imagination capacity? Preliminary work such as this always raises a battery of issues and questions. Nevertheless, a great deal of research needs to be further conducted in this area. We sincerely wish that the utilization of this study will in turn, inspire the construction of appropriate instructional strategies to assist students and develop their imagination.

Acknowledgments

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多媒體學生的想像促發：
做中悟的中介效果

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摘要

本研究旨在分析何種心理與環境因素會促發多媒體（網站）設計系所學生的想像，以及這些因素的影響效果。調查研究橫跨臺灣各地共七所大學院校，有效樣本共計821份。研究結果驗證想像具有：專注、具象、辯證、有效、探索、直覺、新穎、生產、感受，和轉用等十個能力特徵。影響想像的心理因素可分為六個構念：生產性認知、內在動機、正向情緒、負向情緒、自我效能，與做中悟。影響想像的環境因素可分為五個構念：物理環境、學習資源、組織措施、社會氣氛，及文化特質。本研究以做中悟為中介的假設模型，獲得部分支持。結構方程模型顯示，文化特質、生產性認知、內在動機、負向情緒，和自我效能等因素，對想像力具有顯著的間接效果。人才培育、後續研究與研究限制等均有所討論。

關鍵詞：環境影響，想像，做中悟，中介效果，心理影響

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Chicago格式(note)範例[*]

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若網頁文獻無法得知作者時，應以「網站擁有者」為作者，這時上述之第三部分可
省略。

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9. **同一註釋有多筆引用文獻，以分號【；】為區隔**（Multiple References within a Single Note）

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11. **同一註釋重複出現**（Ibid.）

同一註釋連續出現時，以「同上註」呈現；非連續出現時，以簡寫呈現。

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教育資料與圖書館學
APA格式範例[*]

Ver 1.3 (May 24, 2010)

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[*] 本中文範例主要取自張保隆、謝寶煖（2006）。學術論文寫作APA規範。台北市：華泰文化。特此致謝。英文範例以 *Publication Manual of the American Psychological Association* (6th ed.)為準，範例若不足，請逕參閱該二書。採用本刊格式時，亦請留意年代（西元年號）、出版品（標楷體）有別於其餘字體（新細明體）之特別要求；以及期刊論文若同時具有卷期，只須著錄出版年，不須登錄月份，但若僅有卷而無期數，則須同時著錄出版年與出版月份（或季節）。

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(4)一般網站或網頁

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(7)大學或政府等大型機構網站中的文章

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10.**二次引用（Secondary Source）**

二次引用必須是謹慎的，當原始資料難以取得之情況下允許使用。APA格式對二次引用的規定為：將二次文獻列在參考文獻（Reference List）之中；在正文中，引用二次文獻並標註原始文獻，以as cited in（英文）或轉引自（中文）表示前後關係，範例如下：

正文內呈現方式：

…Seidenberg and McClelland's study (as cited in Coltheart, Curtis, Atkins, & Haller, 1993).

參考文獻呈現方式：

Coltheart, M., Curtis, B., Atkins, P., & Haller, M. (1993) Models of reading aloud: Dual-route and parallel-distributed-processing approaches. *Psychological Review*, *100*, 589-608.

JoEMLS 註釋（Notes）暨參考文獻（References）
羅馬化英譯說明

Ver1.2 (April 24, 2013)

1. 本刊針對部分國外西文專業資料庫之引文索引建檔與中文辨讀之需求，凡屬中文稿件之英文摘錄末，特別增列中文羅馬化拼音之「註釋」（或「參考文獻」）一式。
2. 作者（含團體作者）、機構名稱（出版者）、地名（出版地）：依事實與習慣為英譯，如無法查證時，中國大陸地區作者以漢語拼音處理，台灣以威妥瑪拼音（Wade-Giles system）處理。
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   e.g. 玉山國家公園解說志工工作滿足之研究 *Yushan guojia gongyuan jieshuo zhigong gongzuo manzu zhi yanjiu*
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   "Chinese Academy of Sciences yu Thomson Scientific Lianshou Tuichu *Zhongguo Kexue Yinwen Suoyin*"
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   範例1
   林信成[Sinn -Cheng Lin]、陳瑩潔[Ying -Chieh Chen]、游忠諺[Chung -Yen Yu]，「Wiki協作系統應用於數位典藏之內容加值與知識匯集」[Application of Wiki Collaboration System for Value Adding and Knowledge Aggregation in a Digital Archive Project]，教育資料與圖書館學 43卷，3期（2006）[*Journal of Educational Media & Library Sciences* 43, no. 3(2006)]：285 - 307。
   範例2
   邱均平[Jun -Ping Qiu]，「網路信息計量學導論」[Wanglu Hsinhsi Chilianghsueh Taolun]，國立成功大學圖書館館刊16期（2007年6月）[*National Cheng Kung University Library Journal* 16 (June 2007)]：19。

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