A Web-based Collaborative Problem-Solving Approach to Enhancing Students' Learning Performance

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Profile

- **學歷**
  - 國立臺南大學 數位學習科技系博士 (2008.2- 2012.1)
  - 英國倫敦密德薩克斯大學 資訊科學所碩士 (2001.9-2003.6)
  - 朝陽科技大學 資訊管理系學士 (1995.9-1997.6)
- **經歷**
  - 國立中山大學資訊管理系 博士後研究員 (2012.8~)
  - 台北市立教育大學數位學習碩士學位學程 兼任助理教授(2013.2-)
  - 南台科技大學資訊傳播系 兼任助理教授 (2010.2-)
  - 勝典科技股份有限公司 數位內容規劃諮詢顧問 (2012.1~)
  - 國立自然科學博物館 數位典藏與數位內容開發顧問 (2012.2~)
  - 屏東縣教育局資訊融入教學教師研習特約講師 (2008.2~2012.7)
- **研究興趣**
  - 體感科技學習(Gesture-based)、網路學習、行動學習
  - 資料探勘 (Learning analytics)

Reviewer for Journals or Conferences

- Computers & Education (SSCI)
- Journal of Educational Technology & Society (SSCI)
- International Journal of Distance Education Technologies (IJDET) (EI)
- International Journal of Mobile Learning and Organization (IJMLO)
- Education Research International
- Program Committee Member of IIAI-LTLE, International Conferences on Advanced Applied Informatics
- 數位學習科技期刊

Research Issues on creative thinking, and problem-solving aspects.

Research Publication

- **Fan-Ray Kuo,** & Gwo-Jen Hwang (in press). A Five-Phase Learning Cycle Approach to Improving the Web-based Problem-Solving Performance of Students. Accepted by Journal of Educational Technology & Society. (SSCI)
- Gwo-Jen Hwang, Chih-Hsiang Wu, & **Fan-Ray Kuo** (in press). Effects of Touch Technology-based Concept Mapping on Students' Learning Attitudes and Perceptions. Accepted by Journal of Educational Technology & Society. (SSCI)
- Chih-Hsiang Wu, Gwo-Jen Hwang, **Fan-Ray Kuo**, & Iwen Huang (2013). A mindtool-based collaborative learning approach to enhancing students' innovative performance in management courses. Accepted to Australasian Journal of Educational Technology, 29(1), 128-142. (SSCI)
- **郭凡瑞**、吳春燕、鍾鼎、林奕汝(2013)。導入創造思考教學策略對學生網路問題解決能力之影響。人文社會學報，9(1)，1-33。
- 吳春燕、**郭凡瑞**、黃國禎、鍾鼎、林奕汝(2013)。創造思考教學策略對科技大學學生網路問題解決能力之影響。人文社會學報，8(1)，1-34。
- **Fan-Ray Kuo**, Gwo-Jen Hwang*, Chun-Chia Lee (2012). A Hybrid Approach to Promoting Students' Web-based Problem Solving Competence and Learning Attitude. Computers & Education, 58(1), 351-364. (SSCI)
- **Fan-Ray Kuo**, Gwo-Jen Hwang*, Szu-Chuang Chen, Sherry Y. Chen (2012). A Cognitive Apprenticeship Approach to Facilitating Web-based Collaborative Problem-Solving. Journal of Educational Technology & Society. 15(4), 319-331. (SSCI)
- Gwo-Jen Hwang*, **Fan-Ray Kuo** (2011). An Information-Summarizing Instruction Strategy for Improving Web-based Problem-Solving Abilities of Students. Australasian Journal of Educational Technology, 27(2), 290-306. (SSCI)
- Gwo-Jen Hwang*, **Fan-Ray Kuo**, Peng-Yeng Yin & Kuo-Hsien Chuang (2010).A Heuristic Algorithm for Planning Personalized Learning Paths for Context-Aware Ubiquitous Learning. Computers & Education., 54, 404-415. (SSCI)
- 巫青燕、張宏俊、**郭凡瑞**、黃國禎(2010)。線上投資理財模擬實習環境之建立與實證。電子商務期刊，12(4)547-570。(TSSCI)

Critical Thinking…

- Purpose of the research
  - Prior questions: 5W1H (what, why, who, when, where, and how…)

A Web-based Collaborative Problem-Solving Approach to Enhancing Students' Learning Performance

- Reading and Thinking in sequence

Abstract → Introduction → Conclusions

Outline of Abstract

- This part should comprise the following points with no more than 250 characters:
  - Why (reason)
  - How (method)
  - Finding (Results)

Abstract

- With the rapid spread of information technology, cultivating web-based problem-solving to deal with upcoming challenges and problems is essential and important.
- Nevertheless, students might encounter problems in dealing with web-based problem-solving tasks without real-time supports; in particular, for elementary school students.
- To cope with this problem, a web-based collaborative problem-solving approach is proposed. Thus, an experimental method with two groups was conducted to examine the effects of the proposed collaborative approach.
- The research findings show that the experimental group with collaborative learning approach gained better learning outcomes than control group with traditional individual approach.
- The affective measurement for the proposed approach revealed highly positive.

Introduction

- Fast Internet technology brings society more convenience, but has leaded to some issues related to information explosion as well.
- Studies have found students might easily get lost while searching for information to solve complex problems on the web (Hargittai, 2006; Li & Kirkup, 2007).
- Schools should play an active and critical role to assist students in the facilitation of web-based problem solving ability.
- Past studies proposed supporting tools and strategies to assist learners in web-based learning performance (Chen, 2010; Zamani & Shoghlabad, 2010).
- Particularly, Meta-Analyzer (Hwang, Tsai, Tsai, & Tseng, 2008), was developed and widely applied to web-based learning activity for improve elementary students' problem-solving ability.

Introduction

- However, these studies were inclined to individual learning context in which one might easily get lost or feel frustrated while searching for information to solve complex problems without real-time guidance on the Internet.
- To cope with this issue, the study proposes a web-based collaborative problem-solving approach.
- To examine the effectiveness of the proposed approach, sixty-three high graders of elementary school participated in the experiment.
- The relevant suggestions are proposed based on the research findings.

Research issues

- Based on the introductory section, the research issues were aimed to focus on:
  1) Whether the web-based collaborative problem-solving approach could produce significantly better learning gain of students than traditional individual problem-solving approach?
  2) Whether the web-based collaborative problem-solving approach can be adopted via the affective measurement, e.g. perceived ease of use, perceived usefulness, system quality and intention scales?

Points for Literature review

Basically, this part may focus on critical points based on the research topic and paper types (conference/journal).

- A web-based problem solving environment (methodology) (M)
- Cognitive/ Learning styles (influencing factor) (O)
- Cognitive load (outcome) (O)
- Perceived usefulness, ease of use, intention (outcomes) (O)
- …

M: must; O: option

Points of Research design

There are some points needed to introduce when it comes to "Research design", shown as follow:

- Participants (including course required)
  - Number, gender, year of age
- Learning contexts (experimental vs control groups)
  - Experimental procedure
- Measurements (as to RQs)
  - Reliability analysis of scales

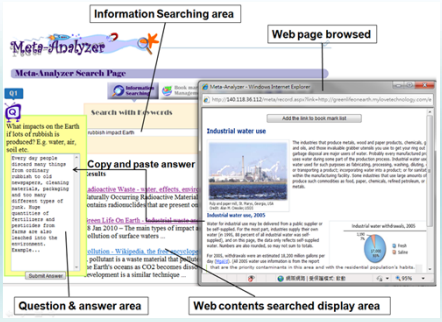
Research design

- *Research subjects:*
  - A total of 63 of 6th graders (11-12 of age), distributed in two groups, the experimental group and control group.
  - The experimental group with 32 graders conducted in the proposed collaborative learning approach and was grouped into 8 subgroups via heterogeneous grouping method, while the control group with 31 conducted in the traditional approach with individual manner.
  - The two groups have similar academic achievements and ever experienced basic computer training course on the 4th grade.
  - One teacher was assigned to teach social studies for two classes in the same computer classroom at different times of the day.

Research design

- Web-based learning setting for cont. group

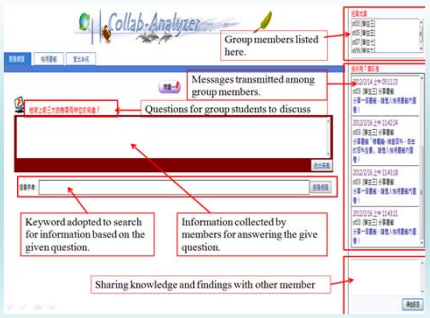
- The control group was conducted with the web-based individual learning approach via Meta-Analyzer system shown below.



Research design

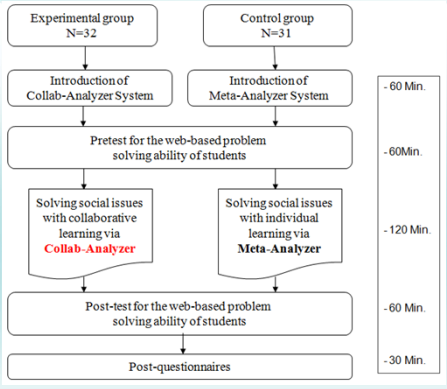
- Web-based learning setting for exp. group

- The experimental group was conducted with web-based collaborative problem-solving approach via Collab-Analyzer system shown as follow.



Research design

- Experimental procedure (Important)



Research design

- Measuring tools

- *Assessment of web-based problem solving ability*
  - The assessment of web-based problem-solving ability originated from Kuo, Hwang and Lee (2012) was managed through solving social issues as pre- and post-test in the social study course, given both social issues of "Renewable energy" and "Garbage problem," respectively.
  - To ensure inter-rater reliability, two senior social studies course educators from the elementary school were involved in the rating.
  - Before the formal rating of the experiment, 25 non-experimental high-grade students participated in the test in an attempt to verify the correlation among the raters, in which inter-rater reliability reaches a high Cronbach's α value of 0.875 (Cohen, 1988).
  - The higher the score a student obtains, the better web-based problem-solving ability the student presents.

Research design

- Measuring tools

- *Research scales*
  - The post-questionnaire with four dimensions, *perceived ease of use, perceived usefulness, intention* adapted from Technology Acceptance Model developed by Venkatesh and Davis (1996), and *system quality* adapted from Meyers et al. (1997).
  - These four dimensions are measured via a six-point Likert scale, ranging from 1 (strongly disagree) to 6 (strongly agree).
  - Moreover, the items have been modified and adapted via an iterative personal interview process with two senior social studies course teachers and one expert to verify the completeness, wording, and appropriateness of the scales so as to confirm its content validity.
  - The Cronbach's α values of the four dimensions present 0.87, 0.81, 0.82 and 0.86, respectively, with high reliability of scale (Cohen, 1988).

Mostly used statistical tools

- Descriptive statistics
- T test
  - Paired-sampled t-test (Affective outcomes)
  - Independent-sampled t-test (Cognitive outcomes)
- ANOVA
- ANCOVA
  - Pre-test as covariance
- Reliability/ consistency analysis
- Correlation analysis

Experimental Results
-Analysis of web-based problem-solving ability

- Examine of prior ability for two groups
  - The basic web-based problem-solving ability of two groups was measured with Independent Samples *t* test.
  - Table 1 shows the pretest score between two group students has no significant difference (t=-1.95, p>.05), implying that two group students have equivalent web-based problem-solving ability before the experiment.

Table 1. Independent sample *t* test for pretest of web-based problem-solving ability of two groups

Group	N	Mean	S.D.	*t*
Experimental group	32	66.01	4.33	-1.95
Control group	31	68.03	3.94	

Experimental Results
-Analysis of web-based problem-solving ability

- Analysis of posttest for two groups
  - The web-based problem-solving ability of two groups was measured with Analysis of covariance (ANCOVA) method.
  - Table 2 shows the posttest score between two group students presents significant difference (t=3.57, p<.001), implying that the experimental group students who adopted collaborative learning approach to learn social studies could gain better web-based problem-solving ability than those who accepted individual learning approach.

Table 2. ANCOVA for post-test of web-based problem-solving ability for two groups

Group	N	Mean	Adjust Mean	S.D.	*t*
Experimental group	32	80.25	80.44	5.85	3.57***
Control group	31	74.35	74.16	7.21	

***p<.001

Experimental Results
- Analysis of affective measurement

- Table 3 shows the four dimensions, *perceived ease of use, perceived usefulness, system quality and intention*, with significant difference, respectively.

Table 3. Independent Samples t test of four dimensions for two groups

Dimension	Experimental. Group (N=32)		Control Group (N=31)		*t*
	Mean	S.D.	Mean	S.D.	
Perceived ease of use	5.57	.520	4.90	1.22	-2.79*
Perceived usefulness	5.62	.618	5.14	.927	-2.39*
System quality	5.26	.903	4.01	1.443	-4.10***
Intention	5.45	.830	4.83	.869	-2.89**

*p<.05, **p<.01, ***p<.001

Discussion and implication

- This part mainly concentrate on the research findings, criticize the results of the research, and propose rational explanations.
- The findings may come from results of previous studies, or not.
  - If it is consistent, it is a proof.
  - If it is inconsistent, it is a new finding.

Conclusions and future works

- To enhance students' web-based problem-solving ability quicker and more accurate, a web-based collaborative problem-solving approach is proposed.
- The research findings showed that the experimental group students who learned with the web-based collaborative problem-solving approach gained better web-based problem-solving performance than those who learned with the conventional individual learning approach whatever in aspects of cognitive or affective gains.
- The result can be explained by Bandura' Social Learning theory.
- That indicates students adopted the proposed collaborative approach could gain real-time supports via online discussion when solving social issues.
- In the future, it is noteworthy investigating other factors that might affect students' learning performance in web-based collaborative problem-solving activities, such as *gender, achieving ability, cognitive styles* and *grouping strategies*.

Suggestions for writing a papers

- Why do we write papers?
  - We want others to read our papers.
  - Title and abstract are very important.
  - Think about what others want to see by starting with a promising problem.
  - How others can benefit from our research findings.
- Writing has to be in a good flow by telling an interesting story.
  - Identify a problem.
  - Find out what others have done to solve the problem, what is already being done, what are not done yet.
  - Research questions come after literature review, not before literature review.
  - Propose a potential solution based on literature review for a justification.

Suggestions for writing a papers

- Implement your solution
- Findings have to refer back to the original research questions.
- How confidence your are about your research findings, implications, limitations.
- Further research questions or directions.
- Tips for writing a paper
  - Make a few bullet points for each section to make the logical flow correct.
  - Write the stuffs your are keen to write, write you really would like to write.
  - Keep reading and writing, practice makes perfect.

Thank you for patience.

Wish you gain more.

Q&A

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